LLT Journal, e-ISSN 2579-9533, p-ISSN 1410-7201, Vol. 29, No. 1, April 2026, pp. 259-277

LLT Journal: A Journal on Language and Language Teaching
http://e-journal.usd.ac.id/index.php/LLT
Sanata Dharma University, Yogyakarta, Indonesia

APPLYING CLIL TO ENHANCE BOTH ENGINEERING KNOWLEDGE AND TECHNICAL ENGLISH FOR ENGINEERING STUDENTS

Trieu Khoa Nguyen[1*], Van-Chinh Truong[2], Vu-Hai Le[3], and Minh-Tuan Nguyen[4]
[1,2,3,4]Industrial University of Ho Chi Minh City, Vietnam
nguyenkhoatrieu@iuh.edu.vn[1], truongvanchinh@iuh.edu.vn[2], levuhai@iuh.edu.vn[3], nguyenminhtuan@iuh.edu.vn[4]
*correspondence: nguyenkhoatrieu@iuh.edu.vn
https://doi.org/10.24071/llt.v29i1.399
received 29 August 2024; accepted 06 March 2026

Abstract
This study explores the use of Content and Language Integrated Learning (CLIL) to improve both engineering knowledge and technical English for Vietnamese university students. As English becomes increasingly important in technical professions, combining subject learning with language development offers a practical way to strengthen students' global competence. A quasi-experimental design was conducted with two Mold Engineering classes (n = 55) at the Industrial University of Ho Chi Minh City. The experimental group learned using the CLIL method, in which English technical terms were introduced and explained alongside Vietnamese, while the control group followed the traditional learning method in Vietnamese. Data were collected from pre- and post-tests on technical English vocabulary, final exam results on subject knowledge, and a survey. Descriptive statistics and independent t-tests were used to analyze the data. The results showed that students who studied with CLIL made greater progress in their specialized English skills compared to the control group. Although the difference in engineering exam results was not statistically significant, CLIL helped maintain stable academic performance and encouraged more active learning. The study provides initial evidence that CLIL can be effectively applied in engineering education in Vietnam. This demonstrates that integrating technical content with English supports both language development and subject matter understanding, offering a useful approach for universities to enhance bilingual competence in engineering fields.

Keywords: content and language integrated learning (CLIL), engineering English, mold engineering, quasi-experimental design, second language (L2)

Introduction

It is projected that by 2025, more than 1.5 billion people globally will speak English either as a first or second language (Galan, 2025). English stands out as the most widely used language worldwide, surpassing other prominent languages like Chinese, Hindi, or Spanish (Balakrishnan et al., 2020; Thi et al., 2023). Consequently, owing to globalization and the prevalence of international commerce, English has emerged as the common language (Balakrishnan et al., 2020). Similarly, technical English is gaining ever more significance (Abellán-Nebot, 2018; Barbosa et al., 2022). Although English is now incorporated into most educational programs, its role in engineering and technology education is particularly important, as proficiency in specialized English is essential for understanding specific content and participating in global professional activities. Consequently, numerous contemporary English teaching and learning approaches have emerged to address students' needs, particularly the growing demand for *technical English* in specialized disciplines, with one of the most widely adopted methods being Content and Language Integrated Learning (CLIL) (Coyle et al., 2010; Goris et al., 2019). Over the past two decades, CLIL has gained extensive usage as a second language (L2) learning technique among students (Anh & Phuong, 2018). CLIL is widely recognized as a pedagogical methodology that integrates the learning of a second language (L2) with the study of academic content taught in that language (Urgal, 2022). This method enables students to absorb subject knowledge while naturally acquiring the L2, making it particularly suited for technical disciplines where English serves as a medium of global communication (Syahril, 2019).

Introduced and initially implemented in Europe during the 1990s, CLIL has risen to prominence as a favored pedagogical approach in European educational institutions and has gradually attracted increasing attention in other regions, including Asia (Cenoz et al., 2014). It entails teaching non-linguistic subjects in a foreign language (European Commission, 2006) with equal emphasis placed on developing proficiency in the subject matter as well as the language of instruction. However, CLIL diverges from the traditional objective of English as a Medium of Instruction (EMI) in Asian universities. In the case of EMI, subject content is primarily delivered in English to enhance comprehension of the subject matter, often disregarding the reality that some students may lack the fundamental English skills necessary to grasp the material presented in English (Byun et al., 2011). The CLIL method intends to foster proficiency in subject content as well as English language skills, representing a relatively novel approach for Asian universities (Thi et al., 2023).

As CLIL refers to the approach of teaching a subject through a foreign language with the dual aim of improving both subject understanding and language proficiency (Thi et al., 2023), it simultaneously promotes subject-specific knowledge and second language (L2) development (Tamilselvi, 2018). This occurs because language learning is integrated into a real-world subject context, allowing students to absorb technical concepts and terminology while using the language for subject-related communication. It has been widely studied, with strong evidence of its effectiveness in enhancing students' language competence (Cenoz, 2015; Dalton-Puffer, 2011). However, most of these studies primarily emphasize linguistic outcomes, often overlooking the equally important development of subject knowledge, especially in technical and engineering contexts.

In the field of engineering education, CLIL has shown promise. Zeidmane and Cernajeva (2011) recommended its use in engineering courses to boost students' foreign language proficiency while also increasing their engagement in class. Kanoksilapatham and Khamkhien (2022) demonstrated that CLIL improved engineering students' reading comprehension and technical vocabulary. Paula et al.

(2012) found that CLIL, when integrated into mechanical engineering courses, improved instructors' understanding of subject content and helped lower dropout rates. Antov and Pancheva (2017) concluded that CLIL not only enhanced language proficiency but also improved cognitive skills and cultural awareness among engineering students. Similarly, Aguilar and Rodríguez (2012) reported that both students and instructors had positive perceptions of CLIL in technical subjects, although challenges such as teacher's limited English proficiency and students' anxiety about learning technical content in English were noted.

CLIL has been argued to enhance technical education through several mechanisms (Hu et al., 2025). First, it scaffolds complex technical terminology by combining explanations in both English and the native language, making abstract engineering concepts more accessible. Second, it promotes dual-focused learning by encouraging students to simultaneously comprehend technical content and acquire English vocabulary relevant to their field. Additionally, CLIL fosters higher-order thinking skills by requiring learners to analyze, evaluate, and apply knowledge across two languages. As noted by Dalton-Puffer (2011), CLIL also develops cognitive discourse functions such as reasoning, hypothesizing, and problem-solving, which are particularly essential in engineering education. However, despite these theoretically established advantages, empirical evidence remains limited on how these mechanisms function in engineering classrooms in developing Asian countries, where students' English proficiency is often uneven and engineering subjects are typically taught in their native language. This gap raises the crucial question of whether CLIL can effectively balance language development and comprehension in such contexts, thus justifying the need for empirical research in the present study.

While research on CLIL has predominantly been carried out in European countries (Antov & Pancheva, 2017), investigations into this method in the Asian region, particularly in Vietnam, remain scarce (Nguyen, 2019). There is a dearth of research assessing the efficacy of CLIL in engineering classes in Vietnam. In particular, studies to assess the efficiency of CLIL for technical courses in Vietnam are still very rare despite Vietnam being recognized as an emerging country with a considerable average growth rate (O'Cass & Ngo, 2011), and English plays a vital role in university-level education, especially as globalization progresses (Van, 2013). Nevertheless, many Vietnamese universities have yet to adopt CLIL, thus overlooking its advantages, which include bolstering motivation to learn foreign languages and enhancing specialized cognitive abilities (Nguyen, 2019).

Most Vietnamese universities continue to rely on traditional methods, such as delivering technical content exclusively in Vietnamese or adopting English for Specific Purposes (ESP) courses that separate language learning from subject content (Nguyen, 2019; Van, 2013). While ESP can improve English proficiency, it may not foster deep subject knowledge simultaneously. In contrast, CLIL offers an integrated approach that aligns with the increasing demand for English proficiency in technical professions in Vietnam.

The adoption of CLIL is crucial for Vietnam, given the increasing demand for a workforce proficient in both technical knowledge and specialized English due to global economic integration. In modern engineering practice, mastering technical concepts alone is insufficient if graduates lack the ability to access, interpret, and communicate specialized knowledge in English, which remains the dominant language in technical documentation, standards, and international cooperation. Without the swift implementation of integrated approaches like CLIL, Vietnamese graduates may face significant disadvantages in the international labor market, including reduced competitiveness, limited access to global knowledge resources, and difficulties in cross-border collaboration. Therefore, delaying the adoption of CLIL could further widen the skills gap between Vietnamese students and those in countries that prioritize the simultaneous development of technical expertise and specialized English proficiency.

Given these considerations, this study seeks to fill the gap by exploring the application of CLIL in teaching Mold Engineering courses at a Vietnamese university. Specifically, this research aims to investigate whether CLIL can simultaneously improve technical English proficiency and subject understanding among engineering students in Vietnam. The research question addressed is: "How does the application of CLIL affect both technical English proficiency and subject understanding in Mold Engineering courses among Vietnamese engineering students?"

Method

CLIL implementation in the Mold engineering course

In the context of this study, CLIL was partially implemented in Mold Engineering classes, using English as the L2. While lectures were primarily delivered in Vietnamese, technical terms were introduced in English as shown in Figure 1, supported by explanations in the native language when necessary (Michaeli et al., 2001). This bilingual scaffolding aligns with CLIL principles and facilitates both comprehension of engineering content and acquisition of technical English. The following subsections describe the quasi-experimental procedure used to assess the effectiveness of this CLIL-based pedagogical method.

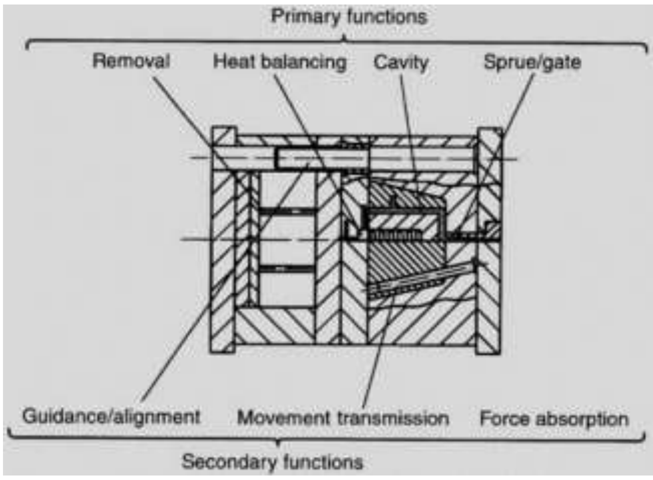

Figure 1. An example of technical English in the Mold engineering subject

Quasi-experimental design

To assess the efficiency of the CLIL methodology, a quasi-experimental design as proposed by Shadish et al. (2002) was used. Although this study did not use randomization (Alfiana et al., 2022; Indrilla & Ciptaningrum, 2018), the two mold engineering groups included students of mostly the same age and educational level. These were students in the same course, the same 2 majors, randomly registered in 2 molding engineering classes. The participants in this study were undergraduate students majoring in Mechanical Engineering Technology and Manufacturing Engineering Technology at the Industrial University of Ho Chi Minh City (IUH), Vietnam. Two intact classes enrolled in the same Mold Engineering course during the same academic semester were selected for this study. The sampling process was non-random but naturally quasi-experimental, as students registered for the classes without prior knowledge of the study.

A total of 55 students participated in the initial stages of the study. The experimental group (n = 30) received CLIL instruction, while the control group (n = 25) followed the traditional Vietnamese-medium instruction. Both groups consisted of third-year undergraduate students majoring in Mechanical Engineering Technology or Manufacturing Engineering Technology, with an average age of approximately 21 years. Pre-test results showed no significant difference in English proficiency between the two groups, confirming their comparability before the application. Most of students were male, reflecting the typical gender distribution in engineering programs at the university. There was only one female student in the control class. Therefore, we ignored the influence of gender.

Participation in this study was entirely voluntary. Students were informed about the purpose and nature of the research at the beginning of the semester, and verbal consent was obtained prior to data collection. No incentives were offered, and participants were assured that their grades and academic standing would not be affected by their decision to participate or not. All data were anonymized to ensure confidentiality, and verbal ethical approval for conducting the study was obtained from the Faculty of Mechanical Engineering at the Industrial University of Ho Chi Minh City.

A pretest was administered to assess the English ability of both classes before applying the current method. This test has been designed to include 100 English vocabulary words related to mold engineering subjects. The test was designed by the Faculty of Mechanical Technology, IUH. Teaching molding engineering subjects as well as giving students tests and exams were done by the same lecturer.

CLIL implementation process

The CLIL method was partially applied in the experimental group's Mold Engineering classes. Specifically, English terminology related to mold engineering was systematically incorporated into lectures, course materials, and class discussions. Key English terms were introduced alongside Vietnamese explanations to facilitate comprehension. Practical examples and visual aids, such as diagrams and models, were also utilized to reinforce both technical knowledge and language acquisition. Students were informed about the CLIL approach at the beginning of the course.

The research adopted a quasi-experimental design consisting of five sequential stages. First, as shown in Figure 2, a pre-test was administered to both groups at the beginning of the semester. This test, designed by the Faculty of Mechanical Engineering, included 100 technical English vocabulary items related to Mold Engineering and was used to assess students' baseline English proficiency.

Next, during the teaching application phase, the experimental group received CLIL-based instruction that incorporated English terminology into Mold

Engineering content, while the control group was taught using the traditional Vietnamese-medium approach. This instructional period lasted for one academic semester.

Following the application, a set of post-tests was conducted. Both groups completed the same post-test containing the 100 technical English terms used in the pre-test to measure vocabulary improvement. In addition, all students sat for the same Mold Engineering final examination, which was designed and graded by the same instructor to ensure consistency in assessing subject knowledge.

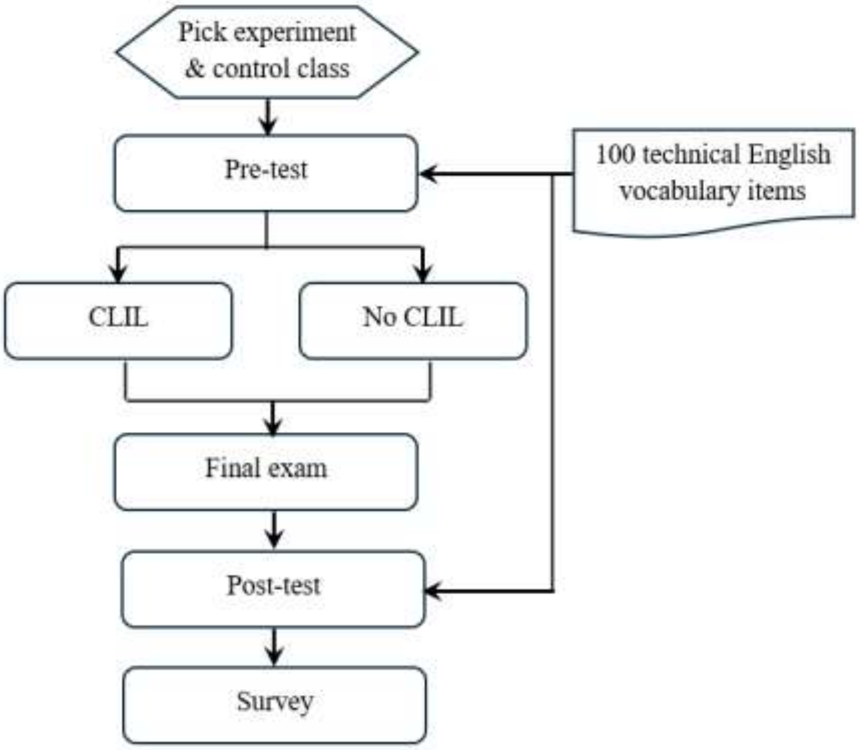

Figure 2. The CLIL implementation process

At the end of the semester, a survey was distributed to all participants. This structured questionnaire aimed to collect students' perceptions of the importance of English in technical fields and their views on the CLIL instructional approach. Because regulations of the university did not allow additional tests to be mandatory after official grades were released, participation in the post-test was voluntary. As a result, only students who were willing and available chose to complete it.

Finally, the data analysis phase involved the use of descriptive statistics and independent samples t-tests to evaluate differences between the groups. This approach follows the recommendations of Shadish et al. (2002), who emphasize the use of descriptive and inferential statistics in quasi-experimental designs to compare treatment and control groups. In addition, the pre-test/post-test design reflects common practice in CLIL and educational application research to evaluate learning gains (Cenoz, 2015; Dalton-Puffer, 2011). Comparisons were made between pre-test and post-test scores to assess the impact of the CLIL method on both English proficiency and subject comprehension. Survey data were also analyzed to gain insights into students' attitudes toward English and the integration of CLIL into their learning experience. Similar to Aguilar and Rodríguez (2012) and Kanoksilapatham and Khamkhien (2022), the current study combined test results with survey data to capture both performance outcomes and learner perceptions for a more comprehensive evaluation.

This implementation was adapted from established CLIL models, particularly Coyle, Hood, and Marsh's (2010) framework, which emphasizes the integration of content, communication, cognition, and culture. Similar approaches have been successfully applied in engineering contexts (Antov & Pancheva, 2017; Paula et al., 2012; Zeidmane & Cernajeva, 2011), and the current study localized these principles by systematically introducing English terminology alongside Vietnamese explanations to match the specific learning conditions of Vietnamese engineering students.

This structured process ensured that the research captured both objective and subjective dimensions of the CLIL method's effectiveness. Objective data were obtained through pre- and post-test scores, which quantified improvements in students' technical English proficiency and subject knowledge. The post-test was constructed on the same basis as the pre-test, using 100 technical English vocabulary words selected directly from the Mold Engineering syllabus. This ensured consistency and comparability between the two tests, allowing for measurable progress in vocabulary development thanks to the CLIL method. By employing the same pool of items, the validity and reliability of the assessment were maintained in line with quasi-experimental design principles. Subjective data were gathered through student surveys, offering insights into learners' perceptions of English language needs and their attitudes toward CLIL-based instruction. The survey questions were designed to capture students' views on the importance of English and technical English, their learning needs, and their willingness to engage with active teaching methods such as CLIL. While not directly adopted from a standardized instrument, the items were developed with reference to themes in prior CLIL perception studies (e.g., Aguilar & Rodríguez, 2012; Kanoksilapatham & Khamkhien, 2022) and were reviewed by faculty colleagues to ensure clarity and suitability for Mold Engineering students. By combining these complementary data sources, the study was able to provide a more comprehensive and balanced evaluation, strengthening the reliability and practical relevance of its findings.

Findings and Discussion

Findings

English needs and CLIL integration

An online survey questionnaire was sent to 55 senior students who had taken a mold engineering class at IUH. Fifty complete responses were then received. Of the 50 respondents, 98% considered English necessary when graduating and going to work (Figure 3). Among them, 86% (43) of students considered English to play a very important role, and 14% (7) of students considered English to be important both in their lives and careers. Significantly, as shown in Figure 4, 90% of students reported that they had experienced difficulties in learning English. It is important to note that this figure reflects students' perceptions and self-reported challenges, rather than their actual English performance or test results. These perceived difficulties highlight students' awareness of their struggles with English and provide additional support for the need to explore alternative teaching methods such as CLIL.

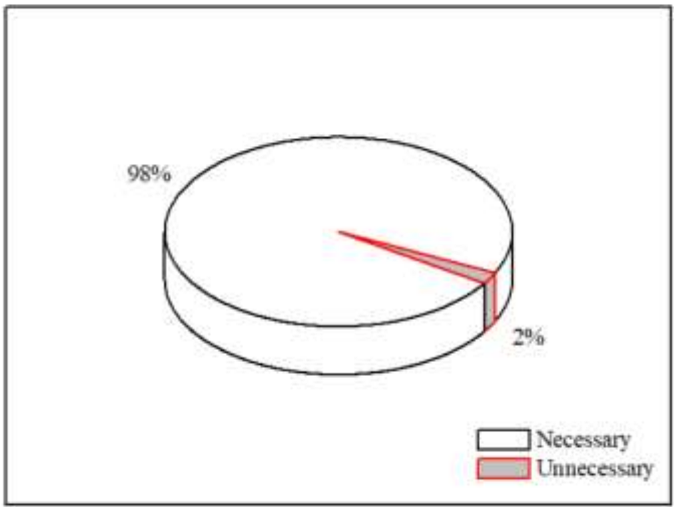

Figure 3. The necessity of English when working

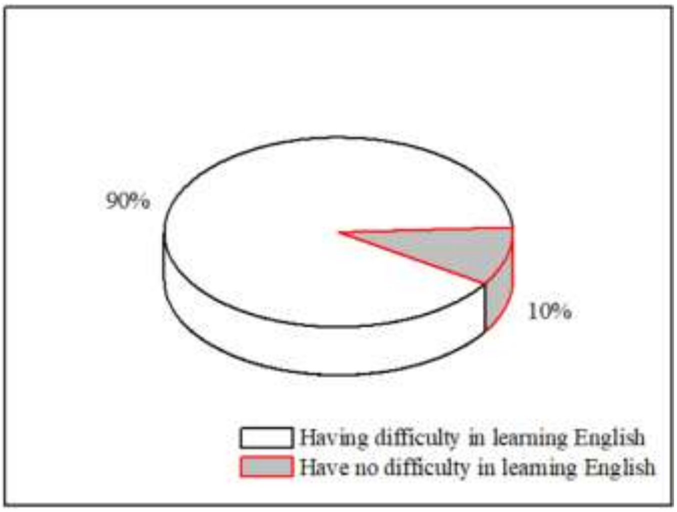

Figure 4. Number of students having difficulty in learning English

Moreover, Figure 5 demonstrates that 96% of students concurred on the necessity of integrating English into courses for their prospects. Specifically, as indicated in Figure 6, 97.9% of surveyed students deemed the current method essential for attaining comprehensive English ability.

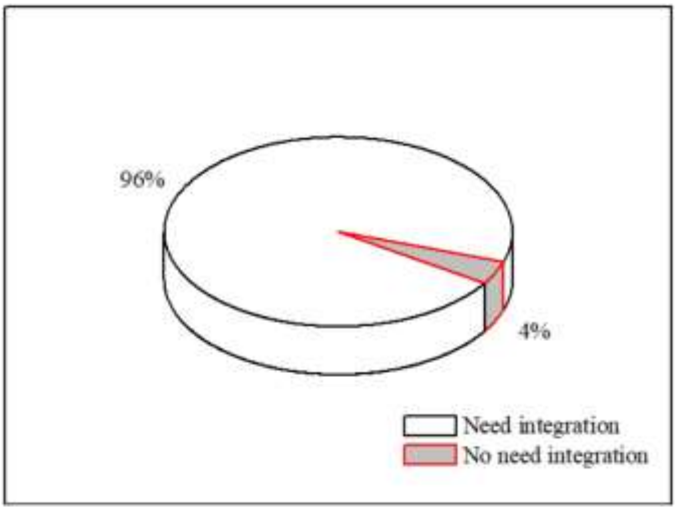

Figure 5. The need to integrate English into engineering courses

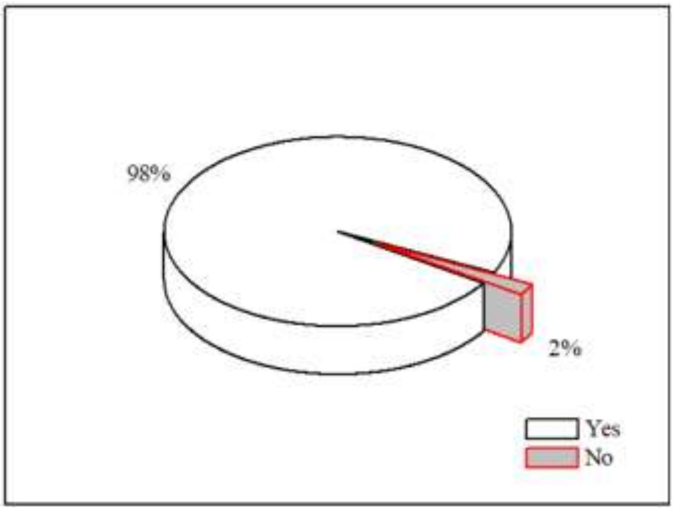

Figure 6. Students' agreement on the benefits of CLIL for English improvement

Pre-test results for baseline comparability

A preliminary test was conducted before the teaching intervention to ensure similarity in English proficiency between the experimental and control groups. Descriptive statistics described in Table 1 as well as the t-test for independent samples showed no significant differences between the experimental group (n = 30; Mean = 5.63) and the control group (n = 25; Mean = 4.76) regarding English level before applying the CLIL method.

Table 1. Comparison of English proficiency between groups before CLIL

		Descriptive Statistics		
Group	N	Mean	Std. deviation	Std. error mean
1	30	5.63	6.054	1.105
2	25	4.76	5.854	1.171

Post-test results for studying the impact of CLIL on technical English proficiency

After that, a test after applying the CLIL was conducted to compare the English level between the experimental group and the control group after applying the CLIL approach with 100 specialized vocabularies in English. The tool was also designed by the Faculty of Mechanical Engineering, IUH. The descriptive statistical results described in Table 2 and the t-test for the independent sample showed a significant difference between the experimental group (n = 16; average value = 31.69) and the control group (n = 10; Mean = 15.10) in English proficiency after applying the CLIL method. It is worth noting that, when comparing Table 1 and Table 2, the number of students in each group decreased. This was because the number of students willing to take the survey after the final exam results were released was not large.

Table 2. Comparison of English proficiency between groups after CLIL

	Descriptive Statistics			
Group	N	Mean	Std. deviation	Std. error mean
1-CLIL	16	31.69	21.571	5.393
2-No-CLIL	10	15.10	10.148	3.209

It is important to clarify that the mean scores presented in Table 1 and Table 2 are based on test results, not on survey responses. These tests specifically measured students' English proficiency in technical vocabulary related to mold engineering. The tests were designed by the Faculty of Mechanical Engineering at IUH and administered by the same lecturer who taught both the experimental and control groups. Thus, the data reflect actual test performance rather than self-reported survey results.

However, it should be noted that the number of students who participated in the post-test (as shown in Table 2) was lower than the initial sample. While the pre-test included most students enrolled in the courses, fewer students participated in the post-test. This reduction in sample size occurred because the post-test was conducted after the final course grades were released, and participation was voluntary. As a result, some students chose not to take the post-test, leading to fewer responses.

Given this reduction, it is acknowledged that the post-test findings may not fully represent the entire student population enrolled in the courses. While useful initial insights into the potential effects of the CLIL method are still provided by the results, caution has been exercised to avoid overgeneralization of the findings. This limitation has now been explicitly noted in the study, and it is suggested that future research be conducted with larger and more consistent samples to confirm these results and improve the robustness of the conclusions.

Subject knowledge assessment through final exam scores

In addition, another test after applying CLIL has also been conducted to compare the average GPA between the experimental group and the control group after applying the CLIL approach. The tool was also designed by the Faculty of Mechanical Engineering, IUH to assess students' achievement in Mold engineering exam. In this final exam, all students were given the exam at the same time and took the same exam questions. Once cut for confidentiality and fairness, the same lecturer graded all exam papers.

Table 3. Comparison of engineering level between groups after CLIL

	Descriptive Statistics			
Group	N	Mean	Std. deviation	Std. error mean
1-CLIL	39	6.11	1.731	0.277
2-No-CLIL	35	5.85	1.347	0.228

Figure 7 is a boxplot visualizing the distribution of values for the "CLIL" and "No-CLIL" groups. The boxplot helps compare the central tendency and spread of the two groups, making it easier to observe any differences or similarities between them. The larger number of participants compared to the earlier surveys is because the final exam was a compulsory course requirement, ensuring full participation from both CLIL and non-CLIL groups. Table 3 shows that the mean score of the CLIL group is higher than that of the non-CLIL group. However, this result alone does not allow anyone to draw definitive conclusions about the differences between the two groups. Therefore, a t-test was conducted to check whether the observed difference was statistically significant.

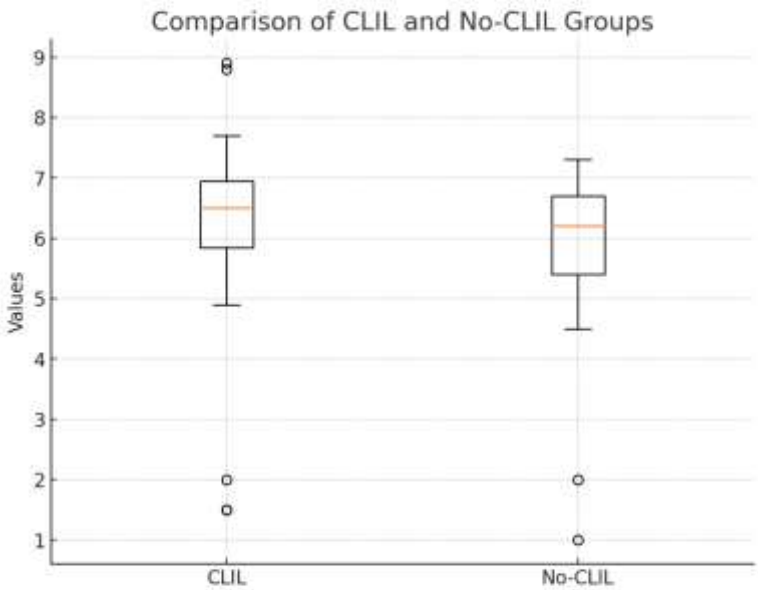

Figure 7. Comparison of CLIL and No-CLIL groups in terms of the final exam scores

A t-Test, two-sample assuming equal variances, was performed for these two groups as shown in Table 4.

Table 4. t-test, two-sample assuming equal variances

	CLIL	No-CLIL
Mean	6.112820513	5.854285714
Variance	2.996410256	1.815495798
Observations	39	35
Pooled Variance	2.438756207	

	CLIL	No-CLIL
Hypothesized Mean Difference	0	
df	72	
t Stat	0.711025668	
P(T<=t) one-tail	0.239682725	
t Critical one-tail	1.666293696	
P(T<=t) two-tail	0.479365449	
t Critical two-tail	1.993463567	

The t-test is used to determine whether there is a statistically significant difference between the means of two groups (Nguyen & Nguyen, 2024). In this case, the "CLIL" group (DHCT14ATT) was compared to the "No-CLIL" group (DHCT14BTT). In this test, the variances (the spread or dispersion of the data) in the two groups were assumed to be equal. The t-test measures the magnitude of the difference relative to the variability in the data. A larger t-statistic indicates that the groups are more different (Nguyen & Nguyen, 2024). Here, a t-statistic of 0.711 suggested that the difference between the groups was relatively small compared to the variability within the groups. The p-value indicates the probability that the observed difference between groups is due to chance (Mouffok et al., 2023). A low p-value (typically less than 0.05) suggests that the difference is statistically significant, meaning it is unlikely to have occurred by random chance (Lee & Kang, 2021). In this case, the p-value was 0.479, which was quite high. This meant that there was a 47.9% chance that the difference between the "CLIL" and "No-CLIL" groups could have occurred by random chance.

Discussion

Impact of CLIL on technical English proficiency

This research contributes to education by checking the usability as well as the efficiency of the current teaching approach in technical courses in our country. The majority of surveyed learners reported encountering difficulty in learning the English language. This issue provided us with the theoretical and motivational basis for this study, hoping that through the consideration of the effectiveness of the CLIL method, the university will offer more effectual policies to help students learn English through teaching engineering subjects. Furthermore, 98% of students deemed the CLIL method essential for developing foreign language skills and preparing for future employment opportunities. This revelation was consistent with the results of several other works published in European countries (Aguilar & Rodríguez, 2012; Bower et al., 2024; Siepmann et al., 2023; Zeidmane & Cernajeva, 2011) on the optimistic opinions of most learners on the current teaching approach. These findings mark more than a promising beginning they provide empirical justification for the application of CLIL in engineering education, particularly in contexts like Vietnam where English proficiency remains a persistent barrier to global engagement.

A pre-test and 2 post-tests, using a quasi-experimental design, were implemented to assess the efficiency of the used approach on English ability and the demands of the subject's professional content. For English proficiency, a test before applying CLIL confirmed that the two groups had the same level of English. Following the implementation of the CLIL method, the experimental group demonstrated a significant improvement in English proficiency compared to the control group (Table 2). This improvement can be plausibly explained by the structured use of bilingual teaching, where English technical terms were consistently introduced alongside Vietnamese explanations, thereby reducing comprehension barriers and supporting incremental vocabulary acquisition. This finding is consistent with Kanoksilapatham and Khamkhien (2022), who emphasized that scaffolding strategies in CLIL helped engineering students acquire technical vocabulary more effectively. In addition, the integration of visual aids and practical examples contextualized the new terminology, making it easier for students to internalize and apply English in subject-specific settings, a benefit also observed by Antov and Pancheva (2017) in their work on engineering education. Aguilar and Rodríguez (2012) similarly reported that CLIL enhanced both content learning and language development when instructors provided sufficient pedagogical support. Furthermore, studies on teaching in English in an Asian context have shown that inadequate support can hinder comprehension (Byun et al., 2011). In contrast to those conflicting results, our findings suggest that a partial CLIL approach with bilingual and contextual support can overcome these limitations, helping students simultaneously improve both their professional knowledge and technical English proficiency.

While our findings confirm that CLIL can simultaneously enhance both technical knowledge and English proficiency, earlier research has reported more diverse outcomes. For instance, Aguilar and Rodríguez (2012) noted that students in technical programs often had trouble following complex content when taught fully in English. Similarly, Byun et al. (2011) found that English-medium instruction in Asian contexts sometimes hindered subject comprehension, particularly when students lacked sufficient baseline language skills. By contrast, in our study, the use of bilingual scaffolding (introducing English terminology alongside Vietnamese explanations) helped avoid such difficulties and may explain why students showed consistent gains in both language and subject knowledge.

It is important to note that the number of participants in the post-test ($n = 26$) was smaller than in the pre-test due to voluntary participation after the final exam and scheduling conflicts. Due to the centralized exam schedule, at IUH, students who finish one subject will have to immediately prepare for the final exams of other subjects. While this was acknowledged as a limitation, efforts were made to ensure that the analysis remained meaningful by comparing the relative gains between groups. The consistent improvement in English proficiency among CLIL students aligns with findings from Kanoksilapatham and Khamkhien (2022) and Antov and Pancheva (2017), who reported vocabulary gains and enhanced reading skills through CLIL in engineering contexts.

Impact of CLIL on subject knowledge (Mold Engineering exam scores)

From Table 3 as well as Figure 7, the experimental group had higher final exam scores than the control group. The superior performance of CLIL-group students in both language and content assessments serves as compelling evidence for the method's integrated benefits. This dual improvement challenges the assumption that language-focused instruction might compromise technical learning. However, whether this difference is statistically significant or not requires a t-test.

Because the p-value was greater than 0.05, there was not enough evidence to reject the null hypothesis (Indira, 2022). The null hypothesis assumed that there was no difference between the means of the two groups. Therefore, a conclusion that the difference in means between the "CLIL" and "No-CLIL" groups was not statistically significant could be obtained. Hence, for the practical implication, the data did not show a meaningful difference between the CLIL and No-CLIL groups in terms of the measured variable. One plausible reason is that students in both groups shared a similar academic background and had already developed comparable levels of subject knowledge, which minimized outcome differences in the final exam (Paula et al., 2012). Another reason may be that the Mold Engineering exam primarily assessed technical knowledge, while the added benefits of CLIL were more visible in language proficiency rather than content mastery (Aguilar & Rodríguez, 2012; Cenoz et al., 2014; Kanoksilapatham & Khamkhien, 2022). Furthermore, the relatively short application period might have limited the extent to which differences could emerge in subject scores. However, the accumulation of many subjects can make a difference. That is what pedagogues aim for when researching with the hope of further popularizing the CLIL method.

Long-term implementation of CLIL in Mold Engineering courses

Following the initial experimental study, the CLIL approach was subsequently implemented in Mold Engineering courses over the next three academic semesters at IUH. This extended application aimed to further examine the long-term effects and stability of this teaching method in enhancing both engineering knowledge and technical English skills. Figure 8 is the box plot summarizing the distribution of values in each column for this application. The box plot shows the median, quartiles, and any potential outliers in the data.

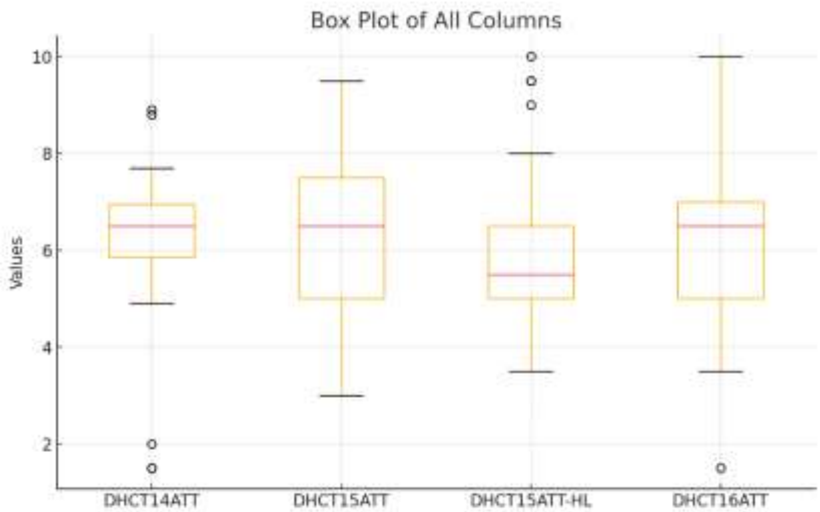

Figure 8. The application of CLIL in next 4 semesters

The mean values across all four columns (DHCT14ATT, DHCT15ATT, DHCT15ATT-HL, and DHCT16ATT) are quite close, ranging between 6.03 and 6.18. This suggests that the central tendency of the data is fairly consistent across these metrics. The histograms indicate that the data for each column is relatively symmetrically distributed, with no significant skewness. This implies that the data points are fairly evenly spread around the mean for each column. Overall, the data appears stable and consistent across the different metrics. While there are some outliers and weak correlations, the dataset suggests that the various metrics are not strongly interrelated and maintain similar central tendencies. This has shown a high level of stability in student learning outcomes after implementing CLIL. These consistent outcomes suggest that the CLIL method contributed to a stable learning environment. Although the engineering course content itself remained unchanged, the enhanced teaching methods, such as more frequent testing, student surveys, and explicit communication about the use of CLIL, appeared to increase student engagement and motivation. This heightened awareness may have encouraged students to take a greater interest in the subject, potentially contributing to their sustained performance.

The findings of this study provide clear evidence regarding the dual impact of CLIL on both technical English proficiency and subject understanding in Mold Engineering courses. The quasi-experimental results demonstrated that the CLIL group significantly outperformed the control group in technical English proficiency after the application, as shown by the post-test scores (Table 2). Similar improvements in vocabulary and language competence through CLIL have also been reported in engineering contexts (Antov & Pancheva, 2017; Kanoksilapatham & Khamkhien, 2022). Furthermore, although the differences in subject knowledge, measured through final exam results, were not statistically significant, the CLIL group consistently achieved slightly higher average scores than the non-CLIL group (Tables 3 and 4), indicating that the CLIL method did not hinder their technical learning process. This finding is consistent with Aguilar and Rodríguez (2012), who showed that CLIL can maintain subject learning outcomes when sufficient scaffolding is provided, but it also contrasts with studies on English-medium instruction in Asia that found comprehension difficulties when such support was lacking (Byun et al., 2011). Furthermore, the application of CLIL across multiple semesters has shown consistent learning outcomes across student groups, demonstrating that this method supports sustainable learning in both English language skills and subject matter knowledge. This long-term stability reflects results from European CLIL research (e.g., Cenoz et al., 2014; Papaja, 2023; Ruiz de Zarobe, 2025) while contributing new evidence from the Vietnamese engineering education context (Nguyen et al., 2024).

The findings suggest that the implementation of CLIL not only improved students' English proficiency and technical knowledge during the initial application but also maintained consistent academic results over multiple semesters. This reinforces the potential for broader, long-term integration of CLIL, especially combining it with active teaching methods such as flipped classroom and team-based learning (Nguyen & Truong, 2024), in engineering education at IUH.

Conclusion

This study introduced the CLIL approach as an innovative teaching method for integrating technical content with English language learning in engineering education. Beyond the initial experimental results, the CLIL method was continuously applied over multiple semesters in Mold Engineering courses at IUH, demonstrating its potential for long-term integration and stable academic outcomes. Through a quasi-experimental design, the study confirmed that CLIL significantly improved students' English proficiency, while its impact on engineering subject performance was modest and not statistically significant. However, the approach ensured that students' content learning was not negatively affected and even showed signs of improvement. The consistent results across several cohorts further suggest that CLIL can foster sustained learning effectiveness without compromising students' grasp of technical knowledge. Despite Vietnam's significant economic growth and increasing demand for English proficiency in technical fields, innovative teaching methods like CLIL remain underutilized, particularly in university-level engineering courses. In this regard, CLIL can serve as a promising strategy for Vietnamese universities, helping students improve both technical competencies and English language skills simultaneously. Thus, Vietnamese universities should incorporate the CLIL method into their programs, particularly in engineering courses. This is especially crucial given that technical subjects in Vietnam are conventionally taught in the native language, Vietnamese. In addition, all textbooks are written in Vietnamese or have been translated into Vietnamese. This may impede both instructors' and learners' capacity to broaden their knowledge by utilizing more current documents written in the English language.

However, this study acknowledges certain limitations, including the relatively small sample size, the voluntary nature of post-test participation, and the focus on a single institution and course. Future research with larger and more diverse samples is recommended to validate the broader applicability of CLIL in other technical disciplines and institutions across Vietnam.

Acknowledgments

This research was conducted at IUH on students of Mechanical Engineering Technology and Manufacturing Engineering Technology in the Faculty of Mechanical Engineering. The authors would like to give special thanks to the training courses from BUILD-IT Project by Arizona State University, sponsored by USAID.

References

Abellán-Nebot, J. V. (2018). Project-based experience through real manufacturing activities in mechanical engineering. *International Journal of Mechanical Engineering Education, 48*(1), 55-78. https://doi.org/10.1177/0306419018787302

Aguilar, M., & Rodríguez, R. (2012). Lecturer and student perceptions on CLIL at a Spanish university. *International Journal of Bilingual Education and Bilingualism, 15*(2), 183-197. https://doi.org/10.1080/13670050.2011.615906

Alfiana, H., Karyono, H., & Gunawan, W. (2022). The application of SAMR model and self-efficacy on critical thinking and procedural knowledge. *LLT Journal: A Journal on Language and Language Learning, 25*(1), 200-217. https://doi.org/10.24071/llt.v25i1.3893

Anh, L. T., & Phuong, V. D. (2018). Equipping the contents of CLIL for students in mathematics education major, taught in English. *VietNam Journal of Educational Sciences, 3*, 42-46.

Antov, P., & Pancheva, T. (2017). *Application of content and language integrated learning (CLIL) in engineering education.* Paper presented at the XIXth International Scientific Conference "Management and Sustainable Development", Yundola, Bulgaria.

Balakrishnan, S., Abdullah, N. L., & Linda Khoo, M. S. (2020). English language learning anxiety and its relationship with language achievement: A study on learners in a technical university. *Journal of Technical Education and Training, 12*(3), 161-170. https://doi.org/10.30880/jtet.2020.12.03.017

Barbosa, F. V., Lobarinhas, P. A. M., Teixeira, S. F. C. F., & Teixeira, J. C. F. (2022). Project-based learning in a mechanical engineering course: A new proposal based on student's views. *International Journal of Mechanical Engineering Education*, *50*(4), 767-804. https://doi.org/10.1177/03064190221078259

Bower, K., Rutgers, D., & Quigley, L. (2024). Learner perceptions of a national CLIL innovation in foreign languages in the Republic of Ireland (5474). *Frontiers in Education,* 9, Article 1456630. https://doi.org/10.3389/feduc.2024.1456630

Byun, K., Chu, H., Kim, M., Park, I., Kim, S., & Jung, J. (2011). English-medium teaching in Korean higher education: Policy debates and reality. *Higher Education, 62*(4), 431-449. https://doi.org/10.1007/s10734-010-9397-4

Cenoz, J. (2015). Content-based instruction and content and language integrated learning: The same or different? *Language, Culture and Curriculum, 28*(1), 8-24. https://doi.org/10.1080/07908318.2014.1000922

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

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

Dalton-Puffer, C. (2011). Content-and-language integrated learning: From practice to principles? *Annual Review of Applied Linguistics, 31*, 182-204. https://doi.org/10.1017/S0267190511000092

European Commission, European Education and Culture Executive Agency: Directorate-General for Education, Youth, Sport, and Culture. (2006). *Content and Language Integrated Learning (CLIL) at school in Europe*. Publications Office of the European Union. Retrieved on August 29, 2024, from https://op.europa.eu/en/publication-detail/-/publication/756ebdaa-f694-44e4-8409-21eef02c9b9b

Galan, S. (2025, November 19). The most spoken languages worldwide 2025. *Statista.* https://www.statista.com/statistics/266808/the-most-spoken-languages-worldwide/

Goris, J. A., Denessen, E., & Verhoeven, L. T. W. (2019). Effects of content and language integrated learning in Europe A systematic review of longitudinal experimental studies. *European Educational Research Journal, 18*(6), 675-698. https://doi.org/10.1177/1474904119872426

Hu, D., Chen, J., Li, Y., & Wang, M. (2025). Technology-enhanced content and language integrated learning: A systematic review of empirical studies. *Educational Research Review, 47*, Article 100677. https://doi.org/10.1016/j.edurev.2025.100677

Indira, K. (2022). Blended learning approach to engineering education: Students' perceptions on learning experience and effectiveness. *Journal of Engineering Education Transformations, 35*(3), 160-170. https://doi.org/10.16920/jeet/2022/v35i3/22099

Indrilla, N., & Ciptaningrum, D. S. (2018). An approach in teaching writing skills: Does it offer a new insight in enhancing students writing ability. *LLT Journal: A Journal on Language and Language Learning, 21*(2), 124-133. https://doi.org/10.24071/llt.v21i2.1036

Kanoksilapatham, B., & Khamkhien, A. (2022). CLIL implemented and scaffolded in an EFL higher education context: Engineering research methodology course. *Indonesian Journal of Applied Linguistics, 11*(3), 502-514. https://doi.org/10.17509/ijal.v11i3.36913

Lee, S.-Y., & Kang, S.-J. (2021). The effects of team-based learning (TBL) education on critical thinking, interpersonal relationships, self-leadership and academic major satisfaction. *Journal of Engineering Education Transformations, 34*(4), 104-112. https://doi.org/10.16920/jeet/2021/v34i4/160693

Michaeli, W., Greif, H., Kretzschmar, G., & Ehrig, F. (2001). *Training in injection molding: A text- and workbook 2nd Edition.* Hanser Gardner Publications.

Mouffok, K., Hamzaoui-Elachachi, H., & Omari, F. Z. I. (2023). Students' anxiety in foreign language learning environments: Online versus on-site classrooms. *LLT Journal: A Journal on Language and Language Learning, 26*(2), 470-482. https://doi.org/10.24071/llt.v26i2.6401

Nguyen, G. N., & Nguyen, T. K. (2024). Entrepreneurial passion of business and technical students: The roles of subjective norms, entrepreneurial education, entrepreneurial self-efficacy, and risk propensity. *The International Journal of Management Education, 22*(3), Article 101012. https://doi.org/10.1016/j.ijme.2024.101012

Nguyen, N. G., & Nguyen, T. K. (2024). Creative and pure imitation under environmental turbulence: Evidence from an emerging economy. *International Journal of Innovation Management, 28*(01n02), Article 2450008. https://doi.org/10.1142/S1363919624500087

Nguyen, T. B. N. (2019). *Content and language integrated learning in Vietnam: evolution of students' and teachers' perceptions in an innovative foreign language learning system* (PhD Thesis), University of Paul Sabatier-Toulouse III.

Nguyen, T. K., & Truong, V. C. (2024). Enhancing engineering education through a combined flipped classroom and team-based learning approach with team leaders. *International Journal of Mechanical Engineering Education,* 1-22. https://doi.org/10.1177/03064190241302405

Nguyen, T. T. H., & Nguyen, T. M. H. (2024). Content and Language Integrated Learning (CLIL) in Vietnam: Challenges and solutions. *VNU Journal of Foreign Studies*, *40*(2), 1-14. https://doi.org/10.63023/2525-2445/jfs.ulis.5246

O'Cass, A., & Ngo, L. V. (2011). Winning through innovation and marketing: Lessons from Australia and Vietnam. *Industrial Marketing Management, 40*(8), 1319-1329. https://doi.org/10.1016/j.indmarman.2011.10.004

Paula, H., David, E., Harri, E., Jorg, W., & Juha, V. (2012). *Development and analysis of a professional-oriented CLIL model for university level mechanical engineering education.* Paper presented at the SEFI 40th Annual Conferences - European Society for Engineering Education, Thessaloniki, Greece.

Papaja, K. (2023). Content and Language Integrated Learning (CLIL) in European higher education. *Multidisciplinary Journal of School Education*, *12*(23), 251-273. https://doi.org/10.35765/mjse.2023.1223.11

Ruiz de Zarobe, Y. (2025). *Content and Language Integrated Learning (CLIL)*. Cambridge: Cambridge University Press. https://doi.org/10.1017/9781009439251

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). *Experimental and quasi-experimental designs for generalized causal inference*. Houghton Mifflin.

Siepmann, P., Rumlich, D., Matz, F., & Römhild, R. (2023). Attention to diversity in German CLIL classrooms: Multi-perspective research on students' and teachers' perceptions. *International Journal of Bilingual Education and Bilingualism*, *26*(9), 1080-1096. https://doi.org/10.1080/13670050.2021.1981821

Syahril, I. (2019). The new generation of high-quality ESL-EFL teachers: A proposal for interdisciplinary teacher education. *LLT Journal: A Journal on Language and Language Learning, 22*(1), 33-45. https://doi.org/10.24071/llt.v22i1.1797

Tamilselvi, A. (2018). Smart communication app (Roach) CLIL for better language acquisition. *Journal of Engineering Education Transformations, 31*, 15-21. https://doi.org/10.16920/jeet/2018/v31i4/125199

Thi, B. P. H., Van, C. T., Thi, H. N., & Nguyen, T. K. (2023). Content and language integrated learning: An initial case study for mold engineering courses at the Industrial University of Ho Chi Minh City, Vietnam. *Journal of Engineering Education Transformations, 36*(4), 120-127. https://doi.org/10.16920/jeet/2023/v36i4/23122

Urgal, C. C. (2022). Focusing on competence as a strategy to teach ESP in content and language integrated learning contexts. *LLT Journal: A Journal on Language and Language Learning, 25*(2), 729-738. https://doi.org/10.24071/llt.v25i2.5259

Van, H. V. (2013). The role of English in the internationalization of higher education in Vietnam. *VNU Journal of Foreign Studies, 29*(1), 72-80.

Zeidmane, A., & Cernajeva, S. (2011). Interdisciplinary approach in engineering education. *International Journal of Engineering Pedagogy (iJEP)*, *1*(1), 36-41. https://doi.org/10.3991/ijep.v1i1.1604