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The Effect of Content and Language Integrated Project (CLIP) Instruction through Co-Teaching on Electrical Engineering Students' Vocabulary Knowledge for Professional Purposes

Kobra Tavassoli*
Department of Teaching English and Translation, Ka.C., Islamic Azad University, Karaj, Iran
Naime Khedri
Department of Teaching English and Translation, Ka.C., Islamic Azad University, Karaj, Iran
Maryam Rahmatollahi
Department of Teaching English and Translation, Ka.C., Islamic Azad University, Karaj, Iran

Abstract

The current study aimed to explore the impact of content and language integrated project (CLIP)-based instruction on electrical engineering students' vocabulary knowledge. To this end, a sample of 60 electrical engineering students was selected based on their performance on the Cambridge English Objective Proficiency Practice Test (CEOPPT). The participants were subsequently divided into two groups including an experimental and a control group. The study comprised five main stages: administering the proficiency test, conducting a vocabulary pretest, implementing the treatment, administering a vocabulary posttest, and administering a Content and Language Integrated Learning (CLIL) questionnaire. Both groups received CLIP/CLIL instructions over the period of eight sessions. The experimental group, however, received their instructions enriched by the assistance of co-teachers following a team model and supplemented by video-based instructions. At the end of the treatment, the vocabulary posttest and a questionnaire were used to collect the data. The results of a repeated-measures two-way ANOVA revealed that CLIP instruction delivered through co-teaching had a substantial positive effect on the electrical engineering students' vocabulary knowledge. This finding was further corroborated by the results obtained from the CLIL/CLIP questionnaire, showing the participants' positive attitude toward CLIP instructions.

Keywords: Content and Language Integrated Learning (CLIL), Co-Teaching, Professional Purposes, Vocabulary Knowledge

* *Corresponding author:* Department of Teaching English and Translation, Ka.C., Islamic Azad University, Karaj, Iran. *Email address:* kobra.tavassoli@kiau.ac.ir

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1. Introduction

Over the last few years, there has been a notable surge in research on various dimensions of Content and Language Integrated Learning (CLIL) and Content and Language Integrated Project (CLIP) instructions. According to Cenoz (2013), the principles underlying CLIL and CLIP are regarded as the same method of teaching. CLIP provides students with opportunities which are linguistically and communicatively beneficial and enables them to acquire knowledge of the subject with interest and motivation (Hidalgo & Ortega-Sánchez, 2023). This methodology concentrates on utilizing a foreign language as a key medium of instruction, facilitating students' language acquisition across different disciplines including primary, secondary, and vocational subjects. Integration of foreign languages with other curricular content involves individuals studying subject matters like history or science using a language other than students' native language. CLIL offers significant advantages for both learning a language and subjects being taught in that language (Sukardi et al., 2021). CLIP is transformative and adjustable in nature to accommodate learners' individual preferences and specific needs, criterion of language competence, and general educational achievements (Cinganotto et al., 2019). CLIL has two primary pedagogical principles including making content intelligible for learners by presenting understandable language input and inspiring learners' effective language use (Escobar Urmeneta, 2019). It has become a pivotal and promising concept for many academics, scholars, and policymakers alike (Busse, 2012). As a matter of fact, education has shifted from what is known as conventional study-abroad programs and evolved toward fostering cross-cultural understanding and providing access to a higher level of teaching and learning.

Undoubtedly, the effectiveness of CLIL/CLIP has gained prominence in the field of education and academic research, in general, and foreign language learning, in particular. As asserted by Dalton-Puffer (2007), when compared to conventional language classes, research outcomes have consistently confirmed the advancements made by the advocates of CLIL/CLIP. It is, however, noteworthy to acknowledge that the majority of CLIL/CLIP studies have predominantly focused on examining the benefits of this approach by emphasizing a single variable among a particular group of EFL learners, that

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is, in reality, a considerable deficiency has been observed in investigating the progress of professional students within CLIL classes, in comparison with non-CLIL classes. In other words, apparently, there is a significant inadequacy in attention given to comprehensively understanding the major features and key attributes of CLIL/CLIP, and in achieving a balance between language and content in various research endeavors. Filice (2020) underscore that simple integration of language and content in CLIL classes may not be constructive for learning the language or content. Further specification of the instructional course is imperative, necessitating the conduction of further experiments on CLIL with different designs (Hao et al., 2023). By the same token, Hidalgo and Ortega-Sánchez (2023) asserted that "research on CLIL does not seem to reach unanimous conclusions on the learning effects in the classroom (p. 915)."

Moreover, in the realm of English language teaching, numerous studies have concentrated on the importance of implementing co-teaching in the academic context (Cook, & Friend, 1995). However, apparently, little attention has been paid to the impact of co-teaching models in the domain of English for specific purposes (ESP). In Iran, for instance, the Ministry of Education obligates all educational decisions for the entire educational system. Investigations on co-teaching practices and their impacts on various aspects of language teaching have sunk into obscurities (Ghafourzadeh, 2018). In addition, educational institutions and schools of the country tend to avoid transitioning from traditional model of teaching to co-teaching due to their lack of knowledge and reluctance to bear additional expenses of employing two teachers in a single class.

Accordingly, the current study strives to explore the challenges faced by electrical engineers while encountering a particular content through the implementation of co-teaching and CLIP instructions. It also seeks to help the participants to comprehend the content better. By concentrating on the acquisition of technical vocabulary within the context of electrical engineering projects and co-teaching instructions, this study contributes to a broader direction and perspective within the CLIP framework.

To reach the purpose of the study, the following research question was posed:

- **RQ:** Does the application of Content and Language Integrated Project (CLIP) instructions through co-teaching among electrical engineering students significantly affect their vocabulary knowledge?

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2. Literature Review

2.1. Background of the Study

Piaget's cognitive theory (Piaget, 1963) postulated that language acquisition has a direct relation with intelligence development and implies the individual's construction of knowledge, which is encapsulated in their previous learning. In other words, the cognitive theory proposes that appropriate conditions are essential for learning and provide a rational opportunity for CLIL instruction (Van de Craen, 2007). Furthermore, the socio-constructivist theory, proposed by Vygotsky (1980), claimed that acquiring language, both mother tongue (L1) and second language (L2), is interconnected to the interaction with the environment. In this regard, both teachers and peers facilitate learning and help students to receive the zone of proximal development (ZPD). CLIL classes are the influential contexts in which scaffolding can occur through that interaction between learners and students (Van de Craen, 2007). Moreover, Krashen (1985) clarified that human being is born with a special language system; that is, language acquisition occurs naturally (Abaunza et al., 2020). Krashen (1985) believed that an individual can obtain conscious learning only by focusing on meaning in an instructional context (Zarepour Moghadam & Fatemipour, 2014). Therefore, CLIL classes provide opportunities through which students focus on the meaningful materials and bring about an environment in which learning is considered as a vehicle for instruction rather than as an ultimate purpose (Van de Craen, 2007).

2.2. Content and Language Integrated Project/Learning

CLIP/CLIL is an innovative methodology emphasizing the simultaneous integration of learning a project or language from subject areas such as sciences (Coyle et al., 2010). It has been put into practice in European educational contexts as well as in the rest of the world. This method is considered as a swift expanding phenomenon in the school system (Van de Craen, 2007). In fact, CLIL-type provision is part of the prevailing school educational programs in numerous countries all around the globe at primary and secondary levels (Xanthou, 2011; Zarepour Moghadam & Fatemipour, 2014). Nikula and Moore (2019) asserted that CLIL is an umbrella term involving a diverse array of variants based on the context wherein it is used. It is, thus, difficult to be defined at practical and theoretical levels. Generally speaking, however, scholars consented that it is an approach that merges (foreign) language development and disciplinary knowledge in an educational context. As explained by Coyle et al. (2010), CLIL refers to "a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language" (p. 1). Such being the case, content is defined as the subject matter related

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to a specific learning domain, and the medium of teaching and learning is a foreign language (Vo et al., 2023)

Evidence indicates that CLIL is applicable at all stages of language teaching, ranging from elementary school to university (Zarepour Moghadam & Fatemipour, 2014). For example, Langman (2003) carried out research based on English language learners in the middle-school classroom and observed the improvement of vocabulary retention and concepts of the content through CLIL instruction. Moreover, Xanthou (2011) employed quantitative data to investigate the effectiveness of the CLIL instructions on L2 vocabulary improvement. Three videotaped lessons were provided to observe the students' reactions to learning content and vocabulary in the environment. The results showed observation data provided opportunities for acquiring language in a meaningful context, and the lessons provided numerous opportunities to interact with teachers. Moreover, Lasagabaster and Sierra (2009) analyzed the impact of CLIL on learners' attitudes toward English as a foreign language (EFL) and the two official languages called Basque and Spanish. The study was done in the curriculum of a bilingual setting. Researchers chose 287 secondary students as participants from four different schools. The results indicated a positive attitude toward language learning through CLIL programs in general. They explained that CLIL approach provided more intense results and more meaningful chances to use the target language in comparison with the traditional model of classes. In addition, Yufrizal et al. (2017) investigated the effectiveness of project-based CLIL on the speaking skill of individuals studying scientific subject. The research was done for program lasting one semester of a two-credit English subject at mathematics with the association of 88 students. The traditional way of teaching, that is, preparing reading material followed by comprehension questions, was compared with using English as a medium of communication within the process of teaching a subject matter. The findings of the project-based CLIL English language course in mathematics, at the University of Lampung, indicated the effectiveness of implementing CLIP, in comparison with traditional methods of teaching.

2.3. Co-Teaching

Co-teaching could be a collaborative service delivery option in which two or more certified professionals, including general educated teachers and specialized educated teachers, focus on roles such as lesson planning, instruction methods, self-monitoring improvement, and assessment for a diverse or blended group of scholars. These professionals collaboratively make instructional decisions while sharing a single physical space (Friend & Cook, 2004).

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Research findings have shown the effectiveness of co-teaching on language skills. In support of this proposition, Yeganehpour and Zarfsaz (2020) and Bagheri Nevisi et al. (2023) carried out studies on the effectiveness of co-teaching on Iranian EFL learners' ability to write. In both studies, the co-teaching approach involved two teachers simultaneously teaching subjects. A traditional class was also administered as a placebo. On the basis of the comprehensive analysis of the data, the results revealed a noteworthy disparity in the writing abilities of students of the co-teaching class and the traditional one, that is, the students in the co-teaching class had a significant improvement in their writing ability, compared to those in the traditional class. Boland et al. (2019) endeavored to explore the effect of co-teaching on EFL learners' language performance and mastery on four language skills. The obtained results revealed that students who received instruction through co-teaching achieved better results, compared to those experiencing teaching methods with a single teacher. The results, in fact, highlighted that well-structured co-teaching programs creates academic settings that provide students with effective support that ultimately result in higher-quality learning. Rao and Yu (2019), also, investigated the impact of co-teaching on learners' English proficiency by recruiting a native and a non-native English teacher. Employing three co-teaching models including (1) one educator instructing while the other assisting, (2) group instructing, and (3) station instructing, the researchers observed that the students show positive inclinations toward co-teaching and attributed its effectiveness to factors such as generating pleasant linguistic atmosphere, producing enjoyable cultural environment, and creating complementary teaching behaviors.

2.4. Vocabulary Knowledge

Vocabulary knowledge involves the realm of language learning that is associated with the knowledge of words and word meanings (Tavassoli & Beyranvand, 2023). CLIL has been shown to have a significant impact on enabling students to acquire vocabulary knowledge (Dalton-Puffer, 2007). Vázquez (2014), however, suggested that no distinction is observed in vocabulary improvement in CLIL class and no-CLIL class. He also argued that such results might be due to the younger and lower-proficiency level of CLIL students. Therefore, the relation between students' knowledge of vocabulary and the method they used to memorize what they perceive from the context puts considerable demands on classroom teachers, curriculum organizers, students, and program developers (Moghadam et al., 2012).

In the case of English for Academic Purposes (EAP), Crossman (2018) studied the lexical gains of ten participants through the implementation of CLIL classes in an educational context at a Canadian

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university. The productive, receptive, and academic vocabulary knowledge of students was measured by analyzing pretest and posttest results. The outcome was unique in that it utilized a variety of tools in tandem to assess vocabulary development. These tools involve lexical measurement tools including the Gates MacGinitie Test of Reading (Vocabulary), and the Productive Academic Word Test, together with writing analysis by employing specific software to assess lexical sophistication. Each measurement revealed an improvement in vocabulary based on CLIL instructions at the time of posttest in both receptive and productive vocabulary as well as academic words.

3. Method

3.1. Participants

To achieve the research objectives, convenience sampling was used to recruit 79 participants from graduate students, including both male and female individuals ranging in age from 29 to 40. The participants were homogenized on the basis of the level of their language proficiency and their academic background, all majoring in electrical engineering in Iran. In the process of research, 19 students were excluded from the research because of obtaining extreme scores on the proficiency test. The remaining 60 graduate students were then randomly divided into two groups, the experimental and control groups. Table 1 shows the demographic information of the participants.

Table 1.

Demographic Information of the Participants

N	60 (30 in each group)
Age Range	29 to 40 years
Gender	37 Male and 23 Female
Education	Electrical Engineering (graduate level)
Nationality	Iranian

3.2. Instruments

3.2.1. Cambridge English Objective Proficiency Practice Test (CEOPPT)

To gauge the proficiency level of students regarding their vocabulary knowledge, the CEOPPT test (Cambridge University Press, 2013) was employed in both the experimental and control groups. This

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standardized test is well recognized for its ease of administration and its ability to appropriately measure and represent the fundamental language capabilities of students at the university level.

3.2.2. Lifelong Learning Program-CLIL Questionnaire

At the end of the term, in order to achieve appropriate and sufficient information regarding the effectiveness of CLIP instruction, a practical version of the students' questionnaire, provided by Lifelong Learning Program-CLIL, (European Union, 2011), was administered.

3.2.3. Pretest and Posttest

In order to assess the students' baseline vocabulary knowledge level, a vocabulary pretest with 30 multiple-choice items was administered. The test questions were selected from the book titled *Master's Degree in English for Electrical Engineering* by Maghsodi (2006), published by Azadeh.

To assess the treatment outcome and explore the efficacy of the intervention, the researchers administered a researcher-developed vocabulary posttest, which had been carefully piloted to both control and experimental groups within the domain of electrical engineering. The test included 30 items in fill-in-the-blank and multiple-choice formats, since these formats were used more in the course-books. It was specifically designed to entail the new electrical engineering words that held a high frequency of occurrence in the course-books, assuring the applicability and the relevance of the instructional content. The list of the words in the vocabulary posttest appears in the Appendix.

3.3. Materials

To enhance the vocabulary knowledge of electrical engineering students, the following materials were utilized in the course of the study:

(1) Earthing system by Pars Hassas group published by total electrical and instrument services in 2008.
(2) English for students of power, electronics, control, and telecommunications by Haghani published by Azadeh in 2017.

The selectin of these two course books was because of their availability and widespread use to teach English to electrical engineering students in Iran. The instructors taught all the different sections of these course books to teach both the content of electrical engineering and the English language to the students.

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3.4. Procedure

The researchers utilized the quasi-experimental design in this study. Initially, to ensure the homogeneity of the participants who were selected through convenience sampling, a CEOPPT test was administered to assess their proficiency level. The duration of the test was set at one hour, and the extreme scores were discarded from the study. Only the scores falling within the range of minus and plus one standard deviation from the group mean were eligible to be included in the research sample. The CEOPPT scores were utilized in determining the participants' proficiency level. Then, the participants were categorized into two groups and were randomly assigned to the experimental and control groups, each comprising 30 learners. Next, a vocabulary pretest was administered to all students, and the pretest scores determined the initial step of the study.

Subsequently, the control group received instruction using the aforementioned course book entitled *English for the Students of Power, Electronics, Control & Telecommunications Engineering* together with a project-based pamphlet. This was done without the involvement of co-teachers and video-based instructions. In contrast, the experimental group received instruction employing the same course book and pamphlet, but with the active engagement of co-teachers and the incorporation of video-based instructions. In other words, the control group was taught both books by a language teacher following the routine of usual professional purpose courses without the involvement of co-teachers, while the experimental group received the two course-books with the application of the CLIL/CLIP approach. Specifically, a team-teaching model was implemented for the co-teaching classes, involving a language teacher and a subject teacher, who was a professional electrical engineer in the building supervision industry. Before initiating the course, the two teachers prepared a timeline collaboratively and consulted about the lessons to be delivered in the class. In addition, they consulted on how to teach, how to divide each part, and what parts to include in the projects. Throughout the treatment, both the language teacher and the subject teacher emphasized the crucial aspects of the CLIL/CLIP instructions to the participants, with the objective of fostering creativity through using project-based activities and integration of content to language and vice versa.

In the experimental group, both the language and subject teacher worked collaboratively to teach English to electrical engineering students. At first, the language teacher introduced the objectives of CLIL/CLIP instruction recommended by Coyle (2007) to the students. Then, the students became familiar with various aspects of CLIL/CLIP instruction including content, communication, cognition, and culture. During the treatment sessions, through the passages in the course-books, students were

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taught technical electrical engineering words based on the integration of language and content. Besides, the subject teacher clarified the content and introduced the words introduced in the passage. The students gradually learned how to describe the information mentioned in the course-books by using the technical words. Also, they learned how to discard the ambiguity of the issues in the passages. The students were supposed to paraphrase the sentences by understanding the technical words. In addition, to implement the projects, the technical words were demonstrated to the students via videos. To focus on the cognition and communication aspects of CLIL/CLIP instruction, the students learned the electrical engineering concepts and principles via projects. The co-teachers put emphasis on the importance of questioning in the classroom, too. The students' knowledge of electrical engineering was established based on project-based activities. In fact, the projects helped them to become autonomous learners. The students were supposed to explain the technical words by utilizing their technical skills, organizational awareness, and communication skills.

On the other hand, the participants in the control group did not receive any special treatment. They were taught each unit of the course-book by the language teacher without the assistance of the co-teacher. The control group went through the routine procedures of professional purpose courses where English is taught by a language teacher to the students. The technical words of the course-books were described to the participants without the principles of CLIL/CLIP instruction.

At the end of the instructional period, which lasted for 8 weeks in each class, the vocabulary posttest was used to find out the effectiveness of the treatment. In addition, the Lifelong Learning Programme-CLIL questionnaire (European Union, 2011) was given to the students to identify the students' perceptions and opinions regarding the utilization of CLIL/CLIP instructions throughout the course. The primary objective was to ascertain the extent to which the students were satisfied with the implementation of CLIL/CLIP instruction. The ultimate decision was made by comparing and analyzing the students' performance in the pretest, posttest, and the insights gathered from the CLIL/CLIP questionnaire as well.

4. Results

4.1. Preliminary Investigations

4.1.1. Normality of the Tests

There are several assumptions to determine the normality of the test data, but a commonly used method is the One-sample Kolmogorov-Smirnov test. The Significance levels (Sig) obtained from the CEOPPT

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test for both the experimental and control groups were 0.13 and 0.9, respectively. Being larger than the conventional threshold of 0.05, these values indicate that the data distribution can be considered as normal (Pallant, 2020). This conclusion is further strengthened by the fact that the asymptotic two-tailed levels of significance for both the pretest and posttest scores of the experimental (0.58 and 0.14 respectively) and control groups (0.1 and 0.69 respectively) in vocabulary knowledge surpassed 0.05. Consequently, the parametric formulas seemed appropriate to be utilized in the study.

4.1.2. Homogeneity of the Experimental and Control Groups

One crucial point requiring verification is the participants' initial level at the outset of the study, as it determines the effectiveness of the treatment presented. In order to reach this goal, the scores of the samples were tested through the utilization of Levene's Test of Equality of Error Variance for the experimental and control groups in the CEOPPT test, pretest, and posttest. According to the outcomes of the Levenen's Test, as the level of significance is 0.972, which is larger than the 0.5 critical level of significance, it is concluded that the participants of study were not different in terms of their vocabulary knowledge at the onset of the study, and the assumption of homogeneity of variance was met. Furthermore, the sig value for the T-test for equality of the means is 0.623 exceeding the value of 0.05. Hence, it could be inferred that no statistically significant difference can be observed between the mean scores of the two groups in terms of their vocabulary knowledge. In addition, the significance values for the pretest and posttest on vocabulary knowledge (0.7, and 0.9) were greater than the research confidence interval of 0.05. Thus, the equal variance assumption was satisfied, affirming that the scores of both the experimental and control groups in pretest and posttest were homogeneous.

4.1.3. Reliability of the Test

The reliability of a test is a fundamental aspect that assesses its ability to measure the construct consistency. It is important to note that test reliability is closely associated with its validity (Tavakol et al., 2008). In the present study, the reliability of the tests utilized was estimated using Cronbach's Alpha. The calculated Cronbach's Alpha values for the pretest were 0.838 and 0.812, indicating a high reliability index for the experimental and control groups. Furthermore, the consideration of Cronbach's Alpha values of $\alpha = 0.63$ and $\alpha = 0.61$, for the posttest of the experimental and control groups, demonstrate an acceptable level of reliability and internal consistency.

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4.1.4. Mauchly's Sphiricity

Repeated measures ANOVA requires the assumption of Sphericity, which is tested using Mauchly's test. The Sig-value was 0.01. Sphericity is considered to be met if Sig value is greater than 0.05. However, in this study, the Sphiricity assumption was not met. Therefore, the researchers were obliged to make some adjustments, such as using Greenhouse-Geisser and Huynh-Feldt to compensate for this violation.

4.2. Investigating the Research Question

After confirming that the preliminary assumptions of the tests were met in this study, the researchers proceeded with the analyses necessary to answer the research question of the study.

First, the descriptive statistics of the scores of the pretest and posttest of the two groups (Table 2) revealed that their mean scores had only minor variations and altered on a small value.

Table 2.

Descriptive Statistics of the Pretest and Posttest of the Two Groups

	Pretest	Posttest
Control Group (*N*=30)		
Mean	15.48	17.76
SD	3.18	3.25
Experimental Group (*N*=30)		
Mean	15.60	19.17
SD	4.46	4.84

As observed in Table 1, there is an increase in the mean scores of the experimental group (from 15.60 to 19.17) while there is less increase in the mean scores of the control group (from 15.48 to 17.76). The mean scores indicate the higher improvement of the participants in the experimental group from the pretest to the posttest, suggesting that the strategies of CLIP/CLIL instruction with the assistance of the co-teachers enhanced the participants' performance in the posttest.

Second, to assess the improvement of the participants in each group, the within-subject and between-subject effects of the pretest and posttest were calculated, which are represented in Table 3.

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Table 3.

Test of Within-Subject and Between-Subject Effects on the Pretest and Posttest for the Control and Experimental Groups on Vocabulary Knowledge

Source	SS[a]	Tests of Within-Subjects Effects				partial η^2
		df	MS	F	*p*	
Time						
Sphiricity Assumed	538.844	2	269.422	437.581	.000*	0.795
Green-house Geisser	538.844	1.758	306.430	437.581	.000*	0.795
Huynh-Feldt	538.844	1.840	292.785	437.581	.000*	0.795
		Tests of Between-Subjects Effects				
Intercept	49833.472	1	49833.472	1078.678	.000*	0.960
Class	34.672	1	34.672	0.751	0.039*	0.71
Time* Class						
Sphiricity Assumed	5.733	2	2.867	4.656	.011*	0.118
Green-house Geisser	5.733	1.758	3.260	4.656	.015*	0.118
Huynh-Feldt	5.733	1.840	3.115	4.656	.014*	0.118

[a] SS Calculated using SPSS default (Type III).

The term “Time”, used to denote the first row, refers to the time interval between the pretest and posttest of both the experimental and control groups. The significance value of time is .00, indicating that the Within-subject effects results demonstrate a high impact of the treatment on the improvement of the participants’ vocabulary knowledge in both groups. In other words, both groups showed a significant amount of progress from pretest to posttest. However, the indicated partial eta squared with the value of 0.795 for the first row indicates a medium effect size.

The term “Class”, used in the second row, indicates the difference in the performance of the experimental and control groups. This difference was further confirmed by the test outcomes, which showed a significant difference in the posttest scores of the two groups. Specifically, the significance value is 0.039, which is smaller than the critical value of 0.05. Moreover, the amount of this difference was medium, as indicated by the partial eta squared of 0.71, representing a medium effect size. In other words, the effect of the treatment provided in the two groups was not the same.

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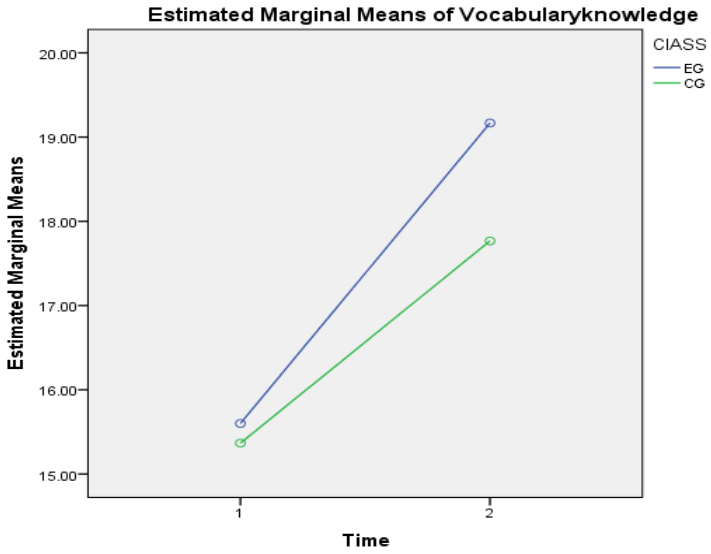
Ultimately, the last row labeled as "Time* Class", is dedicated to examining the effect of time and class interaction. The significance value of the interaction of time and class is 0.015, which is smaller than 0.05, indicating a significant difference in performance between the two groups from pretest to posttest. This result is considered the most crucial piece of information. Therefore, it can be concluded the CLIP and co-teaching instructions can be utilized to enhance electrical engineering students' vocabulary knowledge in language learning. Upon closer examination of the posttest scores of the two groups in Table 1, it becomes evident that the CLIP instruction through co-teaching aided the members of the experimental group in performing better in comparison with the control group. Finally, the outcomes are further analyzed in Figure 1 for a more tangible representation.

Figure 1.

Difference between the Pretest and Posttest of Students' Vocabulary Knowledge



To clarify this figure, it should be noted that the factor of time in both the experimental and control groups, from pretest to posttest, is represented on the horizontal axis. The slope of the experimental group (the left line), however, is considerably steeper, compared to the slope of the control group (the right line). This figure depicts that the improvement of the two groups was not equal. In fact, the students in the experimental group outperformed in the posttest, and the descriptive statistics further highlight the superiority of the treatment in the experimental group. While the two groups performed

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relatively similarly on the pretest, it is evident that the experimental group significantly performed better than the control group in the posttest.

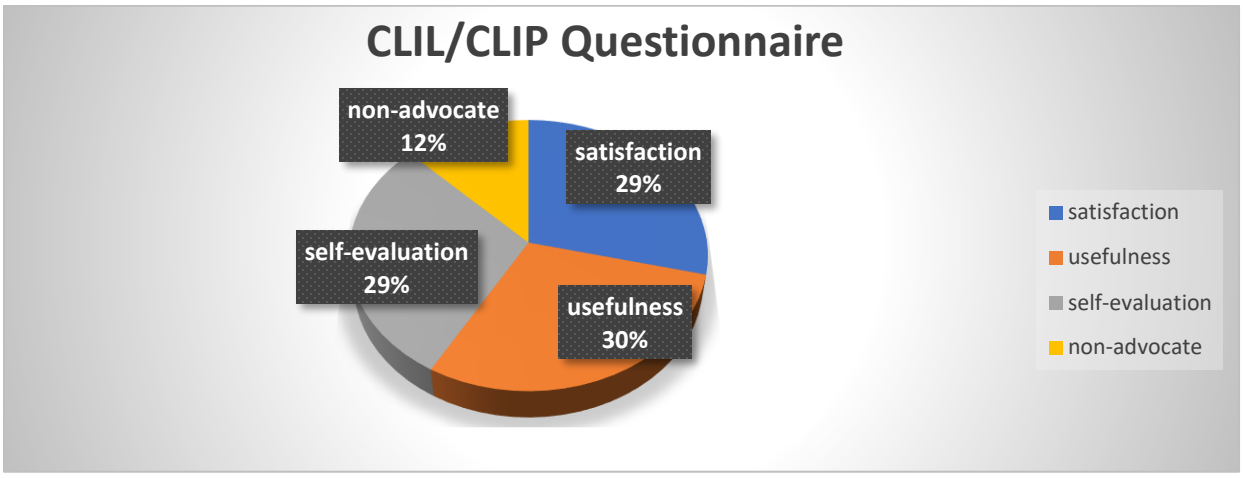
4.3. Investigation of the Questionnaire

At the end of the term, to gather appropriate and sufficient information about the effectiveness of CLIP instruction, a practical version of the students' questionnaire provided by Lifelong Learning Program-CLIL (European Union, 2011), was administered to the experimental group. The Lifelong Learning Program-CLIL questionnaire consists of eight major questions aimed at assessing students' opinion on the CLIP experience. Firstly, the questions of the questionnaire were categorized into three main parts: usefulness, self-evaluation, and satisfaction. The usefulness part includes 5 questions, further divided into 29 sub-questions. The self-evaluation part comprises 3 questions, subdivided into 7 sub-questions, while the satisfaction part consists of one question.

The purpose of utilizing this questionnaire was to consider the participants' opinions regarding the teachers' attitudes, actions, experiences, and expectations toward the new approach. This was done to account for and analyze the successful implementation of content and language integrated learning/project in the classroom.

Figure 2.

Percentage of Participants' Answers to the CLIL/CLIP Questionnaire



According to Figure 2, the percentage of participants who were advocates of the CLIL/CLIP class was much higher (88%), compared to non-advocate participants (12%). The results of the questionnaire

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indicated that the implementation of CLIP instruction through co-teaching stimulated the willingness of electrical engineering students to improve their vocabulary knowledge. Based on Figure 2, 29% of the participants were satisfied with the application of CLIP instruction in their classes, 30% found this technique useful, and 29% could self-evaluate themselves based on it. According to European Union (2011), the complexity of integrating language and subject in such classes may reduce students' satisfaction, even though many studies, as observed, have shown a positive insight into different CLIL experiences. Thus, the 12% dissatisfaction was attributed to the complexity of instruction, while a large percentage of students (i.e., 88%) expressed a positive inclination toward pursuing the instruction and acknowledged the usefulness of the CLIL experience.

5. Discussion

After conducting statistical analysis, the findings of the study demonstrated the rejection of the null hypothesis since it was observed that the implementation of CLIP instruction with the assistance of co-teachers has remarkably affected the participants' vocabulary knowledge. To put it differently, in comparison to the control group, the experimental group indicated substantially superior performance at the end of the study. Moreover, to further gauge the effectiveness of the treatment, a questionnaire was given to the students to assess their level of satisfaction with using CLIP instruction in the course. The results of the questionnaire confirmed the effectiveness of the CLIP instruction through co-teaching, as it took into account the students' perspectives and opinions. Consequently, it can be concluded that "CLIP instruction through co-teaching implementation has a significant effect on vocabulary knowledge of electrical engineering students".

In brief, the utilization of CLIP instruction has been observed to exert a substantial influence on enhancing the electrical engineering students' vocabulary knowledge. This outcome aligns with the outcomes of the research done by Zarepour Moghadam and Fatemipour (2014), who similarly demonstrated the positive impact of CLIL instructions on the advancement of EFL learners' vocabulary proficiency. The outcomes of data gathered from the students attending to course and the ones attending ordinary classes, who had no exposure to the CLIL treatment, showed that the students using CLIL instructions exhibited notably higher vocabulary development and retention, in comparison with their counterparts in ordinary classes. Such performance could primarily be attributed to their engagement in the CLIL program. In a study conducted by Memon et al. (2023), the researchers investigated the level of students' vocabulary acquisition through CLIL methodology at a military institute and observed that

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by enforcing the learners' interest in the text, CLIL led to a better understanding of vocabulary and its acquisition.

As observed in the study, the group that received CLIL instruction through co-teaching demonstrated superior performance in their vocabulary test, in comparison with the other group. Such findings align with the results of the study conducted by Kamalmanesh (2015). Regarding the association between vocabulary learning strategies and co-teaching classes, Kamalmanesh's study confirmed the effectiveness of two models of co-teaching, called parallel and team teaching. The study aimed to evaluate the improvement of EFL learners' vocabulary achievement in comparison with traditional teaching. The analysis of collected data revealed that both team teaching and parallel teaching were effective in enhancing EFL learners' vocabulary achievement. It is noteworthy to maintain that the mean scores indicated team teaching was higher when compared to parallel teaching. Such findings can be justified by taking various points into account. Co-teaching can generate a classroom environment in which students are exposed to different teaching styles, aiding them in gasping and retaining vocabulary more effectively and efficiently. Moreover, co-teaching is collaborative and interactive in nature. This aspect of co-teaching allows students to engage in dynamic discussions, receive consistent feedback, and actively participate in the learning process.

6. Conclusion

CLIL methodology seems to play a pivotal role as a catalyst for educational transformation and professional advancement in both school and academic contexts. By incorporating CLIL/CLIP instruction, a supportive atmosphere is nurtured, facilitating the adaptation and dispersion of innovative, learner-centered, and cognitively stimulating teaching methodologies. In addition, it encourages the cultivation of a culture of collaboration among teachers and educators (Barrios & Dolores Milla Lara, 2018). Integration of language with curricular content generates opportunities wherein learners' cognitive skills and creative thinking enhance (Hidalgo & Ortega-Sánchez, 2023). Norhasanah and Setiawan (2023) found CLIL beneficial and effective to teach English and maintained that it not only boosts students' English language skills but also expands their insights globally. Bower et al. (2022) also asserted that applying CLIL in English language teaching enables students to enhance their language competence and cultivate their viewpoints, awareness, sensitivity, and global insights. Khoiriyah and Soeparto (2022) exclaimed that integrating content course and language practices empowers educators to equip students with skills required to their academic lives and professional endeavors. More specifically, the present

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study attempted to explore the effect of implementing CLIP through co-teaching on electrical engineering students' vocabulary knowledge. Based on the results presented in the research, it can be asserted that the utilization of pretest and posttest assessments together with the comprehensive statistical analyses and graphical representations provide compelling evidence regarding the beneficial effect of implementing CLIP instruction through co-teaching on students' vocabulary knowledge in the given context. Accordingly, it can be concluded that "the application of content and language integrated project (CLIP) instructions through co-teaching among electrical engineering students significantly affects their vocabulary knowledge".

CLIP instruction emerges as a valuable avenue for students to bolster their vocabulary knowledge. The results of this study offer valuable insights into the efficacy of learning vocabulary through applying Coyle's (2007) suggestions and recommendations in the classroom. Furthermore, the implementation of co-teaching techniques furnishes the class by creating a cooperative and supportive learning environment wherein teachers may constructively collaborate and offer practical assistance during the instructional process. Moreover, the potential of CLIP instructions to improve professional students' vocabulary knowledge is evident from the results of the study. The findings provide compelling evidence for valuing learning vocabulary in an appropriate context for professional purposes. With respect to teachers, as they bear an important responsibility in the classroom, it is crucially influential to shift away from traditional-oriented instructions toward a more flexible approach of teaching which encourages students to learn in a real context (Kabilan, 2000).

The primary objective of this study arises from the concerns that CLIL, as a dual-focused approach, necessitates the assessment of students' performance not only in content but also in language domains. This study focused on evaluating electrical engineering students' vocabulary knowledge. It is crucial for testers to be aware of the fact that the content should only be tested in a foreign language if it was taught in the foreign language (Massler et al., 2014). Adhering to this principle is important to guarantee an efficient and accurate assessment by creating a fruitful balance between the content and language in L1 and L2. Such a practice, however, may cause some challenges for ESP teachers, especially in academic contexts. To ensure the effectiveness of the instructional materials, the incorporation of acceptable materials becomes vital and necessary. The process of materials development encompasses various practical tasks including the production, assessment, adaptation, and extraction of materials designed to promote language acquisition and development (Farhady et al., 2018). Based on the results

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of this study, materials developers are encouraged to prioritize CLIP instruction and co-teaching implementation as an effective means to enhance the students' vocabulary knowledge.

It is necessary to bear in mind that the outcomes of the current research can be interpreted with caution as the number of individuals participated was limited. As it was mentioned above, this study concentrated on the electrical engineering students' vocabulary knowledge. The inherent features of other subjects and their related linguistic aspects may lead to different results. Moreover, an effective assessment, as Massler (2011) asserted, should reflect the teaching practice while concentrating on the content and the instructional approach employed in delivering the content. Accordingly, there is a need for more insights to be obtained regarding the connection between educators' content knowledge, subject-specific language, the strategies they utilized in the class, the assessment procedures they employed, and the way all these factors are interwoven and reflected in the students' performance. Furthermore, living in the world that is occupied by gadgets and devices here and everywhere necessitates academics and scholars to delve into digital technology in their classes. Establishing a multimodal learning environment, technology may facilitate generating CLIL materials and therefore stimulate the students and expedite their learning process.

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Appendix

List of the Words Used in the Vocabulary Posttest (in Alphabetic Order)

Associated, Avoid, Capacitive, Circuit, Communication, Composed, Conducted, Connection, Contribute, Converter, Dimension, Divided, Enlarge, Evasion, Fabricated, Inductor, Leakage, Limit, Magnitude, Parallel, Permissible, Prohibited, Protect, Reduce, Regulate, Resonant, Screwed, Transformer, Tuned, Twisted

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