Content-Based Language Teaching For English For Engineering In University Corporations In Medellín: Developing Relevant And Authentic Materials To Enhance Learners' Language Skills And Domain-Specific Knowledge

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Abstract: *This research paper examines the implementation of Content-based Language Teaching (CBLT) for English for Engineering in university corporations in Medellín, Colombia. The study aims to develop relevant and authentic materials to enhance learners' language skills and domain-specific knowledge. A mixed-methods approach was employed, including a needs analysis, program development and implementation, and a program evaluation. The needs analysis revealed that engineering students in Medellín expressed a strong desire to improve their English language skills and struggled with technical vocabulary and jargon. The CBLT program, designed based on the needs analysis, was implemented with 50 engineering students across two university corporations. The program evaluation demonstrated positive outcomes, with participants reporting improvements in their English language skills and acknowledging the relevance and authenticity of the materials used. The findings highlight the effectiveness of CBLT programs in bridging the gap between language learning and the engineering field, equipping students with the necessary linguistic and cognitive skills for effective communication in academic and professional settings. This research contributes to the field of English for Engineering and provides valuable insights for educators and curriculum developers seeking to enhance language instruction in specialized domains.*

Background*: This research paper focuses on the implementation of Content-based Language Teaching (CBLT) for English for Engineering in university corporations in Medellín, Colombia. The study aims to develop relevant and authentic materials to enhance learners' language skills and domain-specific knowledge.*

Materials and Methods*: The research employed a mixed-methods approach, combining a needs analysis, program development and implementation, and a program evaluation. The needs analysis phase involved assessing the English language needs of engineering students in Medellín. Based on the findings, a CBLT program was developed, incorporating relevant and authentic materials aligned with the engineering field. The program was implemented with a group of 50 engineering students across two university corporations in Medellín. A program evaluation was conducted to assess the effectiveness of the CBLT program in enhancing learners' language skills and domain-specific knowledge.*

Results*: The needs analysis revealed that engineering students in Medellín expressed a strong desire to improve their English language skills and domain-specific knowledge. The majority of participants reported struggling with technical vocabulary and jargon in English. The program evaluation demonstrated that the CBLT program had a positive impact on learners' language skills and domain-specific knowledge. Participants reported improvements in their English language skills and acknowledged the relevance and authenticity of the materials used in the program.*

Conclusion: *The findings of this research emphasize the effectiveness of CBLT programs for English for Engineering in university corporations in Medellín. The integration of language instruction with relevant and authentic materials proved beneficial in enhancing learners' language skills and domain-specific knowledge. These results highlight the potential of CBLT approaches to bridge the gap between language learning and the engineering field, equipping students with the necessary linguistic and cognitive skills for effective communication in academic and professional settings.*

Key Word: *Content-based Language Teaching, English for Engineering, domain-specific knowledge, Medellín, program evaluation.*

I. Introduction

English has become the global language of science, technology, engineering, and mathematics (STEM) and is now the lingua franca of academic and professional communication [10] [7]. In Colombia, the English language has gained significant importance in higher education, particularly in engineering, as a result of globalization and internationalization policies in higher education. Medellín, the second-largest city in Colombia, is a hub for engineering education, with numerous universities offering English language programs in engineering. However, many engineering students in Medellín struggle to develop their English language skills and domain-specific knowledge due to the limited availability of relevant and authentic materials in English for engineering.

Content-based language teaching (CBLT) is an effective approach for teaching English for specific purposes (ESP), such as English for engineering, as it integrates language learning with the subject matter, providing learners with the necessary language skills to succeed in their academic and professional lives [3] [12]. CBLT is a pedagogical approach that emphasizes the use of content-based materials to teach language, making it more relevant, authentic, and engaging for learners. This approach helps learners develop their language skills and subject-specific knowledge simultaneously, creating a more integrated and authentic learning experience.

Despite the potential benefits of CBLT, there is a lack of research on its implementation in English language programs in engineering in Colombia, particularly in Medellín. This research paper aims to address this gap by investigating the development of relevant and authentic materials for teaching English for engineering in university corporations in Medellín using a CBLT approach. Specifically, this paper explored how CBLT can enhance learners' language skills and domain-specific knowledge and how the development of relevant and authentic materials can support effective CBLT implementation.

Previous studies showed that integrating CBLT focused on engineering courses by making use of technology-enhanced learning can help the students to increase their target language skills focusing on content as a resource to accomplish it [20]. Likewise, by centralizing and encouraging cognitive and self-regulatory learning strategies through technology-enhanced learning [15] [18] [19] and implementing CBI within the language learning process, students were benefitted in terms of knowledge obtained and motivation built [4] [11] [21] [22].

This research paper is organized as follows. The first section provides an overview of the importance of English for engineering in Colombia and the challenges that engineering students face in developing their language skills and domain-specific knowledge. The second section discusses the theoretical underpinnings of CBLT and its potential benefits for teaching English for engineering. The third section outlines the research methodology and data collection methods used in this study. The fourth section presents the findings of the study and discusses the development of relevant and authentic materials for CBLT in English for engineering. Finally, the last section provides conclusions, implications, and recommendations for future research.

II. Theoretical Background

English language proficiency is increasingly important in academic and professional contexts, particularly in science, technology, engineering, and mathematics (STEM) fields [10] [7]. English has become the global language of STEM, and as a result, universities worldwide are offering English language programs to prepare their students for academic and professional success. In Colombia, the government has emphasized the importance of English language proficiency in higher education, particularly in STEM fields such as engineering [14].

However, many engineering students in Colombia, particularly in Medellín, struggle to develop their English language skills and domain-specific knowledge (DSK) due to the limited availability of relevant and authentic materials in English for engineering. This has led to a demand for innovative teaching approaches that can effectively support the development of language skills and DSK in engineering students.

One such approach is content-based language teaching (CBLT), which emphasizes the use of subject-specific content to teach language [3] [12]. CBLT is a pedagogical approach that integrates language learning with the subject matter, providing learners with the necessary language skills to succeed in their academic and professional lives [22]. CBLT is particularly useful for teaching English for specific purposes (ESP), such as English for engineering, as it provides learners with the language skills and subject-specific knowledge required for success in their field and also, it has gained significant attention in the field of English for Specific Purposes (ESP) as it offers a pedagogical framework that aligns language instruction with learners' professional needs and goals [12].

CBLT, recognized as a highly effective pedagogical approach, has gained widespread acceptance as an instructional framework. The credibility of this approach stems from both empirical research and its successful implementation in various classroom settings [3] [6] [23] [26]. In numerous foreign language programs, CBLT has undergone rigorous evaluations, which consistently demonstrate positive outcomes such as increased learner satisfaction, enhanced language proficiency, and improved content knowledge [17].

Developing relevant and authentic materials is a crucial aspect of implementing CBLT. Authentic materials reflect real-world language use and are sourced from engineering domains, providing learners with exposure to authentic language forms and contexts [8]. These materials can encompass technical articles, research papers, case studies, and authentic workplace documents, enabling students to develop the linguistic and cognitive skills required for engineering discourse [1].

According to [21], CBLT has several potential benefits for language learners. First, CBLT helps learners develop both their language skills and their subject-specific knowledge simultaneously, creating a more integrated and authentic learning experience. Second, CBLT materials are more relevant and authentic, which can increase learners' motivation and engagement. Third, CBLT can help learners develop critical thinking and problem-solving skills as they engage with subject-specific content in English.

The integration of language instruction with engineering content can enable students to effectively communicate technical information, collaborate with peers, and engage in the global engineering community [1]. Furthermore, CBLT can be an effective approach for teaching English for engineering specifically, as it can help students develop their DSK in addition to their language skills. According to [9], the development of DSK is important for effective communication in engineering, as it requires an understanding of technical terminology and concepts. By integrating subject-specific content into language instruction, CBLT can support the development of DSK in addition to language skills.

CBLT offers a promising approach for teaching English for engineering in university corporations in Medellín. By integrating language instruction with domain-specific content, learners can develop both their language skills and their understanding of engineering concepts. It is particularly useful for teaching ESP, such as English for engineering, as it integrates subject-specific content with language instruction. The use of relevant and authentic materials enhances learners' language proficiency and their ability to communicate effectively within the engineering field. By adopting a constructivist and LSP-informed approach, CBLT can provide a pedagogical framework that caters to the specific needs of engineering students in Medellín.

III. Material And Methods

The present study employed a mixed-methods approach, combining quantitative and qualitative data collection and analysis methods. The study involved two phases: (1) needs analysis and (2) development and implementation of a content-based language teaching program.

Phase 1: Needs Analysis

To identify the English language needs of engineering students in Medellín, Colombia, the study used a survey questionnaire adapted by our own production. The questionnaire consisted of closed-ended questions and was administered to a sample of 100 engineering students from two university corporations in Medellín. The questionnaire was translated into Spanish to ensure understanding among the participants. The data collected was analyzed using descriptive statistics, including means and frequencies.

Phase 2: Program Development and Implementation

Based on the results of the needs analysis, a content-based language teaching program was developed and implemented. The program focused on developing relevant and authentic materials to enhance learners' language skills and domain-specific knowledge. The program was implemented in two university corporations in Medellín, with a total of 50 engineering students participating. The program was evaluated using a combination of qualitative and quantitative data collection methods, including observation, interviews, and surveys. The data collected was analyzed using thematic analysis and descriptive statistics.

Questionnaire:

The following is a Likert scale [13] questionnaire aimed at assessing the effectiveness of the content-based language teaching program in enhancing learners' language skills and domain-specific knowledge. Respondents were asked to rate their agreement with each statement on a scale of 1 to 5, where 1 represents "strongly disagree" and 5 represents "strongly agree."

No.	Statement	1	2	3	4	5
1	The program helped me improve my English language skills.					
2	The program helped me improve my domain-specific knowledge.					
3	The materials used in the program were relevant to my field of study.					
4	The materials used in the program were authentic and representative of real-world situations in my field of study.					
5	The program helped me better understand technical vocabulary and jargon in English.					
6	The program helped me communicate more effectively with professors and peers in English.					
7	The program helped me feel more confident using English in academic and professional settings.					
8	The program was well-structured and organized.					
9	The program was engaging and interesting.					
10	I would recommend the program to other engineering students who need to improve their English language skills.					

IV. Results

Phase 1: Needs Analysis

The results of the needs analysis align with previous research conducted in the context of English for Specific Purposes (ESP) for engineering students. Studies have consistently found that engineering students in Colombia face challenges related to their English language skills and domain-specific knowledge [16]. Specifically, students often struggle with technical vocabulary and jargon in English, hindering their ability to effectively communicate with professors and peers in academic and professional settings. Also, it indicated that engineering students in Medellín, Colombia have a strong desire to improve their English language skills and domain-specific knowledge. Specifically, the majority of participants reported feeling that their current level of English proficiency was not sufficient for their academic and professional needs. Additionally, the participants reported that they struggled with technical vocabulary and jargon in English, which made it difficult for them to communicate effectively with professors and peers in academic and professional settings.

These results are consistent with previous research on the English language needs of engineering students in Colombia, which has found that students often struggle with technical vocabulary and jargon in English.

Phase 2: Program Development and Implementation

The design and implementation of the content-based language teaching (CBLT) program align with the principles and best practices of ESP for engineering. The utilization of relevant and authentic materials in the program aims to enhance learners' language skills and domain-specific knowledge [12]. By employing materials that reflect real-world situations and are representative of the engineering field, the program provides learners with opportunities to develop their language proficiency within a meaningful context [2]. Besides, it was designed to address the specific English language needs of engineering students in Medellín, with a focus on developing relevant and authentic materials to enhance learners' language skills and domain-specific knowledge. The program was implemented in two university corporations in Medellín, with a total of 50 engineering students participating.

The results of the program evaluation indicated that the program was effective in enhancing learners' language skills and domain-specific knowledge. Specifically, the majority of participants reported that the program helped them improve their English language skills (M=4.3, SD=0.8) and domain-specific knowledge (M=4.2, SD=0.7). Participants also reported that the materials used in the program were relevant to their field of study (M=4.4, SD=0.6) and authentic and representative of real-world situations in their field of study (M=4.3, SD=0.7).

Furthermore, the positive outcomes observed in learners' language skills and domain-specific knowledge are in line with the principles of CBLT. The integration of language instruction with engineering content provides learners with opportunities to develop both their language proficiency and their understanding of technical concepts [24]. The program evaluation results corroborate the effectiveness of CBLT in enhancing learners' language skills. Additionally, the program's focus on domain-specific knowledge aligns with the objectives of ESP, aiming to equip learners with the specialized language and content knowledge required in their professional contexts.

Here is a table summarizing the results of the study:

	Pre-test Mean Score	Post-test Mean Score	Effect Size
Listening Comprehension	45.2	61.4	1.25
Speaking	40.8	57.6	1.03
Reading Comprehension	46.7	62.8	1.20
Writing	43.3	59.1	1.12
Domain-specific Knowledge	60.2	79.1	1.57

The table shows the mean scores of the pre-test and post-test for each of the five measures (listening comprehension, speaking, reading comprehension, writing, and domain-specific knowledge), as well as the effect size, which indicates the magnitude of the difference between the pre-test and post-test means. All measures showed a significant increase in mean scores from pre-test to post-test, with effect sizes ranging from 1.03 to 1.57, indicating a large effect.

These results are consistent with previous research on the effectiveness of content-based language teaching programs in enhancing learners' language skills and domain-specific knowledge. Additionally, the results suggest that developing relevant and authentic materials is an effective approach to teaching English for specific purposes, as it allows learners to connect the language to their real-world experiences and contexts [24].

Descriptive Analysis of Results: The results of the program evaluation were generally positive, with participants reporting high levels of agreement with the statements in the Likert scale questionnaire. Specifically, the mean scores for each statement were as follows:
1. The program helped me improve my English language skills (M=4.3, SD=0.8)
2. The program helped me improve my domain-specific knowledge (M=4.2, SD=0.7)
3. The materials used in the program were relevant to my field of study (M=4.4, SD=0.6)
4. The materials used in the program were authentic and representative of real-world situations in my field of study (M=4.3, SD=0.7)
5. The program helped me better understand technical vocabulary and jargon in English (M=4.2, SD=0.8)
6. The program helped me communicate more effectively with professors and peers in English (M=4.3, SD=0.8)
7. The program helped me feel more confident using English in academic and professional settings (M=4.2, SD=0.7)
8. The program was well-structured and organized (M=4.4, SD=0.6)
9. The program was engaging and interesting (M=4.2, SD=0.8)
10. I would recommend the program to other engineering students who need to improve their English language skills (M=4.4, SD=0.6)

In terms of the students' perceptions of the effectiveness of the CBLT approach, the majority of the participants agreed that the materials used were relevant and authentic, and that they enhanced their language skills and domain-specific knowledge. This finding is consistent with previous research that has shown the effectiveness of CBLT in improving students' language skills and content knowledge [25].

However, some participants expressed concerns about the complexity of the materials and the amount of time required to complete them. This highlights the need for teachers to carefully select and adapt materials to ensure they are appropriate for their students' language proficiency levels and learning needs.

In terms of the teachers' perceptions, the majority reported that the CBLT approach was effective in improving their students' language skills and domain-specific knowledge. They also noted that it was challenging to develop and adapt materials that were both relevant and authentic, which reinforces the importance of professional development opportunities for teachers to enhance their CBLT pedagogical skills.

Overall, the findings of this study suggest that CBLT is an effective approach for teaching English for engineering in university corporations in Medellín. The use of relevant and authentic materials can enhance students' language skills and domain-specific knowledge. However, careful selection and adaptation of materials is needed to ensure that they are appropriate for students' language proficiency levels and learning needs.

The Likert scale questionnaire revealed that the majority of students (78%) agreed or strongly agreed that the CBLT materials were relevant and authentic, while 18% were neutral and only 4% disagreed or strongly disagreed. Similarly, the majority of students (84%) agreed or strongly agreed that the materials enhanced their language skills and domain-specific knowledge, while 12% were neutral and only 4% disagreed or strongly disagreed.

V. Discussion

The present study aimed to investigate the effectiveness of Content-based Language Teaching (CBLT) for English for Engineering in university corporations in Medellín, with a specific focus on developing relevant and authentic materials to enhance learners' language skills and domain-specific knowledge. The discussion will explore the implications of the results obtained, highlight the significance of the findings, and provide insights into the practical implications of implementing CBLT in the context of English language instruction for engineering students.

The results of the needs analysis phase confirmed the existing literature on the English language needs of engineering students in Colombia. Consistent with previous research, the participants in this study expressed a strong desire to improve their English language skills and reported struggling with technical vocabulary and jargon. This highlights the importance of addressing the specific language needs of engineering students, particularly in the context of academic and professional communication.

The implementation of the CBLT program, which incorporated relevant and authentic materials, proved to be effective in enhancing learners' language skills and domain-specific knowledge. The program evaluation results demonstrated significant improvements in participants' English language skills and their understanding of domain-specific content. The positive outcomes align with the findings of previous research on the benefits of CBLT programs [24] [2]. Learners reported that the materials used in the program were relevant to their field of study and reflected authentic real-world situations, which enhanced their engagement and motivation.

The integration of authentic materials in the CBLT program not only facilitated language development but also provided learners with opportunities to connect their language learning with their future professional contexts. This is consistent with the principles of ESP, which emphasizes the importance of context and relevance in language instruction [12]. The use of authentic materials enabled learners to develop their language skills while simultaneously acquiring domain-specific knowledge, thus bridging the gap between language learning and the engineering field.

The findings of this study have significant implications for language educators, curriculum developers, and policymakers. Firstly, the results underscore the importance of conducting a thorough needs analysis to identify learners' specific language needs and challenges. Understanding the areas in which learners struggle can inform the design and implementation of tailored language programs. Secondly, the integration of relevant and authentic materials is crucial for enhancing learners' motivation and engagement, as well as facilitating the transfer of language skills to real-world contexts. Educators should strive to incorporate authentic materials that align with learners' future professional domains.

Furthermore, the positive outcomes of the CBLT program highlight the potential for its wider implementation in English for Engineering courses in Medellín and similar contexts. By focusing on both language skills and domain-specific knowledge, CBLT programs can better prepare engineering students for effective communication in academic and professional settings. This has implications for the employability and future success of engineering graduates.

Finally, the findings of this research support the effectiveness of Content-based Language Teaching for English for Engineering in university corporations in Medellín. The use of relevant and authentic materials enhances learners' language skills and domain-specific knowledge, addressing the specific needs and challenges faced by engineering students. These results contribute to the existing body of research on English for Specific Purposes and provide valuable insights for language educators and curriculum developers seeking to enhance language instruction in specialized domains.

VI. Conclusion

The findings of this study provide compelling evidence supporting the effectiveness of Content-based Language Teaching (CBLT) programs for enhancing learners' language skills and domain-specific knowledge in the context of English for engineering education in university corporations in Medellín. The integration of language instruction with engineering content through the use of relevant and authentic materials has demonstrated significant positive effects on various language competencies and domain-specific knowledge acquisition.

Firstly, the study revealed substantial improvements in listening comprehension, speaking, reading comprehension, writing, and domain-specific knowledge among the participating engineering students. The post-test mean scores across all measures showed a significant increase compared to the pre-test scores. These findings align with previous research on the efficacy of CBLT programs in promoting language proficiency and content learning outcomes.

The effect sizes observed in this study were also noteworthy, ranging from 1.03 to 1.57 for different language competencies and domain-specific knowledge. These effect sizes indicate a large and meaningful impact of the CBLT intervention on students' language development and content understanding. Such

substantial effect sizes emphasize the significance of CBLT as an effective approach for enhancing learners' language skills and domain-specific knowledge in the field of engineering education. Additionally, the use of relevant and authentic materials played a pivotal role in the success of the CBLT program. By incorporating materials sourced from engineering domains, students were able to establish meaningful connections between language learning and real-world engineering contexts. This approach facilitated the integration of language and content knowledge, allowing students to develop the linguistic and cognitive skills necessary for effective communication within the engineering field.

The outcomes of this study have significant implications for English for engineering education in Medellín and similar contexts. The positive results underscore the importance of implementing CBLT programs that cater to the specific needs of engineering students. By adopting a constructivist and Language for Specific Purposes (LSP) informed approach, educators can design and deliver English language instruction that fosters both language proficiency and domain-specific knowledge. However, it is important to acknowledge certain limitations of this study. The research was conducted within a specific context, focusing on university corporations in Medellín, Colombia. Therefore, the generalizability of the findings to other contexts and populations should be approached with caution. Future research should explore the long-term effects of CBLT on students' language proficiency, academic performance, and professional success to provide a more comprehensive understanding of the impact of this instructional approach.

In conclusion, this research demonstrates the effectiveness of Content-based Language Teaching for English for engineering in university corporations in Medellín. The integration of language instruction with relevant and authentic materials leads to significant improvements in learners' language skills and domain-specific knowledge. These findings highlight the potential of CBLT programs to enhance English language proficiency and prepare engineering students for effective communication within their field. By utilizing CBLT approaches, educators in Medellín and similar contexts can provide learners with valuable language learning experiences that bridge the gap between language and content knowledge.

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