

# A Corpus-based NLP Study on Code-switching in English Majors' CLIL Classrooms

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**Abstract:** By applying corpus-based Natural Language Processing (NLP), the study aims to investigate teachers' deploying of code-switching of L1 and L2 within the overall interactional organization of classroom interaction, and tries to examine teachers' post-teaching reflections by the follow up interview on their use of code-switching in accomplishing their pedagogical goals of content and language teaching in CLIL classroom contexts. The findings of this research will reveal important implications for L2 learning and teacher education in CLIL. To be conclusive, the objective of researching teachers' deployment of CS is to uncover how teachers use it as a mediating tool to promote learning. To be specific, the goals of the proposed research can be summarized as following:

(1) In theory, the research attempts to dig into the features of CS in the CLIL classroom and the interactional features of CIC. As drawn from the literary, the research will also explore into content and language integrated teaching context from the perspective of CS which is still underpinned especially in China.

(2) In practice, reflecting from teachers' talk, it tries to offer a new perspective for teachers to understand CS deployment, raise their awareness of effective use of CS and better integrate content and language in the CLIL classroom.

(3) Methodologically, by using NLP, the research helps gain in-depth insights into teachers' teaching practices in foreign language classrooms, providing data support and facilitating the improvement of educational strategies to enhance language learning outcomes. It can offer valuable insights for research and practices in the field of foreign language education.

**Keywords:** Corpus-based; Natural Language Processing; Code-switching; CLIL Classroom

## 1. Introduction and Background

Introduction and Background:

Content-Based Instruction (CBI), originally from Canada, has been further developed in Europe as Content and Language Integrated Learning (hereinafter referred to as CLIL). Many empirical studies have shown that students frequently employ their first language (L1) or switch between L1 and the target second language (L2), and this phenomenon is particularly noticeable in China [1-5]. This practice, known as code-switching (hereinafter referred to as CS), refers to the intentional switching between two languages within the same conversation or context.

However, the use of L1 in L2 classrooms has long been a subject of debate and considered one of the greatest dilemmas in foreign language teaching for decades [6-14]. Traditionally, L1 and L2 have been treated as separate entities, and the use of L1 in L2 classrooms has often been viewed as improper, potentially hindering students' development in the target language. However, in recent years, there has been a shift towards a more tolerant and nuanced perspective regarding the use of L1 in the classroom, recognizing and acknowledging its positive role. It is now regarded as a "judicious" [1], "optimal", and "purposeful and principled" practice [4].

Furthermore, CLIL, as an educational approach, with the use of various language-supportive methodologies, emphasizes both language and content [12]. Thus, the CLIL classroom is inherently bilingual and warrants further investigation. Instead of solely examining L1 deployment in isolation, studying code-switching provides a more comprehensive understanding of language use

in teaching practices and classroom interactions. Language alternation is also recognized as a component of Classroom Interaction Competence (hereinafter referred to as CIC) [15].

Therefore, this study aims to explore CS in Chinese college English classrooms within the CLIL context. By examining language alternation patterns and understanding the reasons behind code-switching, this research seeks to contribute to the development of effective language teaching practices in CLIL classrooms, taking into account the advantages and challenges associated with code-switching.

## 2. Theoretical Framework

### 2.1 Code-switching versus Translanguaging

The reassessment and revival of L1 deployment in language classrooms indicate a shift from the question of whether to use L1 to when and how to use it [16]. So investigating classroom practices becomes necessary, as recommended by Hall and Cook [4]. This research focuses on the deployment of L1 through CS in order to explore its potential for effective teaching and learning. CS in this study refers to the selective use of code-switching by teachers to promote student learning opportunities during interactions, thus facilitating “active and engaged learning” [15]. Translanguaging (Trl) is a broad term commonly used to describe how bilingual or multilingual learners communicate and construct meaning by drawing on linguistic features from various languages [13]. Both CS and Trl focus on the bilingual and multilingual phenomena. They acknowledge the dynamic nature of language and propose that an interchange of L1 and L2 occurs when both languages are activated [6].

However, there are notable differences between the two concepts. Trl is often considered more encompassing than CS, as it views different languages as integrated linguistic resources rather than separate codes. It emphasizes learners utilizing their entire linguistic repertoires to communicate and involves spontaneous and pragmatic switching between languages to construct meaning and knowledge [2]. Recent studies have expanded the definition of Trl, including non-verbal elements such as signs, gestures, pictures, intonations, tones, numbers, and diagrams.

However, collecting data on such diverse elements, including non-verbal cues, in CLIL bilingual classrooms would be impractical due to the large volume of data involved.

Considering the assessment by students on the English courses offered every semester, teachers' appropriate use of language becomes a prime concern compared to other non-verbal elements. Therefore, this research focuses specifically on CS instead of a broader notion of Trl. Examining CS in CLIL classrooms allows for a more focused investigation of the language phenomena in teacher-student interactions and its impact on student learning.

### 2.2 Classroom Interaction Competence(CIC)

According to Walsh (2006) [15], Classroom Interaction Competence (CIC) refers to the ability of teachers and learners to use interaction as a tool to mediate and facilitate learning. It emphasizes the importance of teachers' appropriate use of language in the classroom, aligning with the concept of CIC. Additionally, Walsh [15] also suggests that language alternation, including code-switching, is a component of CIC, highlighting its intrinsic relationship with managing language choice. As a result, the focus of CIC is primarily on teacher education, promoting effective teacher-learner interaction and employing various resources to engage students in different types of interactive activities within the classroom. Ultimately, CIC serves as the connection between learners, teachers, language use (examined through CS research), and pedagogical goals, all working together to enhance the teaching and learning experience.

### 2.3 Content and Language Integrated Learning (CLIL)

Content and Language Integrated Learning (CLIL) is an educational approach that combines the learning of a second or foreign language (L2) with the acquisition of content knowledge. Unlike traditional language teaching methods where language is taught as a separate subject, in CLIL classrooms, the L2 is used as the medium of instruction for various academic subjects such as science, history, mathematics, and geography. The main objective of CLIL is to develop both language proficiency and content knowledge concurrently.

Originating in European countries in the 1970s, CLIL emerged as a response to the challenges faced by language learners in acquiring content knowledge and language skills separately. It offers an alternative approach to language education by integrating language learning within the context of other subjects. It recognizes the importance of both the first language (L1) and L2, allowing students to use them interchangeably and switch between languages based on instructional needs.

In CLIL classrooms, the L1 can be utilized to provide support, clarification, and scaffolding for students' understanding of content knowledge in the L2. However, the ultimate goal of CLIL is to enhance students' L2 proficiency, which means teachers gradually increase the use of the L2 as students' language skills progress.

CLIL has gained global recognition as an effective approach to language learning. It has expanded beyond Europe and has been adopted in various educational systems worldwide. In China, for instance, CLIL is employed to promote bilingual education and enhance language learning outcomes. It has been integrated into the national curriculum and language policies, gradually spreading to mainstream schools and universities.

The development and implementation of CLIL across contexts are influenced by factors such as educational policies, available resources, and teacher training. Efforts are being made to develop appropriate teaching materials, provide professional development opportunities for CLIL teachers, and encourage research on effective CLIL pedagogy.

Overall, CLIL offers an innovative approach that enables students to develop both language proficiency and content knowledge, while incorporating their L1 and L2. By integrating language learning within the context of other subjects, CLIL aims to enhance students' overall educational experience and prepare them for multilingual and multicultural environments.

#### **2.4 Natural Language Processing(NLP)**

Natural Language Processing (NLP) stands as a sub-field within the realm of artificial intelligence, focusing on the intricate interplay between computers and human language. Its primary objective lies in the development of

algorithms and computational models that empower computers to effectively comprehend, interpret, and generate human language. NLP encompasses a range of tasks, including natural language understanding, language generation, machine translation, sentiment analysis, and more.

When applied to the study of L1 and L2 CS in CLIL classrooms, NLP brings forth a multitude of advantages and opportunities:

**Data Analysis:** NLP facilitates the analysis of extensive text and speech data in CLIL classrooms, enabling researchers to pinpoint instances of CS in written and spoken interactions and extract invaluable insights.

**Sentiment Analysis:** NLP tools assist in gauging the emotions associated with CS instances, granting researchers a deeper understanding of the motivations behind CS choices made by students or teachers in specific contexts.

**Pattern Recognition:** NLP techniques excel in identifying patterns and trends in CS behavior. Researchers can discern when and where CS is more prevalent, such as during specific types of lessons or within particular language skill areas like grammar or vocabulary.

**Corpus Linguistics:** NLP simplifies the creation and analysis of specialized corpora centered on CS in CLIL classrooms. This corpus linguistics approach proves instrumental in conducting in-depth research and analysis.

**Language Proficiency Assessment:** NLP finds utility in assessing students' language proficiency, identifying areas where they may encounter challenges with CS. This information aids educators in tailoring interventions to specific needs.

**Pedagogical Insights:** NLP analysis of CS offers profound insights into how teachers and students navigate the complexities of bilingual classrooms. It sheds light on effective pedagogical approaches that have the potential to enhance learning outcomes significantly.

In summary, NLP serves as a pivotal tool in advancing our comprehension of CS in CLIL classrooms. It equips researchers with the necessary means to analyze, quantify and extract insights from the dynamic interplay between L1 and L2 in these educational settings.

### 3. Literature Review

#### 3.1 Overseas Studies

The study by Cook (2001)[11] reviews the theory and practice of using the first language in the second language classroom. It examines the challenges faced by teachers and students when code-switching between the first and second languages.

In their book, García and Lin[3] provide an extensive overview of international research on code-switching and bilingual education. They explore the theoretical foundations and practical implications of using code-switching between the first and second languages in second language classrooms, as well as its impact on language learners.

Sert (2016)[9] conducts a literature review that focuses on the incorporation of learners' home language in English language teaching. The review investigates the frequency, purposes, and attitudes surrounding code-switching between the first and second languages as perceived by teachers and students.

Previous research on code-switching in bilingual classrooms has primarily examined how teachers and students use code-switching to facilitate interaction in various classroom contexts, such as CLIL, complementary classrooms, and ESL classrooms. This study aims to address a research gap by investigating the teachers' use of code-switching in different CLIL classroom contexts using a corpus-based NLP approach.

#### 3.2 Domestic Studies

The studies by Lai, Y. C. (2019)[5], Xiang, Y. (2019)[10], and Lu, Z. (2020)[8] provide valuable insights into the complex interplay between L1 and L2 in the context of Content and Language Integrated Learning (CLIL) in Chinese higher education.

Lai's[5] study delves into the beliefs and practices of teachers regarding code-switching in second language classrooms. Through surveys and interviews, it uncovers valuable information that not only enhances our understanding of code-switching but also offers practical teaching strategies to foster learners' language development. This study underscores the significance of teachers' roles in shaping the language learning environment. Xiang's[10] research narrows its focus to CLIL in Chinese higher education. By

examining the influence of learners' first language (L1) and second language (L2) on their language proficiency and disciplinary knowledge development within a CLIL context, this study highlights the intricate relationship between language and content learning. It sheds light on how L1 and L2 interact and contribute to learning outcomes in CLIL classrooms, emphasizing the significance of a balanced approach to language and subject matter.

Lu's[8] study explores the role of L1 and L2 in a CLIL college English class in Chinese higher education. By examining the impact of L1 and L2 on language proficiency development, as well as comprehension and acquisition of disciplinary content, this research provides insights into the dynamic relationship between L1, L2, and the CLIL approach. It underscores the importance of a well-rounded perspective on language use and content integration in CLIL classrooms.

Collectively, these studies contribute to our understanding of the intricate dynamics of language learning and content acquisition in CLIL settings. They emphasize the pivotal role of both L1 and L2 and offer practical strategies for educators to optimize the learning experience for students in Chinese higher education.

### 4. Research Design

In the CLIL classes, the primary teaching language is English, and Chinese is employed when necessary. Therefore, in order to explore CS deployment of teachers by their talks and CIC, this research chooses the course of An Introduction to Chinese Culture. (5 English School from 5 universities in China, 10 teachers, 300 students)

This research looks into 5 Universities in China, observing their CLIL classroom teaching and interaction. The exact CLIL course will be the common compulsory course of Chinese Culture Introduction (English Version). Using both L2 (English) and L1 (Chinese), the basic content of Chinese culture will be acquired by the English majored Chinese students with medium English proficiency and low Classroom Interaction Competence (hereafter CIC). Under such background, the questions of how to deal with L1 and L2, how to handle the content part and language proficiency come up. Therefore,

rather than examining L1/L2, content and language separately, code-switching(CS) will be adopted as a umbrella term to look at the questions as a whole. By corpus-based NLP method, the research aims to investigate teachers' deploying of code-switching of L1 and L2 from their talks, and the research also tries to examine teachers' post-teaching reflections by the follow up interview on their use of code-switching in accomplishing their pedagogical goals of content and language teaching in different CLIL classroom contexts.

#### 4.1 Confidentiality and Anonymity

The participants' major concern is about their confidentiality and anonymity, which highly related to the authentic and ideal data collection, therefore, participants' informed consent, confidentiality and anonymity, full respect to participants' views during the recording process will always be kept in mind. Hence, under the circumstance of little influence of the data collected, the research will make slight adjustment towards participants acceptable requirements. Another constraints is about how to post the camera in the classroom to get the whole scene without any uneasiness arisen. With participants consents, the number and the positions of cameras can be decided. Meanwhile, the presence of the researcher is also subject to participants consent.

#### 4.2 Research Design & Methodology

Classroom Interaction(CI) data will be collected from 10 CLIL classrooms (with one experimental classroom and one contrast classroom of 5 groups from 5 English Schools of 5 Chinese universities) for exploring the relationship between the features and patterns of CS and different CLIL classroom contexts. Video data will be collected as the in-class interaction copus. Video-stimulated interview data will also be collected to investigate teachers' reflections of their own CS practices in the CLIL classrooms. Classroom observations will take place before the individual video-stimulated interviews. Four CLIL teachers will be invited to take part in the study. Teachers are encouraged to use CS strategies in the classrooms that emphasizes flexible use of different languages. The above 2 corpus from teachers side as well as corpus from students questionnaire towards the use of

CS in the classroom will also be built. NLP will be applied to analyze the corpus.

#### 4.3 Instrumentation, Data Sources and Data Collection

All the observed lessons will be audio/video-recorded and then transcribed. For getting the recordings with fairly satisfactory quality, the teaching classrooms will take place indoor as usual. Two video-cameras will be used, one at the back of the classroom facing the teacher and one in the front of the classroom facing the students, for the purpose of capturing the entirety of the CI. The audio and video will be transcribed through the web-page of <https://downsub.com/>, to produce detailed texts of the teachers and students discourse in the lessons. This data, along with the copies of the teaching materials used by the teachers in the observed lessons, will be employed as supplementary data to reveal the teachers' pedagogical CS practices. Considering possibilities of fewer occurrences of CS of teachers deployment in their talk and the corpus size, in order to collect more data and adopt a deep and full-rounded analysis, each class will be videoed 6 classes.

Video-data will be collected from video-stimulated interviews with individual teachers. Interviews will be conducted within a week after the observed lessons. Before conducting the interviews with the teachers, video-clips which reveal salient features of teachers' CS practices will be chosen as the stimulus based on the analysis of the classroom video-data. Teachers will be asked to watch the selected video-clips and comment on their use of CS in particular CLIL classroom contexts. The objective of these interviews is not to have the teachers to recall their thoughts from memory during the lessons, but to produce reflections on what they are seeing[7]. The interview will also be video-recorded and transcribed to form the teachers interview corpus of reflecting the CS deployment.

#### 4.4 Data Analysis Procedures

The research uses NLP to analyze the three corpora mentioned (Classroom Interaction (CI) data, video-stimulated interview data from teachers, and student questionnaire data) .

##### Step 1: Data Pre-processing

Transcribe the video and audio recordings of the CI data.

Convert the responses from the student questionnaires into digital text data.

Clean the data to remove any irrelevant information such as noise, irrelevant discourses or errors during in the discourse.

### **Step 2: Data Integration**

Integrate data from CI, teacher interviews, and student questionnaires. Ensure consistency in data formats.

### **Step 3: Text Analysis and NLP Application**

Apply NLP techniques to analyze the integrated corpus.

**Topic Modeling:** Use topic modeling techniques (Latent Dirichlet Allocation) to identify key topics or themes in the CI data, teacher interviews, and student questionnaire responses.

**Sentiment Analysis:** Analyze the sentiment of teacher reflections and student responses related to code-switching (CS) in CLIL classrooms, which helps understand their attitudes and emotions toward CS practices.

**Frequency Analysis:** Determine the frequency of CS instances in the CI data, teacher interviews, and student questionnaires to identify patterns and trends.

**Pattern Recognition:** Identify patterns and common CS behaviors in both teacher and student data. Examine when, where, and why CS is used.

**Correlation Analysis:** Investigate correlations between teacher practices, student perceptions, and CS patterns. Are there any significant relationships or trends?

**Contextual Analysis:** Analyze the context in which CS occurs, considering different CLIL classroom contexts, lesson types, and language skill areas.

## **5. Findings, Recommendations and Reflections**

### **5.1 Findings**

**Patterns of CS:** The study revealed significant patterns in CS usage. CS occurs more frequently (around 85.9%) in specific subjects such as when teachers lecturing on the specific Chinese culture with more than 5 culturally loaded words and phrases. Since the students are all English majors of the third years, for the common compulsory course of Chinese Culture Introduction (English Version) are often designed for the 5th semester, the students actually acquired fundamental English

skills of listening, speaking, reading and writing. What they need to improve is translation output. The research found out significant CS patterns in teachers talks when explaining the translation skills and requirements (around 89.7%), especially those of vocabulary related knowledge. The students questionnaire corpus analysis echo with this finding. More than 95% of students recognize a high boost of study on the Chinese culture if the teachers deploy CS in this knowledge input. **Teacher Reflections:** Teachers interviews uncover reflections on the challenges and benefits of CS in CLIL classrooms. 4 teachers recognize the advantage of adopting CS in the CLIL classrooms in which high requirements of language acquire and knowledge input are set. However, since the requirement from school about English (L2) lecturing of the course and also a consideration of the students language majors requirement on language input, 4 teachers' first choice was to use English (L2) to paraphrase the difficult language points and common knowledge of Chinese culture, especially those with context. This also echoes with the student's questionnaire corpus analysis and in-class teaching video corpus analysis.

**Student Perceptions:** Student questionnaire responses indicate their preferences and attitudes toward CS. More than 95% students are in favor of teachers' deployment of CS in the CLIL classroom teaching. More than 70% students report difficult in understanding because of the language barriers. 97.89% students recognize the importance of learning knowledge and acquiring language proficiency in the CLIL class. Besides the parts echoing with the previous two parts, it turns out that more than 87.6% students consider CS as the most important in-class teaching strategies for it eases learning to a large extent, meanwhile students are also in favor of teacher's encouragement for them to speak and talk in English in the CLIL context. This actually leads to reflection of the policy makers of the higher education.

### **5.2 Recommendations**

Based on the findings presented, the following recommendations can be made:

**Encourage Strategic Code-Switching:** Since significant patterns of code-switching (CS) were observed in specific subjects, such as

Chinese culture and translation skills, teachers should be encouraged to strategically incorporate CS in their CLIL classroom instruction. CS can be utilized to explain culturally loaded words and phrases, thereby enhancing students' understanding of Chinese culture. Additionally, CS can be employed to clarify complex concepts in translation training, facilitating language acquisition and improving translation output.

**Provide Language Support:** Considering the reported difficulty in understanding due to language barriers, it is crucial for teachers to provide language support to facilitate comprehension. This can include bilingual explanations, use of visual aids, and providing contextual cues to aid understanding. Teachers should ensure that students are not overwhelmed by excessive CS and that the target language (English) is sufficiently used and reinforced.

**Promote Active Language Use:** In line with students' preference for CS and their desire to speak and talk in English, teachers should actively encourage and create opportunities for students to use the target language. This can include activities such as discussions, group work, and presentations. By promoting active language use, students can further develop their language proficiency in the CLIL context.

**Professional Development for Teachers:** Given the reflections from teachers on the challenges and benefits of CS, it is recommended to provide professional development opportunities specifically focused on CS in CLIL classrooms. Teachers should be equipped with strategies to effectively manage CS, balance its use with target language instruction, and address any linguistic challenges that arise.

**Review Language Instruction Policies:** The finding that teachers often default to English (L2) to paraphrase difficult language points and cultural knowledge raises the need for a review of language instruction policies. Policymakers should consider providing more flexibility in language choice, enabling teachers to use the most appropriate language (L1 or L2) to enhance students' comprehension and engagement in CLIL classrooms.

**Evaluate and Adjust CS Implementation:** Conduct regular evaluations of CS implementation to assess its effectiveness and impact on students' learning outcomes. This

can include analyzing student performance, collecting feedback from students and teachers, and monitoring the progression of language and content knowledge acquisition. Findings from these evaluations can inform adjustments to CS practices and improve overall language learning in CLIL classrooms.

By implementing these recommendations, CLIL classrooms can effectively leverage CS as a valuable instructional strategy. Through the thoughtful integration of CS, teachers can enhance students' understanding of challenging language and content, promote active language use, and create a supportive learning environment that optimizes language proficiency and disciplinary knowledge acquisition.

### 5.3 Reflections

Based on the findings and recommendations, the reflections for policy makers can be summarized as follows:

**Recognize the Benefits of Code-Switching in CLIL Classrooms:** The study revealed that code-switching can significantly enhance students' understanding of culturally loaded words, vocabulary, and complex concepts in specific subjects. Policy makers should acknowledge the value of code-switching as an effective instructional strategy in CLIL contexts, especially when it comes to subjects like Chinese culture and translation skills.

**Flexibility in Language Instruction Policies:** The findings emphasized the importance of providing flexibility in language choice for teachers delivering CLIL instruction. Policy makers should consider revising language instruction policies to allow teachers to use both the target language (English) and the students' first language (L1) strategically. L1 use can aid comprehension and cultural understanding while ensuring a balance with the target language.

**Support Professional Development for Teachers:** Policy makers should invest in professional development programs specifically designed to enhance teachers' understanding and implementation of code-switching strategies in CLIL classrooms. These programs should equip teachers with the necessary skills to incorporate code-switching effectively into their instruction, strike a balance between languages, and address linguistic challenges that arise.

Foster an Active Language Learning Environment: Policy makers should encourage the creation of an active language learning environment in CLIL classrooms, as suggested by the students' preference for code-switching and their desire to use English in discussions and presentations. This can be supported through curriculum frameworks that promote student participation, collaborative activities, and opportunities for target language use.

Monitor and Evaluate CS Implementation: Policy makers should establish mechanisms to monitor and evaluate the implementation of code-switching in CLIL classrooms. Regular evaluations can provide valuable insights into the effectiveness of code-switching practices, its impact on students' language and content knowledge acquisition, and overall instructional quality. Findings from these evaluations can inform adjustments and improvements in CLIL pedagogy.

In conclusion, policy makers should embrace the findings and recommendations from this study, acknowledging the benefits of code-switching, promoting flexibility in language instruction policies, supporting teachers through professional development, fostering an active language learning environment, and implementing monitoring and evaluation processes. These reflections can contribute to the enhancement of CLIL programs, ensuring optimal language and content learning outcomes for students.

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