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The use of CLIL in a Science class

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Abstract

Content and Language Integrated Learning (CLIL) is an approach that has been used since the year 2000. However, this approach is not well known by all educators. Thus, the present research synthesis aimed to analyze the different effects, opportunities, and obstacles that could appear with CLIL in a Science class. Fifteen studies, which used different approaches/methods and occurred at different settings and levels, were gathered. The results indicate that even though CLIL is still a new approach, there are several positive effects on students at different levels, especially in secondary education. Similarly, the findings also demonstrate that with the proper use of a strategy; such as scaffolding, code-switching, or multilingual repertoires, students could improve their knowledge about Science and English simultaneously and in a better way. Further research studies are recommended based on the issues that were raised in the analysis.

Keywords: Content and Language Integrated Learning. Strategies. Effects. Limitations



Resumen

El Aprendizaje Integrado de Contenido y Lenguaje (CLIL por sus siglas en inglés) es un enfoque que se ha utilizado desde el año 2000. Sin embargo, este enfoque no es bien conocido por todos los educadores. Por lo tanto, la presente síntesis de investigación tuvo como objetivo analizar los diferentes efectos, oportunidades, y obstáculos que podrían aparecer con el uso de CLIL en una clase de Ciencias. Se reunieron quince estudios, que utilizaron diferentes enfoques / métodos y ocurrieron en diferentes entornos y niveles. Los resultados indican que, aunque CLIL sigue siendo un enfoque nuevo, existen varios efectos positivos en los estudiantes de diferentes niveles, especialmente en la educación secundaria. Del mismo modo, los resultados también demuestran que el uso adecuado de una estrategia; como andamios, cambio de código, o repertorios multilingües, los estudiantes podrían mejorar sus conocimientos sobre Ciencias e Inglés al mismo tiempo y de una mejor manera. Se recomiendan más estudios de investigación basados en los problemas que surgieron en el análisis.

Palabras clave: Aprendizaje Integrado de Contenido y Lenguaje. Estrategias. Efectos. Limitaciones.



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Dedication

To my family.



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Introduction

Nowadays, the growth and development experienced in every field demand people to use English for various purposes. Consequently, the learning and teaching process of English as a second language is taking more importance in the educational context (Patel & Jain, 2008).

Various teaching methods have been developed over the years to make learners acquire the language quickly and efficiently. However, teachers must consider different necessities and factors such as age, English level, learning styles, subject content, and others before applying specific methods and strategies.

CLIL is an approach used in education which makes use of a foreign language as an essential tool for teaching a subject's contents in a specific classroom (Jappinen, 2005; Morton, 2012; Vallbona, 2014). Thus, since 2000, CLIL has impacted the educational system, especially in Europe. This research synthesis focuses on using the Content and Language Integrated Learning Approach (hereafter referred to as CLIL) during a Science class since using this approach might be an effective method that helps students and teachers obtain knowledge better (Bret, 2011; Escobar, 2013; Vallbona, 2014).

This research synthesis aims to collect and analyze data from empirical studies to show the different effects of CLIL in a Science class. For this paper, the following question was addressed:

1. What are the reported effects of using CLIL to teach Science?

This paper presents six chapters. The first chapter describes the research that contains the background, problem statement, rationale, and the research question. In the second chapter, a theoretical framework is presented to cover definitions and key terms related to CLIL. The third chapter shows the literature review that synthesizes the



results of empirical studies essential to answer the research question. Then the fourth chapter is the methodology of the research. The fifth chapter is the analysis of the empirical studies that demonstrate the achievement of the goals. Finally, the last chapter, number six, presents the conclusions and recommendations.



Chapter I

Description of the Research

1.1 Background

Content and Language Integrated Learning (CLIL) is an approach used in education in which a foreign language is an essential tool for teaching the contents of a subject in a specific classroom (Jappinen, 2005; Morton, 2012; Vallbona, 2014).

Marsh (as cited in Vallbona, 2014) defined CLIL as “a situation in which the subject matter or part of the subject matter is taught via a foreign language with a two-fold objective: the learning of those contents and the simultaneous learning of a foreign language” (p.33). Coyle (as cited in Yamano, 2013) emphasized that insightful frameworks have been developed to define CLIL practices clearly; in this case, the four principles of CLIL or the 4C's structure. Gonzalez (as cited in Yamano, 2013) said that using 4C's framework fosters both positive attitude and motivation toward the acquisition of the new language.

Vallbona (2014) mentioned:

Interest in CLIL, especially in Europe, has grown since the 1990s due to the actions of the own institutions of the continent and their commitment to a multilingual Europe. According to the *White paper on Teaching and Learning* (1995), a document issued by the European Community, one of the main objectives of European policy in education is for European citizens to become proficient in three languages: their first language, a language of international communication, and a personal adoptive language. (p.33)

According to this statement, it can be inferred that CLIL began to be used mainly in Europe to improve the English language through a different approach for education in schools.



CLIL might be an effective method that teachers could use to improve the way of teaching and learning during classes. This methodology produces different effects in L1 and L2. Ruiz de Zarobe and Lasagabaster (as cited in Vallbona, 2014) have claimed that longitudinal studies of the impact of CLIL on L1 and L2 acquisition should be given priority. The proper use of CLIL is based not only on strategies but also on other students' internal factors. In this way, Pérez-Cañado (2012) and Bruton (2013) agreed by stating that factors such as

Motivation, sociocultural status, the gender of the learners, the type and location of the school, the amount of exposure to the target language, and the pupils' previous exposure to the target language play a crucial role on the development of CLIL method.

Besides, Gabillon and Ailincăi (2013) applied CLIL in a Science class through an experiment in a French primary school. The results demonstrated that successful CLIL practice is feasible with breakthrough level young learners, and also dialogic exchanges are useful both as a means for scaffolding content and language learning.

1.2 Statement of the Problem

One of the main problems in language classes is that “the main focus is on doing things with words and not using words to achieve things” (Marsh, 2008, p.238), which turns the EFL classroom into an “artificial environment where the focus is on language itself” (Lasagabaster & Sierra, 2009, p.13) rather than on the use of the language.

Consequently, due to the learners' need to have a wider domain over the language, CLIL was proposed as an innovative form of education that could respond to the modern age's demands and expectations (Coyle, Hood & Marsh, 2010). Graddol (as cited in Coyle, Hood & Marsh, 2010) named CLIL as the ‘ultimate communicative methodology’.



Lasagabaster and Sierra (2009) claimed:

In the CLIL approach, however, the focus of the classroom shifts from language to achieving something concrete with the language, and language learning becomes almost an incidental activity. CLIL caters to all types of learners/different learning styles and provides much richer communicative situations and “can do” opportunities which engage students and foster the development of language awareness. (p.13)

In addition, the use of CLIL makes students active participants for developing their potential to acquire knowledge and skills (education) using inquiry (research) and through a complex cognitive process and different means to solve problems (innovation) that could appear in their daily routine (Coyle, Hood & Marsh, 2010).

Another aspect that seems to have turned into a problem is the kind of materials used in traditional EFL classes. For many years, teachers tend to use only the provided materials (books and dictionaries), following a standardized curriculum (Dalton-Puffer,2013). “As a self-evident example, EFL teachers realize that in most of the cases, many textbook role-plays are unrealistic, boring, produce anxiety, and do not have relevant meaning for a certain type of students” (Lasagabaster & Sierra,2009, p.13).

Also, regarding methodologies, most of the methodologies used in EFL classroom are teacher-centered and only focused either on primary or secondary education (Cenoz, 2001). Those aspects do not occur with CLIL because this approach suits for all types of learners and enhance the development of language awareness through the generation of richer communicative situations (Lasagabaster & Sierra, 2009).

According to the analysis, the lack of communicative activities, materials and methodologies presented during the learning process in EFL classrooms led teachers to



think about the use of a different approach. The use of CLIL provides richer communicative situations where all type of students can participate and achieve their personal and academic purposes (Coyle, Hood & Marsh, 2010). Regarding materials, CLIL offers different materials that all type of students can use. Those materials could avoid boring, anxiety, and apathy on students during the learning process (Lasagabaster & Sierra,2009). Finally, unlike EFL teacher-centered methodology, CLIL integrated the participation of not only teachers, but also students at different levels through the generation of various situations that enrich the knowledge about content and language (Lasagabaster & Sierra, 2009).

1.3 Rationale

The use of the CLIL approach during a Science class generates different positive aspects that promote meaningful learning (Šulistová, 2013). Some positive aspects that can be named are the acquisition of communicative skills, the creation of proper materials, and the implementation of new methodologies during the class (Cenoz, 2001; Lasagabaster & Sierra,2009; Coyle, Hood & Marsh, 2010).

One of the reasons to consider the use of this approach is that CLIL enhances the acquisition of communicative skills during the class through students' active participation in different situations (Lasagabaster & Sierra, 2009). This active participation produces opportunities for critical thinking development and the capacity to look for solutions that could help students solve problems (Coyle, Hood & Marsh, 2010).

Another positive aspect is the kind of materials that teachers could use during the class. Instead of using a language textbook, students could have a CLIL Science book. Still, if teachers cannot use those books for different reasons, they can produce their materials (sources and activities) or adapt authentic materials to reach CLIL



educative goals (Morton, 2013). The advantage of producing those materials is that coherence may be easily achieved since they derive from subjects' content or learner-contributed content (Banegas, 2013). Also, collaborative work for creating materials could help teachers reduce the load and share not only materials but also experiences and practices (Banegas, 2016).

Additionally, the use of Veen diagrams, pie charts, and ICT applications contributes to understanding the subject's content, enhancing language production, and promoting thinking skills development (Guerrini, 2009).

Regarding the methodologies, CLIL class could be tutor-centered but with the variant that teachers generate different tasks and encourage group work activities that led students to produce and share different ideas about the topic of the class (Banegas, 2012). Furthermore, those activities promote integration and motivation in the students who are more capable of being part of the community of speakers generated during the class (Herrarte & Beloqui, 2015).

In this sense, the use of CLIL could be relevant for constructing English and Science knowledge. Through the use of this approach, both students and teachers can benefit in different ways during the teaching and learning process, respectively. However, it is necessary to analyze empirical studies on the use of CLIL in Science classes to determine the impact that the teaching of content and language has on students' learning.

1.4 Research Question

After analyzing the relevant literature on the chosen topic, the following question has arisen.

What are the reported effects of using CLIL to teach Science?



1.5 Objectives

General

-To analyze the reported effects of using CLIL to teach Science.

Specific

-To identify the different CLIL strategies used by teachers during a Science class.

-To determine the advantages and disadvantages of using CLIL in a Science class.



Chapter II

Theoretical Framework

2.1 Introduction

In this section, the concepts, features, and theories regarding the use of CLIL will be presented. Those elements are essential in order to understand this work. Three main aspects will be developed in this section, such as the definition of CLIL, scaffolding as a tool for improving CLIL, and CLIL 4 C's framework.

2.2 Definition of CLIL

According to Vallbona (2014), CLIL (Content and Language Integrated Learning) refers to any educational approach in which a second/foreign language is used to teach the contents of a subject included in the curriculum. Likewise, Jappinen (2005) mentions that CLIL refers to all those situations where there is a connection between a foreign language used as a medium of instruction and content taught, including immersion and some forms of bilingual education (p.149).

Also, Gabillon and Ailincăi (2013) mention that the label CLIL is used to describe all types of practices that use a foreign language to teach school subjects regardless of the variations in conceptual frameworks, theoretical underpinnings, and actual classroom practices (p.169).

According to Bret (2011), CLIL became popular in the 1990s. Many European schools have implemented CLIL as an innovative approach to teaching foreign languages and achieving the aims stated by the European Commission regarding multilingualism in Europe (p.1).

Gabillon and Ailincăi (2013) mention that CLIL also aims to educate pupils as citizens of the world through the use of naturalistic learning environments and prepare them for an international society, which would offer them better job prospects. This



statement is based on the main purpose that was established in a document called the *White Paper on Teaching and Learning* created by the European Commission (Vallbona, 2014, p.33). This commission wanted to have multilingual European citizens in order to guarantee their future prospects in the context of a globalized world (Llinares, 2015).

Coyle, Hood, and Marsh (2010) allude that since CLIL started to be used, it was connected with a famous pedagogical theory, it is the Bloom's taxonomy. Bloom's taxonomy is a multi-tiered model that led to a classification of thinking according to six cognitive levels of complexity. Those levels are knowledge, comprehension, application, analysis, synthesis, and evaluation. The first three levels belong to the lowest level, and the others belong to the highest level. However, after many years there was a change in the terminology of this taxonomy. The change proposed was from nouns to verbs, so they were renamed as remembering, understanding, applying, analyzing, evaluating, and creating. In this sense, this model is like the stairs that students have to pass one by one to reach the main goal. By using Bloom's taxonomy, teachers could measure their students' abilities in an organized way (Forehand, 2010; Armstrong, 2016).

Additionally, it is important to mention that the different contextual and situational variables where CLIL is applied could influence or determine the position of this approach. The context could vary in the compulsory education sector and in kindergarten, vocational, and professional learning. In this sense, Marsh (as cited in Coyle, 2007) mentions that

Usage of this term allows us to consider the myriad variations without imposing restrictions which might fail to take account of school or region-specific implementation characteristics. It does not emphasize to either language



teaching or learning, or content teaching and learning, but sees both as integral parts of the whole. (p.545)

Finally, an important point to mention is the division of CLIL. This approach is divided into two types: hard-CLIL and soft-CLIL. Hard CLIL means that the subject curriculum is taught in a foreign language, in this case, in English. However, the main lesson objective is the content objective, not the language. On the other hand, in soft CLIL, the subject's content is subordinate to the language goal. It means that there is more emphasis on learning the language (Šulistová, 2013).

2.3 Scaffolding as a tool for improving CLIL

Some different tools or strategies could be used during a CLIL class, such as mother tongue, code-switching, and conversational analysis. However, most of the studies show that the most common tool that has been used is scaffolding. Hammond and Gibbons (2005) illustrate the term by explaining that scaffolding is placed around the outside of new buildings to allow builders access to the emerging structure as it rises from the ground. Once the building can support itself, the builder removes the scaffolding.

Also, Hammond and Gibbons (2005) mention that

The metaphor of scaffolding has been widely used in recent years to argue that in the same way builders provide essential but temporary support, teachers must do with their students. Teachers need to provide temporary supporting structures to help learners develop new understandings, concepts, and abilities. As the learner acquires these skills, teachers need to withdraw that support. (p.8)

In this sense, in CLIL, the use of scaffolding is also crucial because the use of various instructional scaffolding methods such as using realia, identifying objects by touching, seeing, or smelling provide support for the learning of both the L2 and the



disciplinary content (Gabillon & Ailincal, 2013). Also, Gabillon and Ailincal (2013) mention that CLIL aims to promote real learning environments in the classroom by setting and advocating authentic language use, real-life situations, gestures, realia, and so forth through which children can acquire the target language (foreign or regional) naturally (p.169).

Besides, Escobar and Evnitskaya (2014) mention that the way the teacher organizes and manages classroom interaction and the instructional choices of conversational adjustments and non-verbal resources (scaffolding) afford students opportunities to take charge of the interaction (p.177).

Also, the use of scaffolding during the class is significant because, in the lesson or experiment, the teacher can use different mediation or remediation strategies as she introduces a concrete object from the outside-the-classroom context. In this way, realia helps students to understand the proper meaning/concept of new terms (Escobar & Evnitskaya, 2014).

2.4 CLIL 4C's framework

Coyle (2007) mentions that the 4C's framework is not a theory but a conceptualization of CLIL, rooted in a philosophical stance related first with education and then with CLIL. This framework focuses on the interrelationship among communication (language), cognition (learning and thinking), content (subject matter), and culture (social awareness of self and 'otherness'). Coyle (2007) emphasizes that the 4 C's framework takes account of 'integration' on different levels: learning (content and cognition), language learning (communication and cultures), and intercultural experiences.

For instance, regarding communication, it involves the use of CLIL through the participation of teachers and students and the developing of the language to accomplish



three different purposes. First, the language of learning that is related to knowledge of basic concepts and skills of the topic, so it analyzes the language. Second, language for learning that is focused on the kind of language that learners use according to the context where s/he is participating. Third, language through learning that suggests that learning cannot occur without the active involvement of language and thinking in the sociocultural context (Coyle, 2007).

Coyle (2007) emphasizes that CLIL learners need language to assist their thinking, and they need to develop their higher-order thinking skills in language learning (p.554).

The cognitive demand of tasks requires students to use the different knowledge, concepts, skills, and strategies they previously learned. Those elements help students establish connections between the parts of language being practiced/learned and previous knowledge. It is relevant because this connection promotes the strengthen not only in learning but also in retention (Coyle, 2007).

The learner should be aware of the different abilities that s/he can use to improve and generate the acquisition of new knowledge in a better way. Based on this, content is related to learning and thinking (cognition). Content must be analyzed for its linguistic demands to enable learners to create their interpretations. Also, McGuinness states:

Changing content alone will not automatically lead to quality learning experiences. Standards can only be raised when attention is directed not only to what is to be learned but on how children learn and how teachers intervene to achieve this. (as cited in Coyle, 2007, p.553)

Culture is considered an essential part of the 4 C's framework. Culture affords a better integration between language and thought. Brown mentions that the language of a culture reflects the different characteristics that are involved in it. Language and culture



are connected and produce different worldviews among the different cultures; the language used for this purpose may be relative and specific to each view (as cited in Coyle, 2007).

Culture is an essential factor for learners because it provides them the opportunity to acquire new knowledge, especially language skills. After all, each culture owns identity, so it is an essential factor for the learner to share their culture and learn more about different aspects, especially the language, from the other culture (Coyle, 2007).

Based on the aforementioned information, it can be assumed that the use of the 4C's framework for planning lessons can make the teacher consider communication, cognition, content, and culture to achieve the goals established in the syllabus or curriculum.

To conclude this section, once some relevant concepts have been revised, the project's main points can be understood in a better way. To support the information of this chapter, the next section will show the analysis of the different studies.



Chapter III

Literature Review

In this section, a brief review of the relevant literature will be presented. The studies have been classified according to the approaches or methods used in them. The classification is as follows: the use of extra-linguistic artifacts or scaffolding, learning differences between CLIL and NON-CLIL groups, using pre-task, and post-task in CLIL.

3.1 The use of extra-linguistic artifacts or scaffolding

The use of extra-linguistic artifacts such as realia, demonstrations, dialogues, or gestures during the learning process at different levels are essential and helpful strategies for the proper development of CLIL (Gabillon & Ailincăi, 2013).

The study conducted by Grandinetti, Langellotti, and Ting (2013) had to transform a teacher-centered lecturing into learner-centered learning through the use of scaffolding between comprehensible language and accessible content. This study took place in Italy with secondary students aged 16. Supplementary materials were used to present "human heart anatomy" in two lessons of 90 minutes each. At the beginning, the students had to play a game using their diagram about the "human heart anatomy" to acquire the new language. However, the teacher had to explain the different terms in familiar words to make it understandable. Later, the students had to perform various activities related to filling the blanks or answer different questions, but in this instance, the teacher's participation was minimal. Results showed that through the proper use of other learning materials, the use of a foreign language (FL) for Science improves the learning of Science. Also, it is essential to mention that the scaffolding between the content and language cognitive loads led the students to construct and enhance new understandings about content and academic language competence. Besides, the aim of



the study guided by Bret (2011) was the effects of CLIL on students' L2 English oral performance after three years of CLIL exposure, in this case, 105 hours in total. For this study, the participants belonged to the fifth and sixth grade of a primary school in Spain. The students were divided into two groups: control and treatment. Data for both groups were collected at two different times. During an interview, the students had to tell a story (narrative task) based on different pictures presented by the interviewer. When a kid showed some difficulty telling the story; the interviewer began to ask some key questions to help the student produce new words in English that were useful for completing the story.

On the other hand, the students also had an oral task that consisted of asking some questions related to different aspects of the students' personal life so that they use their vocabulary according to their activities. Also, they had the opportunity to ask the interviewer some questions to acquire more confidence during the interview. The results showed that students were able to improve many aspects of language production because of the use of scaffolding.

Gabillon and Ailincăi (2013) applied CLIL in a Science class through an experiment. Sixteen French primary school pupils between ages 10 and 11 participated in the study; they had had approximately a year of EFL experience. The lessons made use of extra-linguistics artifacts to complement the L2 lessons and helped learners understand new concepts. During the CLIL lessons, the teacher tried to make the L2 input comprehensible using input simplification and linguistic and extra-linguistic context (Gabillon & Ailincăi, 2013; Escobar & Evnitskaya, 2014). The data obtained from this experience suggested that CLIL could be applied at different levels, considering that the use of extra-linguistics artifacts may vary.



Escobar and Evnitskaya (2014) mentioned that one of the most daunting tasks for Science teachers is to transform complex and abstract explanations produced by Science into comprehensible pedagogical ones. The study conducted was in a bilingual Catalan-Spanish secondary school classroom in Barcelona, in which 16 students (aged 12) learned biology in English. Through a video-recorder, the study examined a teacher-led discussion generated while the teacher and the class checked a true–false activity on different types of cells, set as homework. During the development of the activity, the teacher started to ask for information about each statement. Feedback of the exercises was given immediately. If a student did not understand meanings of some words, the teacher provided its definition using examples of everyday situations (scaffolding), performed a discussion of possible meanings (interaction), or as the last resource gave its translation.

As a conclusion, the way that the teacher organized and managed classroom interaction, the instructional choices of conversational adjustments, the use of scaffolding, and non-verbal resources afforded students opportunities to take charge of interactions, generating development in their interactional competence through the very act of participating (Markee,2000).

3.2 Learning differences between CLIL and NON-CLIL groups

The studies included in this section were selected based on the division of two groups: CLIL and NON-CLIL. The results are remarkably varied.

Bret (2011) carried out a study whose purpose aims at investigating the effects of CLIL on students' L2 English oral performance after three years of CLIL exposure (105 hours in total). The analysis was carried out on 32 primary students in grades five and six of a semi-private school in a village located within the province of Barcelona. The 16 students in the control group had only received the mandatory curricular English



hours a week. In contrast, the treatment group subjects had had CLIL lessons for three consecutive years (105 hours in total) besides the hours of regular EFL lessons a week (Bret, 2011). The results showed that according to the number of answers, the CLIL group produced a higher number of appropriate responses than the NON-CLIL group. It suggested that the amount of CLIL instructions is an essential factor for helping students to construct knowledge. In this case, CLIL instructions may have a positive influence on the learning process.

Besides, based on the study guided by Jappinen (2005), cognitive development was studied in Finland with 335 students aged 7-15. The participants spoke three different languages English, French, and Swedish. There were two control groups (NON-CLIL) and one experimental (CLIL). One of the experiments applied in the Science class was "the sun and the planets and their influence on the succession of the seasons;" first, it focused on weather observation and forecast and later on interpreting and completing different activities related to the weather, the atmosphere, and the Sun's radiation on the Earth. According to the results, the control group was behind the experimental group. In this case, "CLIL supports the thinking and content learning processes resulting in the same kind of cognitional development as in teaching through the mother tongue" (p.156). It can be said that a CLIL group could obtain better results because they use language learning as a significant resource for improving knowledge.

Fernández, J., Fernández, A., and Arias (2017) conducted a study in 18 primary schools. The schools were divided into two groups (nine CLIL and nine NON-CLIL) in urban and semi-urban areas. The team applied two surveys to all the schools: a student socio-economic survey and an evaluation test for science contents. "Both tools were validated by a group of experts composed of teachers of Primary Education (teaching Science in the 6th year) and university lecturers working in educational research



methods" (p.6). Both tests were answered in Spanish to check students' command of Science in their native tongue. The use of code-switching was frequent in the various schools, so it means that students used to learn half of the subject in L1 and the other half in L2 (Fernández, J., Fernández, A. & Arias, 2017). After the application of the tests, the results showed a clear difference between CLIL and NON-CLIL groups. For the CLIL group, students perform slightly below non-CLIL pupils when evaluating their knowledge of Science in the L1. It could be because they learned more content in L2 that is limited in some schools.

3.3 Use of pre-task and post-task in CLIL

Nikula (2015) argued that there is a close affinity between CLIL and task-based approaches to language learning. A central concern for both is enhancing language by engaging students in meaningful language use. He performed a study in which the data consisted of six 45-minute lessons of physics and chemistry. The recordings were made in two Finnish lower secondary schools. Those schools were derived from a larger CLIL classroom corpus collected by the University of Jyväskylä. The number of students was 19. In both groups, they were thirteen-years-old of grade seven. In both cases, hands-on activities were carried out in pairs or groups of three.

In chemistry lessons, the teacher gave quite detailed instructions for the hands-on tasks and introduced the theory regarding the pre-task phase. The instructions involve a detailed description of the procedure and the equipment used and explicit references to the type of phenomenon in chemistry that the experiment relates to. However, in the physics lesson, the teacher did not go into similar depth and detail to introduce the theme and its concepts and terminology. Instead, the teacher began by explaining the activity and then letting students do the hands-on task before covering the related topic at any length.



On the other hand, despite the teachers' strategies, the post-task phases were necessary for the learners to make connections between the more science-related phenomena and their illustrations (Nikula, 2015). The author showed that the tasks were clearly designed to support content learning. Regarding attention to language, it can be argued that if the tasks are approached from general focus-on form perspectives, that is, concerned with participants' attention to linguistics elements, CLIL classroom tasks do not appear as language-oriented activities at all (Nikula,2015).

Furthermore, Escobar and Sánchez (2009) performed a study that tried to measure the gains that students showed in fluency and lexical repertoire using a pre-test and post-test research design. The study included six natural, intact compulsory secondary education classrooms in three public high schools in Catalonia, involving four teachers and 127 secondary-school students. A device for the collection of data was created, consisting of the collection of pre-treatment (T1) and post-treatment (T2) data with three different tests.

At the beginning, the students saw twenty slides with different pictures about the tropical rainforest and the Amazons. During this presentation, the teacher did not provide any verbal information in L1 or L2. This was useful for giving the students an idea about the topic. As a pre-task activity, first, the students had to produce a written reply of three open-ended questions. Then, they had an oral explanation; following this, the students were given a specific lexical recognition test of 25 multiple-choice items. The post-test was carried out immediately after finishing the teaching sequence, following the process described for the pre-test point by point, except for the omission of the slideshow before doing the exercises. The results of the data analysis presented in this study support the authors' optimism for the adopted approach. Students' progress in



terms of fluency and lexical repertoire is evident because they showed considerable students' evolution between 10% and 43% in those repertoires.

3.4 Conclusion

After checking this relevant literature review, it can show a critical connection among the different components presented in this chapter. This section also led people to know about the results obtained in different countries and with different educational levels. Likewise, this literature review includes the basis for the future analysis and interpretation of information of this research synthesis. The next section will explain how the information was obtained for analysis.



Chapter IV

Methodology

4.1 Introduction

This research synthesis is a bibliographical research study. Various online databases such as Elsevier, ResearchGate, Mendeley, and Scholar Google have been used for this research.

4.2 Inclusion Criteria

In order to get a better idea of the effects of using CLIL in a Science class, the criteria to select the articles were as follows. The articles must be empirical studies that must include Science as the main subject to teach. Also, in order to the literature gathered will be relevant, the studies published from 2000 onwards were considered.

4.3 Key-words

The terms used to look for these research articles were the following: (a) teaching, (b)CLIL, (c) science, (d) approach, (e) effectiveness, (f) literature review, (g) strategies, (h) benefits, (i) opportunities, (j) factors, (k) conditions.

There were not be any restrictions related to the design of the studies. The methods that were considered for the present study were qualitative, quantitative, or mixed.

4.4 Journals

Some journals were revised such as *The language learning Journal*, *Language Education*, *International Journal of Bilingual Education and Bilingualism*, *Teaching and Teacher Education*, among others. Lastly, according to different criteria, 15 studies were selected to perform this research synthesis.

Chapter V

Analysis

5.1 Introduction

For the present synthesis, a coding process was implemented to analyze the 15 studies in different categories. The analysis is organized in the following categories: publication year of the studies, educational level, types of CLIL, CLIL effects, studies limitations, and strategies.

5.2 Publication Year of the Studies

Table 1

Publication Year of the Studies

Year of Publication	Number of Studies	Studies	Percentage
2005-2013	8	Jappinen (2005); Escobar & Sanchez (2009); Moore & Dooly (2010); Bret (2011); Evnitskaya & Morton (2011); Morton (2012); Gabillon & Ailincal (2013); Grandinetti, Langellotti & Ting (2013)	53%
2014-2020	7	Escobar & Evnitskaya (2014); Vallbona (2014); Nikula (2015); Pérez & Roquet (2015); Kaanta, Kasper & Piirainen-Marsh (2016); Fernández, J., Fernández, A., & Arias (2017); Valdés-Sánchez & Espinet (2020)	47%

Note. N=15

Table 1 shows the studies classified according to their year of publication. Eight (53%) were published within the last seven years, but the rest of them, seven (47%), were published earlier. CLIL is a term that the European Network of Administration,



Researchers, and Practitioners (EUROCLIL) acquired in the mid-1990s (Coyle, 2007).

However, in 2001 the Council of Europe issued two documents: *The Common European Framework of Reference for Languages: Learning, Teaching, Assessment* and the *European Language Portfolio* to spread language learning (Vallbona, 2014, p.19).

During this year, some changes in the educative system started, including the use of CLIL in the majority of educational institutes so this approach began to be spread all around the world (Vallbona, 2014). For that reason, the information previous mentioned may be considered an essential part because in this way people could know how CLIL became a new educational approach, especially since 2000, that generates a significant impact in the educational system mainly in Europe.

5.3 Educational Level

Table 2

Educational Level

Setting	Number of Studies	Studies	Percentage
Elementary School	6	Bret (2011); Gabillon & Ailincal (2013); Vallbona (2014); Kaanta, Kasper & Piirainen-Marsh (2016); Fernández, J., Fernández, A., & Arias (2017); Valdés-Sánchez & Espinet (2020)	40%
Secondary School	8	Escobar & Sanchez (2009); Evnitskaya & Morton (2011); Morton (2012); Grandinetti, Langellotti & Ting (2013); Jappinen (2005); Escobar &	53%



		Evnitskaya (2014); Nikula (2015); Pérez & Roquet (2015)	
Higher education	1	Moore & Dooly (2010)	7%

Note. N=15

Table 2 shows the different settings where the studies took place and the percentage that they represent for the total number of studies. It shows that eight (53%) studies took place in secondary school. Hence, it probably means that students possess a higher level of knowledge in various areas because they are more capable of maintaining a discussion than the students in elementary school (Escobar & Sánchez, 2009; Morton, 2012; Langellotti & Ting, 2013) that were presented in six (40%) of the studies. However, there is one (7%) study in which the context was University. This study, which was carried out by Moore and Dooly in 2010 emphasized that the students were not the CLIL participants of the study; however, they were learning how to develop a CLIL class properly. This group of students had to formulate questions in English that they could ask to an imaginary group of primary-school pupils about apples so they had to act as teachers and the researches could evaluate how they performed a Science class through the use of verbal and non-verbal resources. It is important to mention that the students had a primary teacher as a model so in this way they realized how to act correctly as a primary teacher.

5.4 Types of CLIL

Table 3

Types of CLIL

Type	Number of Studies	Studies	Percentage
Content-driven (Hard CLIL)	3	Jappinen (2005); Morton (2012); Kaanta, Kasper & Piirainen; Marsh (2016)	20%
Language-driven (Soft CLIL)	4	Escobar & Sánchez (2009); Bret (2011); Gabillon & Ailincal (2013); Pérez & Roquet (2015)	27%
Equal language and content driven (Dual focus)	8	Grandinetti, Langellotti & Ting (2013); Moore & Dooly (2010); Evnitskaya & Morton (2011); Escobar & Evnitskaya (2014); Vallbona (2014); Nikula (2015); Fernández, J., Fernández, A., & Arias (2017); Valdés-Sánchez & Espinet (2020)	53%

Note. N=15

Table 3 shows the studies classified into three CLIL categories. First, content-driven (Hard CLIL), whose main purpose is focusing on content, not language. Second, language-driven (Soft CLIL), where the language is the main goal, content is subordinated to it. Third, equal language and content-driven (Dual focus) that has into consideration not only content but also language as a goal (Šulistová, 2013). The majority of the 53% studies belong to equal language and content-driven (Dual focus). Most of the studies that belong to this category focus on fostering language that includes linguistic and non-linguistic knowledge such as emphasizing utterances, marking direct speech, and providing the meaning of different words, interaction, and more (Moore & Dooly, 2010; Fernández, J., Fernández, A., & Arias, 2017). However, those improvements related to linguistic and non-linguistic knowledge are connected with the Science subject, giving importance to content and language.



Additionally, four studies (27%) emphasized soft CLIL which is language-driven. In this group, language has received more attention than content that is noticeable in productive and receptive skills such as improving vocabulary; oral performance related with complexity; accuracy, fluency; production of better utterances (Escobar & Sánchez, 2009; Bret 2011; Pérez & Roquet, 2015).

Lastly, three studies (20%) are related with hard CLIL which is content-driven. Those studies put more emphasis on teaching content about Science. The improvement is focused on the application of different Science terminology or concepts and their proper use during the class as happened in the study guided by Jappinen (2005).

5.5 CLIL Effects

Table 4

CLIL Effects

CLIL Effects	Number of Studies	Studies	Percentage
Oral Production/Performance	4	Escobar & Sánchez (2009); Gabillon & Ailincal (2013); Escobar & Evnitskaya (2014); Bret (2011)	29%
Language Competence	3	Grandinetti, Langellotti & Ting (2013); Vallbona (2014); Pérez & Roquet (2015)	21%
Cognitive development	3	Jappinen (2005); Nikula (2015); Fernández, J., Fernández, A., & Arias (2017)	21%



Discursive Interaction	4	Evnitskaya & Morton (2011); Morton (2012); Kaanta, Kasper & Piirainen-Marsh (2016); Valdés-Sánchez & Espinete (2020)	29%
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Note. N=14

Table 4 shows the different four main focus of the studies. Language competence, oral production/proficiency, cognitive development, and discursive interaction. The presented 14 studies answer the question about the reported effects of using CLIL to teach Science.

The first point refers to oral production/performance. The main objective in the study guided by Bret (2011) was to determine the effects of CLIL on students' L2 English oral performance, especially in terms of CAF (complexity, accuracy, and fluency). The study demonstrated that CLIL students obtained slightly higher results in terms of verbs, nouns, right formulation of sentences, error-free, and proper use of language compared with non-CLIL students.

Similar positive effects were found in the study guided by Escobar and Sánchez (2009), whose primary focus was to measure students' gains in terms of fluency and lexical repertory during a Science class. The results were positive because, in terms of fluency, the increase in the number of words and number of sentences produced by learners based on the topic (Science) was noticeable. These results suggest that the activities carried out had a significant positive effect on improving students' fluency in Science during the academic learning in the foreign language. Also, students obtained a significant lexical improvement related to specific lexical linguistic recognition and unique words.



Regarding language competence, the study guided by Pérez and Roquet (2015) had language proficiency as the primary focus (productive and receptive skills). Through pre-test and post-test implementation, the results determined that all the skills were not accomplished. Nevertheless, students obtained noticeable gains in reading and writing skills.

On the other hand, the study carried out by Vallbona (2014) contained different evaluations for each skill. There were two groups divided according to the subject (Science and Arts & Crafts). The results show that there were more beneficial effects of using CLIL in Science than in Arts & Crafts in terms of listening because of the highly-structured lessons provided by the teacher that helped students to understand and remember different Science terms more than in Arts & Crafts class (Vallbona, 2014).

The last point is related to discursive interaction: the different roles that the participants, teachers, and students acquire to talk during class. According to the turn of participation that the students have, they could be speakers, listeners, storytellers, and more. In this way, this active participation led students to build meanings and improve knowledge (Evnitskaya & Morton, 2011). A longitudinal study guided by Valdés-Sánchez and Espinet (2020) took place in a public primary school located in Barcelona, Spain. This study focused on the discursive interaction with the implementation of a co-teaching CLIL program that consisted of the collaboration between Science teachers and English teachers to reach different educational goals. Both teachers used discursive interaction patterns such as semantics, language, and participation in the same group of pupils. The participants had to perform different Science activities related to air, plants, forces, and more.

Data was obtained through video recordings that were divided into separate episodes. Each episode contained "an interactional sequence of variable length in which



both co-teachers interact with the whole class to complete a specific task" (p.13). The results showed that discursive interaction during a CLIL class produces positive effects in the participants (students and teachers), especially in teachers, because it helps them acquire or identify the different roles for developing the class in the best way. Also, discursive interaction could make the participants go beyond the comfort zone and produce better answers. Consequently, knowledge acquisition will be more significant.

5.6 Studies limitations

Table 5

Studies Limitations

Limitations	Studies
Educational system	Jappinen (2005); Grandinetti, Langellotti & Ting (2013); Escobar & Evnitskaya (2014), Vallbona (2014)
Methodological limitations	Bret (2011) *; Escobar & Sánchez (2009); Vallbona (2014) *; Nikula (2015)
CLIL is still new	Gabillon & Ailincal (2013); Bret (2011); Grandinetti, Langellotti & Ting (2013) *
CLIL students' competence	Fernández, J., Fernández, A., & Arias (2017)

Note. N= 9

*The studies match for more than one category.

Table 5 emphasizes the limitations that some studies presented. For this analysis, only nine studies were taken into consideration because they showed specific limitations. One of the limitations mentioned is related to the different problems generated in the educational system. In the study guided by Jappinen (2005), curricular



difficulties were presented. During the study, some of the participants were absent because schools did not have a proper organization with teaching and testing periods.

A similar case occurred in the study presented by Vallbona (2014), the limitation was that the school has an overloaded syllabus. It means that the school provided just one hour per week for applying CLIL. Then, the researcher could not use CLIL as she wanted; nonetheless, the results indicate the effectiveness of CLIL in terms of language learning.

In addition, Escobar and Evnitskaya (2014) mentioned that there would be necessary to incorporate some education programs for teachers to improve CLIL teaching because not all the teachers have all the information about how to teach with this approach, and it could be an obstacle.

On the other hand, some methodological limitations were presented in some studies. The samples' limited scope was insufficient to make a proper analysis because the information provided just produce a small number of significant results (Escobar & Sanchez, 2009; Bret, 2011; Nikula, 2015). In contrast, the study's limitation in the research guided by Vallbona (2014) was the obtention of many results what hampered to get particular conclusions that only focused on its primary purpose.

Gabillon and Ailincăi (2013) suggested that one limitation found in the study is related to the idea that CLIL is a new approach introduced recently for educational purposes, especially in Europe. For that reason, teachers did not have enough ideas or materials for developing CLIL in a significant way. Also, they could not create different techniques and strategies as they wanted. The implementation of CLIL means a change in the curricula of each school. It is related with CLIL students' competence because this new approach could teachers do not have the proper training. Consequently, educators



do not have a clear idea about the use and creation of materials for a CLIL class (Fernández, J., Fernández, A., & Arias, 2017).

5.7 Strategies

Table 6

Strategies

Strategies	Number	Studies	Percentage
	of		
	studies		
Scaffolding or Multimodal resources	8	Bret (2011); Evnitskaya & Morton (2011); Morton (2012); Gabillon & Ailincal (2013); Grandinetti, Langellotti & Ting (2013); Escobar & Evnitskaya (2014); Vallbona (2014); Kaanta, Kasper & Piirainen-Marsh (2016)	67%
Use of mother tongue and code-switching	2	Jappinen (2005); Fernández, J., Fernández, A., & Arias (2017)	17%
Others	2	Moore & Dooly (2010); Valdés-Sánchez & Espinet (2020)	17%

Note. N= 12

Table 6 shows the different strategies used by teachers during a Science class. It is important to mention that not all the studies show a specific strategy used for the research. For that reason, only 12 studies were taken into consideration for this category.

The study guided by Gabillon and Ailincal (2013) shows the use of dialogic exchanges as scaffolding during the teaching process in a Science class. The main purpose was to provide the children with language practice and teach new content about



Science. The dialogic exchanges occur between the teachers and the students. Through the use of dialogic exchanges, the learners acquire new concepts and words, use the target language in natural settings, and realize and correct some errors committed by themselves (self-repair).

"Learners were able to articulate their understanding of the topic by using both L1 and L2, and other means such as artifacts, and gestures" (p.173). Besides, the teacher did not use a complex structure of dialogic exchanges. Instead of made use of complex structures, the teacher used simply gestures or artifacts in order to build concepts for being understood by students in an easier way (Gabillon & Ailincăi, 2013).

Also, multimodality was used as a strategy in order to the participants' different resources were used for organizing their actions. This strategy involves the use of language, gestures, gaze, body position and movement, material artifacts, etc. (Evnitskaya & Morton, 2011; Kaanta, Kasper & Piirainen-Marsh, 2016).

Another strategy used during a CLIL class is 'codeswitching' that is the use of L1 and L2 during the course. In the study guided by Fernández, J., Fernández, A., and Arias (2017), the use of this strategy was approved by parents who thought that it was a good idea for teaching different knowledge about Science to the learners in a manageable and understandable way.

Besides, Valdés-Sánchez and Espinet (2020) used co-teaching as a strategy during the class. It is the collaboration between English and Science teachers. They decide together what to teach, the language to use, and who leads the different conversations during the class. As a result, teachers could share their knowledge about Science and English in order to build a proper lesson plan and maintain the proper organization of the class.



Another strategy is the use of plurilingual repertoires that consists in the use of different languages during the class. The study carried out by Moore and Dooly (2010) used this strategy during classroom interaction to create a favorable environment for performing different activities that could improve the Science knowledge and motivation during the learning process. The use of multiple languages (English, Catalan, and Spanish) enhanced interaction during the class through the scholar community members' dynamic and simultaneous negotiation (students and teachers). Besides, creating a secure environment generated better and natural answers from the students.

CLIL is a new approach that has been implemented in the educational system of many countries, especially in Europe. It is necessary to have a clear idea about the different implications involved with the use of CLIL because in this way teachers could manage the learning process in a better way taking into consideration the different benefits that the use of this approach involves. Some limitations could appear due to fact that this approach is still new which could affect CLIL lessons' development. Still, despite those obstacles, participants (teachers, students, and researchers) make an effort to improve the application of CLIL and get good results.

Educators and the educational system, in general, have to take into consideration the multiple positive effects that the use of this approach produces. To take advantage of the opportunities offered by CLIL, it is essential that teachers use different strategies during the class such as scaffolding, use of mother tongue, code-switching, and more to produce better results during the learning process (Jappinen, 2005; Bret, 2011; Gabillon & Ailincăi, 2013).



Chapter VI

Conclusions and Recommendations

6.1 Conclusions

The purpose of this research synthesis was to identify the reported effects, different opportunities, and obstacles that could appear with the use of CLIL in a Science class. For this reason, fifteen published studies were coded into six categories that aimed to answer the following research question: What are the reported effects of using CLIL to teach Science?

As the analysis showed, Content and Language Integrated Learning (CLIL) is a new approach that has been causing an impact on Europe's educational system and all around the world (Jappinen, 2005; Vallbona, 2014), especially in secondary education.

The analysis of the different studies showed that some methodological limitations appeared during the application of CLIL at various institutions. Some authors mentioned that the researchers could not have a proper research sample number and different institutions did not have a formal organization in terms of schedules and syllabus to develop CLIL in a good way (Bret, 2011; Escobar & Evnitskaya, 2014; Nikula, 2015; Fernández, J., Fernández, A., & Arias, 2017).

It is impossible to mention just one strategy as the best one since different authors presented some useful strategies to develop a CLIL Science class properly. Teachers have to decide which one is the best for the students, considering some aspects of their students, such as the level, learning style, culture, age, and others related to the 4 C's framework mentioned by Coyle (2007).

Some strategies that could be used with CLIL during a Science class are scaffolding, multimodal resources, code-switching, use of mother tongue, co-teaching, and plurilingual repertoires (Jappinen, 2005; Gabillon & Ailincal, 2013; Kaanta, Kasper



& Piirainen-Marsh, 2016; Valdés-Sánchez & Espinet, 2020).

However, to apply CLIL, a revision of the curriculum is needed. As mentioned, CLIL is not only a strategy but an approach that tackles various essential factors, such as the subject's content, language, techniques, and tools.

6.2 Recommendations

Based on the analysis and its results, there are certain recommendations for implementing CLIL in the classroom and future research studies. First, institutions must provide teachers training about the use of CLIL so they could innovate and produce new resources to use in the class. Second, different schools' authorities have to be prepared to construct a curriculum where CLIL could be developed, using proper materials and strategies that could improve not only students but also teacher's content and language competence.

Further research should also address the different materials and strategies that could be useful during a CLIL Science class. The knowledge about those materials and strategies could be helpful for some investigations because, in this way, they obtain an extensive scope and show more results that inspire teachers to use CLIL more frequently during their classes.

Regarding further research, it is necessary to know about the application of CLIL in Ecuador.

Lastly, the present findings should encourage schools and English teachers to incorporate CLIL since research has shown positive academic results.



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Appendix



The next studies were used for the analysis.

Author/Year	Name of The Study
Bret, 2011	“Implementing CLIL in a Primary School in Spain: The Effects of CLIL on L2 English Learners’ Oral Production Skills”
Escobar and Evnitskaya, 2014	“Do you know Actimel? The adaptive nature of dialogic teacher-led discussions in the CLIL science classroom: a case study”
Escobar and Sánchez, 2009	“Language Learning through Tasks in a Content and Language Integrated Learning (CLIL) Science Classroom”
Evnitskaya and Morton, 2011	“Knowledge construction, meaning- making and interaction in CLIL science classroom communities of practice”
Fernández, J., Fernández, A., and Arias 2017	“Analyzing students ‘content-learning in Science in CLIL vs. non-CLIL programmes: empirical evidence from Spain”
Gabillon and Ailincăi, 2013	“CLIL: A Science lesson with breakthrough level young EFL learners”
Grandinetti, Langellotti, and Ting, 2013	“How CLIL can provide a pragmatic means to renovate science education – even in a sub-optimally bilingual context”
Jappinen, 2005	“Thinking and Content Learning of Mathematics and Science as Cognitive Development in Content and Language Integrated Learning (CLIL): Teaching Through a Foreign Language in Finland”
Kaanta, Kasper, and Piirainen-Marsh, 2016	“Explaining Hooke’s Law: Definitional Practices in a CLIL Physics Classroom”
Moore and Dooly, 2010	“How Do the Apples Reproduce (Themselves)?” How



	Teacher Trainees Negotiate Language, Content, and Membership in a CLIL Science Education Classroom at a Multilingual University
Morton, 2012	“Classroom talk, conceptual change and teacher reflection in bilingual science teaching”
Nikula, 2015	“Hands-on tasks in CLIL science classrooms as sites for subject-specific language use and learning”
Pérez and Roquet, 2015	“The linguistic impact of a CLIL Science programme: An analysis measuring relative gains”
Valdés-Sánchez and Espinet, 2020	“Coteaching in a science-CLIL classroom: changes in discursive interaction as evidence of an English teacher’s science-CLIL professional identity development”
Vallbona, 2014	“L2 competence of young language learners in science and arts” CLIL and EFL instruction contexts