

Co-teaching among English pre-service teachers for integrated STEAM+CLIL education

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ABSTRACT: In Spain, primary education teachers teaching subject matter in a foreign language through Content and Language Integrated Learning (CLIL) require new pedagogical competencies. Teaching in a second language often poses problems, as many teachers have no specific training in CLIL and often wish to gain greater self-confidence when teaching some subjects, for example, Natural Sciences, in a foreign language. In that scenario, two general objectives are proposed in this study within the framework of pre-service CLIL teacher training: to examine the impact of a co-teaching programme on the development of the pedagogical competences of pre-service English as a Foreign Language (EFL) teachers engaged in STEAM+CLIL integrated education; and 2) to study the impact of the programme on the perceived self-confidence of pre-service teachers when teaching CLIL. The results of this research involving three experimental cohorts of pre-service teachers showed an improvement in their pedagogical competencies at designing integrated STEAM+CLIL didactic units, compared to the respective control groups; and an increase in their perceived self-confidence when teaching EFL through CLIL. These results point towards an alternative pathway for primary school teacher training in a foreign language, particularly English.

Keywords: co-teaching, teacher training, EFL, STEAM, CLIL

Codocencia para la formación inicial de docentes de inglés en educación STEAM+AICLE integrada

RESUMEN: En España, la enseñanza de asignaturas en una lengua adicional a través del Aprendizaje Integrado de Contenidos y Lengua Extranjera (AICLE) en Educación Primaria requiere nuevas competencias pedagógicas por parte de docentes. Esta situación suele plantear un problema, ya que muchos no tienen una formación específica en AICLE y consideran que necesitan más autoconfianza para enseñar dichas asignaturas en una lengua adicional, por ejemplo, en Natural Science. Ante este escenario, en este estudio se plantean dos objetivos generales en el marco del profesorado AICLE en formación: 1) examinar el impacto de un programa de codocencia en el desarrollo de competencias pedagógicas de futuros maestros de inglés como lengua extranjera en educación STEAM+AICLE integrada, y 2) estudiar el impacto de este programa en la autoconfianza hacia la enseñanza AICLE generada por los futuros maestros. Los resultados obtenidos en la investigación con tres cohortes experimentales de maestros en formación muestran una mejora de sus competencias peda-

gógicas para diseñar propuestas didácticas STEAM+AICLE integradas, en comparación con sus respectivos grupos de control; también a un aumento de su autoconfianza en la enseñanza de inglés como lengua extranjera a través de AICLE. Estos resultados parecen mostrar una alternativa para la formación docente de maestros de Educación Primaria en lengua adicional, particularmente inglés.

Palabras clave: codocencia, formación docente, inglés como lengua extranjera, STEAM, AICLE

1. INTRODUCTION

We live in multilingual and multicultural societies where there is an urgent need to improve communication in several languages, due to the positive effects that it can have on personal mobility, employment, education, and access to information. The decisions of the Council of Europe and the European Union on educational language policy have helped the governments of the Member States to adapt their education systems and to rise to the challenge of the European Education Area, particularly in the field of language teaching, learning, and evaluation. The Content and Language Integrated Learning (CLIL) initiative emerged within that context, with the aim of contributing to achieving European objectives with regard to the improvement of language competences (Commission of the European Communities, 2003).

The progressive implementation of CLIL has been presented as one of the most relevant educational language-teaching innovations for European education over several decades (Pérez Cañado, 2018). CLIL is presented with the aim of improving the plurilingual and pluricultural competence of European citizens and is defined as "a dual-focused educational approach in which an additional language is used for the learning and teaching of both content and language" (Coyle *et al.*, 2010, p. 1). It is worth noting that Spain is one of the countries that has pioneered the implementation of this approach in Europe (Coyle, 2010) and where Spanish educational administrations at the regional level within a Spanish Autonomous Community have, since their earliest days, established the curricular requirements and professional qualifications of teachers for this type of teaching in what are known as 'bilingual schools' (Hughes *et al.*, 2018, p. 31). The rapid increase in the implementation of this approach in primary and secondary education over the last two decades, together with the lack of prior initial teacher training, has undoubtedly had an impact on the professional profile of CLIL teachers, who have had to take on board the rapid extension of CLIL within their schools (Pérez Cañado, 2018; Pons Seguí, 2020).

In that situation, teacher training for CLIL is therefore a prerequisite and must be prioritized and consolidated. All the more so as teacher training in this field, especially initial teacher training (Marsh, 2002), has notable effects on the sustainability of quality bilingual education (Coyle, 2011). However, the teacher training scenario related to CLIL is still quite heterogeneous throughout Spanish universities (Custodio-Espinar, 2023).

Additionally, integrated Science, Technology, Engineering, Arts and Humanities, and Mathematics (STEAM) education is aligned with the need to move beyond disciplinary barriers, so as to improve the comprehensive training of students when solving the complex problems of modern society. Having gained prominence over recent years, STEAM is consistent with the inclusive nature of CLIL and good student literacy outcomes have been

reported in a variety of contexts (Aguilera & Ortiz-Revilla, 2021; Ata Aktürk & Demircan, 2017; Colucci-Gray *et al.*, 2018; Kang, 2019). Furthermore, although it is important to recall that the situation may vary depending on the school, educational levels, and local educational policy, the most common subjects taught in a foreign language in Spain, especially English, include Natural Sciences, Social Sciences, Art, and Mathematics. So, STEAM and CLIL can be applied to a wide range of subject matter, although some combinations are no easy matter. The intention behind educational research on integrated STEAM education is to facilitate its application in practice, as teachers have described its interpretation and implementation in the classroom as challenging. Any such feelings might be related to an oversimplified understanding of STEAM education among teachers, who interpret it as a series of activities and tasks, rather than as an integrated approach to learning (Jamil *et al.*, 2018). Even after participating in training courses, teachers continue to express some confusion over how to integrate and to assess particular subjects (Kim & Bolger, 2015; Ortiz Revilla *et al.*, 2023). The same appears to happen with the CLIL approach, in view of the urgent need highlighted in several studies to equip CLIL teachers with the skills and expertise needed to ensure its successful implementation (Szczesniak & Muñoz Luna, 2022). A self-perceived lack of skills and therefore confidence can prompt insecurity among in-service and pre-service teachers with regard to their role in the classroom (Breeze & Azparren Legarre, 2021), yet research into emotions and self-confidence among CLIL teachers continues to be scarce (Belmonte Carrasco & de la Maya Retamar, 2023). As Ioannou-Georgiou (2012) noted, preparing a CLIL classroom and feeling comfortable and confident enough to teach with this approach in the classroom can imply quite a lot of work. She therefore stressed the need for mutual support among teachers. In that sense, the didactic strategy of co-teaching appears to be a promising strategy for pre-service teachers following a training in STEAM+CLIL (Alonso-Centeno *et al.*, 2022; Custodio-Espinar *et al.*, 2022; de la Maya Retamar & Luengo González, 2015).

In that scenario, two general objectives are proposed in this study within the framework of CLIL teacher training: 1) to examine the impact of a co-teaching programme on the development of the pedagogical competences of prospective EFL teachers engaged in STEAM+CLIL integrated education; and 2) to study the impact of the programme on the perceived self-confidence of the pre-service teachers towards CLIL teaching.

2. THEORETICAL FRAMEWORK

2.1. Initial teacher training for CLIL primary education teachers

Improving the quality of the CLIL approach is largely dependent on the professional profile of the teachers who will be teaching CLIL, so a closer look at the effectiveness of the curricula and methodologies that constitute the initial training for such teachers is considered necessary. Strategies, curricular recommendations, and competences for initial teacher training, professional development in CLIL, and curricular planning are now contemplated in European framework documents (Bertaux *et al.*, 2010; Kelly *et al.*, 2004, Marsh *et al.*, 2010), which contribute to the development of integrated CLIL competence profiles for teachers. Despite the efforts of European institutions, the initial training of CLIL teachers is still an

unresolved issue, in view of the large gap between the curricula for teacher-training and the specific demands of bilingual programmes within schools (Fernández César *et al.*, 2013). Thus, teachers of non-language subjects reveal signs of insecurity and uncertainty linked to the performance of their teaching activity in CLIL, due to the lack of prior teacher training in CLIL-specific pedagogical competences (Pavón Vázquez & Rubio, 2010). In Spain, CLIL teachers of Primary Education are expected to hold a university degree in Primary Education and to possess a certain level of linguistic competence, which varies according to each Spanish Autonomous Community. In that respect, Ortega-Martín (2015) pointed to a lack of homogeneity in the linguistic teaching requirements for the implementation of the CLIL approach in Spain. For the most part, English is the additional language of the CLIL programmes taught within the education systems of almost all European countries, and especially in Spain, as the majority of students within Europe study EFL in both primary and secondary education (Eurydice, 2023).

In that context, it is urgent to take steps to develop the professional profile of CLIL teachers at higher education institutions (Pons Seguí, 2020). Universities must be aware of the need to provide future CLIL teachers with the necessary knowledge, skills, and strategies to implement bilingual education (Delicado Puerto & Pavón Vázquez, 2016). Hence, a thorough review of the curricular designs and methodologies used for CLIL teacher training at Spanish universities is needed. Its focus must be on favouring the development of specific professional competences for CLIL teaching that not only entails the improvement of linguistic knowledge, but also the acquisition of a solid methodological training in CLIL (Ortega-Martín & Trujillo, 2018). In line with this vision, we adopted the competency profile of the CLIL teacher, based on the integrated development of the 7 competences proposed in the model of Pérez Cañado (2018): linguistic competence refers to a teacher's command of the target language especially every day and academic language. Pedagogical competence refers to the active methodologies of students. Scientific competence refers to the content knowledge they teach and to CLIL theory. Organizational competence refers to classroom management knowledge. Interpersonal and collaborative competencies refer to a capacity to create a learning atmosphere, and the need to work with other teachers. Finally, reflective and personal development competencies refer to the capacity for reflection on CLIL and lifelong learning of CLIL; all are essential if teachers are to ensure quality CLIL teaching.

Difficulties over understanding the epistemological concepts of the integrated CLIL approach were identified in a study on the classroom plans of pre-service teachers in primary schools with a bilingual section (Guillén Díaz & Sanz Trigueros, 2019). The connection between theory and practice of CLIL needs to be strengthened and incorporated in the teacher-training curricula (Iakovou, 2020). It is therefore also necessary to approach the understanding of CLIL curriculum design both through an integrated approach to language and content in that additional language and through a specific competence for CLIL teaching: 'selecting, adapting, creating and evaluating materials' (Melara Gutiérrez & González López, 2013, p. 1342). In that sense, Custodio Espinar and García Ramos (2023) assessed the competence of pre-service teachers of English to programme CLIL lessons for both Pre-school and Primary Education. They highlighted the successful development of the capability to programme CLIL lessons at those stages when both scientific content and language training

were being developed within collaborative integrated approaches, thus balancing both the linguistic and methodological training necessary for the development of the CLIL professional profile and related competences.

Considering the current needs for initial CLIL teacher training, we believe that the pre-supposed methodological change for CLIL teachers may in an efficient manner also be extended to the classrooms of future primary school teachers, so that they can understand and gain confidence in what CLIL teaching really means, as an integrated approach to language and content in an additional language. In that sense, co-teaching among teachers working in the various curricular areas, including foreign languages, appears to be a promising strategy.

2.2. Co-teaching for disciplinary integration in Higher Education

Co-teaching has for some years been considered as an effective strategy for the inclusion of special needs students within mainstream classrooms, thereby bringing learning to all students from an inclusive perspective (Scruggs, Mastropieri & Mc Duffie, 2007). From that point of view, the practice of co-teaching is understood as a guarantee in educational processes that can address integration (Folch Dávila *et al.*, 2020), insofar as it is presented as the presence of two or more teachers committed to teaching the same group of students. A further advantage is that it promotes the integrated learning of content that might otherwise be more difficult to achieve on an individual basis (Suárez-Díaz, 2016). It is worth underlining that Higher Education teachers often collaborate in research tasks, although collaboration is far less common in teaching and co-teaching is very rare in the university classroom. Something that is due to the peculiarities of the education system itself, based on disciplinary fragmentation and rigid curricular frameworks, factors that lead to scant little collaboration between teachers from different areas (Bautista *et al.*, 2015).

The practice of integration involves using theoretical concepts and methodologies specific to the range of subject matter covered in the co-teaching process. Moreover, integration demands specific characteristics of the teachers, in order to understand and to adapt to the complexity of co-teaching, as it can be perceived in different ways, depending on the discipline in use at any given time (Delgado, 2009). Co-teaching applied to disciplinary integration provides an opportunity for students to benefit from different and complementary points of view regarding each subject and the proposals, guidelines, and orientations of each teacher in the classroom also enhance that process (Folch Dávila *et al.*, 2020). Co-teaching must be understood as a joint-teaching process where ideas are planned and shared, in order to achieve a global understanding of practice with common purposes (Scantlebury *et al.*, 2008). In addition, two other components must be taken into account: co-instruction and co-assessment (Suarez-Díaz, 2016). Thus, co-teaching involves "a genuine peer learning relationship in which communication moves between different contexts inside and outside the classroom" (Rytivaara & Kershner, 2012, p.1001). In that process, it should be noted that the knowledge built up in the theoretical and practical content of each teacher is modified, adapted, and constructed through interactions with the other co-teachers, in order to determine concrete situations of teaching action. In other words, co-teaching brings with it multiple options for the teachers, through cooperative reconstructions of subject matter knowledge. It is therefore a matter of working together, while encouraging dialogue and agreement in

decision-making (Alonso-Centeno *et al.*, 2022), as these interpersonal connections between co-teachers are not easily managed, and hardly arise in a natural way (Clancy *et al.*, 2015),

There are different models of co-teaching (Lock *et al.*, 2016); in this paper, co-teaching refers to a situation in which several teachers share planning, teaching-learning, and assessment strategies agreed within the same teaching action over an extended period of time. Through the promotion of interdisciplinary and holistic learning, the use of this model breaks with the traditional disciplinary fragmentation in curricula, replacing it with integrative curricular practices, and horizontal coordination between jointly managed activities and projects among the teachers.

The potential of co-teaching in Higher Education and specifically in teacher training in bilingual contexts is therefore worth highlighting, to overcome the unavoidable challenge that university institutions face when seeking to provide sufficient methodological training for future CLIL teachers (Custodio-Espinar *et al.*, 2022; Palacios *et al.*, 2018; Pham & Unaldi, 2021). Thus, the incorporation of co-teaching in teacher training favours the understanding of a collaborative model among university co-teachers. It also facilitates the development of the necessary collaborative competences among future CLIL teachers (Marsh *et al.*, 2010; Montgomery & Akerson, 2019). Although studies on the effects of co-teaching in CLIL teacher training are scarce (de la Maya Retamar & Luengo González, 2015), the effectiveness of co-teaching in CLIL contexts has been studied and reported in the literature over recent years (Alonso-Centeno *et al.*, 2022; López-Hernández, 2019; Sanz de la Cal & Greca, 2021). López-Hernández (2019) reported that the practice of co-teaching in two subjects on a teacher training program resulted in both better motivation and better academic results compared to the results of similar subjects taught according to a more "traditional" model; Alonso-Centeno *et al.* (2022) investigated the perceptions of interdisciplinary integration among pre-service teachers after the implementation of an iSTEAM+CLIL co-teaching proposal and pointed to improved levels of disciplinary integration perceived both before and after the intervention.

2.3. STEAM + CLIL: the SeLFiE model

The SeLFiE pedagogical model "STEAM educational approach and foreign language learning" (Gatt *et al.*, 2021; Sanz de la Cal & Alonso-Centeno, 2021) unites the different elements of CLIL and STEAM, advocating the integration of STEAM disciplines and the learning of an additional language in bilingual educational contexts. Scientific content is therefore linked to the learning of an additional language in Primary Education. In this model, storytelling in an additional language plays a key role, as it serves as a common thread that motivates students to approach a topic, relating one investigation to another as they investigate different aspects included in a story. Storytelling in an additional language validates students' learning and conveys the values and emotions that give meaning to their lives (Ellis & Brewster, 2014). Thus, students are invited to practice collaborative participation in authentic activities that are closely linked to the picture book and integrated in a range of subject matter -Natural Sciences, Social Sciences, Mathematics, Arts Education, and Music Education- taught in an additional language. Furthermore, the learning of this additional language is addressed as part of those activities, which facilitates the development of listening and reading comprehension, oral and written expression, and oral and written

interaction, as well as mediation according to the age of the pupils. The use of technology facilitates the learning process from a multi-referential approach, providing learners with diverse and varied forms of representation and communication in the additional language, as they can use them to participate in oral and written discourse through the use of the computer to create images, videos, podcasts, *etc.*

3. METHODOLOGY

3.1. Design

A three-phase qualitative quasi-experimental study was conducted with three experimental and three control groups (Creswell & Guetterman, 2019).

3.2. Context and participants

The first phase of the study was conducted during the academic year 2020/21, the second during the academic year 2021/22, and the third during the academic year 2022/23. A total of $N = 138$ students in the fourth year of the Bachelor's Degree in Primary Education (English Language) at the University of Burgos (Spain) participated in the study. All students were enrolled in the subjects: *Encouraging Reading in English in Primary Education* and *Research and Innovation in Learning about the Environment*. Both subjects were taught in English in the experimental groups while *Encouraging Reading in English in Primary Education* was only taught in English in the control groups. However, the co-teaching program was only implemented in the experimental groups. The three experimental groups were comprised of both females ($N = 79$) (68.3%) and males ($N = 79$) (31.6%), as were the three control groups, ($N = 59$) (71.1%) and ($N = 59$) (28.8%). The ages of the participants ranged between 21 and 26 years old. The students had no previous CLIL training and their English Language proficiency levels were between B2 and C1. Before taking those subjects, they had followed a two-month internship in primary schools. It is worth stressing that all the groups were comparable in terms of their English and scientific knowledge and previous teaching experience.

The sample distribution is shown below in Table 1.

Table 1. *Distribution of the sample*

YEAR	N EXPERIMENTAL	N CONTROL
2020-2021	27	27
2021-2022	23	16
2022-2023	29	16
Total	79	59
		138

3.3. Procedure and Data collection

During the three academic years referred to above, three teachers from the areas of Didactics of Language and Literature, Didactics of Experimental Sciences and Didactics of Social Sciences, responsible for the subjects *Encouraging Reading in English in Primary Education* and *Research and Innovation in Learning about the Environment* implemented a co-teaching program (the latter was, in turn, structured in two parts: the natural environment and the social environment). As detailed below, the programme involved jointly planned teaching work: design, common objectives and criteria, timetabling, content, shared monitoring of student work and assessment. It is worth underlining that the teachers who were in charge of the Natural and Social sciences, although with previous research experience on integrated approaches, had no training in CLIL.

At the beginning, the EFL pre-service teachers from the experimental groups were informed of the project, the working rules, and the evaluation procedure. During the first semester of each academic year, the students of both subjects (three curricular areas) designed activities with active methodologies specific to each discipline (story-based approach, inquiry methodology in Natural Sciences and Social Sciences, engineering design, among others), methodologies that they subsequently used in their integrated proposals that are explained below. In parallel to the development of the specific contents of each subject and under the monitoring and tutoring of the three teachers, the students were divided into working groups who designed a STEAM+CLIL didactic proposal based on the SeLFiE model. Two premises were laid down: that the proposal could be taken to the Primary Education classroom with a bilingual EFL section and that it should, at least, integrate subject matter related to Social Science, Natural Science, and English. In accordance with the co-teaching approach, it may be noted that the three teachers jointly evaluated the didactic units and the task was the same in the three curricular areas.

Thus, the members of the working groups assumed the role of future teachers of each of the linguistic and the non-linguistic subjects; one of the students was also appointed as the bilingual coordinator whose role was to oversee the subjects taught in English at the bilingual schools. The starting point was the choice of a picture book in English, the plot of which was established as the common thread that facilitated the design and meshing of the integrated activities. Each group of students therefore selected between 3 and 5 stories, previously discussed with the three teachers, before making an independent choice.

At the end of the semester, each working group then presented its didactic proposals both in written and oral form for subsequent shared evaluation. The EFL oral presentation took the form of a short video (15-20 minutes), in which the students were expected to select only a few activities from each curricular area and present them as they would do in class. Once the presentations had been reviewed, a group interview of a maximum duration of 15 minutes was held between the three teachers and each working group, during which doubts linked to the presentations could be clarified and the students' perceptions of the project were investigated, in order to detect both strong and weak points for improvement.

It is worth stressing that the students from the control group also had to present a didactic unit in keeping with the CLIL approach towards the subject *Encouraging Reading in English in Primary Education*, which therefore included other content areas. Those students

had the same subjects as the experimental groups, the same teacher for *Encouraging Reading in English in Primary Education*, and they shared 70% of their classroom time with the students from each experimental group in that subject. However, different teachers taught the subject *Research and Innovation in Learning about the Environment* in Spanish and the teachers from Natural Science and Social Science never jointly monitored and evaluated the students' didactic units throughout the term.

Besides those activities, a requirement of the subject *Encouraging Reading in English in Primary Education* was that each student hand in a portfolio with final reflections on the learning process.

In congruence with the research objectives, two different sources of data were collected.

The didactic proposals of the groups were used to examine the impact of the programme on the development of the pedagogical competences of the future teachers. Besides, the individually prepared portfolios of each student were used to study the impact of the programme on their perceived self-confidence towards teaching in bilingual sections through CLIL.

3.4. Data analysis

The data analysis also consisted of two distinct parts, in accordance with the research objectives and the two sources for data collection.

On the one hand, deductive coding was used in the analysis of the STEAM+CLIL didactic proposals (Corbin & Strauss, 2014). Specifically, the objectives, activities and sequence of activities were analysed, assigning a level of conceptualization of disciplinary integration based on the levels proposed by Gresnigt *et al.* (2014, p. 52): isolated (separate and distinct subjects or disciplines), connected (explicit connection between separate disciplines), nested (a skill or knowledge from another discipline is addressed within a subject area/discipline), multidisciplinary (two or more subjects are organized around the same theme or subject, but the disciplines retain their own identity), and interdisciplinary (disciplinary perspectives are lost and emphasis is placed on skills and concepts across subject matter rather than within disciplines). The evaluators designed a rubric with the main characteristics to be observed in the categorization process, which one author implemented and two other authors reviewed. In case of discrepancy, they arrived at a consensual agreement over the final category.

In addition, the individual portfolios of each student were subject to thematic analysis (Braun & Clarke, 2006). Based on Fiorilli *et al.*'s (2020) questionnaire on confidence in learning, a list was compiled with the terms that were theoretically related (with either a positive or a negative connotation) to self-confidence towards teaching in a foreign language (motivation, confidence, competence, and difficulty, among others). Then, each term on the list was searched for within each portfolio to locate sentences related to self-confidence in relation to CLIL teaching, which were categorized as either positive or negative. Three authors performed the process on an individual basis and then met up to reach a full consensus. The number of statements of each type was then counted and divided by the number of learners to determine a homogeneous measure (in this case, number of statements per learner), to compare the results between the experimental and the control groups.

4. RESULTS

The results of the levels of integration of the didactic proposals of the students forming part of the experimental and the control groups and their categorization are presented below in Table 2 and Table 3, respectively.

Table 2. *Level of integration of the didactic proposals of the three experimental groups*

EXPERIMENTAL GROUP 1 (2020-2021)		EXPERIMENTAL GROUP 2 (2021-2022)		EXPERIMENTAL GROUP 3 (2022-2023)	
WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL	WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL	WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL
1	Multidisciplinary	1	Multidisciplinary	1	Multidisciplinary
2	Connected	2	Multidisciplinary	2	Connected
3	Multidisciplinary	3	Multidisciplinary	3	Connected
4	Multidisciplinary	4	Multidisciplinary	4	Nested
5	Multidisciplinary	5	Multidisciplinary	5	Interdisciplinary
6	Isolated	6	Multidisciplinary	6	Connected
7	Isolated	7	Interdisciplinary	7	Connected
				8	Multidisciplinary

Table 3. *Level of integration of the didactic proposal of the three control groups*

CONTROL GROUP 1 (2020-2021)		CONTROL GROUP 2 (2021-2022)		CONTROL GROUP 3 (2022-2023)	
WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL	WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL	WORKING GROUP	LEVEL OF INTEGRATION OF THE PROPOSAL
1	Isolated	1	Isolated	1	Isolated
2	Isolated	2	Isolated	2	Isolated
3	Isolated	3	Connected	3	Connected
4	Isolated	4	Nested	4	Nested
5	Isolated	5		5	Isolated
6	Isolated	6		6	Multidisciplinary
7	Isolated	7		7	Connected

As can be seen, the didactic proposals of the experimental groups present much more sophisticated levels of disciplinary integration, in coherence with the CLIL approach, than those of the control groups. Specifically, in the experimental groups, connected and multidisciplinary proposals predominated. However, in the control groups, isolated proposals predominated. Moreover, it should be noted that some proposals reached the interdisciplinary level in the experimental groups, whereas in the control groups, only one proposal reached the multidisciplinary level.

On the one hand, the best results for the experimental groups were observed in the 2021/22 academic year. On the other, the worst results for the control groups were observed in the academic year 2020/21.

Table 4 shows the results for the coefficient of sentences with either positive or negative connotations on perceived self-confidence per student, in both the experimental and the control groups.

Table 4. *Ratio of positive and negative perceived self-confidence in judgements*

COURSE	N EXPERIMENTAL	N CONTROL
	+/-	+/-
2020/21	3.74/0.07	1.92/0.18
2021/22	2.69/0.04	1.68/0.75
2022/23	5.62/0.24	2.12/0.5

As can be seen, the three experimental groups showed much higher measures of positive perceived self-confidence in their judgements than their respective control groups. In addition, the experimental groups showed lower measures of negative judgments than their respective control groups.

In addition, it is worth noting that the students' positive judgements in the case of the experimental group are much more intense than those of the control group. Below are some examples of each type.

Control Groups:

- Positive judgements: *Most things are new to me, but at the same time they are very useful and I am sure I will implement them in the classroom (year 21-22); Comparing the first day of the subject and the knowledge I had with what I have now, I can affirm that during these months I have gathered many useful resources, as well as tools to develop myself tomorrow as a future teacher (year 21-22).*

- Negative judgements: *I realised that this profession requires a great deal of knowledge and know-how that is impossible to acquire in four years (year 20-21); I can't wait to see what will be waiting for me in the class I will be teaching these next three months, even if I have that fear of the unknown, and a bit of fear of teaching in a language other than my own (year 21-22).*

Experimental Groups:

- Positive judgements: *Although it has been difficult and time-consuming to design it in the best possible way, I consider the amount of knowledge we have learned to be much greater (year 21-22); I enjoyed it myself, I felt very comfortable and I think that everything I learnt will be useful for my future (year 21-22).*

- Negative judgements: *I felt a sense of fear because I realised that it was very long and a lot of time and effort had to be spent on it. Right now, I could say that it is one of the projects that has surprised me the most because, despite being hard, I have learnt how to make a good Didactic Unit (year 21-22).*

5. DISCUSSION AND CONCLUSIONS

This study had two objectives within the context of CLIL pre-service teachers: to examine the impact of a co-teaching programme on the development of the pedagogical competences of EFL pre-service teachers in STEAM+CLIL integrated education; and to study the impact of this programme on the perceived self-confidence of EFL pre-service teachers towards CLIL teaching.

With respect to the first objective of this research, the greater sophistication of the levels of integration in the didactic proposals of the experimental groups with respect to the control groups pointed to highly developed pedagogical competences of the EFL pre-service teachers, in this case, for the design of integrated STEAM+CLIL proposals. This general conclusion was reinforced by more specific results: the predominant proposals of the experimental groups were connected, multidisciplinary, and in some cases even interdisciplinary proposals, while the control group proposals were mostly isolated, and only very occasionally multidisciplinary. It can therefore be affirmed that the programme has had a positive impact. These results coincided with others reported in previous studies on the viability of co-teaching for teacher training in integrated approaches (Alonso-Centeno *et al.*, 2022, Greca *et al.*, in press), and on the effectiveness of both co-teaching (Custodio-Espinar *et al.*, 2022) and the combination of STEAM for CLIL teacher training (Tytarenko *et al.*, 2021). Finally, these results have reinforced the necessity and the plausibility of training in integrated approaches for future teachers (Ortiz-Revilla *et al.*, 2023).

Although the results of the experimental groups over the three years were much better than those obtained for the control groups, their results were hardly homogeneous; the best results were detected for the experimental group during the second implementation (academic year 2021-2022). These results reinforced the importance of the organisation and the coordination of co-teaching (Yanamandram & Noble, 2005), because the foundations had not yet been well established in the first implementation (2020-2021) and one of the teachers had to be replaced by another teacher, in the last one (2022-2023), who had to be integrated into the dynamics from scratch. It may be added that the same programme was implemented over all three years. In fact, coordination between teachers, coherence of the discourse, and the subject-related activities were elements that the students highlighted in their portfolios as relevant to their perceived self-confidence and, ultimately, to their understanding of integration. In the literature, we found that the perceived contradictions or differences of opinion among the co-teachers regarding activities and evaluation were among the major disadvantages of co-teaching (Dumas, 1999). In this respect, our own experience was that, despite the continuous dialogue, the prior planning was better in the second rather than in the first year of implementation in which the co-teachers often solved one issue or another in an improvised manner. It all generated contradictory messages for the students which, although they were later corrected, left their mark.

The picture of the positive impact of the co-teaching programme on the training of future teachers was reinforced by the second objective of the research. The higher coefficients of positive judgements, and the lower coefficients of negative judgements among the experimental group students with respect to the control group students, also showed a positive impact of the programme on the perceived self-confidence of EFL pre-service teachers towards

CLIL teaching. These results were consistent with the importance of teacher collaboration for change in teachers' self-perceptions and beliefs about their pedagogical roles (Pham & Unaldi, 2021), and their learning experience (Buckingham *et al.*, 2021).

6. LIMITATIONS OF THE STUDY AND PEDAGOGICAL AND THEORETICAL IMPLICATIONS

A limitation of this work concerns whether we are measuring perceived self-confidence toward CLIL teaching or perceived self-confidence in teaching in general. In that respect, the material under analysis was taken from the portfolio that was a specific requirement of the subject *Encouraging Reading in English in Primary Education*, in which students were invited to record their experiences, perceptions, *etc.*, in the context of this specific subject. Given that the use of CLIL is emphasized in that subject, we understand that what was measured corresponded to perceived self-confidence in relation to CLIL teaching. However, the training described in this paper may have in general also increased their perceived self-confidence in their teaching capability.

The pedagogical implications of our study appeared to show a powerful methodological alternative for the initial training of Primary Education teachers in CLIL, particularly in English. In addition, we can highlight the relevance of these results, given that the capability of future teachers to implement integrated approaches is the most frequently used argument when questioning integrated proposals. It has been shown in this work that arguments on the supposed lack of initial CLIL teacher training can be overcome, demonstrating that coherent experiences based on the available scientific evidence can be effective. It all opens up a promising line of research for the advancement of integrated education in bilingual education. As there are no CLIL courses on our ITT curriculum, this study has prompted us to rethink the implementation of a CLIL course where pre-service teachers could access a previous CLIL training in Year 3, thereby filling the gap in our curriculum between CLIL theory and practice.

The impact of the implementation of a co-teaching program in the initial training of CLIL teachers at secondary school could be implemented in future studies, as this study was focused on primary education. The profile of primary education teachers tends to be more generalist, whereas there is greater specialization in subject areas within secondary education. In that sense, it would be very interesting to extend the co-teaching program to the initial CLIL training of secondary teachers. Research is also necessary on how to participate in a co-teaching program that can lead to an improvement in the competences of teachers who are in charge of initial teacher training at university. It would therefore be very interesting to investigate the impact of the trainee teachers following the initial teacher training on the effectiveness of the co-teaching program. Moreover, further studies could replicate the current study on initial teacher training within European Higher Education Area.

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