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Systematic Review

A Systematic Review on the Role of ICT and CLIL in Compulsory Education

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Abstract: The ubiquity of digital technologies for teaching at large is a reality that can be observed at diverse educational stages and in numerous fields, including the teaching of foreign languages, which is the field of study of this research. In view of this situation, this work is intended to determine the role of ICT in foreign language teaching that follows a CLIL method. It was decided to conduct a systematic review based on PRISMA model and adding information obtained from the analysis of fugitive literature. The literature review was carried out on a total of 22 articles. The main inclusion criteria were a temporal selection from January 2017 to February 2022, the inclusion of the terms CLIL/AICLE and ICT/TIC in the title, abstract or keywords of the articles, and the focus on primary and secondary education. The main results show an increasing tendency of this topic, notably in English research. Most relevant conclusions of the systematic review evidence a positive relationship between ICT and CLIL to improve the learning of a foreign language, although some negative aspects are also highlighted as there is still a lack of resources and teacher training.

Keywords: ICT; CLIL; primary education; secondary education

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Citation: Martínez-Soto, T.; Prendes-Espinosa, P. A Systematic Review on the Role of ICT and CLIL in Compulsory Education. *Educ. Sci.* **2023**, *13*, 73. https://doi.org/10.3390/educsci13010073

Academic Editors: João Piedade and James Albright

Received: 20 September 2022
Revised: 27 December 2022
Accepted: 29 December 2022
Published: 10 January 2023

1. Introduction

Foreign language learning has evolved from the arrival of the 20th century to deal with different changes in society as traditional methods based solely on the grammatical structures of the language and not on its practical skills did not reflect the nature of languages. Similarly, Information and Communication Technologies (ICT) have become a vital factor in every field, as it is the field of education. As a consequence of globalization, European legislation reflects the importance of developing digital and communicative competences. The Council of the European Union [1] identifies eight competences that citizens need for personal fulfilment and lifelong learning among which multilingualism and digital and technology-based competences are included. To achieve this twofold aim from an early age, this work focuses on the compulsory educational stages of primary and secondary education.

1.1. A Shift in Foreign Language Teaching

Different approaches to language teaching have been influenced by the fields of sociology and psychology from the arrival of the 20th century under the idea that a language is part of a society and its identity, which led to an evolution in the history of language teaching. The end of this century paved the way for new communicative approaches [2–5] concerned with teaching a language in ways that allowed learners to communicate meaning, rather than memorising structures or rules. Thus, the teaching of a foreign language needed to be re-examined in terms of goals, materials and activities. In addition, the growing tendency of bilingual programmes on the European scene [6] led to recent trends, namely Content and Language Integrated Learning (CLIL).

European legislation seeks to promote the integration of ICT in compulsory education. In supporting digital adaptation and training, they promoted the Digital Education

Action Plan 2021/2027 [7]. This plan was designed to improve digital competences and abilities, and to develop an effective digital learning environment. In addition, the Common European Framework of Reference for Languages (CEFRL) argues for the need to be communicatively competent to enhance citizens' professional profile and defends making full use of the potential of ICT [8].

1.2. CLIL

CLIL emerged to refer to a situation in which school subjects are taught using a foreign language with a dual aim: content learning and foreign language learning. That is to say, "an educational approach to foreign language teaching in which the linguistic form ceases to be an end in itself and becomes the means to express non-linguistic contents" [9] (pp. 317–318). Thus, the aim is to use a language of instruction other than the students' mother tongue in order to learn formal content. The target language is learnt as a result of triggering linguistic competences in order to take in the content that is required in a specific subject.

The type of resource is vital in this method to provide access to both linguistic and non-linguistic contents, where there is a tendency to choose digital resources rather than analogic to fulfil this aim [10,11]. The use of digital resources permits the integration of updated, communicative, real and authentic materials in the classroom, what matches the current society demand. In this line, new areas of interest have arisen as in the case of TELL (Technology Enhanced Language Learning) [12] to defend the role of technology not as a means for guiding the language learning process, but as part of the learning environment. Although it is true that the use and implementation of new resources does not entail a proper methodological change, digital technologies may have a huge potential in a bid to improve language learning and the educational scene in a broad sense.

1.3. ICT in Education

The widespread use of technology is constantly advancing, and European citizens are digital technology users in the present climate [1]. Also called digital technologies, ICTs refer to a group of technological tools and resources that allow processes related to the transmission, processing, storage and exchange of information given that there is technological support [13–15]. In view of the fact that the introduction of ICT in every field has led to its integration in education, an impact on teaching and learning habits was to be expected [15].

In addition, ICTs have widened the possibilities of education since they have made distance learning, electronic learning and blended-learning possible [15]. They also permit the personalization and adaptation of the information presented and there is a wide range of online reinforcement and extension activities to contribute to this use [11], which may also contribute to autonomy, self-learning and creativity [16]. Furthermore, ICT may serve as a tool to foster a student-centred methodology since it presumably leads to participation and the promotion of active learning in which students feel the protagonists of their learning process [16,17]. Hence, they trigger students' interaction and collaborative work [18]. The reason for fostering participation and interaction relies on motivation since some studies have suggested that digital technologies are set to increase interest towards the target language [19].

Different digital tools coexist in most of today's schools among which we find the digital whiteboard as a substitute for the traditional screen and projector that increases creativity, stimulates cognition and underpins learning [20]. Another example is the learning management system (LMS), a digital platform to incorporate other digital elements for educational institutions [21]. In a similar sort of fashion, some studies have considered the use of mobile technologies (smartphones, tablets, laptops) in the classroom, which has also led to other emerging approaches [22]. A set of technologies that facilitates content comprehension and fosters skills development by creating a real-world experience through digital devices is virtual and augmented reality [23,24]. Yet, software elements

are increasingly becoming a vital support in classes. Although there is not an established classification, some authors [25] have tried to classify them according to teachers' goals. Following these guidelines, some categories such as presentations, diagrams, storage of information, timelines, documents to register information, videos, communication tools, audios, portfolios, evaluation tools and management of tasks have been proposed.

In addition, some approaches have been adapted to integrate ICT, giving rise to emerging methods supported by the use of digital technologies, even though they are not strictly linked to ICT. For instance, mobile learning allows learning to occur at any time and place while it fosters motivation and cooperation [22]. Another example is the flipped classroom, which replaces lectures by using videos or other materials and class time is used for practical activities and the resolution of doubts [26]. Gamification or game-based learning also benefits from the use of ICT, fostering motivation and cooperation, and leading to digital educational games such as breakout EDU [27,28]. Cooperative learning based on ICT allows for different ways of communication to share knowledge, ideas and opinions [18]. Similarly, project-based or task-based language learning make students collaborate in tasks involving critical thinking, problem resolution and decision making [29].

1.4. CLIL and ICT in Primary and Secondary Education

Since the learning of a foreign language has already been supported, CLIL is a method that could foster the acquisition of a plurilingual profile and development of digital skills promoted by European legislation. The integration of ICT in the CLIL classroom may be beneficial in hindering anxiety, fostering motivation and interaction and providing formal content and target language learning. This is because ICT may provide more in-depth explanations through visual aids [9,30]. Thus, ICT in the CLIL classroom can be a learning facilitator. It could also broaden the possibilities of face-to-face learning and permit distance learning.

On the other hand, some negative aspects have been recognized since students may have a low level of command of the language of instruction or it may result in subject content loss [31]. This may be due to the fact that teachers need to attend to two curricular goals (subject content and language of instruction), what may result in a slower teaching. Another negative point is the digital divide [32]. In low educational stages it is easy to find students from different backgrounds and needs. Thus, it is not appropriate to conduct a proper online digital CLIL, but to introduce and combine different digital technologies.

For a deeper insight of the relationship between CLIL and ICT, let us now examine real learning experiences in compulsory education. Yet, the literature on this topic seems limited. Some studies have argued for the use of hardware and software elements along with other digital resources in different groupings of students. Although both subject contents and language command improved, some flaws including connection troubles, software incompatibilities and the need for teachers' supervision were highlighted [33]. Moreover, other studies have suggested a combined use of search engines, educational websites and the Internet, presentations, text editors, video projector, multimedia CD-ROM and DVD, e-mail, smart board, digital camera and video, games, educational software packages, spreadsheets, chats, video conferences and digital microscope. Although teachers may stand for the potential of integrating ICT in CLIL, some negative aspects have been recognized: lack of training and resources, students' low levels and the fact that it is a time-consuming task [34].

1.5. CLIL and ICT from a Teacher's Perspective

As we have seen, teachers seem to agree that the integration of ICT in the classroom can be a positive step forward, even though it may be fraught with challenges. CLIL has brought an incoming tide of designing learning materials and resources [11] and ICT aims at facilitating this issue offering tools to create support materials. For instance, to create online activities, or to search and present information. Be that as it may, teachers have

admitted that it is a time-consuming task. Moreover, there is a need for collaboration between educators since they may not master specific subject contents, or they may not be proficient in language command [19]. In addition, new teaching approaches require teaching training to be digitally competent [35–37]. The importance of teachers' digital competence is recognized in the European Framework for the Digital Competence of Educators (DigCompEdu) [38].

On the surface, it seems that integrating ICT in education is currently becoming a priority since the impact of COVID-19 may have contributed to this urge [7]. Thus, teachers' digital competence favors the integration of ICT in education so that students learn from their digital knowledge and skills.

2. Materials and Methods

A systematic review adding fugitive literature was conducted as a procedure to analyse the ICT and CLIL relation in order to determine the need for its implementation in compulsory education. The reason for selecting a systematic review relates to its value in the field of educational research [39] as it involves processes of identification, synthetisation and assessment to provide a reliable and critical answer to research [40]. Since its development and production requires a rigorous procedure [41], the process was conducted throughout the digital tool Rayyan. Furthermore, this systematic review was in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses approach (PRISMA) [42,43], and it also followed other guidelines for systematic reviews and meta-analysis and for the use of fugitive literature [39,40]. Then, other sources of information, apart from those selected for systematic reviews, were also considered in order to mitigate publication bias.

2.1. Research Questions and Objectives

A wide range of research studies have addressed the role of ICT in CLIL to foster foreign language learning along with the current legislation. Then, our research problem was: what is the role of ICT in a CLIL-based classroom of primary and secondary education?

To answer this question (research problem), this work intended to follow this main objective: to analyse the implementation of ICT as a facilitator of foreign language learning in the CLIL classroom of compulsory education (primary and secondary). In the same vein, to achieve this goal, this work had some research questions and objectives (Table 1).

Table 1. Research questions and objectives.

Research Problem	Research Questions	Research Objectives
What is the role of ICT in a CLIL-based classroom of compulsory education?	Are ICTs facilitators of teaching and learning of foreign languages when teachers apply CLIL method? Do teachers use ICT in CLIL method based on educational stage?	To identify the main studies around ICT and CLIL in the last 5 years (from 2017 to February 2022), according to educational stage, type and object of study
	What type of digital technologies use teachers of foreign languages in CLIL classroom? Do they use other type of resources more traditional?	To analyse the type of technology implemented in CLIL in primary and secondary education.
	What is the impact of using ICT in CLIL classroom? Are they useful to learn? Do we have empirical data to demonstrate the usefulness of ICT in CLIL classroom?	To analyse the role of the integration of ICT in CLIL to determine the extent to which digital technologies affect foreign language learning

2.2. Information Sources and Search Strategy

The research was conducted in the databases Scopus and WOS in the first days of March 2022. The keywords used were CLIL and ICT in English and AICLE and TIC in Spanish. These terms were considered in the search field "title, abstract, keywords" of

each database using the Boolean operator "and". As this work also aimed to consider other sources of information that may be significant but missed in PRISMA approach [39], fugitive literature was included to mitigate this matter. In addition, as research in Scopus and WOS led to a vast majority of documents in the English language, the inclusion of fugitive literature [40] was also intended to broaden the sample of Spanish results. To this effect, research was conducted in the database Dialnet using the Spanish keywords AICLE and TIC in the search field "title, abstract, keywords" and using the Boolean operator "and".

2.3. Eligibility Criteria

The boundaries of this systematic review had the following inclusion and exclusion criteria.

The inclusion criteria were as follows:

- Publications were articles from scientific journals and book chapters;
- Time selection from 2017 to February 2022;
- Inclusion of the terms CLIL/AICLE and ICT/TIC in title, abstract or keywords;
- Articles focused on primary and/or secondary education;
- Articles which were correctly referenced, not redundant and the role of ICT and CLIL was a main topic in the discussion;
- The object of study related to students, pre-service teachers, teachers and materials;
- Articles were available under open access.

The exclusion criteria were as follows:

- Articles focused on preschool level, higher education or adult education;
- ICT and CLIL were not related;
- Articles were not available under open access.

2.4. Phases and Procedure

As we have described, the first phase was the search in Scopus and WOS in March of 2022. This first phase led to the finding of 56 results in these databases in accordance with the search strategy defined. Research in English evidenced 24 results in Scopus and 32 in WOS, while research in Spanish reflected 2 results in Scopus and 0 in World of Science.

In the second phase, articles were analysed by their title, abstract and keywords, which led to 13 duplicates and the exclusion of 16 articles that were not in accordance with the inclusion criteria of primary and secondary education. Then, these excluded articles focused on preschool level, higher education and adult education. Moreover, another article did not put forward a relation between the topic ICT and CLIL.

In the third phase, the resulting sample of 27 articles were fully examined and 8 articles did not match the inclusion criteria, but it was not possible to determine this fact in the second phase by only examining the title, abstract and keywords. These articles were not focused on primary or secondary education and the relation between ICT and CLIL was not a priority issue. Then, this third phase led to a sample of 19 articles. Figure 1 provides some insight over the complete development of this process.

The fourth phase was to include fugitive literature in an attempt to introduce other sources of information and to broaden the sample of Spanish research. Research in Dialnet evidenced 32 results of which 3 were included in synthesis as they were focused on primary and secondary education, according to our inclusion criteria.

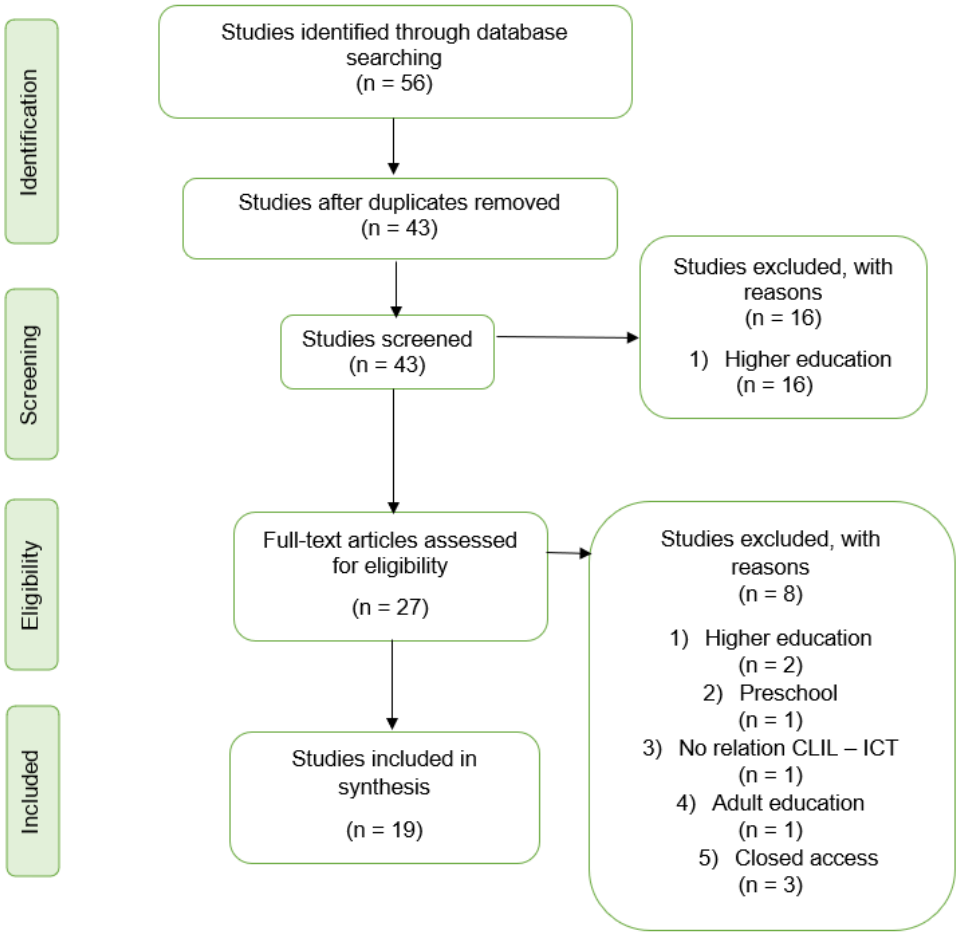

Figure 1. Results based on the PRISMA diagram template for systematic reviews.

3. Results

A total amount of 19 articles were included in the synthesis following PRISMA guidelines for systematic results, along with three articles from the fugitive literature, what made a total of 22 studies in the corpus of this research. The factors of analysis of the results related to date, language, level and object of study and type. As for date, articles were analysed according to their date of publication. Articles were limited from 2017 to February 2022. As regards language, articles were observed attending to language. That is to say, English, use of English language in the research, and Spanish, use of Spanish language in the research. Considering the level and object of study, articles were analyzed according to their educational stage (primary education, secondary education) and object of study (materials, students, teachers or pre-service teachers). It should be noted that students' ages may vary since there is not an established educational stage distribution common to different countries. Moreover, primary education involves all types of works concerned with students and teachers in Primary Education. On the other hand, secondary education involves involves all types of works concerned with students and teachers in Compulsory Secondary Education. As for type, articles were analysed according to type, establishing empirical, revision studies, and those providing an educational proposal. Empirical studies refer to those where there is a real learning experience conducted on the use of ICT in CLIL classes. Revision studies are those where there is not a formal experience or methodology implemented, but a theoretical review of literature. Educational proposal studies provide an educational proposal. It may show a prior investigation to determine needs and a later implementation, or it may not have been implemented but remains as a planned set of decisions. Following these categories, the sample of 22 studies was classified as shown in Table 2.

Table 2. Description of the studies.

Study	Date	Language	Level and Object of Study	Type
Carrión Candel et al. [35]	2021	English	Secondary education students	Empirical
Garcia-Esteban and Bueno-Alastuey [44]	2021	English	Pre-service teachers	Empirical
Tarricone [45]	2021	English	Secondary education teachers	Revision
Manchado Nieto [46]	2021	Spanish	Pre-service primary teachers	Empirical
Lorenzo and Granados [47]	2020	English	Primary and secondary education teachers	Empirical
Pérez-Gracia et al. [48]	2020	English	Primary education teachers	Empirical
Carrión Candel and Pérez Agustín [49]	2020	Spanish	Secondary education students	Educational proposal
Pérez Jurado and Martínez-Aznar [50]	2020	English	Primary and secondary education teachers	Empirical
Schietroma [51]	2019	English	Secondary education materials	Revision
Escobosa et al. [52]	2019	Spanish	Teachers	Educational proposal
Albero-Posac [53]	2019	English	Secondary education students	Educational proposal
Bueno-Alastuey et al. [54]	2018	English	Pre-service teachers	Empirical
Merzlykin et al. [55]	2018	English	Secondary education students	Revision
Nieto-Moreno-de-Diezmas [56]	2018	English	Secondary education students	Empirical
Della Ventura [57]	2018	English	Primary and secondary education students and teachers	Revision
Abbate [58]	2018	English	Secondary education teachers	Educational proposal
Carrión Candel [59]	2018	Spanish	Secondary education students	Educational proposal
Ludovico and Zambelli [60]	2017	English	Primary education students	Empirical
Rodríguez Merayo and Cebrián Bernat [61]	2017	English	Secondary education students	Educational proposal
López Pérez and Galván Malagón [62]	2017	English	Primary education students	Educational proposal
Abbate [63]	2017	English	Secondary education students	Revision
Batrova et al. [64]	2017	English	Secondary education students	Empirical

The 22 articles resulting from the methodological process presented in Section 2 were subjected to an exhaustive review and classified according to five analytical categories. The type of technology determined an analysis of articles according to the type of technology implemented: hardware (technological devices and peripherals), software (programs and applications), other types (digital tools, webpages, multimedia materials). Hence, the analysis of results was conducted as follows:

- Date;
- Language;
- Level and object of study;
- Type of study;
- Type of technology.

3.1. Date

Focusing on date of publication, there was an increase in 2018 (six articles) [54–59], followed by a decrease in the number of later studies up to the current date. Although the last years seemed to turn to a higher publication of articles on this topic [35,44–50], the interest in the use of ICT in the CLIL classroom was in decline. Yet, it is still worth considering that this tendency will continue throughout 2022 and the ensuing years (see the next Figure 2).

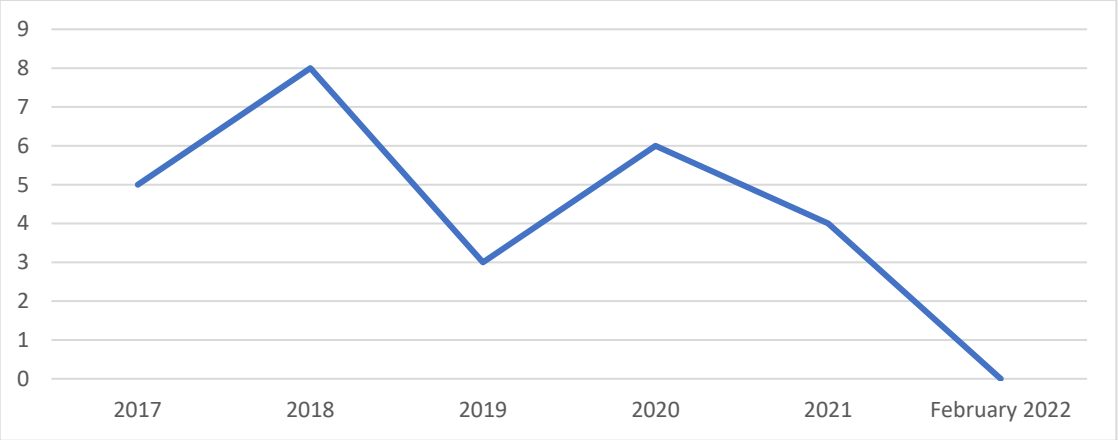

Figure 2. Number of results according to date.

3.2. Language

The systematic review only left one study on this topic using the Spanish language in research [49]. On the other hand, the inclusion of fugitive literature expanded Spanish research narrowly with three more studies [46,52,59]. See the Figure 3.

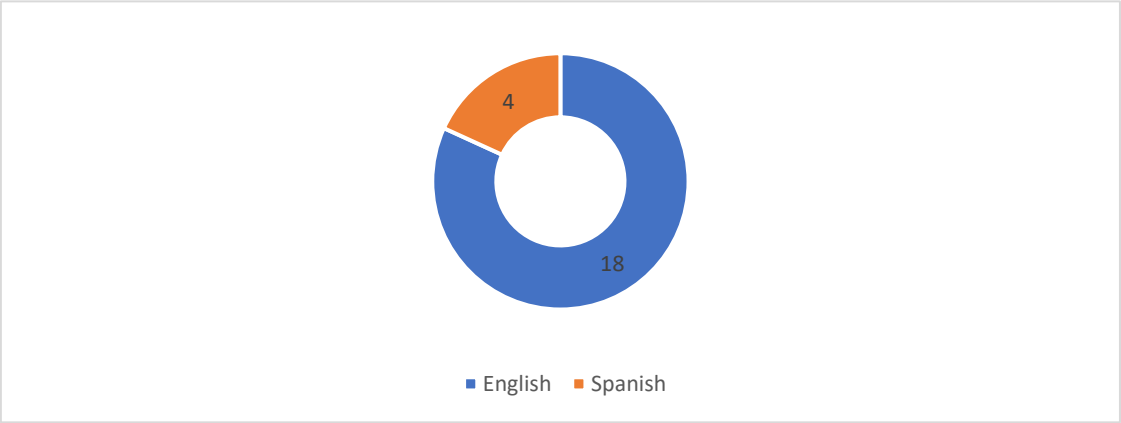

Figure 3. Number of results according to language.

3.3. Level and Object of Study

With regard to the educational stage and object of study, 10 results were concerned with ICT and CLIL implementation in Secondary Education [35,49,53,55,56,58,59,61,63,64]. Similarly, in the same educational stage, only one study analysed the issue from the perspective of the materials and resources implemented by teachers [51]. Primary Education represented a minority in this field as it only provided a sample of three studies [60,63]. One study was concerned with analysing students' multilevel perspectives on the topic [57], involving both primary and secondary education, but it also seemed to represent a non-significant issue. Moreover, eight studies [44–48,50,52,54] addressed the topic by means of a pre-service teachers' or teachers' perspective, either in primary or secondary education (Figure 4).

3.4. Type of Study

There was a predominance of empirical studies that represented 45% of the sample [35,44,46–48,50,54,56,60,64], even though they still represented a lack of articles in this field (ten results). Notwithstanding, revision studies (five articles) [45,51,55,57,63] or educational proposal studies (seven articles) [49,52,53,58,59,61,62] represented a minor sample, 23% and 32% of the total of studies, respectively.

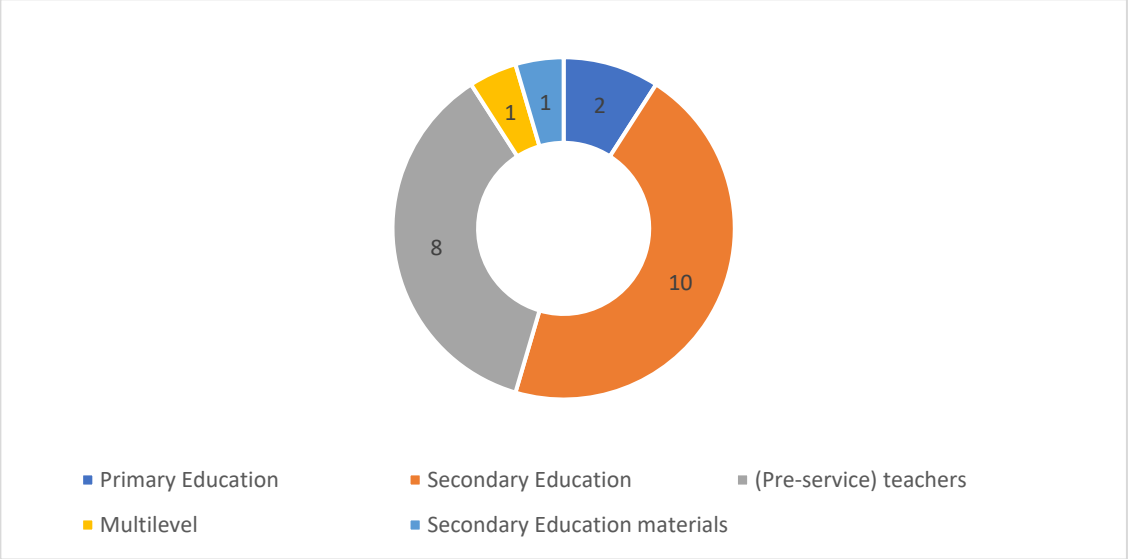

Figure 4. Number of results according to level and object of study.

3.5. Type of Technology

Concerning the type of technology implemented in empirical studies, we can determine that a wide range of studies tended to introduce hardware elements in CLIL classes, especially whiteboards and computers or similar devices [48,60]. Then, another percentage of studies made use of software elements as was the case with applications such as Plickers and programmes such as PowerPoint [35,45,46,52,53,58,59,61,64]. Interestingly, there was a wide variety of software elements implemented to mitigate the educational scene over the course of the pandemic situation of COVID-19. What is more, there was a widespread use of resources coming from the Internet including audios, videos, webpages, etc. [47,49–51,53,56,62–64]. Most of these materials were highly linked to fulfil an interactive and collaborative purpose. Moreover, it is significant to comment on the inclusion of communicative technologies. For instance, the virtual collaboration or telecollaboration [44,54], blogs where students can share information and comment, and other channels of communication such as e-mail. Similarly, there was an increasing tendency in the use of software elements, especially LMS (Google Classroom, Microsoft Teams) and digital tools to fulfil different purposes in the CLIL classroom [45,46,53,57]. Notwithstanding, only one article was concerned with introducing a different type of technology as it is augmented reality [55].

4. Discussion

The results of the sample of studies concurred with each other that there is a need to move forward traditional methodologies and make room for the integration of digital technologies in the classroom of the 21st century. This agreement is in accordance with previous findings that uphold the integration of technological elements in the teaching-learning process.

The introduction of ICT in the CLIL classroom of primary and secondary education triggers interaction and collaboration, resulting in content and language learning [44,46,47,56,60]. Nonetheless, collaboration goes further in relation to students' work since it also implies teachers, what matches previous findings in the literature [19].

In a similar sort of fashion, ICT involves the idea of social communication given that there is a technological support [14]. Then, there is a social aim in using ICT and bilingualism to fulfil the needs of the current society [50], which is supported by the previous literature [16,17]. In the same vein, the act of collaboration favors a student-centred methodology [35,56,57]. Thus, combining ICT and CLIL leads to an autonomous learning, which is in line with previous findings [16,17].

In addition, the integration of ICT in the classroom is a motivating factor for students [35,44,48,51,60,62], what matches the idea of ICT as engaging elements to foster willingness to participate and work towards achieving foreign language command [19].

Another important factor in ICT and CLIL is the use of authentic materials. ICT provides access to a wide range of materials and resources [45,46,48,50,56]. CLIL provides exposure to the language through authentic materials [2,11]. Thus, digital materials and resources make learning attractive, real and useful for students.

The unprecedented COVID-19 situation was a starting point to increase the use of ICT [46], which has led to flexible ways of learning, particularly distance learning [14,15,53]. Be that as it may, this widespread use has highlighted the existence of a greater digital divide. Moreover, the results point out that it is a time-consuming activity [47,52].

Another key element of discussion is digital competence. Its development is a consequence of introducing ICT in the CLIL classroom [54,56]. A CLIL-based approach favors ICT integration [47,48], which correlates with the current European legislation. Then, it is of the uttermost importance that teachers develop digital competence so that students will be able to benefit from those skills and knowledge [38]. Along with digital competence, the relationship between ICT and CLIL develops other competences and skills including information management, problem solving, and decision making [54,56].

Furthermore, ICT may facilitate language learning and content understanding since it provides visual, auditory or any other type of aid [56,63]. ICT enhances access to knowledge for every type of learner since it eases the possibilities of adaptation [11,15]. Although these ideas demand a change in traditional approaches [50,56,64], findings highlight that there is still a lack of teacher training and resources [35,48,50,52,54] and schools require qualified teachers in the subject content and the language of instruction along with specific digital equipment [60]. Figure 5 presents a synthesis of these ideas.

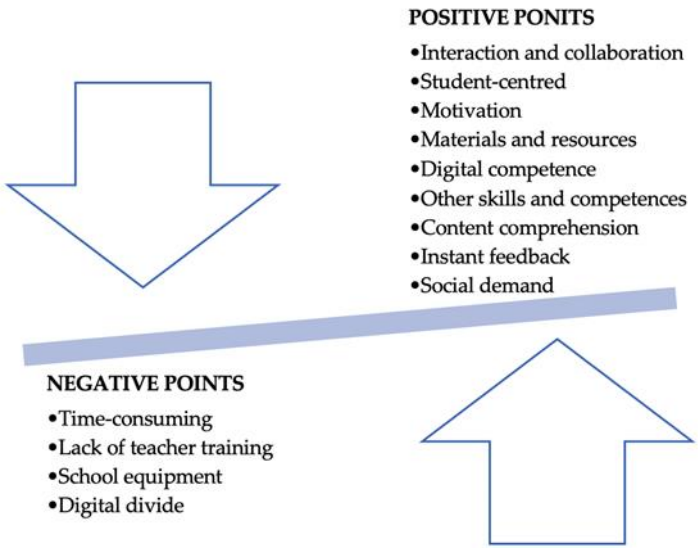

Figure 5. Synthesis of positive and negative aspects of ICT integration in CLIL.

5. Conclusions and Directions for Future Research

All things considered, this work has discussed the role of ICT in CLIL in primary and secondary education. The findings suggest a positive connection between digital technologies and foreign language that follows a CLIL approach. This conclusion answers the main objective of this work. Nonetheless, as for our first objective, we can conclude that there is still insufficient research in primary and secondary educational stages, which may be a consequence of the absence of Spanish research on this topic. Another of the main conclusions to be drawn from the analysis is the answer to our second objective. Although previous studies seem to be more concerned with digital technologies regarding the isolated use of hardware elements, the tendency has evolved to the integration of

these hardware elements along with software elements, especially thereafter COVID-19. Another significant conclusion that answers our third objective is that the inclusion of ICT in the CLIL classroom have led to some positives that have contributed to foreign language learning, but some flaws can also be highlighted as it is the lack of resources, teacher training and digital divide. Thus, the role of ICT results positive in foreign language learning and, more precisely, in CLIL. But further work is needed to fully implement ICT in CLIL since it is still an insufficiently explored field. For instance, it would be interesting to examine the process by which these negatives aspects may be mitigated or surmounted, which has not been the object of the present research.

Author Contributions: Conceptualization, T.M.-S. and P.P.-E.; research design, T.M.-S. and P.P.-E.; data curation, T.M.-S.; formal analysis, T.M.-S.; writing—original draft preparation, T.M.-S. and P.P.-E.; writing—review and editing, T.M.-S. and P.P.-E. All authors have read and agreed to the published version of the manuscript.

Funding: This research was partially funded by Project Erasmus+ AROSE Nº 33023 (2019-1-ES01-KA201-065597).

Institutional Review Board Statement: The study did not require ethical approval.

Informed Consent Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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