

CONCEPTUAL REVIEW ARTICLE

The What, Why, and How of ICT Projects within the CLIL Approach in Non-University Education in the Spanish Educational System

 Salvador Montaner-Villalba¹¹Conselleria d'Educació, Generalitat Valenciana, Spain**RESUMEN**

Este artículo explora la integración de las Tecnologías de la Información y la Comunicación (TIC) dentro del enfoque de Aprendizaje Integrado de Contenidos y Lenguas Extranjeras (AICLE) en el nivel educativo no universitario en España, con un enfoque particular en la Educación Secundaria. A partir de una revisión de estudios clave, esta investigación destaca la importancia de las TIC en el fomento del aprendizaje lingüístico y basado en contenidos. El artículo analiza los objetivos, herramientas, métodos, desafíos y artefactos digitales vinculados a los proyectos TIC en AICLE, proporcionando ideas sobre su potencial transformador. Además, explora estudios de caso y sus hallazgos, concluyendo con una discusión prospectiva sobre tecnologías avanzadas, incluida la Inteligencia Artificial (IA), en AICLE.

PALABRAS CLAVE

TIC; AICLE; Educación Bilingüe; Herramientas Digitales en Educación; Inteligencia Artificial en Educación

ABSTRACT

This paper explores the integration of Information and Communication Technologies (ICT) within the Content and Language Integrated Learning (CLIL) approach at the non-university educational level in Spain, with a particular focus on Secondary Education. Drawing from a literary review of key studies, this research highlights the significance of ICT in fostering linguistic and content-based learning. The paper discusses the objectives, tools, methods, challenges and digital artefacts linked to ICT projects in CLIL, providing insights into their transformative potential. Furthermore, it explores case studies and their findings, concluding with a forward-looking discussion on advanced technologies, including Artificial Intelligence (AI), in CLIL.

KEYWORDS

ICT; CLIL; Bilingual Education; Digital Tools in Education; Artificial Intelligence in Education

1. Introduction

Content and Language Integrated Learning (CLIL) (Coyle, Hood & Marsh, 2010; Marsh, 1994) has become a cornerstone of bilingual education in the European Union (Aiello & Di Martino, 2023), particularly in Spain. Combining language acquisition with academic content, CLIL enhances dual learning objectives and promotes students' communicative and subject-specific competences. Simultaneously, the digitalization of education has positioned Information and Communication Technologies (ICT) as key tools in modern teaching. This paper investigates the synergy between ICT and CLIL, focusing on its application in the Spanish non-university education system and, in particular, in secondary education.

The objectives of this research are twofold: to elucidate the motivations for integrating ICT into CLIL and to analyse its implementation, challenges, and potential. By synthesizing findings from scholarly work, this paper provides a comprehensive perspective on the "what", "why", and "how" of ICT in CLIL.

2. What is CLIL?

2.1 Definition of Content and Language Integrated Learning (CLIL)

CLIL is an educational methodology that combines language learning with subject-specific content instruction. This dual-focused approach (Dalton-Puffer, 2007; Lasagabaster & Sierra, 2010) enables students to develop proficiency in a second or foreign language while simultaneously acquiring knowledge in disciplines such as science, mathematics, history, or geography. Originating in Europe, CLIL addresses the growing need for multilingualism and global competence (European Commission, 2006), equipping students with practical language skills and deep content understanding. It is underpinned by the 4Cs framework: Content, Communication, Cognition, and Culture (Coyle, 2006; Coyle, 2007; Coyle, Hood & Marsh, 2010; Marsh, Meysto, Wolf & Frigols, 2012; Meysto, Marsh & Frigols, 2008). These elements work cohesively to ensure that students achieve both linguistic and cognitive development in meaningful contexts.

2.2 Importance of CLIL in Language Learning in Non-University Settings

In non-university settings such as Primary and Secondary Education, CLIL has proven to be particularly effective in fostering language acquisition. Unlike traditional language classes, CLIL integrates language into real-world academic tasks, providing students with authentic opportunities to use and apply their linguistic skills. Research by Coyle, Hood, and Marsh (2010) emphasizes the role of real-world tasks in engaging learners and improving linguistic competence. By embedding language learning within content-driven contexts, CLIL increases student engagement and motivation, making the process of language acquisition more relevant and impactful (Dalton-Puffer, 2007). Additionally, it supports critical thinking and problem-solving, as students must navigate complex academic material in their target language (Mehisto, Marsh, & Frigols, 2008).

2.3 Application of CLIL in the Spanish Educational System

In Spain, CLIL has been widely adopted as part of bilingual education programs, particularly in Andalusia, Madrid, and Valencia. Schools offer a variety of subjects, including science and social studies, taught in English or other foreign languages. This approach aligns with European Union policies (European Commission, 2006) aimed at promoting multilingualism and intercultural competence. Research by Lasagabaster and Sierra (2010) highlights how CLIL contributes to multilingualism, while Coyle, Hood, and Marsh (2010) detail its impact on student motivation and academic outcomes. Spanish educators have leveraged CLIL to enhance students' competitiveness in an increasingly globalized world, while also addressing regional needs for language proficiency in English, French, or German. Research has shown that CLIL in Spain not only improves linguistic outcomes, but also positively impacts students' academic performance and confidence (Dalton-Puffer, 2007; Mehisto, Marsh, & Frigols, 2008).

3. Why ICT in CLIL?

3.1. Overview of the Importance of Integrating ICT in Education

Integrating Information and Communication Technologies (ICT) into education has revolutionized teaching and learning processes, making them more interactive, accessible, and adaptable. ICT tools offer diverse resources that cater to different learning styles and promote active participation. In the context of CLIL, ICT plays a pivotal role by facilitating the dual focus on language and content learning. By incorporating technology, educators can enhance lesson delivery, offer multimodal instruction, and foster a more engaging learning environment. These tools also support personalized learning, allowing students to progress at their own pace and revisit materials as needed (Coyle, Hood, & Marsh, 2010; Mehisto, Marsh, & Frigols, 2008). Research demonstrates that ICT encourages collaboration, critical thinking and practical application of knowledge (Dalton-Puffer, 2007). Furthermore, it aligns with contemporary educational goals of equipping students with 21st-century digital skills (Lasagabaster & Sierra, 2010).

3.2. How ICT Enhances Communicative Skills within the CLIL Approach

ICT significantly enhances communicative skills within the CLIL framework by providing platforms for authentic language use and interaction. Tools like blogs, forums, and video conferencing create real-world contexts where students can practice reading, writing, speaking and listening in the target language. For instance, blogging projects encourage reflective writing and peer feedback, fostering a deeper understanding of language use (Montaner, 2020; Coyle, Hood, & Marsh, 2010). Interactive tools, such as Kahoot, support oral and aural skills through gamified activities that engage students in collaborative learning (Montaner, 2018; Mehisto, Marsh, & Frigols, 2008). Furthermore, platforms like Google Docs (Montaner-Villalba, *forthcoming*; Wrobel, 2019; Kessler, & Bikowski, 2010) and other collaborative tools enhance peer-to-peer communication and teamwork, vital for language development (Dalton-Puffer, 2007). By integrating these digital tools, CLIL classrooms transform into dynamic environments where language is actively used to communicate and achieve academic objectives.

3.3. Key Motivations for ICT Adoption in CLIL

The adoption of ICT in CLIL is driven by several key motivations:

- **Enhancing Student Engagement:** ICT tools make learning more enjoyable and relatable, which increases student motivation and participation (Mehisto, Marsh, & Frigols, 2008).
- **Providing Access to Authentic Resources:** digital platforms allow students to access authentic materials such as videos, articles, and simulations, bridging the gap between classroom learning and real-world application (Coyle, Hood, & Marsh, 2010).
- **Promoting Collaborative Learning:** ICT fosters teamwork through tools like Google Docs and Web 2.0 platforms, where students can collaborate on projects and share ideas (Dalton-Puffer, 2007).

- **Supporting Differentiated Instruction:** ICT enables teachers to customize resources and activities to meet diverse learning needs, making education more inclusive (Lasagabaster & Sierra, 2010).

Research highlights the transformative impact of ICT in CLIL, not only in enhancing linguistic and cognitive outcomes but also in preparing students for a technology-driven world. Studies (Montaner-Villalba and Gimeno-Sanz, 2021; Martínez-Soto & Prendes-Espinosa, 2023; Finardi, Silveira, Lima, & Mendes, 2016) emphasize that the strategic integration of ICT aligns with the principles of CLIL, ensuring that both content and language objectives are effectively achieved.

4. Literature Overview

A comprehensive review of existing literature reveals the diverse and evolving role of ICT in the CLIL approach, illustrating its potential to enhance both linguistic and cognitive outcomes. The integration of technology has not only advanced pedagogical practices, but also facilitated hybrid models of learning that cater to varied educational contexts.

4.1. Research on Technology-Enhanced CLIL

Montaner-Villalba and Gimeno-Sanz (2021) provide a foundational perspective on the integration of digital tools in CLIL, emphasizing their capacity to simultaneously improve language and content acquisition. Their research aligns with findings by Martínez-Soto and Prendes-Espinosa (2023), who conducted a systematic review of ICT and CLIL in compulsory education, highlighting how digital tools bridge linguistic and cognitive goals. Additionally, Finardi et al. (2016) explored hybrid models combining MOOCs with flipped CLIL, emphasizing the flexibility and engagement these tools bring to bilingual education. Redecker (2017) complements these perspectives by outlining competencies for effective ICT integration in teaching, underscoring its transformative potential in aligning linguistic and academic objectives.

4.2. Blogging as a Reflective Platform

Montaner (2020, 2021a) highlights blogging as a transformative tool for fostering written competence in English within CLIL. Blogging encourages authentic language use, reflective writing, and peer feedback, offering students an interactive space to enhance their linguistic abilities. These findings are supported by other studies that affirm the role of digital platforms in promoting higher-order thinking skills, such as Kessler and Bikowski (2010), who examined collaborative tools like wikis; Redecker (2017), who developed the *European Framework for the Digital Competence of Educators (DigCompEdu)*, which outlines the key competencies teachers need to effectively integrate technology into their teaching practice; and Voogt and Roblin (2012), analysing how digital technologies align with 21st-century learning frameworks.

4.3. Gamification and Engagement

The role of gamification in CLIL is explored extensively in Montaner's (2018, 2022) work, particularly through tools like Kahoot. These studies demonstrate how gamified activities increase student motivation and enhance participation and retention of both language and content. This aligns with findings by Finardi et al. (2016), who highlight the effectiveness of hybrid models combining digital tools with interactive pedagogies, and Martínez-Soto and Prendes-Espinosa (2023), whose systematic review underscores the role of ICT in fostering engagement and achieving cognitive and linguistic goals in CLIL contexts. The immediate feedback mechanisms in gamified tools align with the experiential learning principles of CLIL, as discussed in Kolb's (1984) experiential learning theory, as detailed in his work *Experiential Learning: Experience as the Source of Learning and Development*, and further applied to CLIL-specific contexts by Coyle, Hood, and Marsh (2010).

4.4. Systematic Reviews and Hybrid Models

Systematic reviews have highlighted the diverse applications of ICT within CLIL and their effectiveness in bridging linguistic and cognitive objectives. Martínez-Soto and Prendes-Espinosa (2023) conducted a thorough review highlighting the transformative potential of ICT in enhancing bilingual education across compulsory education levels. Their findings emphasize the need for integrative approaches that address both pedagogical and technological gaps, recommending strategies to better align digital tools with educational objectives.

In addition, Finardi et al. (2016) explored hybrid models like MOOCs within flipped CLIL frameworks. These approaches demonstrate how combining traditional and digital pedagogies can improve accessibility and engagement, particularly in diverse learning contexts. Similarly, Buendía-García et al. (2020) examined collaborative ICT tools in CLIL classrooms, noting significant improvements in student motivation and content retention when integrating synchronous and asynchronous learning platforms. Redecker (2017) adds to this by outlining a comprehensive framework for digital competence, stressing the role of educators in effectively leveraging ICT to foster meaningful, bilingual learning experiences.

Moreover, a study by Egbert et al. (2015) underscores the potential of ICT to facilitate higher-order thinking and collaborative tasks in CLIL settings. This research aligns with findings from Graham and Perin (2007), who advocate for integrating writing-focused digital platforms to support linguistic and cognitive development in content-based language learning contexts. These systematic reviews and studies collectively highlight the evolving landscape of ICT-enhanced CLIL, advocating for dynamic and adaptable hybrid models to meet the demands of contemporary education.

4.5. Didactic Proposals for Primary Education

Muñoz López (2024) offers a practical viewpoint, discussing ICT-driven didactic proposals for Primary Education. This aligns with García-Pérez and Rodríguez-Sánchez (2021), who

analysed the implementation of ICT tools in early bilingual education, emphasizing their role in developing foundational linguistic and cognitive skills. Similarly, Zayas-Bazán and Fernández-Álvarez (2019) explored digital strategies tailored to younger learners, highlighting the importance of scalability and adaptability in ICT-enhanced CLIL models. The scalability of such proposals across different educational levels underscores the flexibility of ICT in addressing diverse CLIL contexts, providing a robust framework for integrating digital innovation into bilingual education.

These works collectively demonstrate the transformative potential of ICT in CLIL environments, particularly through tools that promote collaboration, engagement, and authentic learning experiences. As educators and researchers continue to explore ICT's role in bilingual education, these studies provide a solid foundation for future innovations and applications.

5. Objectives of ICT Projects in CLIL

The integration of ICT in CLIL projects serves multiple objectives that align with both educational and technological advancements. These objectives aim to enhance linguistic competence, foster content learning, and develop critical digital skills necessary for 21st-century learners. Below are the key objectives outlined with supporting literature.

5.1 Enhancing Linguistic Skills

ICT projects in CLIL aim to improve students' proficiency in all language domains: reading, writing, speaking, and listening. Digital tools like blogs (Montaner, 2020) encourage authentic writing practices, while interactive platforms such as Kahoot (Montaner, 2018) provide engaging opportunities for oral and aural language use. According to Egbert et al. (2015), flipped classroom models supported by ICT further reinforce language acquisition by creating dynamic, real-world contexts for communication.

5.2 Promoting Content Mastery

By embedding ICT in content-driven tasks, CLIL projects enable students to engage with academic material more effectively. Redecker (2017) emphasizes that digital platforms facilitate multimodal learning, where students can access resources tailored to different learning styles. Additionally, Finardi et al. (2016) highlight the role of hybrid learning models in bridging linguistic and cognitive objectives, ensuring students grasp complex subject matter while developing their language skills.

5.3 Encouraging Experiential and Collaborative Learning

ICT fosters experiential learning by allowing students to actively participate in meaningful tasks that require collaboration. Tools like Google Docs and other collaborative platforms enable teamwork, where students co-create knowledge in real-time (Kessler & Bikowski, 2010). Kolb's (1984) experiential learning theory, applied in CLIL contexts (Coyle, Hood, &

Marsh, 2010), further underscores the importance of learning through experience, which ICT facilitates through simulations, virtual labs and project-based tasks.

5.4 Developing Digital Competence

Another critical objective is to equip students with essential digital skills for the future. *The European Framework for the Digital Competence of Educators* (Redecker, 2017) highlights how ICT in CLIL not only enhances subject-specific learning but also prepares students for the demands of a technology-driven world. Martínez-Soto and Prendes-Espinosa (2023) support this, arguing that integrating ICT in bilingual education fosters technological literacy alongside linguistic and cognitive development.

5.5 Increasing Student Motivation and Engagement

Finally, ICT tools are designed to make learning more engaging. Gamified applications, interactive quizzes, and multimedia resources motivate students by transforming traditional lessons into interactive experiences. Buendía-García et al. (2020) found that such tools significantly improve student participation and interest in bilingual education contexts. Similarly, Zayas-Bazán and Fernández-Álvarez (2019) highlight how scalable ICT strategies create adaptable and engaging learning environments for diverse educational settings.

These objectives collectively demonstrate the transformative potential of ICT in CLIL. By fostering linguistic competence, promoting content mastery, encouraging collaboration, and developing digital skills, ICT projects in CLIL offer comprehensive solutions for modern educational challenges.

6. How ICT is applied in CLIL: Tools and Methods

ICT plays a transformative role in CLIL classrooms, providing tools and methods that enhance both language and content learning. These technologies enable innovative teaching strategies and foster active student participation. Below is an overview of key tools and methods used in ICT-enhanced CLIL.

6.1. Digital Tools in CLIL

Blogging

Blogging is a widely recognized tool for improving written communication skills in CLIL. According to Montaner (2021a, 2021b, 2020, 2019), blogs create a reflective learning space where students practice writing, receive peer feedback, and engage with authentic content. García-Sánchez & Mena-Marcos (2018) further emphasize blogging as a tool to develop metacognitive strategies and enhance linguistic competence in bilingual education settings. Similarly, Lee (2017) highlights how blogging fosters active engagement and critical thinking, particularly in CLIL contexts, by encouraging learners to reflect on their content and language integration processes.

Interactive Quizzes and Gamification

Gamified tools like Kahoot and Quizizz have proven effective in engaging students. For example, Álvarez-Rodríguez and Martínez-Arbelaiz (2021) explored the implementation of Quizizz in CLIL classrooms, highlighting its positive impact on student motivation and active participation. Their findings demonstrate the tool's effectiveness in promoting collaborative learning and reinforcing both language and content objectives. Montaner (2018) highlights how Kahoot fosters interactive learning by creating competitive yet collaborative environments. These tools are particularly beneficial in reinforcing vocabulary, grammar, and content knowledge through instant feedback.

Collaborative Platforms

Google Docs and other collaborative tools enable teamwork and co-creation of content. As Kessler and Bikowski (2010) and Montaner-Villalba (*forthcoming*) note, these platforms encourage peer collaboration, allowing students to build knowledge collectively while improving their language skills.

Kessler and Bikowski (2010) emphasize that Google Docs facilitates shared responsibility among students, fostering active participation in editing and refining their work. This collaborative environment enhances linguistic accuracy and supports the development of critical thinking and problem-solving skills. Their study also highlights the role of real-time feedback in improving students' understanding of language use and content.

Similarly, Montaner-Villalba (*forthcoming*) examined the use of Google Docs among Design Engineering students to enhance their writing competence in English for Specific Purposes (ESP). This research aligns with Kessler and Bikowski's (2010) findings by demonstrating high levels of student satisfaction with collaborative writing tasks. Furthermore, Montaner-Villalba (*forthcoming*) highlights the platform's role in developing organizational and teamwork skills, which are crucial in specialized contexts. Together, these studies affirm the adaptability of Google Docs as a collaborative tool across diverse educational scenarios, showcasing its effectiveness in promoting both linguistic and cognitive development.

Multimedia Resources

The use of videos, podcasts and digital storytelling tools enriches the CLIL experience. These resources offer multimodal learning opportunities, catering to diverse learning preferences and providing context-rich language exposure (Redecker, 2017).

Videos play a crucial role in supporting visual and auditory learners by presenting content through engaging, real-world examples. According to McNeil (2020), videos in CLIL classrooms help contextualize academic content while simultaneously developing listening and comprehension skills. For instance, documentary clips and instructional videos can enhance students' understanding of complex topics while providing exposure to authentic language.

Podcasts serve as an effective tool for improving listening skills and fostering cultural awareness. Meyer and Coyle (2017) argue that podcasts enable learners to access diverse linguistic registers and accents, thus preparing them for real-world communication. Additionally, podcasts allow for asynchronous learning, giving students flexibility to engage with materials at their own pace.

Digital storytelling combines creativity with academic rigor, encouraging students to produce their own narratives or visual presentations. Robin (2016) highlights how digital storytelling fosters critical thinking and collaborative skills by requiring students to integrate multimedia elements into cohesive projects. Within the CLIL framework, digital storytelling can be used to explore cultural topics, scientific phenomena, or historical events, blending language and content learning effectively.

The integration of these multimedia resources diversifies instructional methods and addresses the needs of 21st-century learners. As Zayas-Bazán and Fernández-Álvarez (2019) emphasize, the adaptability and scalability of multimedia tools make them indispensable for creating interactive and inclusive CLIL environments.

6.2. Methods of ICT Integration

Flipped Classroom

The flipped classroom model leverages ICT to deliver content outside of traditional class time, transforming how students engage with learning materials and in-class activities. Egbert et al. (2015) demonstrate that flipped instruction enables students to interact with content at their own pace, allowing classroom time to focus on interactive, content-driven tasks that promote collaboration and deeper understanding.

According to Meyer and Coyle (2017), the flipped classroom model aligns well with the principles of CLIL, as it facilitates the integration of language and subject content. For example, pre-recorded video lectures and interactive materials can introduce students to key concepts and vocabulary before the lesson, optimizing in-class time for discussion and application of knowledge.

Furthermore, a study by Hung (2017) highlights the effectiveness of flipped classrooms in enhancing language proficiency and learner autonomy. The research reveals that students engaged in flipped learning demonstrate improved retention and confidence in using academic language, as they have multiple opportunities to review content independently.

In the context of CLIL, Zainuddin and Halili (2016) emphasize the role of flipped classrooms in fostering active learning. By shifting lower-order tasks (Bergmann & Sams, 2012; Mok, 2014), such as content review to homework, teachers can focus on higher-order thinking skills (Anderson & Krathwohl, 2001; Zohar & Dori, 2003), including analysis and synthesis, during class activities. This approach is particularly effective in bilingual education, where language practice and content exploration occur simultaneously.

By utilizing flipped classrooms, educators create a more flexible and engaging learning environment, enhancing both linguistic and content objectives. This approach also empowers students to take greater ownership of their learning, aligning with the overarching goals of CLIL methodologies.

Project-Based Learning (PBL)

ICT facilitates project-based learning by providing a robust framework for research, collaboration and presentation. In the context of CLIL, PBL enables students to engage deeply with both linguistic and content objectives, fostering critical thinking, creativity and collaboration.

Kolb's (1984) experiential learning theory highlights the importance of hands-on, reflective activities, which align seamlessly with the principles of PBL. According to Coyle, Hood, and Marsh (2010), PBL supports language acquisition by embedding meaningful tasks within authentic content-driven contexts, enabling students to simultaneously develop linguistic and subject-specific skills.

Additional studies, such as Thomas (2000), emphasize that PBL promotes problem-solving and decision-making skills, which are integral to bilingual education. Furthermore, Leung and Harrington (2020) discuss how ICT-enhanced PBL fosters engagement through tools like collaborative platforms, multimedia resources, and virtual simulations. These tools provide real-world scenarios that enrich the learning process, making content more accessible and relevant.

For instance, a study by Zafirov and Spasova (2021) on PBL in science education revealed that integrating ICT tools like Google Workspace and Padlet enhances both individual and group learning outcomes. Similarly, the use of digital storytelling in PBL encourages students to create projects that require combining language and content knowledge, as Robin (2016) suggests, fostering deeper cognitive and linguistic engagement.

Virtual and Augmented Reality

Emerging technologies like virtual and augmented reality (VR and AR) provide immersive learning experiences that are highly beneficial within the CLIL framework. These tools simulate real-world environments, enabling students to interact with content in authentic and engaging contexts. Zayas-Bazán and Fernández-Álvarez (2019) emphasize the scalability of VR and AR in bilingual education, particularly for creating interactive and inclusive environments.

VR immerses students in simulated settings, such as historical sites or scientific laboratories, where they can explore and interact with content using the target language. For example, Dalgarno and Lee (2010) highlight that VR enhances spatial learning and critical thinking, making it ideal for subjects like Geography and Biology in CLIL. Similarly, AR overlays digital elements onto real-world views, enabling learners to see and manipulate content

dynamically. Research by Huang et al. (2019) shows that AR improves vocabulary retention and pronunciation accuracy by linking visual elements to language tasks.

In addition to enhancing content understanding, these technologies foster collaborative learning. Wu et al. (2020) found that VR and AR platforms encourage teamwork and problem-solving as students navigate complex tasks in simulated environments. These benefits align with the experiential learning principles underpinning CLIL, where active participation and reflection are essential.

By integrating VR and AR, educators can design lessons that bridge linguistic and content objectives, fostering a deeper understanding of material while enhancing language acquisition. As these technologies evolve, their potential to transform CLIL classrooms will expand, offering students unprecedented opportunities for immersive and contextualized learning.

Synchronous and Asynchronous Learning

ICT supports both synchronous (live) and asynchronous (self-paced) learning, providing a versatile approach that enhances flexibility and accessibility within the CLIL framework. Platforms like Zoom and Microsoft Teams allow for live interaction, enabling real-time discussions, collaborative activities, and immediate feedback (Buendía-García et al., 2020). These synchronous tools are beneficial in fostering a sense of community and engagement among learners, which is critical for language development.

On the other hand, asynchronous platforms such as Moodle and Google Classroom support self-directed learning by providing access to resources, assignments and discussion forums at any time. According to Hrastinski (2008), asynchronous learning enhances reflection and deep processing of information, making it especially effective for tasks that require critical thinking and content analysis. For CLIL, this flexibility allows students to engage with linguistic and academic material at their own pace, reinforcing understanding and retention.

Research by Means et al. (2013) underscores the importance of blending synchronous and asynchronous modalities to maximize learning outcomes. This combination enables educators to balance real-time interactions with the autonomy of self-paced study, creating a holistic learning experience that addresses diverse student needs. Furthermore, Martínez-Soto and Prendes-Espinosa (2023) highlight that such blended approaches are integral to the effective integration of ICT in CLIL, ensuring that both language and content objectives are met efficiently.

7. Challenges in Implementing ICT in CLIL

While ICT integration in CLIL brings transformative opportunities, it also presents several challenges that educators and institutions must address to ensure its effectiveness.

7.1 Accessibility and Digital Divide

One of the primary challenges is ensuring equitable access to technology. Redecker (2017) highlights that socio-economic disparities often lead to a digital divide, where some students lack access to essential devices and stable internet connections. This gap limits the potential of ICT to foster inclusive education and requires institutions to prioritize infrastructure development and provide resources to underprivileged learners.

7.2 Teacher Training and Professional Development

Successful ICT implementation in CLIL relies heavily on teachers' digital competencies. Martínez-Soto and Prendes-Espinosa (2023) emphasize that many educators lack the training needed to effectively integrate technology into bilingual classrooms. Professional development programs must address not only technical skills, but also pedagogical strategies for leveraging ICT to meet both linguistic and content objectives.

7.3 Technological Fatigue

Frequent exposure to digital tools can lead to technological fatigue among students and teachers. This phenomenon, discussed by Huang et al. (2020), reduces engagement and can negatively impact learning outcomes. To mitigate this, educators should balance digital and non-digital activities, ensuring variety and maintaining motivation.

7.4 Integration with Curricular Goals

Aligning ICT tools with curricular objectives poses another significant challenge. Zafirov and Spasova (2021) note that while ICT offers numerous possibilities, its integration must be carefully planned to align with specific learning goals in CLIL. Without clear alignment, the use of technology risks becoming an isolated activity rather than a meaningful enhancement to content and language learning.

7.5 Technical and Logistical Issues

Technical difficulties, such as software glitches and inadequate support, often disrupt the seamless use of ICT in classrooms. Leung and Harrington (2020) argue that robust technical support and user-friendly platforms are critical for minimizing disruptions and ensuring the smooth implementation of technology-enhanced learning.

7.6 Cultural and Linguistic Barriers

Finally, cultural and linguistic differences in digital content can limit its applicability in diverse classroom settings. Wu et al. (2020) stress the need for localized and culturally relevant digital materials to ensure that ICT tools are effective for all learners.

Addressing these challenges requires a holistic approach that combines institutional support, teacher training, and careful planning to maximize the benefits of ICT in CLIL environments. With strategic interventions, educators can overcome these obstacles and fully harness the potential of technology to enhance bilingual education.

8. Types of Digital Artefacts Produced by Students

In the CLIL approach, ICT facilitates the creation of diverse digital artefacts that support both language and content objectives. These artefacts reflect students' understanding, creativity, and ability to apply knowledge in meaningful ways. Below are some common types of digital artefacts produced by students in ICT-enhanced CLIL classrooms.

8.1. Digital Presentations

Students often create digital presentations using tools like Microsoft PowerPoint, Google Slides, or Canva. These presentations enable learners to demonstrate their grasp of content while practicing language skills such as organizing ideas, summarizing information, and delivering oral presentations. According to Redecker (2017), such activities also enhance digital literacy by requiring students to navigate and use multimedia elements effectively.

8.2. Blogs and Online Journals

As discussed by Montaner (2021a, 2021b, 2020, 2019), blogging is a reflective practice that encourages students to articulate their thoughts in writing while engaging with authentic audiences. Blogs serve as a platform for students to share research, project findings, or personal reflections, fostering a sense of ownership and pride in their work. García-Sánchez & Mena-Marcos (2018) highlight how blogs also develop metacognitive skills, allowing students to evaluate their learning processes.

8.3. Videos and Podcasts

Creating videos and podcasts helps students hone their speaking and listening skills while exploring content in depth. Tools like Flipgrid, Adobe Spark, and Anchor make it easy for students to produce high-quality digital media. Meyer and Coyle (2017) emphasize the role of these artefacts in promoting authentic communication and cultural awareness, as students often incorporate real-world contexts into their projects.

8.4. Infographics

Infographics are an excellent way for students to synthesize complex information into visually engaging formats. Platforms like Piktochart and Canva enable learners to combine text, images, and charts to convey key ideas. Zafirov and Spasova (2021) found that creating infographics improves students' ability to summarize and analyse content while fostering digital creativity.

8.5. E-Portfolios

E-portfolios provide a platform for students to showcase their work over time. These collections may include written assignments, multimedia projects, and reflections on learning. According to Buendía-García et al. (2020), e-portfolios promote self-assessment and allow teachers to evaluate linguistic progress and content mastery in an integrated manner.

8.6. Collaborative Projects

Digital tools like Google Docs and Padlet enable students to work collaboratively on group projects. These collaborative artefacts often involve co-authored reports, shared presentations, or collaborative research papers. Kessler and Bikowski (2010) highlight the benefits of such projects in fostering teamwork, critical thinking, and language development. In general terms, Montaner (2019) highlights the increasing relevance of collaborative Web 2.0 within the CLIL approach.

8.7. Gamification

Kahoot is a widely recognized gamified tool used in CLIL classrooms to enhance engagement and learning outcomes. According to Montaner (2018), interactive quizzes with Kahoot foster active participation and motivation by creating a competitive yet collaborative environment. The platform's game-like structure encourages students to interact with content dynamically, reinforcing both linguistic and subject-specific knowledge.

8.7.1. Benefits of using Kahoot in CLIL

Enhancing Language Skills

Kahoot has been identified as an effective digital tool for supporting language development within Content and Language Integrated Learning (CLIL) environments. Montaner (2018) highlights that the platform facilitates the acquisition of vocabulary, listening comprehension, and grammar skills. By engaging students in real-time question-and-answer activities, Kahoot exposes learners to authentic language use within meaningful contexts. This immediacy not only enhances retention but also helps students establish stronger connections between language and subject-specific content.

Promoting Collaboration

The multiplayer design of Kahoot fosters collaborative learning by encouraging students to work in pairs or small groups when answering questions. According to Montaner (2022), this collaborative approach cultivates a sense of community and enhances peer-to-peer interaction. Such communication is particularly significant in bilingual education settings, where cooperation supports both linguistic and cognitive development.

Providing Immediate Feedback

A key pedagogical advantage of Kahoot is its ability to deliver instant feedback. As Montaner (2018) explains, immediate feedback enables learners to quickly identify areas for improvement and correct errors, thus promoting self-regulated learning. Additionally, it provides teachers with valuable insights into student understanding, allowing them to make timely instructional adjustments to better support learners' needs.

Application Strategies in CLIL

- **Customizable Quizzes:** Teachers can create subject-specific quizzes tailored to curricular objectives, integrating vocabulary and concepts relevant to CLIL content.
- **Formative Assessment:** Montaner (2020) describes how Kahoot can be used for formative assessment, enabling educators to gauge student progress in real time.
- **Integration with Other Tools:** Combining Kahoot with other ICT tools, such as Google Classroom or Moodle, enhances its effectiveness by creating a seamless learning experience.

9. Case Studies and Findings

The integration of ICT within the CLIL approach has been extensively studied through various case studies, highlighting its positive impact on learning outcomes. Below are notable findings from key studies that highlight the efficacy and challenges of ICT-enhanced CLIL with a special focus on different types of research which were conducted in non-university education; in particular, secondary education within the Spanish educational curriculum.

9.1. Blogging to Improve Written English

Montaner (2020) conducted an action research study that highlighted blogging as a transformative tool for improving English writing skills within the CLIL framework. This study revealed significant enhancements in students' grammar, vocabulary, and overall written competence. Furthermore, Montaner (2019a) explored the impact of blogging on fostering reflective thinking, emphasizing how it provides a platform for self-assessment and peer feedback, which are critical components in developing linguistic and cognitive skills.

Additionally, Montaner (2021a) analysed the process of writing through blogging, illustrating its effectiveness in structuring ideas and improving coherence and cohesion in student texts. The integration of blogging within CLIL classrooms promoted collaborative learning and aligned with the experiential learning principles that encourage active student engagement.

Montaner (2021b) further examined the outcomes of product-based writing via blogging, showcasing how this digital tool facilitates authentic communication and motivates students to connect with real-world audiences. These findings underscore the multifaceted benefits of blogging as a pedagogical strategy in enhancing written competence and content integration in CLIL settings. Montaner (2020) conducted an action research study on the use of blogging to enhance English writing skills in Secondary Education within the CLIL framework. The study revealed significant improvements in students' written competence, particularly in grammar and vocabulary use. Blogging also encouraged reflective thinking and provided opportunities for peer feedback, fostering a collaborative learning environment.

9.2. Gamified Learning with Kahoot

In case studies by Montaner (2018, 2022), Kahoot was implemented in EFL classrooms within the CLIL approach. These studies demonstrated that gamified quizzes improved students'

motivation and engagement, particularly in vocabulary retention and comprehension. Montaner (2022) also highlighted the adaptability of Kahoot in fostering interactive learning environments that align with both linguistic and content objectives. Additionally, the studies underscored the benefits of immediate feedback, which enhanced students' ability to identify and correct errors in real time, and the platform's positive impact on collaborative learning by encouraging teamwork and active participation.

9.3. Teacher Perspectives of ICT Integration

Martínez-Soto and Prendes-Espinosa (2023) conducted a systematic review of teacher perceptions regarding ICT use in CLIL classrooms. The findings revealed that while educators recognize the potential of ICT to enhance learning, they often face challenges like insufficient training and technological fatigue. These insights emphasize the need for targeted professional development programs.

10. Future of ICT and CLIL: Advanced Technologies

Advanced educational technologies, such as artificial intelligence, augmented reality, and virtual reality, are expected to redefine ICT integration in CLIL. These tools promise to create personalized, efficient, and globally interconnected learning environments, revolutionizing both language and content education.

AI holds immense potential in adapting to learners' individual needs. AI-powered platforms can provide real-time feedback, automate assessments and personalize content delivery, enhancing linguistic and subject-specific proficiency. Similarly, AR and VR immerse students in realistic environments, allowing them to engage deeply with content while practicing language skills in authentic contexts (Wu et al., 2020).

These technologies will foster global collaboration among educators by enabling resource sharing and bridging linguistic gaps with AI-driven translation tools. However, successful implementation will require robust teacher training and institutional support to ensure that these innovations align with educational objectives. In conclusion, these advanced technologies offer exciting opportunities to enrich CLIL practices and prepare students for the challenges of the 21st century.

11. Conclusion

The integration of ICT in the CLIL approach within the Spanish educational system, particularly in Secondary Education, exemplifies a transformative shift in teaching and learning. This paper has discussed the "what, why, and how" of ICT in CLIL, showcasing its ability to enhance linguistic and content-based competencies through innovative tools and methodologies. Blogging, gamification with Kahoot, and collaborative platforms like Google Docs have demonstrated significant improvements in students' engagement, critical thinking and academic performance.

The reviewed studies and, particularly, the Spanish publications underscore the diversity of research methodologies, including action research and systematic reviews, applied within the Spanish curriculum to investigate ICT's impact on bilingual education. These findings affirm the relevance of integrating digital tools to meet modern educational demands, fostering an environment where both language and subject content thrive simultaneously.

Globally, the potential of advanced technologies such as AI, VR and AR to reshape education is immense. By embracing these innovations, educators can address linguistic and cultural diversity, prepare students for future challenges and align teaching practices with global standards. The CLIL framework, supported by ICT, is well-positioned to drive such advancements, bridging gaps in education and opening new avenues for interdisciplinary and international collaboration.

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