

Building CLIL teacher knowledge: Teaching Mathematics through Irish in English-medium elementary schools in the Republic of Ireland

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Abstract

Content and Language Integrated Learning (CLIL) is increasingly seen as a possible solution to enhance the teaching of the Irish language in English-medium schools in the Republic of Ireland, where Irish is compulsory and taught as a minority second language (L2) (Department of Education and Skills (DES), 2018, 2022). Despite heightened governmental focus on CLIL, challenges persist in its practical implementation, particularly regarding the development of teachers' knowledge base for CLIL (Fahey, 2021). This paper reports on three elementary teachers' lived experiences as they participated in a six-week Community of Practice (CoP) model for CLIL professional growth. Utilising a variety of sources (i.e. focus group interviews, researcher field notes, participant reflective diaries and CLIL lesson plans), data were collected from three teachers as they implemented CLIL for the first time in their kindergarten classrooms, teaching 4-5-year-olds. The paper firstly presents a critical review of the relevant literature base and synthesises findings in an attempt to ascertain what is known from extant studies. Following this, the study is delineated, and significant findings regarding enhanced teacher language confidence, heightened language awareness, and increased awareness of professional development needs in the language of CLIL instruction are presented. Notably, tensions surrounding the augmented language proficiency expectations placed on teachers when instructing Mathematics through the medium of Irish are also acknowledged, particularly as they navigated the linguistic intricacies of planning within a disciplinary curriculum area using a minority language. In conclusion,

suggestions for systemic advancements are considered, and potential avenues for future research are proposed.

Keywords | Content and Language Integrated Learning (CLIL); teacher professional development; language awareness; elementary education

1. INTRODUCTION

In line with international developments in bilingual education, Content and Language Integrated Learning (CLIL) is gaining traction in educational debate in the Republic of Ireland (Harris & Ó Duibhir, 2011; Department of Education and Skills (DES), 2018, 2022), particularly at elementary level. Yet, to date, few studies identify the CLIL-specific competences demanded by the elementary English-medium setting. The primary purpose of this paper is to explore the development of a teacher's CLIL knowledge base within the context of teaching Mathematics through Irish in an English-medium elementary school in the Republic of Ireland. By investigating this aspect, the paper seeks to provide insights into the pedagogical strategies and language awareness required for effective CLIL implementation at the elementary level, contributing to a deeper understanding of CLIL practices and demands in Irish elementary education. The paper begins with an overview of the elementary education landscape in Ireland, followed by an examination of CLIL in English-medium elementary schools. The discussion extends to the enactment of CLIL at the elementary level and the critical role of CLIL Teacher Language Awareness. An interventional study assessing CLIL's impact on student learning is then outlined and findings presented, concluding with insights and implications for elementary education in the Republic of Ireland.

2. EDUCATIONAL LANDSCAPE AT THE ELEMENTARY LEVEL IN THE REPUBLIC OF IRELAND

The Irish language stands as Ireland's first official language, with 1.4% of the population over thirteen years old reporting daily usage (Central Statistics Office, 2022). Irish holds a distinctive position within Ireland, bearing major cultural significance and continuing as a dynamic, living language in modern Irish society. From an educational perspective, the Irish language is taught as an obligatory subject from elementary school to the end of secondary education in Ireland (Ó Ceallaigh & Ní Dhonnabháin, 2015). In English-medium elementary schools, which constitute more than 90% of all schools at this level, Irish is instructed as a second language (L2). Substantial concerns regarding the instruction and acquisition of the Irish language in English-medium elementary schools have been documented (DES, 2018). In the 2018 report, a notable portion of lessons were deemed unsatisfactory in terms of fostering students' language

proficiency and Irish language learning, as well as the utilization of teaching strategies. The report highlights the absence of opportunities for dialogue, discussion, and collaborative activities. This underscores the nuanced nature of Irish language instruction, revealing significant deficiencies in pedagogy that hinder the attainment of learning objectives outlined in the primary language curriculum (The National Council for Curriculum and Assessment (NCCA), 2019). Despite persistent challenges in Irish language education (DES, 2018, 2022), there remains a scarcity of research offering solutions. Nevertheless, the findings of these reports have spurred initiatives for systemic change (Harris & Ó Duibhir, 2011; DES, 2022), aiming to revolutionise Irish language instruction in English-medium elementary schools by harnessing the potential of CLIL.

3. CONTENT AND LANGUAGE INTEGRATED LEARNING (CLIL) IN ENGLISH-MEDIUM ELEMENTARY SCHOOLS

A revised language curriculum (NCCA, 2019) has highlighted new possibilities for teaching Irish in English-medium elementary schools, with specific learning outcomes identified. Recognizing the unique nature of English-medium schools as Irish language learning environments, CLIL is proposed as a crucial approach. However, there is a notable lack of professional development (PD) opportunities for elementary teachers to gain CLIL pedagogy skills. International debate demonstrates that instructional scaffolds are needed for teachers to develop CLIL teachers' knowledge base and equip them with the necessary knowledge, skills, and adequate competencies to implement the contextual change necessary for CLIL pedagogy (Ball et al., 2015; Cammarata, 2016; Cammarata & Ó Ceallaigh, 2020; Coyle et al., 2010).

While the discussion to date has indicated the fragile nature of the Irish language within the Irish educational system in English-medium schools, CLIL has been identified as a key driver in curriculum reform, as echoed in the most recent Chief Inspectorate Report (DES, 2022). The 2022 report urges active exploration of opportunities to expand CLIL to enhance the use of Irish in English-medium primary schools. It acknowledges significant potential to improve students' learning outcomes, motivation, and engagement by implementing CLIL in English-medium schools. More specifically, it acknowledges that elementary schools need intensive support to enable them to

introduce appropriately challenging, targeted interventions to enhance pupils' attainment, engagement, enjoyment and motivation in Irish language learning. Such timely discussion demonstrates that while CLIL is gaining traction in educational debate, further exploration and research are essential to identify teacher needs and requirements. Yet, there is a scarcity of CLIL research within the Irish context (DES, 2022; Ní Dhiorbháin & Ní Bhaoill, 2018), and no evidence of a proven effective CLIL approach, particularly in settings where Irish is taught as a second language (L2). Classroom-based research is therefore necessary to gather evidence on the possibilities or shortcomings with CLIL in English-medium (L2) schools as an Irish language teaching method. Additionally, if CLIL implementation is to be successful, the PD of teachers needs to be based on robust evidence-based research on how best to implement CLIL.

Research points to a gap in the international literature, indicating the need for further research on CLIL at the elementary level (Bower, 2023; Haataja et al., 2011; Ioannou-Georgiou & Pavlou, 2011), especially concerning the integration of languages other than English (LOTE) within the CLIL framework. LOTE contexts enable teachers to implement a curriculum subject through a selected target language other than English with CLIL to support language diversity in schools and protect heritage languages (Bower, 2023; European Centre for Modern Languages, 2024). To ensure successful CLIL implementation in any language, a particular pedagogical knowledge base is essential, which will be explored in detail below.

4. ENACTING CLIL AT ELEMENTARY LEVEL

The successful implementation of CLIL relies heavily on pedagogical integration (Lyster, 2007), is a pedagogically challenging experience (e.g., Cammarata & Haley, 2017; Cammarata & Tedick, 2012) and demands an augmentation of specialised knowledge and pedagogical expertise (e.g., Cammarata & Tedick, 2012; Cammarata & Ó Ceallaigh, 2020). However, we have yet to fully understand and describe what constitutes an ideal CLIL teacher knowledge base for integration (Morton, 2016). Based on Shulman's work (1987), this unique body of knowledge may be defined in terms of the interaction of different knowledge domains (see Figure 1), namely, (a) content knowledge of language of instruction (CK-L), knowledge about the language used as a medium of instruction, (b)

content knowledge (CK-C), knowledge of the content of instruction, (c) pedagogical knowledge (PK) - knowledge about the teaching and learning processes, practices and strategies, (d) PCK-L - the interaction of PK and CK-L, (e) PCK-C - the interaction of PK and CK-C, (f) CK-L/C - the interaction between CK-L and CK-C. PCK for content and language integration (IPCK) is an amalgam of all knowledge domains and may be defined as the situated synthesis of CLIL teacher knowledge (Troyan et al., 2017).

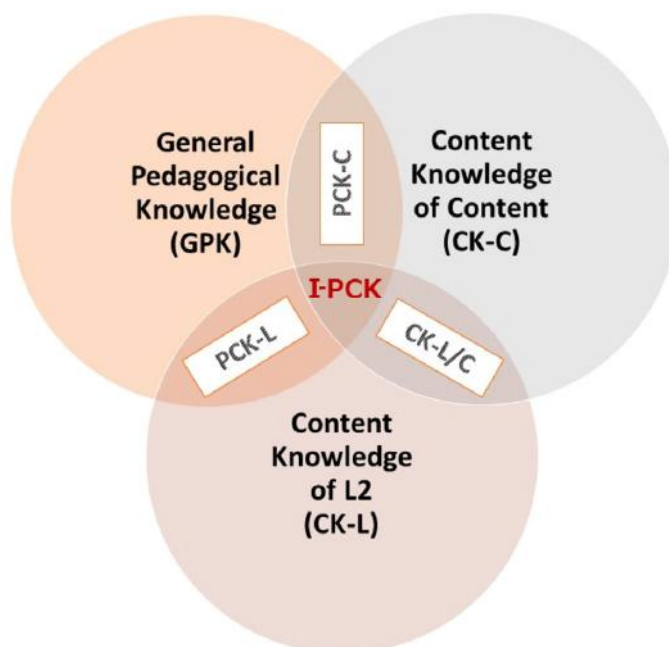


Figure 1

PCK for Content and Language Integration: IPCK

(Adapted from Koehler & Mishra, 2008; Troyan et al., 2017)

The use of IPCK as an analytical tool in CLIL teacher education and PD programmes is promising (Cammarata & Cavanagh, 2018; Ó Ceallaigh et al., 2018). It empowers immersion teachers to participate in continuous, thorough, systematic, and reflective evaluations of their teaching methods while enabling researchers to investigate and delineate various realms of CLIL teacher knowledge, pinpointing specific areas for

enhancement within these domains (Cammarata & Cavanagh, 2018; Ó Ceallaigh et al., 2018). However, it is important to highlight that the aforementioned tool integrates language awareness as a crucial aspect of CLIL teacher knowledge, as educators consistently strive to convey meaning through the target language during content instruction.

5. CLIL TEACHER LANGUAGE AWARENESS

Teacher language awareness (Andrews, 2001, 2007) encompasses the teacher's knowledge of and about target language usage. To be more precise, teacher language awareness has three domains, incorporating the teacher as a language user, a language analyst and ultimately a language teacher (Edge, 1988; Lindahl & Henderson, 2019). In CLIL environments, language awareness pertains to teachers' comprehension of language acquisition and its role in achieving educational objectives (Lo, 2020). This encompasses how teachers utilise their linguistic knowledge to facilitate learning, their attention to language nuances, the sequencing of language activities, and the organization of learning experiences to integrate language with content in various forms (He & Lin, 2018). It is also noted that teacher language awareness evolves as instructors reflect on both the content of CLIL lessons and their own classroom practices (He & Lin, 2018).

6. THE STUDY

Methodology

Guided by an interpretive paradigm, this study set out to explore the following research question:

RQ: How is a teacher's CLIL knowledge base developed when teaching Mathematics through Irish in an English-medium elementary school in the Republic of Ireland?

The goal was to support three teachers in developing the necessary knowledge, skills, and competencies to effectively implement CLIL in their kindergarten classrooms

over a six-week period. The participants, consisting of three kindergarten teachers, conducted daily 40-minute mathematics lessons, informed by the national curriculum, using the Irish language as the medium of instruction. Utilising a Community-of-Practice (CoP) PD model (Wenger 1998; Lave & Wenger, 1991), a culture of continuous improvement was fostered. A CoP approach was deemed suitable for this research to enable the teachers to become familiar with CLIL implementation and to nourish a comprehensive knowledge and understanding of CLIL enactment.

Participants

Purposeful sampling was used to select teacher participants to implement CLIL (Creswell, 2013; Yin, 2014) as a specific cohort of teachers was required. Fully registered kindergarten teachers from an English-medium school context where Irish is taught as a second language (L2) were a requisite. Furthermore, teachers who had no prior experience with CLIL implementation or formal CLIL PD were specifically targeted. The education background and teaching experience at elementary level varied as follows:

Participant	Qualification	Teaching Experience in Elementary	Teaching Experience in Kindergarten
Participant 1	Bachelor of Education	8 years	5 years
Participant 2	Bachelor of Education	16 years	8 years
Participant 3	Master of Education	3 years	3 years

Table 1

Education Background and Teaching Experiences of Participants

Data collection and analysis procedures

At Stage 1 of the study, an online questionnaire was distributed to participants to ascertain their CLIL-specific PD needs. Data generated enabled the researcher to identify existing CLIL knowledge and consider scaffolds and skills required to propel CLIL implementation in the classroom. Moreover, it clarified the level of language-focused support necessary as participants expressed concern about their own

expressive language ability through Irish in a LOTE teaching context. Subsequently, a bespoke, context-responsive PD seminar was designed and developed, informed by questionnaire data, to support and enhance CLIL teacher professional learning. Table 2 below provides an overview of data collection procedures aligned with each stage of the study.

Stage	Data collection procedures
Stage 1	<ul style="list-style-type: none"> Extensive online questionnaire
Stage 2	<ul style="list-style-type: none"> Researcher field notes from onsite PD seminar with participants
Stage 3	<ul style="list-style-type: none"> Review and development meeting (Week 1 - Week 6) - Researcher field notes Teacher reflective diary per week Researcher lesson observations (Week 1 - Week 6) - Researcher observation notes and teacher lesson plans Focus group interview #1 (Week 2) and #2 (Week 4) with the three participating teachers
Stage 4	<ul style="list-style-type: none"> Focus group interviews #3 with the three participating teachers

Table 2

Overview of Stages and Data Collection Procedures

Informed by research from pertinent CLIL scholars (e.g. Ball et al., 2015; Mehisto et al., 2008; Lo, 2020), theoretical and practical perspectives of CLIL were explored with participants at an initial onsite staff PD day at Stage 2 of the study. An exemplification of a CLIL lesson was also conducted to foster in-depth discussion and offer a comprehensive understanding of the requirements for implementing the CLIL approach in their specific context. Furthermore, a scheme of work featuring a sample CLIL lesson template was examined; the template categorised language into content-obligatory (disciplinary-specific) and content-compatible language (language integrated with the topic) (NCCA, 2019). A customised CLIL lesson template (i.e. Mathematics through the

medium of Irish), aligned with curricular requirements for kindergarten Mathematics (Department of Education and Skills, 1999a; Department of Education and Skills, 1999b) was explored.

At Stage 3, a CoP approach (Wenger, 1998), was fostered to help teachers identify lesson-specific requirements which could be teased out to adopt CLIL in their unique school context. Consequently, weekly face-to-face review and development meetings (i.e. six in total) were held to discuss lessons observed by the researcher, who acted as a facilitator/mentor to propel CLIL exploration. Ongoing collaboration and discussion focused on addressing the participants' self-identified needs regarding how to sequence and implement a CLIL Mathematics lesson tailored for their specific school context. Additionally, discussions emphasised the importance of child-centered language learning methodologies like task-based, inclusive, and age-appropriate second language learning experiences to support CLIL implementation. The researcher maintained extensive field notes during review and development discussions, as well as compiling field notes from observed lessons on a weekly basis. Teachers completed weekly diaries to document their CLIL progress and highlight potential areas for development. Group discussions were conducted in English as participants perceived their expressive abilities and competence in Irish to be insufficient for robust CLIL discussions. At Stage 4, a focus group interview was conducted with participants to reflect on learnings and challenges encountered.

All data generated were compiled and data analysis at the end of the intervention process involved the use of NVIVO software using Braun and Clarke's (2006; 2022) six-step approach to data refinement and analysis.

7. FINDINGS AND DISCUSSION

Data analysis revealed the emergence of the following themes: Increased teacher confidence; heightened teacher language awareness; and increased awareness of professional development needs in the language of CLIL instruction. Each theme will be discussed below.

7.1 Increased teacher confidence

Teacher confidence in CLIL grew as the entire kindergarten staff engaged in planning, review and development discussions, and implementation of CLIL lessons within a Community of Practice (CoP) framework for professional development. Regarding language proficiency, participants reported an increased confidence as they used more Irish on a daily basis, particularly in content subjects, as a result of employing a CLIL approach.

I really enjoyed this! I surprised myself at how easily I switched over to using Gaeilge (Irish). I got a great boost from speaking with (X referring to researcher) after she observed me and she said she felt it was a great success. This makes me more confident facing into another week of CLIL. It was just the right amount of challenge, it pushed my teaching while still allowing me to teach confidently and feel I taught the lesson successfully

(Reflective diary, Participant #3, Week one).

The confidence in teaching through Irish surged as the duration of Irish language instruction expanded, transitioning from language-focused classes, which typically revolve around a central theme, to encompassing the Irish language throughout content lessons such as Mathematics. Consequently, the teachers' utilisation of Irish increased from 30 minutes to 70 minutes per day. This increased usage led to increased confidence in their language production or PCK-L (Trojan et al., 2017). This was evident in the weekly CoP review and development meetings also, which provided additional time and a safe, context- embedded space to explore language requirements in Irish for upcoming lessons and scaffold teachers in CLIL for Mathematics lessons through Irish.

Initially I was extremely nervous to begin this process, so I was worried about using Gaeilge (Irish) for a full lesson. And that was before even considering the actual Maths content! I had never seen a Maths curriculum in Gaeilge (Irish), it was extremely daunting, and I didn't hold out much hope for myself teaching Maths through Gaeilge/ language teaching through Gaeilge in Maths. I surprised myself by

how much I enjoyed teaching through Gaeilge, how successful the lessons were and how easily the children took to the lessons.

(Reflective dairy Participant #3, Week 3).

Consequently, participants became adept at self-identifying needs for CLIL as the intervention unfolded. Overall, by the end of the intervention, teachers were planning their own lessons in Mathematics through Irish. Fahey (2021) reports similar findings in relation to teacher confidence as a driver for effective CLIL implementation.

7.2 Heightened level of teacher language awareness

Teachers displayed a heightened level of language awareness and recognized the central role of language knowledge for successful CLIL implementation. Language exploration and reflection intensified for teachers during CLIL lessons making them increasingly language-aware as they had never taught Mathematics or another curriculum subject through Irish before. Insights garnered from qualitative data provided by the teachers illuminate the evolving level of teacher language awareness.

I think that's one of the things, one of the things I underestimated in my understanding of it was actually how much language input you need at the start of it when you're going on to a new topic

(Focus group, Participant #1, Week 6).

Overall, I enjoyed the experience, particularly as the weeks went on. We all grew in confidence together and we definitely started to see the advantages of CLIL in a working classroom

(Reflective diary, Participant #2, Week 6).

The teachers engaged in ongoing reflection about teaching with CLIL through Irish in terms of how to sequence language within and across lessons to facilitate understanding. Furthermore, as noted in lesson observations, teachers gained insight

into when to scale back on content delivery if students encountered difficulties or felt overwhelmed, and when to emphasize language aspects within Mathematics lessons. Throughout the intervention, the researcher noted the teachers' evolving pedagogical understanding with CLIL, wherein both pedagogical content knowledge related to language (PCK-L) and pedagogical content knowledge related to content (PCK-C) were deemed essential for shaping the CLIL instructional process. Ó Ceallaigh et al. (2018) also note the potential of CLIL to boost teacher language awareness.

7.3 Increased awareness of professional development needs in the language of CLIL instruction

Overall, data emerging from the intervention indicate the positive impact of a CoP approach to professional development to enhance CLIL knowledge. The intervention allowed the teachers to become self-reflective and pinpoint their unique, context-bound professional learning requirements for both language and pedagogy through CLIL. In terms of the teachers' knowledge base, underdeveloped pedagogical content knowledge and language awareness initially resulted in an inability to express and deliver content through Irish to facilitate both comprehensible input and content understanding in Mathematics, as noted during lesson observations. In review and development meetings, teachers reported that their conversational fluency (i.e. *basic interpersonal communicative skills*) was effective. However, they also considered, their sophisticated use of language (i.e. *cognitive academic language proficiency*) (Cummins, 2006) to explain concepts in Mathematics was deficient when teaching Mathematics through Irish. This was also noted during observations.

I found the planning process took time, there was a lot of vocabulary that I did not have as Gaeilge so I had to take some time to source this vocabulary and write it down for myself to learn! Even after taking this time to learn the vocabulary (words like bumpy/ cnapánach, prickly/deilgneach) I still found myself stumped for words mid lesson, for example I had forgotten to look up the Irish for hedgehog. Meeting a barrier like this mid lesson can knock my confidence when teaching

(Reflective diary, Participant #3 Week 3).

As noted above, such linguistic deficits (i.e. PCK-L) related to syntax, grammar, word order, and morphology also became pedagogic constraints. Participant #2 notes the following:

I felt stuck at many times in the lesson; stuck for vocabulary for the various animals in the sets, I felt awkward using the word tacar (set) as it is a new word! And just felt this made my teaching quite disjointed and jittery almost. Many of the children did not understand my instructions as Gaeilge to make a set of four, this led to them going off task, I would then have to give them the instructions again in English

(Reflective diary, Participant #2, Week 3).

However, as reported in researcher field notes, CoP discussions facilitated at review and development meetings enabled participants to make context-responsive and informed decisions to develop practice continuously. Deficiencies in PCK-L have also been reported in previous studies (e.g. Fahey, 2021; Ó Ceallaigh et al., 2018) as impacting on teachers' capacity to effectively implement CLIL in elementary classrooms.

8. Conclusion

This PD programme created multiple and varied opportunities for CLIL teachers to implement their emerging understandings and develop a conceptualisation of CLIL teaching and learning which was both theoretically and pedagogically sound. This cyclical, reflective process not only supported them in reflecting on current knowledge and experiences, but also highlighted the importance of self-evaluation as a catalyst for teacher knowledge growth, in particular in IPCK-L and I-PCK. While practical application of subject-specific content and language integration should be at the heart of any CLIL PD initiative design, PD also needs to incorporate CoP (Wenger, 1998) principles, as demonstrated in this study, to stimulate development and cultivate teacher knowledge growth in CLIL.

This study is not without limitations, as it involved a small number of teachers and a limited number of contexts and disciplines and, thus, its findings should be interpreted with caution and are not generalizable in other CLIL settings. Future studies should

extend the range of academic subjects and employ multiple methods of data collection, including peer observations and guided post-observation reflections.

CLIL research within English-medium schools is an emerging area of inquiry in the Republic of Ireland, poised to inform the development of tailored CLIL professional development programs. The significance of the research findings presented in this paper may influence the trajectory of CLIL professional learning and implementation, underscoring the need for comprehensive research at the elementary level in English-medium schools across Ireland. While this study comprised a small-scale case study, it underscores the importance of amplifying teachers' voices from the outset and throughout the CLIL implementation process, drawing from classroom-based, evidence-driven research that incorporates teachers' lived experiences. It advocates for the active engagement of all stakeholders at the macro level to shape and enhance the national vision for CLIL. Extensive and longitudinal CLIL research is imperative within the Irish context before any system-wide implementation of CLIL can be formulated.

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