



OPEN ACCESS

EDITED BY

Lies Sercu,
KU Leuven, Belgium

REVIEWED BY

Samantha Curle,
University of Bath, United Kingdom
Lies Strobbe,
KU Leuven, Belgium
Sigmund Ongstad,
Oslo Metropolitan University, Norway

*CORRESPONDENCE

Julia Hüttner
✉ julia.huettner@univie.ac.at

RECEIVED 05 December 2024

ACCEPTED 02 June 2025

PUBLISHED 23 July 2025

CITATION

Hüttner J, Llinares A and Nikula T (2025)
Conceptualizing bi- and multilingual
disciplinary literacies in CLIL: insights from
a European research network.
Front. Educ. 10:1540211.
doi: 10.3389/feduc.2025.1540211

COPYRIGHT

© 2025 Hüttner, Llinares and Nikula. This is
an open-access article distributed under the
terms of the [Creative Commons Attribution
License \(CC BY\)](https://creativecommons.org/licenses/by/4.0/). The use, distribution or
reproduction in other forums is permitted,
provided the original author(s) and the
copyright owner(s) are credited and that the
original publication in this journal is cited, in
accordance with accepted academic
practice. No use, distribution or reproduction
is permitted which does not comply with
these terms.

Conceptualizing bi- and multilingual disciplinary literacies in CLIL: insights from a European research network

Julia Hüttner^{1*}, Ana Llinares² and Tarja Nikula³

¹Department of English and American Studies, Center for Teacher Education, University of Vienna, Vienna, Austria, ²Facultad de Filosofía y Letras, Universidad Autónoma de Madrid, Madrid, Spain,

³Centre for Applied Language Studies (CALS), University of Jyväskylä, Jyväskylä, Finland

Educationalists across the world aim to prepare their students for the realities of post-school life, be that at university or in the workplace. Increasingly, the expectations on school leavers have diversified also with regard to their linguistic abilities and prominently include subject-specific or disciplinary literacies, which encompass both knowledge of content and ways of conveying it in subject-specific ways. The global status of English has fostered the situation where subject-specific literacies are now not only needed in the main language of education, often the first language (L1) of students and teachers alike, but also in English as the strongest global lingua franca in both educational and professional environments. While this aim of achieving bi- or multilingual disciplinary literacies is implicitly present in all Content and Language Integrated Learning (CLIL) classrooms, the precise means of fostering such literacies vary across contexts. This article will outline work by the research network *CLILNetLE* (www.clilnetle.eu), which brings together over 240 individuals from 32 countries and is funded by the European Union. *CLILNetLE* aims to develop and refine the conceptualization of disciplinary literacies in CLIL taking into account research into (a) specific subjects (history, science, and mathematics), (b) challenges across school levels, including the expectations made in curricula, and (c) the influence of out-of-school and digital practices. To illustrate the multi-faceted nature of literacies, we will home in on one discursive aspect, i.e., Cognitive Discourse Functions and exemplify their use across levels, subjects, curricula, and digital practices. Drawing on this, we will outline how specific points of subject-specific literacies can and should be highlighted in teaching.

KEYWORDS

Content and Language Integrated Learning (CLIL), subject-specific literacies, school-subjects, secondary education, disciplinary literacies, bilingual education

1 Introduction

A child's move from the home environment to school is characterized – among many other things – by learning to “do school” in the sense of learning to use language in ways appropriate to school in general and to specific subjects in particular. This socialization revolves around the ability to integrate growing content or disciplinary knowledge with

appropriate communication patterns. Rather than a novel idea, the connection between language and schooling has been a recurrent theme in educational research. The Bullock Report in the United Kingdom (Bullock Report, 1975) serves as an early example of calling for language across the curriculum (LAC) approaches (see also, de Oliveira et al., 2023). While implementing LAC resulted in mixed outcomes and political controversies (Stubbs, 2000), the challenge of connecting language and content learning remained. Since then, different educational (including linguistic) models have been applied to address this issue. One example is Systemic Functional Linguistics (SFL) approaches for teaching academic literacies, which have spread from Australia worldwide (e.g., Christie and Derewianka, 2008; Schleppegrell, 2004). Another example is the reading for understanding initiative in the United States, which targets specialized and critical reading skills in different content areas (e.g., Greenleaf et al., 2011; Goldman, 2012). In Europe, the language division of the Council of Europe has been active in producing reports and guidelines for connecting language to school subjects and curricula [e.g., Council of Europe (CoE), 2009; Beacco et al., 2016; see also, Vollmer, 2007]. If we turn to the more specific construct of disciplinary literacies (DLs), we align with McConachie and Petrosky's (2009, p. 6) definition of it as the "use of reading, reasoning, investigating, speaking, and writing required to learn and form complex knowledge appropriate to a particular discipline" and Fang's (2012, p. 20) argument that to be disciplinarily literate one must have "both deep knowledge of disciplinary content and keen understanding of disciplinary ways of making meaning." These serve as useful working definitions for us as they expand the notion of DL beyond reading and writing to different ways of approaching and handling knowledge across subjects and pave the way for building an overarching framework of DLs in bi- and multilingual education. By focusing on bilingual programs, and more specifically on Content and Language Integrated Learning (CLIL), i.e., teaching non-language subjects through an additional language in mainstream education (see, e.g., Coyle et al., 2010), we approach DLs not only in a broader sense but also specifically taking into account the involvement of, at least, two educational languages and thus expand on existing work on primary and secondary education (Dalton-Puffer et al., 2024) and the ongoing work on DLs at tertiary level (see, e.g., Dafouz et al., in press).

The complexity of gaining DLs is likely to increase when several languages are involved, especially in CLIL, where legitimate roles are given to the main educational language (often the learners' and teacher's L1) and the L2. Thus, the DLs used and targeted in these settings are rendered inherently bi- or multilingual. This specificity does not ignore the fact that aspects of integrating the learning and use of bi- and multilingual DLs in CLIL are applicable also to L1-medium education but acknowledges that the presence of a foreign language adds a dimension that has been shown to affect learner performance (e.g., Llinares and Morton, 2024). Additionally, as stated by Dalton-Puffer et al. (2024, p. 4) "DL as a concept has been acquiring components, integrating semiotic systems and modalities beyond language. It is now a considerably multifaceted and deeply interconnected conglomerate notion." As will be shown below, the model proposed here takes this interconnectedness into account by embracing several further literacy dimensions, such as multisemiotic and digital, to acknowledge their role in the research and pedagogy in today's educational world.

Up to now, a rich but fragmented research field has addressed content and language integration with a focus on the role of language in CLIL disciplinary learning (see, e.g., Hüttner and Dalton-Puffer, 2024; Lin, 2016; Llinares et al., 2012; Nikula et al., 2016), which has targeted different linguistic resources (e.g., questions: Tagnin and Ní Riordáin, 2021), discourse (e.g., argumentation: Hüttner and Smit, 2018; Arias-Hermoso et al., 2025; explanation: Kääntä et al., 2018), trajectories of CLIL learners' development (e.g., Lorenzo, 2017), the role of scaffolding (Lo and Lin, 2021), and the difference between DLs used to access new content knowledge and to display such knowledge (Hüttner, 2019; Nikula, 2017). Additionally, several overarching models of DLs in CLIL have been suggested as analytic frameworks, such as the "genre egg" (Lin, 2016), pluriliteracies for deeper learning (Coyle and Meyer, 2021), and applications of SFL (Llinares et al., 2012), and Legitimation Code Theory (LCT; Morton and Nashaat-Sobhy, 2024). Like in many research fields, however, similarity of interest does not necessarily result in clear compatibility of analytic frameworks without further conceptual work. This, we would argue, diminishes possibilities to apply this research to school practices.

This article proposes a multifaceted conceptualization of bi- and multilingual DLs drawing on on-going work and activities of the European network *COST Action 21114 CLILNetLE*.¹ This draws together over 240 researchers and practitioners from a range of specializations in the endeavor to synergize and develop current conceptualizations of DLs and do justice to this construct's complexity and multifacetedness. This action has fostered an integrated research agenda across geographical and educational contexts enabling comparative research. The mid-term goal is to enhance CLIL teaching practices, enabling them to better support learners in developing their ability to effectively use a foreign language for professional and disciplinary purposes.

2 Multilevel collaboration to support bi- and multilingual disciplinary literacies

In the conceptualization of bi- and multilingual DLs a crucial step is to acknowledge their role in local contexts with the aim of both improving pedagogy adapted to the needs of those contexts and, at the same time, drawing on those insights for the development of a common conceptual framework on bi- and multilingual DLs. Given its size, *CLILNetLE* provides the perfect setting for this and allows for different levels of collaboration to accomplish this goal. Collaboration represents a priority in CLIL and education in general. In fact, it is present in the United Nations Sustainable Development Goal (SDG) "Quality Education." As pointed out in Dalton-Puffer et al. (2022), where the role of different targets in the SDG "Quality Education" were put in relation to CLIL, target 4.4. "Enhancing the acquisition of relevant skills for financial success" refers specifically to the importance of developing teamwork. In *CLILNetLE*, the following levels of collaboration have been identified as

¹ www.cilinetle.eu

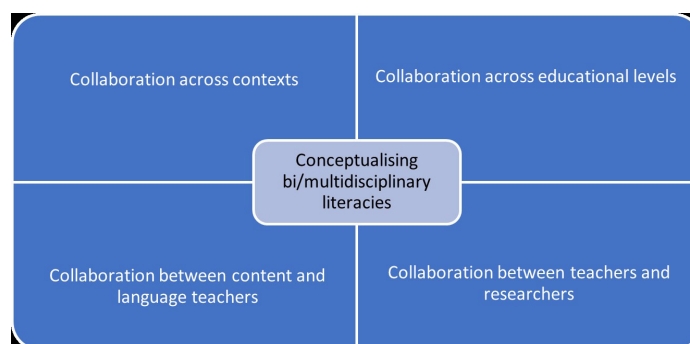


FIGURE 1
Key levels of collaboration in bi- and multilingual literacies.

crucial in sustained work toward bi- and multilingual literacies: collaboration across contexts, collaboration across educational levels, collaboration between content and language teachers, and collaboration between the teaching and the research communities (see Figure 1).

Regarding the first level, collaboration across contexts, the position of *CLILNetLE* as a network provides the perfect scenario for work across contexts. An overview of CLIL provision in 20 countries (Gülle and Nikula, 2024) gives helpful background information about diverging policies and CLIL realizations and thus useful insights for collaborative studies. More specifically, collaboration is illustrated in the reports developed in different working groups (henceforth WGs) on curricular demands (Ting et al., 2024a in WG3), on the development of descriptors for different disciplines (Lorenzo et al., 2024 in WG2), and on students' and teachers' digital practices on DLs (Ghamarian et al., 2024 in WG4). The reports incorporate different contexts in various ways. WG 3 and 4 reports incorporate teachers' and students' views and curricular/teachers' expectations, respectively, from a variety of contexts. The next step will be to carry out comparative studies that can provide insights into the conceptualization of DLs drawing on similarities and differences across these contexts. In contrast, WG2's work on CEFR descriptors for different disciplines has developed descriptors merging objectives and activities from different contexts. The next step, in this case, will be to try out the applicability of these descriptors in different contexts (see Lorenzo et al., forthcoming).

The second level involves collaboration across educational levels. *CLILNetLE* caters for this in two main ways: (a) by addressing curricular needs and teachers' expectations in different school levels (primary and secondary, as in WG3); and (b) by gaining a better understanding of tertiary educators' expectations from students when they leave school (WG5). In addition, this collaboration is needed both regarding general academic language expectations at different levels (for example, a good *definition* should include a class), as well as focusing on subject-specific challenges. Recent studies show differences in students' expression of specific functions such as *evaluating* not only across disciplines but also across educational levels, (Whittaker and McCabe, 2023) but more studies are needed that explore students' bi- or multilingual expression of DLs across contexts.

The third level identified as central in *CLILNetLE* refers to collaboration between content and language teachers. From the beginning, CLIL researchers have pointed out the need for collaboration between content and language specialists (see, e.g., Coyle et al., 2010), but this has always been and remains difficult to achieve. Research has also shown that CLIL teachers' practices in integrating content and language are very much related to their language awareness (Hu and Gao, 2021). Content teachers often claim that language is not their responsibility, while language teachers often place emphasis on language as a formal construct of units (words, phrases, clauses, sentences, and texts), where accuracy plays a major role (Morton and Nashaat-Sobhy, 2024). The need for collaboration in CLIL contexts requires teachers to develop a shared understanding of language that highlights its role as a meaning-making resource. In their study of content and language teachers' reflections on the assessment of students' texts responding to a prompt eliciting hypothesizing, Morton and Llinares (2024) found that guided dialogue between content and language teachers focusing on DLs can be a powerful catalyst for CLIL teacher professional development. Research has also shown that collaborative assessment and discussion of students' production by content and language specialists helps teachers adopt the perspective of the other disciplinary area and, subsequently, enhances adopting an integrative focus on content and language teaching and learning (Llinares et al., 2024).

The fourth level responds to increasing calls for the need for dialogue between researchers and practitioners and the active involvement by practitioners in research studies in education (e.g., McKenney and Reeves, 2019). This need has been claimed more specifically in the field of second language acquisition (e.g., Sato and Loewen, 2019) and also in CLIL (e.g., Llinares et al., 2024). In the first study, Sato and Loewen (2019) show that EFL teachers' awareness of SLA research was low, but they were willing to be actively involved in research as it helped them develop new pedagogical ideas. However, due to the lack of time and resources, the participating teachers demanded communities of practice to facilitate teacher-researcher dialogue, which could lead to their participation in classroom action research. A community of practice between content teachers, language teachers, and researchers was the context of Llinares et al.'s (2024) study, which highlights the role of joint focus-group sessions involving the three groups of experts not only to enhance content and language

teachers' awareness of the role of language in CLIL DLs but also teachers' participation in researching their own students' assessment of their own disciplinary practices.

While these levels of collaboration in bi- and multidisciplinary literacies are promising and important in ensuring greater robustness of concepts and tools, it is worth acknowledging that they also present challenges, especially in their adaptation to a variety of contexts with their own specificities. Collaboration across educational levels, and between content and language teachers and researchers would require more common spaces and time to collaborate; successful existing collaborations often involve teachers who are particularly interested and open to learning about content and language integration, so another challenge is to develop ways of successfully involving also less motivated practitioners. In sum, in spite of these challenges, conceptualizing bi- and multilingual DLs requires attention to disciplinary specificities as well as general academic challenges; to learners' levels of accomplishment and development across educational levels as well as expectations from teachers at higher levels of education (including content and language teachers); to collaboration between content and language teachers, but also between researchers and practitioners to be able to integrate research and practice; and most importantly, it has to draw on collaborative teams representing different ways of implementing and researching on CLIL.

3 Capturing key features of disciplinary literacies

3.1 A multidimensional model of bi- and multilingual disciplinary literacies

As mentioned above, the shared aim of *CLILNetLE* is to develop and refine the conceptualization of DLs in bi- and multilingual education. To support this, a task of one of the *CLILNetLE* working

groups in the early phases of the Action was to outline a common understanding of DLs by producing an initial operationalization of DLs. In line with different levels of collaboration discussed above, this was planned from the outset as a collaborative effort that would, in addition to the existing research literature in the field, build upon the members' varying degrees of familiarity and expertise with both CLIL and DLs. This resonates with the existing research base: there are various angles to the construct of DL, some based more on texts and writing (Shanahan and Shanahan, 2008), others highlighting DLs as pertaining to specific ways of “knowing, doing, believing, and communicating within different disciplinary areas” (Moje, 2008). For this reason, it was deemed important to embrace rather than subdue this heterogeneity even though this entails the challenges of balancing between producing a model coherent enough to support the joint work across the WGs and flexible enough so that instead of restricting or predetermining the work to come, it would help capture different contextual circumstances and allow for respecifying and rethinking the model. Eventually, we outlined a set of five key dimensions that emerged both from the dialogue between existing research literature and WG1 members' experience in researching the topic or teaching subjects in L2 at different educational levels and in diverse disciplines and countries. An important consideration throughout was acknowledging the complexity and dynamicity of knowledge building and identifying what the view of DLs as different ways of making and conveying meaning in different subjects (Fang, 2012; Moje, 2015) entails. The dimensions suggested worthy of consideration are the following: bi-, multi-, and translingual dimension, functional dimension, multi- and transsemiotic dimension, critical dimension, and technological dimension. As depicted in Figure 2, we used a tree-image to highlight the dimensions as inherently intertwined and in a non-hierarchical relationship to each other (see Nikula et al., 2024a, p. 10):

Because this is an overarching operationalization, its abstraction level remains rather high. This raises the need for empirical research both within the Action and beyond to tap into

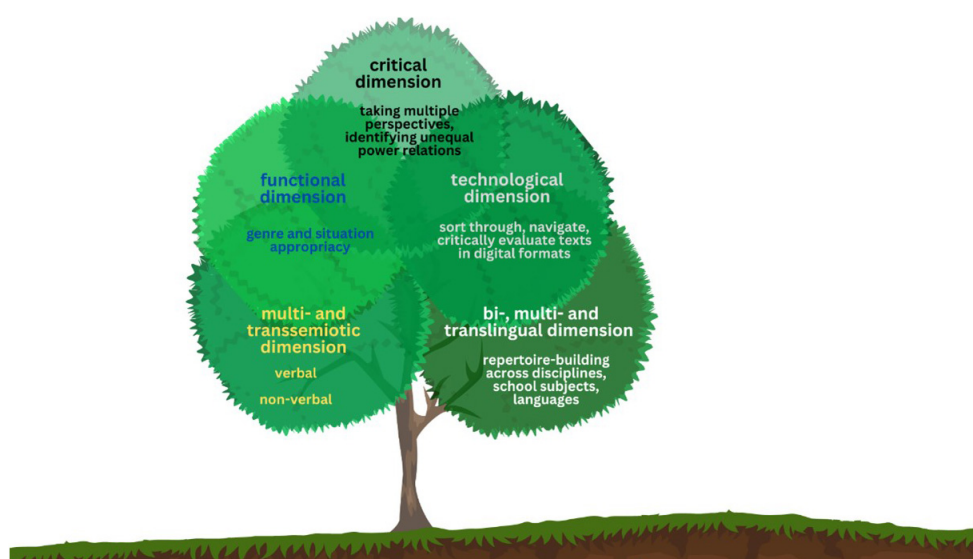


FIGURE 2
The interconnected dimensions of disciplinary literacies.

TABLE 1 Cognitive discourse functions (adapted from Dalton-Puffer et al., 2018, p. 9).

Underlying basic communicative intention	CDF TYPE	Performative verbs
I tell you how we can cut up the world according to certain ideas	CATEGORIZE ¹	Classify, compare, contrast, match, structure, categorize, subsume
I tell you about the extension of this object of specialist knowledge	DEFINE	Define, identify, characterize
I tell you details of what I can see (also metaphorically)	DESCRIBE	Describe, label, identify, name, specify
I tell you what my position is vis a vis X	EVALUATE	Evaluate, judge, argue, justify, take a stance, critique, comment, reflect
I tell you about the causes or motives of X	EXPLAIN	Explain, reason, express cause/effect, draw conclusions, deduce
I tell you something that is potential (i.e., non-factual)	EXPLORE	Explore, hypothesize, speculate, predict, guess, estimate, simulate
I tell you something external to our immediate context on which I have a legitimate knowledge claim	REPORT	Report, inform, recount, narrate, present, summarize, relate

¹This CDF name was changed by Dalton-Puffer and Bauer-Marschallinger (2019) from the original CLASSIFY.

how the different dimensions are realized at the level of language use and pedagogical practices. One useful starting point for this is the construct of Cognitive Discourse Functions (CDFs; Dalton-Puffer, 2013), which provides bridges between communicative intentions, cognitive processes, and their linguistic realizations and that will be discussed in more detail in the following.

3.2 Cognitive discourse functions

In this contribution, we will use CDFs (Dalton-Puffer, 2013, 2016) as an anchor for our presentation of several dimensions of bi- and multilingual DLs. By doing so, we consciously choose a concept at a mid-level granularity of detail in analytic terms and the reasons for doing so are multifaceted (see also Hüttner and Smit, 2024). Importantly in terms of interdisciplinarity, a language-focused concept to be applied in collaborative endeavors involving non-language experts, such as *CLILNetLE*, needs to retain a level of accessibility across expertise and relate clearly to established educational frameworks, such as Bloom's taxonomy of learning objectives (Bloom, 1956; Anderson and Krathwohl, 2001). As outlined below, CDFs have been and are increasingly used in CLIL research and as a lesson planning aid, making them a helpful tool for several activities in *CLILNetLE*, which then can be brought into an informed relationship more effectively.

To provide a little more detail on CDFs, these are “verbal routines that have arisen in answer to recurring demands while dealing with curricular content, knowledge and abstract thought” (Dalton-Puffer, 2016, p. 29) and so provide a framework for making accessible the cognitions involved in accessing, negotiating, refining, and presenting knowledge through a systematic analysis of their connected verbalizations (Dalton-Puffer, 2013, 2016). Language is viewed thus as the way in which new meanings are assimilated into learners' minds, as well as the primary mode for learners to “share their current or new construals of the world with others” (Dalton-Puffer et al., 2018, p. 8). The construct consists of seven types of functions, i.e., CATEGORIZE, DEFINE, DESCRIBE, EVALUATE, EXPLAIN, EXPLORE, and REPORT (see Table 1).

Unlike other models trying to capture learners' thought processes in discourse, CDFs do not assume a hierarchical order in terms of cognitive challenge; rather, each of these can and may be realized in more or less – cognitively and discursively – complex ways. Dalton-Puffer et al. (2018) show the prevalence of CDFs in

CLIL classrooms with between 77 and 84 such functions produced per lesson, with the DESCRIBE emerging as the most common one across most subjects. Subject-specific differences, however, exist in the rankings of further CDFs. In addition to using CDFs as a frame for analyzing classroom discourse in general (e.g., Dalton-Puffer et al., 2018; Evnitskaya and Llinares, 2022) and learner productions (e.g., Whittaker and McCabe, 2023 on EVALUATE; Evnitskaya and Dalton-Puffer, 2023 on CATEGORIZE; Llinares and Morton, 2024 on EXPLORE), CDFs have also been applied in lesson planning and materials design for CLIL (Lersundi Perez, 2023; Morton, 2020; Bauer-Marschallinger, 2019, 2022).

Current applications, such as the ones made in *CLILNetLE*, also focus on the potential of CDFs to link diverse aspects of education, such as curricular analyses, classroom practices, learner productions and teacher education around a shared conceptualization of a crucial aspect of discursively “doing and showing” learning. Regarding learner productions, studies on the CDF DEFINE in history and biology have shown that CLIL students produced the same quality of definitions in the L1 or L2 (Nashaat-Sobhy and Llinares, 2023) and that encouraging learners to define orally as well in written mode provides them with more opportunities of showing their knowledge in different ways (Llinares and Nashaat-Sobhy, 2021). Continuing with the same CDF, an example of a classroom context, targeting the CDF DEFINE is the following:

Example 1:

Pair of Values (Dobner, 2020, p. 83)

1. T: what is the solution for this kind of equation? (5) for this kind of equation (.) what's the solution?
2. Sm1: y.
3. T: y. and?
4. Sm2: x.
5. T: x. so it's not one number, but it's =
6. SX: = two.
7. T: two, what do we call two things together?
8. SX: a pair.
9. T: we call it a pair (.) Ok, so the solution is a pair of numbers </L1de> ein Wertepaar

10. </L1de> {transl: a pair of values} and only if you put in both, then it works.²

In the context of studying algebraic functions, the teacher scaffolds the student productions until the relevant information that the solution to each function is represented with a unique value for each point in the possible range, i.e., the pair of values, is provided, involving several students. This definition is then presented by the teacher explicitly in lines 10–11, including a translanguaged element with the German subject-specific term, i.e., *Wertepaar*.

In the following, we will present the key dimensions and their characteristics and, where relevant, will provide examples of how they have been taken into account in the work conducted within *CLILNetLE*.

4 Dimensions of bi- and multilingual disciplinary literacies

4.1 Functional dimension

Nikula et al. (2024b) refer to the functional (pragmatic) dimension in bi- and multilingual DLs as “the ability to select and use semiotic systems to communicate effectively and appropriately.” For teachers and students to operationalize the act of “communicating,” it is important to identify the purpose of communication. In SFL, Halliday (see Halliday and Matthiessen, 2014) identified three main functions of language: to represent reality (ideational), to establish relationships with the others (interpersonal), and to relate ideas in texts (textual). The language resources that students need are, therefore, different for different functions but also depending on the context. The context plays a key role in the “effectiveness” and “appropriateness” of communication. Drawing on Martin and Rose (2008), the context of culture shapes the genres that characterize different DLs (the language of history is different from the language of biology, and a historical recount is different from a historical argument). In turn, the context of situation makes a written historical argument different from a spoken historical argumentative debate.

The geographical and educational context is another variable that requires attention and studies are needed that look at students’ performance in different contexts [see, for example, Llinares and Nikula’s (2024) comparison of Finnish and Spanish students’ performance of CDFs]. Contextual differences make the teaching of history at lower secondary different in Albania and in the Netherlands, for example. The differences across educational traditions in different countries and regions are reflected in the curricula, which naturally shape educational practices. *CLILNetLE* has provided a unique opportunity for identifying the similarities and differences in the presence of DLs in curricula from 11 countries in different subject areas and educational levels (Ting et al., 2024b). For example, if we compare the Spanish and Polish curricula for biology at lower secondary, biology genres

are not expected to be developed by the students in neither of the two curricula but there are some differences, for instance, in the presence of CDFs (commonly occurring in the Polish curriculum) or references to visual/digital ways of processing knowledge (common in the Spanish one). It would be interesting in future research to find out in how far these curricular differences are mirrored in classroom practices and student performances.

To sum up, the appropriate and effective use of any language for the expression of content in the classroom (L1, L2, or LX) will very much depend on these contextual variables and require a content and language integrated approach (see Llinares, 2024 for an overview of the role of context, genre, register, and the three metafunctions of language in CLIL). These contextual variables become even more challenging in bi- and multilingual contexts where two or more languages are used as the medium of instruction and to lead learners toward subject-specific ways of constructing and displaying knowledge.

4.2 Bi-, multi, and translingual dimension

As we have pointed out above, becoming familiarized with the language of the discipline involves a learning trajectory for all school learners. In the first few years of education, this trajectory involves a move from the primary discourse of the home to the secondary one of school and later in the increasingly intricate and conventionalized ways of knowledge creation and display involving specific disciplinary language practices. While such socialization into new discourse patterns bears challenges even if the language used at home is the same as the main educational language, these are exacerbated by a concurrent switch of language. Some studies reveal DL challenges independently from the language (e.g., Evnitskaya and Dalton-Puffer, 2023). To what extent engaging in DLs triggers processes independent of the specific language used is still an area in need of further research; the idea that similarly to an overall linguistic repertoire of each learner there might also be a DLs repertoire is certainly enticing.

European classrooms are increasingly characterized by a student body that is bi- or multilingual and uses language(s) in the home environment which are different to the main language of education. Across the OECD an average of 13% of all 15-year-olds mainly use a different language from the main language of education in their home environments. There is, however, considerable variation across and within individual countries, ranging from national averages below 5% (e.g., Bulgaria and Poland) to over 20% (e.g., Germany and Austria; see OECD, 2023, p. 208). Research and educational interest have been directed toward pedagogical practices that are sensitive to the needs and abilities of these multilingual children both in terms of general practices (see, e.g., Leisen, 2017) and focused within specific school-subjects (see, e.g., Uribe and Prediger, 2021) for mathematics. Many of these endeavors, however, reserve distinct roles for the languages involved in the learning processes of the students, relegating the L1 to a resource status and affording the role of a legitimate mode of presenting disciplinary knowledge to the main educational language only.

In the context of CLIL, this situation is – at least at times – different; the proto-typical CLIL teacher is a non-native speaker of the CLIL target language, which changes

² Translations into English are given in. For more detailed transcription conventions, see <https://voice.acdh.oew.ac.at/transcription-conventions/>

the power differential based on language proficiency as well as adding an important shared experiential knowledge regarding L2 language learning (Nikula, 2010; Hüttner et al., 2013). Also, participants in CLIL classrooms are typically proficient speakers of the main educational language, making this a favored – and sometimes also legitimized – resource for accessing new knowledge and at times even an additional target for displaying disciplinary knowledge.

The presence of two or more languages in the linguistic repertoires of CLIL participants does not, however, necessitate that these languages live in separate worlds. Indeed, most current research into the use of the L1 in CLIL classroom discourse conceptualizes this as an instance of translanguaging and thus views the participants as bilinguals with “one linguistic repertoire from which they select features *strategically* to communicate effectively” (García, 2012, p. 1, italics in original). Moore and Nikula (2016) and Nikula and Moore (2019) suggest a distinction between translanguaged episodes, which orient to language in content and those that orient to the flow of interaction. In terms of developing and using bi- and multilingual DLs, the former type is more relevant. The following example shows a stretch of discourse from a CLIL history class in Austria, where we can see translanguaging takes place in the orientation to content part, functioning as an additional gloss of the mostly English presentation by student S1. Key phrases and terms are repeated in German, such as, “the tsar abdicated,” or given a definition in German, e.g., bourgeois as “these were the slightly richer people.” Nikula and Moore (2019, p. 244) suggest that this pattern of use mirrors the teacher’s practices and, in any case, it ensures that her fellow pupils can follow the presentation.

Example 2

1. S1: hmm the revolt (.) and in this revolt also (.) they- a sl- the slogan of the revolt was was peace land and bread (.) and they want that the that the tsar (.) ab- (.) abdicate *also dass der zar abdankt* {transl: that the tsar abdicates} and so the the tsar did *also der zar hat dann abgedankt* {transl: and so the tsar abdicated}
2. S3: (xxx)
3. S1: yeah, and a new дума were found- ah were founded (.) and in this дума revolutionary and bourgeois parties oxa-ah they they also this дума consist of revoluna- (.) revolutionary and bourgeois parti- bourgeois *das sind die bürgerlichen gewesen, also die schon etwas reicheren leute* {transl: they were the bourgeoisie, and the richer people}
4. T: bourgeois [[corrects pronunciation]]
5. S1: bourgeois *genau* right *ja und das war’s dann, weil* transl: yeah that’s right while/the riot (.) of- *asso. ja und dann hat der zar abgedankt* (.) *gut* {transl: yes and then the tsar abdicated, good} and ah also workers’ and soldiers’ councils were elected (.) and ah o- *ich seh nix* {transl. I don’t see} and when the tsar abdicate the workers (.) the workers (.) the workers and the peasants expelled the owners from the land

Adapted from Nikula and Moore (2019, p. 244).

While translanguaging has usually been considered as transcending between “named” languages (García and Li, 2014), it is also possible to consider shifts between and across different registers in classroom talk and between more everyday/concrete and more specialized/abstract meanings as a form of translanguaging (Nikula et al., 2024b). A valuable construct to approach such translanguaging is that of *semantic waves* of LCT (Maton, 2013), which essentially describes the processes of moving from the more abstract, context-independent knowledge, typified by subject-specific language, and more concrete, context-dependent knowledge, typified by more everyday language patterns. Especially in the move from subject-specific language to everyday language, switches to the shared L1 or main language of education can be observed.

The roles played by all the languages and linguistic varieties in the repertoire of teachers and learners of CLIL in accessing and – arguably to a lesser extent – displaying new disciplinary knowledge is mirrored to some extent by the influence of multiple semiotic formats. Similarly, the processes involved in translanguaging finds a counterpart in transsemiotising practices. These will be outlined in greater detail in the following.

4.3 Multi- and transsemiotic dimension

It is an important consideration that knowledge building in different disciplines does not only happen through the medium of language. Instead, a rich set of non-linguistic and material resources – often called multimodal or multisemiotic – can be drawn on, ranging from diagrams, formulas, images, and tables to embodied actions and such as gestures, postures, and various artifacts (e.g., Lin, 2019). Nikula et al. (2024b) point out that it is possible to distinguish different orientations to multimodality in earlier research on knowledge-building. On the one hand, multimodality can be seen as an inherent part of subject-specific knowledge itself; for example, the way science subjects organize knowledge multimodally has attracted attention (Doran, 2019; Unsworth et al., 2022). On the other hand, multimodality has been studied from the perspective of what teachers and students do in classrooms, e.g., to build or maintain community of practice or to scaffold learning. In CLIL research to date, the latter perspective has been adopted especially by conversation analytic studies focusing on the use of multimodal means in classroom interaction (for overview, see Evnitskaya and Jakonen, 2017) but less attention has been directed to multimodality as a key component of disciplinary literacy.

In CLILNetLE, the work conducted thus far has some connections to the multisemiotic dimension. In WG3, curriculum documents in different countries were analyzed for indications of attention to students’ productive displays of disciplinary literacy. The coding scheme included options connected to multimodal nature of literacy, relating both to elements of visual literacy for learning or sharing knowledge and to the use of subject-specific realia (see Ting et al., 2024b, p. 21). The country reports on curricular analyses suggest, overall, that while these categories tend to be less common than references to verbal knowledge-building functions such as describe, report or compare, they do play a role in how learning objectives are depicted. Differences were also

noted between educational levels and subjects so that reference to visuals was found to be more frequent in primary than secondary level (Austria, see [Bacovsky-Novak et al., 2024](#)) and more common in mathematics curriculum than in other subjects (Lithuania, see [Horbačauskienė and Ratkevičienė, 2024](#), or the Netherlands), both initial observations worthy of more detailed further exploration.

The second task of WG3 was to survey subject teachers' expectations of students' productive disciplinary literacy. The instrument to explore this involved attention to multisemiotic aspects of disciplinary literacy in asking teachers to provide a semiotic element they like to use in their lessons and then to write down what they expect a good student to produce when the same semiotic item is used to evaluate the learning outcomes. In the analysis, CDFs played a key role as indicators of how the teachers expected their learners to verbalize their learning. Even though the focus was on how learners would be expected to turn the semiotic items into text, the fact that teachers of the key subjects (mathematics, science, and history) readily found and presented different types of visuals as key elements in their teaching (e.g., graphs, maps, pictures, and figures) points to the importance of the multisemiotic dimension of DLs.

The work in WG2 focuses on the description of the main language features of the disciplines. The group has, for example, produced a set of CEFR-based descriptors, based on the key CDFs identified by [Dalton-Puffer \(2013\)](#), for assessing disciplinary literacy in history, mathematics, and social science ([Lorenzo et al., 2024](#)). While language features are the key, the multisemiotic dimension also features at points, for example, when outlining B1 and B2 descriptors for the CDF DESCRIBE in mathematics that include students' ability to "label/highlight important components of visual mathematical representations (graph, figure, table, drawings, etc.)" (p. 25); or when linking the cognitive discourse function EXPLAIN in history to an example from a curricular text inviting learners to "Examine written and visual sources related to the reforms made during Atatürk's era" (p. 16); or when introducing as one aspect of the CDF DESCRIBE students' ability to identify historical phenomena "with or without the aid of a visual representation (timeline, map, table, drawing, etc.)" (p. 18).

4.4 Critical dimension

Critical thinking is also clearly stated as one of the targets of SDG Quality Education (4.4. *Enhancing the acquisition of relevant skills for financial success*). As pointed out by [Nikula et al. \(2024a\)](#), the critical dimension involves students' development of deeper understanding of the texts they read and their ability to produce texts that display this deeper learning (see [Coyle and Meyer, 2021](#), on pluriliteracies and deeper learning). Again, [Dalton-Puffer, Dalton-Puffer's \(2013, 2016\)](#) CDF model can be useful to identify students' engagement with functions that clearly involve critical thinking skills such as the CDFs EVALUATE (judging and expressing stance) and EXPLORE (referring to potential or hypothetical events).

Interestingly, in [Ting et al.'s \(2024a\)](#) analysis of the reference to productive DLs in the curriculum of 11 countries, perhaps unexpectedly, there is ample reference to students' use of this type of CDFs in some of the curricula. If we take the case of the Spanish

context, again in the subject of biology, the distribution of cognitive discourse functions (CDFs) in the curriculum shows a higher prevalence of CDFs associated with taking a reflective or critical stance such as EXPLORE than of the CDFs such as DESCRIBE and REPORT, which often convey more factual information. However, the presence in the curriculum does not necessarily match with classroom practices. In fact, the study by [Evnitskaya and Llinares \(2022\)](#) in the same context (lower-secondary biology in Madrid-Spain), indicates that the frequency of teachers using the CDF EVALUATE is dependent on the perception of their students' cognitive (not language) capacities.

4.5 Technological dimension

The technological dimension directs attention to the fact that disciplinary practices across subject areas are increasingly characterized by their use of multimodal and multi-semiotic texts in digital formats. The competences related to using such texts to both access and display disciplinary knowledge align partly with more general ones as described in overarching digital competence models (e.g., DigComp 2.2., see [Vuorikari et al., 2022](#)). Thus, "information and data literacy" is crucial in DLs contexts in the evaluation of data, information and digital content concerning its trustworthiness and in the ability to analyze and interpret information obtained from digital sources. The competence cluster of "digital content creation" is also of crucial importance in the ability to create and edit digital content in the increasing number of multimodal digital genres. The rise of Artificial Intelligence (AI) technologies, especially those based on large language models (LLM), adds a further dimension to the disciplinary practices encountered.

In addition to the presence of a digital dimension of DLs in target practices by professional language users, the question of how learners and students integrate digital content into their educational practices is of growing concern. Anecdotal reports of learning through online activity are rife as are concerns by teachers of learning inappropriate language practices; research evidence so far has addressed the influence of out-of-school learning on general foreign language competences ([Sundqvist and Sylvén, 2016](#); [Schurz and Sundqvist, 2022](#)) and shown that especially lexical competence ([Peters et al., 2019](#)) increases. However, there is little research on either the practices of integrating digital learning in CLIL classrooms or the effect of learners' engagement with the online world on their DLs development. WG4 of *CLILNetLE* has provided some much-needed baseline data in this regard by conducting two surveys on DLs and digital practices, one aimed at students and one at teachers ([Ghamarian et al., 2024](#), p. 3).

The overarching research questions of these surveys are as follows:

1. Disciplinary literacy student survey: What kinds of digital practices and/or resources do CLIL learners engage in in their CLIL language(s) out of school and in their CLIL lessons, and how do they expose students to knowledge areas?
2. Disciplinary literacy teacher survey: Which digital tools/resources do teachers use to develop bi- and multilingual

DLs in different subject areas, how frequently do they use them and with which age groups? Why do they choose to use technology in this way?

As these surveys aim to provide overviews of current pan-European practices of linking the use of digital technologies to (bi- and multilingual) DLs, both surveys were administered in 11 European countries, i.e. Albania, Austria, Cyprus, Ireland, Italy, Portugal, Romania, Slovakia, Spain, Sweden, and Türkiye, and collected a total of 4,229 (students) and 557 (teachers) valid responses respectively. One finding we would like to highlight here relates to the evaluation of the effect of accessing digitally mediated content and applications on developing (bi- and multilingual) DLs. Students are quite optimistic in this respect and report that accessing digitally mediated content and applications significantly aids their learning in bi- and multilingual DLs (Ghamarian et al., 2024).

This shows the need for case studies investigating how learners and teachers integrate digitally mediated multimodal content in the development of DLs; given the extensive time spent by teenagers online (Schurz and Sundqvist, 2022), it is clearly an important informal learning context. How learners (and their teachers) manage to make use of it clearly varies and more information is needed on the contributing factors.

5 On future directions

This article has outlined a model of bi- and multilingual DLs that highlights the complexity and multidimensional nature of the construct, based on the work conducted within *CLILNetLE*. It is important to bear in mind here that the word *model* may suggest a state of fixity that we do not subscribe to. On the contrary, we see the model as something to be further refined and developed along with the accumulating knowledge-base gained from research conducted within *CLILNetLE* and beyond. By adopting the image of a tree, we hope to capture the potential of this model to grow and develop organically, without reference to any hierarchical order. Validating and refining the usefulness of this model also requires its application in teaching practice and accompanying research endeavors evaluating its effectiveness.

This model is an initial framework which has drawn on previous research insights, pedagogical practices and reflective work among CLIL researchers and educators from different European countries. Although some examples have been provided that support the relevance of the dimensions presented above, empirical studies need to be developed that apply the model that has been preliminarily proposed to conceptualize bi- and multidisciplinary literacies. In order for development and refinement of the model to happen, further collaboration at many levels is necessary. First, as we have outlined above, this model facilitates collaboration across educational and geographical contexts, providing an analytic framework for empirical research and a guiding point for pedagogical practice. Such research will need to focus, among other aspects, on deepening our understanding of the role and pedagogic implementation of different literacy dimensions in specific school subjects, educational

levels and diverse geographic contexts. The diversity of experiences among different regions and countries in implementing CLIL and in focusing on DLs serves to highlight good practices as well as potential learning affordances. Uptake of the model by teachers and teacher educators is important for its further development and validation.

A second point of collaboration revolves around the transition points between educational levels, not only across school levels, but also between school and the tertiary level; the meta-language developed in the bi- and multilingual DLs model aids such dialogue and collaboration. It will also be fruitful to extend collaboration across contexts from CLIL to mainstream education where, due to migration and globalization processes, the instructional language is a second or foreign language for an increasing number of students. The bi- and multilingual DLs model, which is itself language-neutral, can support the teaching and learning of DLs.

Third, the model presented will be useful in strengthening collaboration between language and content experts and exploring the usefulness of the model in building an interdisciplinary and shared understanding of DLs. Drawing on such research collaboration, the bi- and multilingual DLs model suggested here frames language as an integral part of content knowledge and learning in ways that helps to enhance teaching and learning of DLs in all types of classrooms. This also incorporates the more general aspect of collaboration between teachers and researchers; an ongoing and bidirectional dialogue to foster understanding of the processes and the practices involved in children's and teenagers' development of bi- and multilingual DLs.

The final point of collaboration is highlighted in the ongoing work in *CLILNetLE*, which points toward a mismatch between students' and teachers' perceptions (WG4 and WG3), curricular demands (WG3) and classroom practices (Lersundi et al., in press) with regard to DLs; future research will need to connect these three areas of inquiry (see also Nikula et al., 2016).

In this article, we have highlighted the multiple forms of collaboration, i.e., across countries, educational levels, teachers, teacher-researcher, as well as the varied foci of such collaboration, i.e., geographical/educational, curricular, disciplinary, situational, or linguistic. The way these collaborations and contextual applications generate new branches in bi- and multilingual DLs and enlarge or shrink the existing ones offers fascinating scenarios for bi- and multidisciplinary literacies and CLIL research. It also helps ensure that CLIL, as a globalized educational approach, reaches its full potential in fostering school-leavers' competences in succeeding in the DLs demands placed on them in future academic or professional endeavors.

Author contributions

JH: Conceptualization, Funding acquisition, Writing – original draft, Writing – review & editing. AL: Conceptualization, Writing – original draft, Writing – review & editing. TN: Conceptualization, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. The publication of this article was made possible through the financial support provided by the University of Vienna. This article is based upon work from COST Action CLILNetLE CA 21114, supported by COST (European Cooperation in Science and Technology).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Anderson, L. W., and Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Boston: Addison Wesley Longman, Inc.
- Arias-Hermoso, R., Imaz Agirre, A., and Garro Larrañaga, E. (2025). Multilingual disciplinary literacies: Exploring developmental patterns of science writing across secondary education. *J. Multilingual Multicult. Dev.* doi: 10.1080/01434632.2025.2481200
- Bacovsky-Novak, T., Dalton-Puffer, C., Rieder-Marschallinger, S., and Smit, U. (2024). "Austria national report," in *Overview of Curricular Demands of Disciplinary Literacies: An Exploratory Survey and Report by CLILNetLE Working Group 3 Deliverable 7*, eds Y. L. T. Ting, C. Dalton-Puffer, and S. Rieder-Marschallinger 39–50. doi: 10.25365/phaidra.532_20 (accessed November 3, 2024).
- Bauer-Marschallinger, S. (2019). With united forces: How design-based research can link theory and practice in the transdisciplinary sphere of CLIL. *CLIL. J. Innov. Res. Plurilingual Pluricult. Educ.* 2:7. doi: 10.5565/rev/clil.19
- Bauer-Marschallinger, S. (2022). *CLIL with a Capital I - Using Cognitive Discourse Functions to Integrate Content and Language Learning in CLIL history Education*. [Doctoral Dissertation]. Vienna: Vienna University.
- Beacco, J. C., Fleming, M., Goullier, F., Thürmann, E., and Vollmer, H. (2016). *The Language Dimension in all Subjects: A Handbook for Curriculum Development and Teacher Training*. Strasbourg: Council of Europe.
- Bloom, B. S. (1956). "Taxonomy of educational objectives: the classification of educational goals (Handbook I: Cognitive domain)," in *Taxonomy of Educational Objectives: The Classification of Educational Goals (Handbook I: Cognitive Domain)*, eds M. D. Engelhart, E. J. Furst, W. H. Hill, and D. R. Krathwohl (New York: David McKay), 483–498.
- Bullock Report (1975). *A Language for life: Report of the Committee of Inquiry Appointed by the Secretary of State for Education and Science Under the chairmanship of Sir Alan Bullock*. London: Her Majesty's Stationary Office.
- Christie, F., and Derewianka, B. (2008). *I. School Discourse: Learning to Write Across the Years of Schooling*. London: Bloomsbury.
- Council of Europe (CoE) (2009). *Language(s) of Schooling*. Strasbourg: Council of Europe.
- Coyle, D., and Meyer, O. (2021). *Beyond CLIL: Pluriliteracies Teaching for Deeper Learning*. Cambridge: Cambridge University Press.
- Coyle, D., Hood, P., and Marsh, D. (2010). *CLIL: Content and Language Integrated Learning*. Cambridge: Cambridge University Press.
- Dafouz, E., Hüttner, J., and Smit, U. (in press). "Ways forward in understanding disciplinary literacies in english-medium higher education," in *Navigating Disciplinary Literacies in English-Medium Higher Education. Insights from Lecturers, Students and Professional Developers*, eds D. Sánchez-García, A. Sánchez-Hernández, and E. Dafouz (Milton Park: Routledge).
- Dalton-Puffer, C. (2013). A construct of cognitive discourse functions for conceptualising Content-Language Integration in CLIL and multilingual education. *Eur. J. Appl. Linguistics* 1, 216–253. doi: 10.1515/eujal-2013-0011
- Dalton-Puffer, C. (2016). "Cognitive discourse functions: Specifying an integrative interdisciplinary construct," in *Conceptualising Integration in CLIL and Multilingual Education*, eds T. Nikula, E. Dafouz, P. Moore, and U. Smit (Bristol: Multilingual Matters), 29–54.
- Dalton-Puffer, C., and Bauer-Marschallinger, S. (2019). Cognitive Discourse Functions meet historical competences: Towards an integrated pedagogy in CLIL history education. *J. Immersion Content Based Lang. Educ.* 7, 30–60. doi: 10.1075/jicb.17017.dal
- Dalton-Puffer, C., Bauer-Marschallinger, S., Brückl-Mackey, K., Hofmann, V., Hopf, J., Kröss, L., et al. (2018). Cognitive discourse functions in Austrian CLIL lessons: Towards an empirical validation of the CDF Construct. *Eur. J. Appl. Ling.* 6, 5–29. doi: 10.1515/eujal-2017-0028
- Dalton-Puffer, C., Hüttner, J., and Llinares, A. (2022). CLIL in the 21st Century: Retrospective and prospective challenges and opportunities. *J. Immersion Content Based Lang. Learn.* 10, 182–206. doi: 10.1075/jicb.21021.dal
- Dalton-Puffer, C., Hüttner, J., and Nikula, T. (2024). "Introduction," in *Building disciplinary literacies in Content and Language Integrated Learning*, eds J. Hüttner and C. Dalton-Puffer (Milton Park: Routledge), 1–25.
- de Oliveira, L. C., Jones, L., and Smith, S. L. (2023). A language-based approach to content instruction (LACI) for multilingual learners: Six Cs of scaffolding in first grade. *J. Lang. Identity Educ.* 22, 429–444. doi: 10.1075/jicb.21021.dal
- Dobner, L. (2020). *Classroom Discourse in CLIL Mathematics Classes: The Use of Cognitive Discourse Functions*. Unpublished MEd thesis. Vienna: University of Vienna.
- Doran, Y. J. (2019). "Multimodal knowledge. Using language, mathematics and images in physics," in *Teaching Science: Knowledge, Language, Pedagogy*, eds K. Maton, J. R. Martin, and Y. J. Doran (Milton Park: Taylor & Francis), 162–184.
- Evnitskaya, N., and Dalton-Puffer, C. (2023). Cognitive discourse functions in CLIL classrooms: Eliciting and analysing students' oral categorizations in science and history. *Int. J. Bilingual Educ. Bilingualism* 26, 311–330. doi: 10.1080/13670050.2020.1804824
- Evnitskaya, N., and Jakonen, T. (2017). "Multimodal conversation analysis and CLIL classroom practices," in *Applied Linguistics Perspectives on CLIL*, eds A. Llinares and T. Morton (Amsterdam: John Benjamins), 201–220.
- Evnitskaya, N., and Llinares, A. (2022). (In) equity in CLIL programs? Classroom interaction and the development of higher order thinking skills across bilingual strands. *AILA Rev.* 35, 227–249. doi: 10.1075/aila.22026.evn
- Fang, Z. (2012). Language correlates of disciplinary literacy. *Top. Lang. Disord.* 32, 19–34. doi: 10.1097/TLD.0b013e31824501de
- García, O. (2012). "Theorizing translanguaging for educators," in *Translanguaging*, eds C. Celic and K. Seltzer (New York: CUNY-NYSIEB), 1–6.
- García, O., and Li, W. (2014). *Translanguaging: Language, Bilingualism and Education*. London: Palgrave.
- Ghamarian, K., Neville, C., Segura, M., and Smit, U. (2024). *Digital Practices in and Out of the CLIL Classroom: A Pan-European Survey of Students and Teachers: A Report by CLILNetLE Working Group 4*. Available online at: <https://phaidra.univie.ac.at/o:2082898> (accessed November 6, 2024).
- Goldman, S. R. (2012). Adolescent literacy: Learning and understanding content. *Future Children* 22, 89–116. doi: 10.1353/foc.2012.0011

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

Publisher's note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

- Greenleaf, C., Litman, C., Hanson, T., Rosen, R., Boscardin, C. K., Herman, J., et al. (2011). Integrating literacy and science in biology: Teaching and learning impacts of Reading Apprenticeship professional development. *Am. Educ. Res. J.* 48, 647–717. doi: 10.3102/0002831210384839
- Gülle, T., and Nikula, T. (2024). Overview of CLIL Provision in Europe and Country-Specific Insights: A Report by CLILNetLe Working Group 1. Available online at: <https://phaidra.univie.ac.at/o:2076777> (accessed November 6, 2024).
- Halliday, M. A. K., and Matthiessen, C. I. M. (2014). *Halliday's Introduction to Functional Grammar*, 4th Edn. Milton Park: Routledge.
- Horbačauskienė, J., and Ratkevicienė, M. (2024). "Lithuania national report," in *Overview of Curricular Demands of Disciplinary Literacies*, eds Y. L. T. Ting, C. Dalton-Puffer, and S. Rieder-Marschallinger, 76–89. Available online at: https://doi.org/10.25365/phaidra.532_20 (accessed November 8, 2024).
- Hu, J., and Gao, X. (2021). Understanding subject teachers' language-related pedagogical practices in content and language integrated learning classrooms. *Lang. Awareness* 30, 42–61. doi: 10.1080/09658416.2020.1768265
- Hüttner, J. (2019). "Occupying a new space: oral language skills within the disciplines in English-medium instruction," in *Rethinking Directions in Language Learning and Teaching at University Level*, ed. B. Loranc-Paszyk (Research-publishing), 5–26.
- Hüttner, J., and Dalton-Puffer, C. (2024). *Building Disciplinary Literacies in Content and Language Integrated Learning*. Milton Park: Routledge.
- Hüttner, J., and Smit, U. (2018). Negotiating political positions: Subject-specific oral language use in CLIL classrooms. *Int. J. Bilingual Educ. Bilingualism* 21, 287–302. doi: 10.1080/13670050.2017.1386616
- Hüttner, J., and Smit, U. (2024). Collaborative student writing in English-medium business studies: On the use of cognitive discourse functions as an analytic tool. *Wiener Linguistische Gazette* 97, 343–362. Available online at: https://wlg.univie.ac.at/fileadmin/user_upload/p_wlg/972024/HuettnerSmit-collaborative.pdf (accessed April 5, 2025).
- Hüttner, J., Dalton-Puffer, C., and Smit, U. (2013). The power of beliefs: lay theories and their influence on the implementation of CLIL programmes. *Int. J. Bilingual Educ. Bilingualism* 16, 267–284. doi: 10.1080/13670050.2013.777385
- Kääntä, L., Kasper, G., and Piirainen-Marsh, A. (2018). Explaining Hooke's law: definitional practices in a CLIL physics classroom. *Appl. Linguistics* 39, 694–717. doi: 10.1093/applin/aww025
- Leisen, J. (2017). *Handbuch Fortbildung Sprachförderung im Fach: sprachsensibler Fachunterricht in der Praxis*. Stuttgart: Ernst Klett Sprachen.
- Lersundi Perez, A. (2023). *Arloetako Alfabetatzearen Azterketa Batxilergoko diziplinarteko Proiektu Batean: Kasu Azterketa (Analysis of Subject-specific Literacies in a Multidisciplinary Project in Upper-Secondary Education. Case Study)*. [Doctoral dissertation]. Spain: Mondragon University.
- Lersundi, A., Nikula, T., and Garro, E. (in press). "Scaffolding students' performance of oral cognitive discourse functions through classroom interaction," in *Insights into Disciplinary Literacies: Multilingual Perspectives across Educational Levels*, eds A. Imaz Agurre and R. Arias-Hermoso (Bristol: Multilingual Matters).
- Lin, A. M. Y. (2016). *Language Across the Curriculum and CLIL as an Additional Language (EAL) Contexts: Theory and Practice*. Berlin: Springer.
- Lin, A. M. Y. (2019). Theories of trans/language and trans-semiotizing: implications for content-based education classrooms. *Int. J. Bilingual Educ. Bilingualism* 22, 5–16. doi: 10.1080/13670050.2018.1515175
- Llinares, A. (2024). "CLIL and linguistics," in *The Routledge Handbook of Content and Language Integrated Learning*, eds D. Banegas and S. Zappa-Hollman (Milton Park: Routledge), 11–27.
- Llinares, A., and Morton, T. (2024). "Assessing CLIL students' expression of Explore across languages and school disciplines: An interdisciplinary approach," in *Building Disciplinary Literacies in Content and Language Integrated Learning*, eds J. Hüttner and C. Dalton-Puffer (Milton Park: Routledge), doi: 10.4324/9781003403685
- Llinares, A., and Nashaat-Sobhy, N. (2021). What is an ecosystem? Defining science in primary school CLIL contexts. *Lang. Teach. Young Learners* 3, 337–362. doi: 10.1075/ltyl.20010.lli
- Llinares, A., and Nikula, T. (2024). CLIL students' production of cognitive discourse functions: Comparing Finnish and Spanish contexts. *Lang. Educ.* 38, 381–400. doi: 10.1080/09500782.2023.2211049
- Llinares, A., Morton, T., and Whittaker, R. (2012). *The Roles of Language in CLIL*. Cambridge: Cambridge University Press.
- Llinares, A., Morton, T., and Whittaker, R. (2024). Fostering language awareness for integration through teacher-researcher collaboration in a Spanish bilingual education context. *Lang. Awareness* 33, 751–771. doi: 10.1080/09658416.2024.2385766
- Lo, Y. L., and Lin, A. M. Y. (2021). *Teaching, Learning and Scaffolding in CLIL Science Classrooms*. Amsterdam: John Benjamins.
- Lorenzo, F. (2017). Historical literacy in bilingual settings: Cognitive academic language in CLIL history narratives. *Linguistics Educ.* 37, 32–41. doi: 10.1016/j.linged.2016.11.002
- Lorenzo, F., Cvikić, L., Llinares, A., de Boer, A., Adadan, E., Arias-Hermoso, R., et al. (2024). *Assessing Disciplinary Literacy with CEFR Descriptors: History, Mathematics and Science. A Report by CLILNetLe Working Group 2*. Available online at: <https://phaidra.univie.ac.at/o:2082900> (accessed November 2, 2024).
- Lorenzo, F., Llinares, A., Ting, Y. L. T., and Glasnovik, D. (forthcoming). Adapting the common European framework of reference for history, mathematics and science in a second language: signposting disciplinary literacies in multilingual education. *Appl. Ling. Rev.*
- Martin, J. R., and Rose, D. (2008). *Genre Relations: Mapping culture*. Equinox.
- Maton, K. (2013). Making semantic waves: A key to cumulative knowledge-building. *Linguistics Educ.* 24, 8–22. doi: 10.1016/j.linged.2012.11.005
- McConachie, S. M., and Petrosky, A. R. (2009). *Content Matters*. Hoboken, NJ: John Wiley.
- McKenney, S., and Reeves, T. (2019). *Conducting Educational Design Research*, 2nd Edn. New York, NY: Routledge.
- Moje, E. B. (2015). Doing and teaching disciplinary literacy with adolescent learners: A social and cultural enterprise. *Harv. Educ. Rev.* 85, 254–278. doi: 10.17763/0017-8055.85.2.254
- Moje, E. B. (2008). Foregrounding the disciplines in secondary literacy teaching and learning: A call for change. *JAAL* 52, 96–107.
- Moore, P., and Nikula, T. (2016). "Translanguaging in CLIL," in *Conceptualising Integration in CLIL and Multilingual Education*, eds T. Nikula, E. Dafouz, P. Moore, and U. Smit (Clevedon: Multilingual Matters), 211–234.
- Morton, T. (2020). Cognitive discourse functions: A bridge between content, literacy and language for teaching and assessment in CLIL. *CLIL. J. Innov. Res. Plurilingual Pluricultural Educ.* 3:7. doi: 10.5565/rev/clil.33
- Morton, T., and Llinares, A. (2024). "Building teachers' knowledge of Cognitive Discourse Functions to integrate content and language," in *Teacher Development for Content-Based Language Education*, eds S. Ballinger, R. Fielding, and D. Tedick (Bristol: Multilingual Matters), 21–41.
- Morton, T., and Nashaat-Sobhy, N. (2024). Exploring bases of achievement in content and language integrated assessment in a bilingual education program. *Tesol Quart.* 58, 5–31. doi: 10.1002/tesq.3207
- Nashaat-Sobhy, N., and Llinares, A. (2023). CLIL students' definitions of historical terms. *Int. J. Bilingual Educ. Bilingualism* 26, 331–344. doi: 10.1080/13670050.2020.1798868
- Nikula, T. (2010). "Effects of CLIL on one teacher's classroom language use," in *Language Use and Language Learning in CLIL Classrooms*, eds C. Dalton-Puffer, T. Nikul, and U. Smit (Amsterdam: Benjamins), 105–124.
- Nikula, T. (2017). "What's the moment thingy?– On the emergence of subject-specific knowledge in CLIL classroom interaction," in *Discourse Analytic Perspectives on STEM Education: Exploring Interaction and Learning in the Multilingual Classroom*, eds J. Langman and H. Hansen-Thomas (Cham: Springer), 11–29.
- Nikula, T., and Moore, P. (2019). Exploring translanguaging in CLIL. *Int. J. Bilingual Educ. Bilingualism* 22, 237–249. doi: 10.1080/13670050.2016.1254151
- Nikula, T., Dafouz, E., Moore, P., and Smit, U. (2016). *Conceptualising Integration in CLIL and Multilingual Education*. Bristol: Multilingual Matters.
- Nikula, T., Jakonen, T., and Kääntä, L. (2024a). Multimodal practices of unpacking and repacking subject-specific knowledge in CLIL physics and chemistry lessons. *Learn. Instruct.* 92:101932. doi: 10.1016/j.learninstruc.2024.101932
- Nikula, T., Nashaat-Sobhy, N., Minardi, S., Güle, T., Yalçın, S., Kara Duman, S., et al. (2024b). *Towards an Initial Operationalisation of Disciplinary Literacies. A Paper by CLILNetLe Working Group 1*. Available online at: <https://phaidra.univie.ac.at/detail/o:2050621> (accessed October 25, 2024).
- OECD (2023). *PISA 2022 Results (Volume I): The State of Learning and Equity in Education*, PISA. Paris: OECD Publishing, doi: 10.1787/53f23881-en
- Peters, E., Noreillie, A., Heylen, K., Bulté, B., and Desmet, P. (2019). The Impact of Instruction and Out-of-School Exposure to Foreign Language Input on Learners' Vocabulary Knowledge in Two Languages. *Lang. Learn.* 69, 747–782. doi: 10.1111/lang.12351
- Sato, M., and Loewen, S. (2019). Do teachers care about research? The research-pedagogy dialogue. *ELT J.* 73, 1–10. doi: 10.1093/elt/ccy048
- Schleppegrell, M. (2004). *The Language of Schooling: A Functional Linguistics Perspective*. Mahwah, NJ: Lawrence Erlbaum.
- Schurz, A., and Sundqvist, P. (2022). Connecting Extramural English with ELT: Teacher Reports from Austria, Finland, France, and Sweden. *Appl. Linguistics* 43, 934–957. doi: 10.1093/applin/amac013
- Shanahan, T., and Shanahan, C. (2008). Teaching disciplinary literacy to adolescents: Rethinking content-area literacy. *Harv. Educ. Rev.* 78, 40–59. doi: 10.17763/haer.78.1.v62444321p602101
- Stubbs, M. (2000). "Society, education and language: the last 2,000 (and the next 20?) years of language teaching," in *Change and Continuity in*

Applied Linguistics, ed. H. Trappes-Lomax (Clevedon: Multilingual Matters), 15–34.

Sundqvist, P., and Sylén, L. K. (2016). *Extramural English in Teaching and Learning: from Theory and Research to Practice*. Berlin: Springer Nature.

Tagnin, L., and Ní Riordáin, M. (2021). Building science through questions in Content and language integrated learning (CLIL) classrooms. *Int. J. STEM Educ.* 8:34. doi: 10.1186/s40594-021-00293-0

Ting, Y. L. T., Rieder-Marschallinger, S., and Dalton-Puffer, C. (2024a). *The Development of Bi-and Multilingual Disciplinary Literacies Across Educational Levels: An Exploratory Survey. A Report by CLILNetLE Working Group 3, Deliverable 7*. Available online at: <https://phaidra.univie.ac.at/o:2082897>.

Ting, Y. L. T., Dalton-Puffer, C., and Kurt, Y. (2024b). “Curricular expectations of disciplinary literacies: at a glance,” in *Overview of Curricular Demands of Disciplinary Literacies*, eds Y. L. T. Ting, C. Dalton-Puffer, and S. Rieder-Marschallinger (Vienna: PHAIDRA), 19–28. Available online at: https://doi.org/10.25365/phaidra.532_20 (accessed October 15, 2024).

Unsworth, L., Tytler, R., Fenwick, L., Humphrey, S., Chandler, P., Herrington, M., et al. (2022). *Multimodal Literacy in School Science. Transdisciplinary Perspectives on Theory, Research and Pedagogy*. London: Routledge.

Uribe, A., and Prediger, S. (2021). Students’ multilingual repertoires-in-use for meaning-making: Contrasting case studies in three multilingual constellations. *J. Math. Behav.* 62:100820. doi: 10.1016/j.jmathb.2020.100820

Vollmer, H. J. (2007). “Language across the curriculum,” in *Towards a Common European Framework of Reference for Languages of School Education*, ed. W. Martyniuk (Krakow: Universitas), 177–192.

Vuorikari, R., Kluzer, S., and Punie, Y. (2022). *DigComp 2.2: The Digital Competence Framework for Citizens - With New Examples of Knowledge, Skills and Attitudes*. Luxembourg: Publications Office of the European Union, doi: 10.2760/115376

Whittaker, R., and McCabe, A. (2023). Expressing evaluation across disciplines in primary and secondary CLIL writing: A longitudinal study. *Int. J. Bilingual Educ. Bilingualism* 26, 345–362. doi: 10.1080/13670050.2020.1798869