CrossMark

FORUM

Teaching and learning science in linguistically diverse classrooms

Emilee Moore[1,2] · Natalia Evnitskaya[3] · S. Lizette Ramos-de Robles[4]

Abstract In this paper we reflect on the article, *Science education in a bilingual class: problematising a translational practice*, by Zeynep Ünsal, Britt Jakobson, Bengt-Olav Molander and Per-Olaf Wickman (Cult Stud Sci Educ, doi:10.1007/s11422-016-9747-3). In their article, the authors present the results of a classroom research project by responding to one main question: How is continuity between everyday language and the language of science construed in a bilingual science classroom where the teacher and the students do not speak the same minority language? Specifically, Ünsal et al. examine how bilingual students construe relations between everyday language and the language of science in a class taught in Swedish, in which all students also spoke Turkish, whereas the teacher also spoke Bosnian, both being minority languages in the context of Swedish schools. In this forum, we briefly discuss why close attention to bilingual dynamics emerging in classrooms such as those highlighted by Ünsal et al. matters for science education. We continue by discussing changing ontologies in

✉ Emilee Moore
  e.mooredeluca@leeds.ac.uk

  Natalia Evnitskaya
  natalia.evnitskaya@uam.es

  S. Lizette Ramos-de Robles
  lizette.ramos@academicos.udg.mx

[1] Beatriu de Pinós Programme, Generalitat de Catalunya, Barcelona, Spain

[2] School of Education, University of Leeds, Leeds, UK

[3] Faculty of Philosophy and Arts, Universidad Autónoma de Madrid, Madrid, Spain

[4] Centro Universitario de Ciencias Biológicas y Agropecuarias, Universidad de Guadalajara, Zapopan, Mexico

🙊 Springer

relation to linguistic diversity and education more generally. Recent research in bilingual immersion classroom settings in so-called "content" subjects such as Content and Language Integrated Learning, is then introduced, as we believe this research offers some significant insights in terms of how bilingualism contributes to knowledge building in subjects such as science. Finally, we offer some reflections in relation to the classroom interactional competence needed by teachers in linguistically diverse classrooms. In this way, we aim to further the discussion initiated by Ünsal et al. and to offer possible frameworks for future research on bilingualism in science education. In their article, Ünsal et al. conclude the analysis of the classroom data by arguing in favor of a translanguaging pedagogy, an approach to teaching and learning in which students' whole language repertoires are used as valuable resources for constructing meaning and for developing academic competences in the language of instruction. This is a conclusion that we support wholeheartedly and an educational practice that we hope to promote with this forum discussion.

Keywords Science education · Bilingualism · Translanguaging · Classroom interactional competence

Resumen Este foro presenta una serie de reflexiones en torno al artículo de Zeynep Ünsal, Britt Jakobson, Bengt-Olav Molander y Per-Olaf Wickman (en prensa) titulado "Educación en ciencias en una clase bilingüe: problematizando una práctica de traducción". En este artículo los autores presentan los resultados de un proyecto de investigación cuya pregunta principal fue: Cómo se construye la continuidad entre el lenguaje cotidiano y el lenguaje de las ciencias en una clase bilingüe de ciencias donde el profesor y los estudiantes no hablan la misma lengua materna? Específicamente Ünsal et al. analizan cómo los estudiantes bilingües construyen relaciones entre el lenguaje cotidiano y el lenguaje de las ciencias durante una clase cuya lengua de instrucción es el Sueco. En el contexto de enseñanza sueco, la lengua materna de los estudiantes es el Turco y la del profesor el Bosnio. En este foro, discutimos brevemente por qué es importante poner mucha atención en las dinámicas bilingües que emergen en las clases de ciencias tal y como lo señalan los autores. Posteriormente analizamos los cambios ontológicos en relación con la diversidad lingüística y la educación en general. A continuación se introducen investigaciones recientes sobre entornos bilingües de inmersión en el aula, en los llamados temas de "contenido", por ejemplo: Aprendizaje Integrado de Contenidos y Lenguas Extranjeras ya que creemos que estas investigaciones ofrecen perspectivas significativas en términos de cómo el bilingüismo contribuye a la construcción del conocimiento en asignaturas como las ciencias. Por último, se ofrecen algunas reflexiones sobre la competencia interaccional en el aula requerida por los maestros en las aulas lingüísticamente diversas. De esta manera, nuestro objetivo es fomentar el debate iniciado por Ünsal et al. y ofrecer posibles marcos teóricos para futuras investigaciones sobre el bilingüismo en el aprendizaje y enseñanza de las ciencias. En su artículo, Ünsal et al. concluyen el análisis de los datos de clase argumentando a favor de una pedagogía translanguaging y de un enfoque para la enseñanza y el aprendizaje en el cual todos los repertorios de la lengua puedan ser utilizados como recursos valiosos en la construcción de significados y para el desarrollo de competencias académicas en la lengua oficial para la instrucción. Esta conclusión la apoyamos profundamente así como el desarrollo de este tipo de prácticas educativas las cuales esperamos haber apoyado a través de este foro de discusión.

Palabras claves Educación en ciencias · Bilingüismo · Prácticas translingüísticas · Competencia interaccional en el aula

Bilingual dynamics in a science class

In their article, *Science education in a bilingual class: problematising a translational practice*, Zeynap Ünsal et al. present the results of a classroom research project by responding to one main question: How is continuity between everyday language and the language of science construed in a bilingual science classroom where the teacher and the students do not speak the same minority language? Specifically, Ünsal et al. examine how bilingual students construe relations between everyday language and the language of science in a class taught in Swedish, in which all students also spoke Turkish, whereas the teacher also spoke Bosnian, both being minority languages in the context of Swedish schools. If we consider that official recommendations such as those issued by UNESCO (1989) encourage forms of bilingual education that support students' home languages, the case presented by Ünsal et al. is a complex one. In their study, there is divergence in the language repertoires of students and that of their teacher, as well as in the repertoire expected by the institution of schooling. In this forum, in line with the authors' usage in the article being commented on, bilingualism will be the term used to refer to speakers' knowledge or use of more than one language, as opposed to monolingualism. The terms plurilingualism (Lüdi and Py 2009), multilingualism (Conteh and Meier 2014) and unilingualism (Porquier 1994) are used by other scholars in similar ways.

The divergence between the students', the teacher's and the school's language repertoires is represented in Fig. 1. While all participants in the classroom are bilingual, with at least two languages that they use in everyday life, within the classroom communication takes place on different planes, and both monolingually and bilingually, leading to certain tensions. Communication between the teacher and students takes place in Swedish, the language of instruction. However, in their peer to peer interaction and also in their individual studies, students also draw on Turkish, a language that their teacher does not know. The bilingual dynamics observed in the classroom by Ünsal et al. add another layer of complexity, as the authors show in the article, to already complicated processes of knowledge building that draw on both everyday and scientific language. The bilingual dynamics further have implications for the construction of social relationships in the classroom, with the teacher displaying certain frustrations over the divergence in his and his students' linguistic repertoires and school expectations. Ünsal et al. conclude the
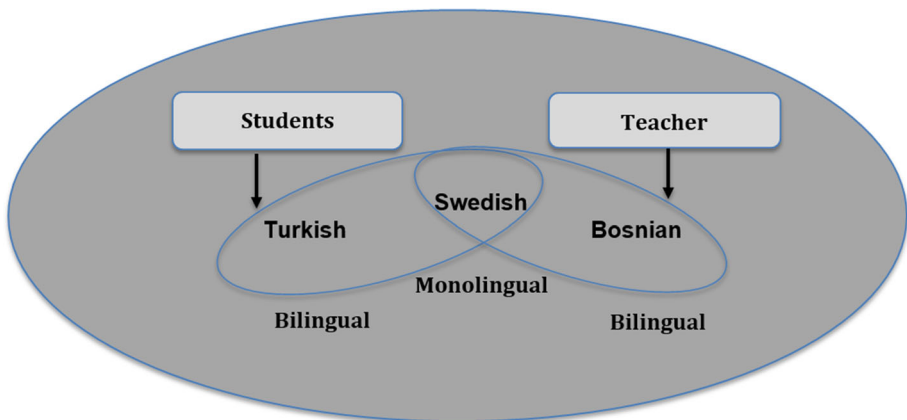
Fig. 1 Divergence in language repertoires of students and the teacher

analysis of the classroom data by arguing in favour of a translanguaging pedagogy (García 2009), an approach to teaching and learning in which students' whole language repertoires are used as valuable resources for constructing meaning and for developing academic competences in the language of instruction. This is a conclusion that we support wholeheartedly.

Given the tensions arising in the classroom around language knowledge and use, and our own particular foci as researchers, in this text we begin by briefly discussing why close attention to bilingual dynamics such as those highlighted by Ünsal et al. matters for science education. We continue by presenting a more in-depth overview of changing ontologies in relation to linguistic diversity and education more generally. We then introduce recent research in bilingual immersion classroom settings in so-called "content" subjects. This includes scholarship on Content and Language Integrated Learning or CLIL, which we believe offers some significant insights in terms of how bilingualism contributes to knowledge building. Finally, we provide some reflections in relation to teachers' classroom interactional competence in linguistically diverse classrooms. In this way, we aim to further the discussion initiated by Ünsal et al. and to offer possible frameworks for future research on bilingualism in science education.

Why is bilingualism important to science education?

We understand the learning of science as a process in which learners gradually build interpretations of natural phenomena in socially situated learning communities, such as classrooms. This process occurs in and through participation in school science activities that have some similarities with the activities carried out by experts. Teaching and learning science are forms of cultural production and enactment; all meaning is socially and contextually negotiated and value-laden (Kincheloe and Tobin 2009). From this perspective, language plays a fundamental role (Espinet et al., 2012), in acting, thinking and transforming ideas in interaction with others, and in creating scientific models of the world. According to Mariona Espinet et al. (2012) we can synthesize the changing role of language as it has been viewed in science education in the following way:

> The first review on language in science education written by Sutton (1998) introduced two important views that are prevalent in science education research community: a) that language is a system for transmitting information; and b) that language is an interpretative system for making sense of experience. Carlsen (2007), in a more recent review on language and science learning, included both views and added a third one: c) that language is a tool for participation in communities of practice. (p. 1388)

The latter idea positions language as fundamental to interactions between people in social spaces where specific activities are carried out and as central to participation in communities of practice (Lave and Wenger 1991). This idea also opens up possibilities for exploring the nature of language and its uses in the field of science education in depth. In the case of school science classes, it is important to analyze the language emerging not only in interaction between participants, but also the natural phenomena studied and the modes of representing those phenomena to facilitate understandings of them. That is, language is considered an artifact mediating knowledge of the world of science.

According to Wolff-Michael Roth (2007), rethinking scientific literacy is a way to rethink language:

> Knowing a language is indistinguishable from knowing your way around the world more generally. In this framing, 'being literate' could be interpreted to mean knowing your way around the world as the powers that be define it…'Being literate' has to imply that one is ready to produce new cultural forms, new communicative forms, ever-new resources that expand possibilities for acting and interacting with others. (pp. 392–393)

In this sense, we can argue that in bilingual science classrooms, possibilities for students' development of literacy are augmented, because along with other semiotic resources, different languages are incorporated. Students and teachers use these resources to overcome difficulties associated with teaching and learning science in the language of schooling. Bilingual classrooms can be defined as complex conversational spaces because they offer the possibility of using and enacting an expanded range of semiotic resources as mediators in the construction of meaning (Ramos-de Robles and Espinet 2013). As we see in the article by Ünsal et al., in gradually changing everyday scientific knowledge expressed through everyday language into school scientific knowledge expressed in more abstract language for talking about conceptual understandings of the world, different semiotic resources, including different languages, are used. This use depends on the agency of teacher and students as well as on institutional constraints.

Situated classroom interaction has become a major focus for science education researchers interested in understanding how modeling processes occur in interaction, and in depicting students' transitions from direct experience into the world of concepts and theories (Buty and Mortimer 2008). By paying close attention to unfolding interactional dynamics in a bilingual science classroom, and to transitions between everyday and scientific discourse, Ünsal et al.'s article represents a significant contribution to a current trend within the field of science education. It also offers important findings for the field of bilingual education more generally, as shall be developed in the following sections, particularly given that the teacher's discomfort with the divergences in his own and his students' language repertoires is not unique to this particular classroom setting.

Linguistic diversity and education

Unfortunately, research and theory in the field of bilingualism until at least the second half of last century departed from the premise that monolingualism, or the clear separation of languages in its absence, was socially and cognitively normal and that anything else was a sign of social disorderliness and individual deficiency. While pioneering an emerging field of enquiry, much early research also supported a commonly held view in academia and in social life that languages should be kept separate through policy interventions in order to coexist in harmony. It followed that different languages known by individuals should be used in different domains such as school, and home, for doing different things, with different interlocutors. A competent bilingual individual should have control over their language use so as not to suffer linguistic interference when communicating in situations, that to be orderly, should also be monolingual. Uriel Weinreich (1953) for example, wrote that:

> The ideal bilingual switches from one language to the other according to appropriate changes in the speech situation (interlocutors, topics, etc.), but not in an unchanged speech situation, and certainly not within a single sentence […] There is reason to suspect that considerable individual differences exist between those who have control of their switching, holding it close to the ideal pattern, and those who have difficulty in maintaining or switching codes as required. (p. 74)

However, since the ground-breaking work by linguistic anthropologists (Gumperz 1964), interactional sociolinguists and socio-cultural language acquisition scholars (Lüdi and Py 1986), a large body of research has demonstrated that bilingual people have a unique linguistic competence that is incomparable to that of a monolingual person. More recently, Georges Lüdi and Bernard Py (2009) defined the bilingual individual as "a free and active subject who has amassed a repertoire of resources and who activates this repertoire according to his/her need, knowledge or whims, modifying or combining them where necessary" (p. 159). From the perspective of language learning, research has further shown how, by using our entire language repertoires, we develop bilingualism and learn to participate in standard monolingual practices (Masats, Nussbaum and Unamuno 2007). Using entire language repertoires means doing things that bilinguals, such as the students in Ünsal et al.'s data, do every day, including code-switching, translating and constructing hybrid words and structures. In a socio-cultural sense, bilingualism is both a learning object and a cultural artifact that mediates learning.

It was also from this focus on holistic language development that Ofelia García (2009), adopting a term first introduced in Gaelic as 'trawsieithu' in the context of bilingual education in Wales, recently popularized the notion of translanguaging. The relevance of translanguaging has since been extended beyond education to the study of social life in linguistically diverse communities more generally. Translanguaging is a central notion in the article by Ünsal et al. and reflects changing ontologies in the language sciences more generally, already hinted at in earlier emic work on bilingualism by Lüdi and Py (1986) and others. The traditional notion of 'a language' as a bounded, linguistic system is rejected in favor of understandings of 'languaging' as an emergent semiotic repertoire for accomplishing social action. Translanguaging, which builds on this ontological development, refers to the multiplicity, fluidity, mobility, locality and globality of semiotic resources drawn on by bilingual individuals for engaging in complex meaning-making processes (García and Li Wei 2014). The term provides a "a way of capturing the expanded complex practices of speakers who could not avoid having had languages inscribed in their body" (p. 18).

Despite these changing approaches to bilingualism, monolingual models still predominate in schools in most places, and this seems to be the case also in Ünsal et al.'s study. In Europe, a discourse of plurilingualism has been adopted in official language policy, by schools, educators, families and even by students. The Council of Europe (2001), in the Common European Framework of Reference for Languages, writes that from the perspective of plurilingualism:

> […] the aim of language education is profoundly modified. It is no longer seen as simply to achieve 'mastery' of one or two, or even three languages, each taken in isolation, with the 'ideal native speaker' as the ultimate model. Instead, the aim is to develop a linguistic repertory, in which all linguistic abilities have a place. This implies, of course, that the languages offered in educational institutions should be diversified and students given the opportunity to develop a plurilingual competence. (p.5)

Despite these official discourses, bilingualism and plurilingualism are often still enacted in schools through what has been long described as an additive approach (Lambert 1975). That is, the curricular and the didactic models that still predominate aim to simply add one, two, three, four… school languages to those spoken by pupils at home, by including different languages as school subjects or languages of instruction. Such additive models aim at an idealization, along the lines suggested by Weinreich (1953), that is very rarely achieved, if at all. This idealization consists in individuals who use their first, second, third, and fourth language in perfectly balanced ways, and who use only one language at a given time, in a given place, with certain people, for doing certain things. Monica Heller (1999) referred to this in terms of parallel monolingualisms, while James Cummins (2008) referred to it in terms of linguistic solitudes. Such ideal competence is rarely reflected in actual language use within or beyond schools, and Ünsal et al.'s bilingual classroom is arguably more the norm than an exception. Yet, the idea that to be competently bilingual is to perform as a monolingual in different languages continues to be pervasive in schools and elsewhere.

Current understandings of bilingualism, and plurilingualism, as we have described them above, are quite incompatible with additive approaches. Rather, they fit within what García (2009) describes as a dynamic school language model, or what has also been referred to in similar ways as a didactics of plurilingualism (Nussbaum 2013), translanguaging pedagogies (García and Wei 2014), multilingual pedagogies (Conteh and Meier 2014), or integrated immersion approaches (Gajo 2013). Such approaches, while including occasions in which students work in just one of the languages in their repertoires, are framed within learning projects in which students are also able to draw on their entire repertoires in constructing knowledge. This is done by promoting interaction around genres, discourses, modalities, etc. that naturally occur in social life in linguistically diverse manners. This working within, between and beyond standard and school language is what bilingualism, and translanguaging as a social and educational practice, is all about. This is precisely what the students in Ünsal et al.'s science classroom do.

How does bilingualism contribute to learning school subjects?

In the following sections, we will explore in more detail how bilingualism may be considered a resource for constructing knowledge in so-called "content" such as science, versus so-called "language" subjects. We do so by considering research carried out in bilingual immersion classrooms, in which explicit measures are put in place to facilitate students' integrated learning of the school language(s), and of subject content.

Research carried out in bilingual immersion classrooms in Switzerland by Laurent Gajo (2007), for example, explores how problematic aspects in relation to language—what he calls opacity—and subject content—what he calls density—emerge in processes of knowledge construction. Gajo argues that students' attention to density, or processes of conceptualization, occurs regardless of whether learning activities are done in their 'first' or additional languages. However, especially in cases where a language they are still developing proficiency in is being used as the medium of instruction, the language used to express content may become opaque. In such instances, remediation activities—"both in the sense of second mediation and in that of restoration" (Gajo 2007, p. 568)—or processes of clarification, may occur. In all of these processes—conceptualization and remediation/

clarification—being able to momentarily resort to all languages in students' repertoires is seen as a resource, rather than a hindrance, for constructing knowledge.

Furthermore, according to Gajo (2007), rather than being a burden, opacity can in fact be considered an advantage for subject learning. It renders visible aspects of subject knowledge that might otherwise go unnoticed, at the same time as it creates opportunities for more in-depth treatment of them. Hence, in bilingual immersion settings, the double burden of linguistic opacity and conceptual density is in fact an extremely rich opportunity for teaching and learning and it sets the stage for complex sequences of mediation and remediation in classroom interaction, such as we see in Ünsal et al.'s data. Gajo and Grobet (2008) further claim that not allowing the use of bilingual resources in such classrooms can lead to the simplification of the subject content. Bilingual practices, according to these authors, help to bring situated negotiations of knowledge to fruition, or what they call completion, and facilitate the accomplishment of sufficient complexity in terms of the academic subject, or saturation.

In this regard, recent research on student group work in bilingual immersion settings has shown, in a similar way to Ünsal et al.'s data, how students often move between bilingual and monolingual modes of interaction when carrying out academic tasks. Emilee Moore (2014), for example, shows how students in a university level English medium immersion subject in Catalonia departed from a learning task and materials designed by their teacher that only used English, while in the process of task completion students often resorted to bilingual resources. She argues that the mobilization of students' whole repertoires allows the joint construction of both the language and content knowledge necessary to elaborate a monolingual and 'expert' product in the medium of their instruction. As Moore (2014) concludes, "these observations lend support to arguments in favor of bilingualism in L2 immersion […] settings as a resource ensuring participation and facilitating clarification, conceptualisation and saturation of emerging knowledge objects" (p. 605).

Teaching in contexts of linguistic heterogeneity

Content and Language Integrated Learning (CLIL) is one approach to bilingual immersion that has quite recently gained popularity in schools in Europe in particular, usually involving the teaching of a content subject through a foreign language. We believe that the sound pedagogical basis on which CLIL is emerging offers insights for linguistically diverse educational contexts more generally. The CLIL approach departs from the understanding that all participants in CLIL classroom communities of practice—teachers and students—are active collaborators in the co-construction of content and language knowledge, including the academic discourse necessary for meaning-making (Dalton-Puffer 2007). In CLIL classrooms, students' and teachers' rich and varied use of inter-actional scaffolding (Donato 1994), as well as their deployment of bilingual and other semiotic resources to mediate knowledge construction, have been found crucial (Escobar Urmeneta and Evnitskaya 2014).

Some of the research in CLIL has focused on teachers' roles in managing content classrooms in which participants have heterogeneous linguistic competences and in which navigating opacity is the norm. This research has shown how the skillful use of a wide variety of interactional strategies by teachers, including the use of bilingual resources, takes on new levels of importance. In CLIL classrooms, teachers facilitate students' understanding of disciplinary knowledge and subject-specific discourse, promote students'

meaningful engagement and participation in this joint process and, finally, guide them in the effective and creative use of their language repertoire in displaying their learning and in participating. In achieving this, teachers make use of certain interactional strategies, moves and adjustments, which constitute classroom interactional competence or CIC (Walsh 2006). CIC is defined as "teachers' and learners' ability to use interaction as a tool for mediating and assisting learning" (Walsh 2011, p. 158). CIC encompasses those features of teacher-student interaction, which result in high quality classroom interaction and thereby make the teaching–learning process more efficient, in particular in linguistically heterogeneous contexts. Some of the teaching strategies aimed at scaffolding classroom interaction and learning so far identified by research are the following (Walsh 2011):

1. The use of learner-convergent language, which is both appropriate to teaching goals and adjusted to the co-construction of meaning and the unfolding agenda of a lesson.
2. The facilitation of interactional space so that students are given opportunities or 'spaces for learning' in which to contribute to classroom interaction, by using effective eliciting strategies, increasing wait-time to permit learners to think, formulate and give a response, promoting extended learner turns by asking 'why' questions, etc.
3. The 'shaping' of learner contributions by seeking clarification, modeling appropriate language use, paraphrasing, reiterating or repairing learner productions. Through shaping the discourse, teachers help students to say what they mean using the most appropriate language to do so.

It would be erroneous to describe CIC as an inventory of potentialities possessed by individual teachers who deploy a catalogue of scaffolding strategies. On the contrary— borrowing Lorenza Mondada and Simona Pekarek Doehler's (2004) definition of communicative competence as situated practice—CIC can be envisaged "as a plurality of capacities embedded and recognized in the context of particular activities." (p. 503) What are at stake are teachers' abilities to make online decisions and locally employ strategies which create spaces for learning, so that all students, regardless of their proficiency in the medium of instruction, are given opportunities to participate in interactional practices relevant for their learning (Escobar Urmeneta and Evnitskaya 2014).

All teachers working in bilingual educational contexts should be encouraged to make abundant, rich and varied use of bilingual and other meaning-making resources. Such use should be directed at providing appropriate support for students' comprehension, at guiding them in their process of knowledge building, and at creating interactional situations that afford opportunities for developing bilingualism. Success in this undertaking depends to a great degree on the quality of the interactions co-constructed between teachers and students, and therefore on teachers' CIC. As a consequence, we believe there is a need for pre-service and in-service teacher education programs, especially in contexts of linguistic diversity, to incorporate a CIC component. Such a component would enhance teachers' awareness of the role that language and other semiotic resources play in students' learning of content and language in and through classroom interactions, which are often bilingual.

Positioning linguistic diversity as the norm

In concluding this short reflection, we would like to emphasize that the case of bilingual classroom dynamics presented by Ünsal et al. is a complex one. However, it is not at all an exceptional case in the world in which we are living. The sociolinguistic complexity that is experienced at present across the globe is well documented and has been termed

'superdiversity' (Vertovec 2007) in some contexts, to allude to a particular type of diversity unique to the twenty-first century. This complexity includes historical or auto-chthonous linguistic diversities, diversities resulting from more recent demographic mobility, and transformations in the ways we communicate as a result of generalized access to digital technologies (Blommaert and Rampton 2011). Educational institutions, and communities more generally, face the enormous challenge of educating the school population for active participation in a diverse, interconnected and ever-changing world, in which monolingual competences and monocultural worldviews are insufficient. The research conducted by Ünsal et al., therefore, makes a contribution to an increasingly important field of enquiry and an increasingly common educational reality.

References

Blommaert, J., & Rampton, B. (2011). Language and superdiversity. *Diversities, 13*(2), 1–22.

Buty, C., & Mortimer, E. (2008). Dialogic/authoritative discourse and modelling in a high school teaching sequence on optics. *International Journal of Science Education, 30*(12), 1635–1660. doi:10.1080/09500690701466280.

Carlsen, W. S. (2007). Language and science learning. In S. Abell & N. Lederman (Eds.), *Handbook of research on science education* (pp. 57–74). Mahwah: Lawrence Erlbaum Associates.

Conteh, J., & Meier, G. (2014). *The multilingual turn in languages education: Opportunities and challenges*. Bristol: Multilingual Matters.

Council of Europe. (2001). *Common European framework of reference for languages: Learning, teaching, assessment*. Strasbourg: Council of Europe.

Cummins, J. (2008). Teaching for transfer: Challenging the two solitudes assumption in bilingual education. In J. Cummins & N. H. Hornberger (Eds.), *Encyclopedia of language and education: Volume 5. Bilingual education* (2nd ed., pp. 65–75). Boston: Springer.

Dalton-Puffer, C. (2007). *Discourse in content and language integrated learning (CLIL) Classrooms*. Amsterdam: John Benjamins. doi:10.1075/lllt.20.

Donato, R. (1994). Collective scaffolding in second language learning. In J. P. Lantolf & G. Appel (Eds.), *Vygotskian approaches to second language research* (pp. 33–56). Norwood: Ablex.

Escobar Urmeneta, C., & Evnitskaya, N. (2014). 'Do you know Actimel?' The adaptive nature of dialogic teacher-led discussions in the CLIL science classroom: A case study. *Language Learning Journal, 42*(2), 165–180. doi:10.1080/09571736.2014.889507.

Espinet, M., Izquierdo, M., Bonil, J. & Ramos, L. (2012). The role of language in modeling the natural world: Perspectives in science education. In K. Tobin, B. Fraser & C. McRobbie (Eds.), *Second international handbook of research in science education* (pp. 1385–1403). New York: Springer. doi:10.1007/978-1-4020-9041-7_89

Gajo, L. (2007). Linguistic knowledge and subject knowledge: How does bilingualism contribute to subject development? *International Journal of Bilingual Education and Bilingualism, 10*(5), 563–581.

Gajo, L. (2013). La enseñanza integrada, la didáctica del plurilingüismo y la enseñanza bilingüe: Jerarquía o alternativa. In J. Dolz & Idiazabal, I. (Eds.), *Enseñar (lenguas) en contextos multilingües* (pp. 51–72). Leioa, Spain: Euskal Herriko Unibertsitateko Argitalpen Zerbitzua.

Gajo, L. & Grobet, A. (2008). Interagir en langue étrangère dans le cadre de disciplines scolaires: Intégration et saturation des savoirs disciplinaires et linguistiques dans l'élaboration des définitions. In Filliettaz, L. & Schubauer-Leoni, M.-L. (Eds.), *Processus interactionnels et situations éducatives* (pp. 113–136). Brussels: De Boeck. doi:10.3917/dbu.filli.2008.01.0113

García, O. (2009). *Bilingual education in the 21st century: A global perspective*. Oxford: Wiley.

García, O., & Wei, L. (2014). *Translanguaging: Language, bilingualism and education*. New York: Palgrave Macmillan. doi:10.1057/9781137385765.

Gumperz, J. J. (1964). Linguistic and social interaction in two communities. *American Anthropologist, 66*(6), 137–153. doi:10.1525/aa.1964.66.suppl_3.02a00100.

Heller, M. (1999). *Linguistic minorities and modernity. A sociolinguistic ethnography*. London: Longman.

Kincheloe, J., & Tobin, K. (2009). The much exaggerated death of positivism. *Cultural Studies of Science Education, 4*, 513–528. doi:10.1007/s11422-009-9178-5.

Lambert, W. E. (1975). Culture and language as factors in learning and education. In A. Wolfgang (Ed.), *Education of immigrant students* (pp. 55–83). Toronto: Ontario Institute for Studies in Education.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press. doi:10.1017/CBO9780511815355.

Lüdi, G., & Py, B. (1986). *Être bilingue*. Bern: Peter Lang.

Lüdi, G., & Py, B. (2009). To be or not to be … a plurilingual speaker. *International Journal of Multilingualism, 6*(2), 154–167. doi:10.1080/14790710902846715.

Masats, D., Nussbaum, L., & Unamuno, V. (2007). When activity shapes the repertoire of second language learners. *EUROSLA Yearbook, 7*, 121–147. doi:10.1075/eurosla.7.08mas.

Mondada, L., & Pekarek Doehler, S. (2004). Second language acquisition as situated practice: Task accomplishment in the French second language classroom. *Modern Language Journal, 88*(4), 501–518. doi:10.1111/j.0026-7902.2004.t01-15-.x.

Moore, E. (2014). Constructing content and language knowledge in plurilingual student teamwork: Situated and longitudinal perspectives. *International Journal of Bilingual Education and Bilingualism, 17*(5), 586–609. doi:10.1080/13670050.2013.860947.

Nussbaum, L. (2013). Interrogations didactiques sur l'éducation plurilingüe. In V. Bigot, A. Bretegnier, & M. Vasseur (Eds.), *En vers le plurilinguisme? 20 ans après* (pp. 85–93). París: Albin Michel.

Porquier, P. (1994). Communication exolingue et contextes d'appropriation: Le continuum acquisition/apprentissage. *Bulletin VALS-ASLA, 59*, 159–169.

Ramos-De Robles, S. L., & Espinet, M. (2013). Expanded agency in multilingual science teacher training classroom. In N. Mansour & R. Wegerif (Eds.), *Science education for diversity: Theory and practice* (pp. 251–271). Dordrecht: Springer.

Roth, W.-M. (2007). Toward a dialectical notion and praxis of scientific literacy. *Journal of Curriculum Studies, 39*(4), 377–398. doi:10.1080/00220270601032025.

Sutton, C. (1998). New perspectives on language in science. In B. J. Fraser & K. G. Tobin (Eds:) *International handbook of science education* (pp. 27–38). Dordrecht, The Netherlands: Kluwer Academic Publishers. doi:10.1007/978-94-011-4940-2_2

UNESCO. (1989). *Educación bilingüe. Materiales de apoyo para la formación docente en Educación Bilingüe Intercultural*. Santiago de Chile: UNESCO.

Ünsal, Z., Jakobson, B., Molander, B.-O., & Wickman, P.-O. (2016). Science education in a bilingual class: problematising a translational practice. *Cultural Studies of Science Education*. doi:10.1007/s11422-016-9747-3.

Vertovec, S. (2007). Superdiversity and its implications. *Ethnic and Racial Studies, 30*(6), 1024–1054. doi:10.1080/01419870701599465.

Walsh, S. (2006). *Investigating classroom discourse*. London: Routledge.

Walsh, S. (2011). *Exploring classroom discourse: Language in action*. London: Routledge.

Weinreich, U. (1953). *Languages in contact: Findings and problems*. New York: Linguistic Circle of New York.

Emilee Moore is a research fellow in the Catalan Government's Beatriu de Pinós program, based in the School of Education at the University of Leeds, UK. She studies meaning-making practices in multilingual and multicultural educational contexts from a perspective that integrates linguistic anthropology, interactional sociolinguistics, ethnomethodology and sociocultural learning theories. Before moving to Leeds in 2015, she was a university lecturer in Barcelona for 5 years, where she helped develop teachers for multilingual preschools, primary and secondary schools, and for multilingual tertiary education.

Natalia Evnitskaya is a postdoctoral fellow at the Department of English Studies at the Universidad Autónoma de Madrid, Spain. Her research focuses on the ways content-and-language integrated teaching and learning and L2 classroom interactional competence are enacted and developed in both teacher-student and peer interaction in CLIL contexts, which she approaches from the perspectives of multimodal conversation analysis, systemic functional linguistics and sociocultural learning theories. She is also actively involved in teacher education programs for EFL and CLIL pre-service primary and secondary school teachers.

S. Lizette Ramos-de Robles is a professor of Biology and Environmental Health Sciences in the Department of Environmental Sciences at the University of Guadalajara, Mexico. Her research focuses on sociological and cultural aspects of discourse in the teaching and learning of science, especially in multilingual contexts. In order to understand scientific literacy more deeply, she uses sociocultural and sociolinguistic perspectives. In addition, her research also focuses on socio-environmental aspects related to Environmental Health, specifically climate change literacy.