Science Teaching and Learning in Linguistically Super-Diverse Multicultural Classrooms

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Abstract

American schools are becoming more linguistically diverse as immigrants and resettled refugees who speak various languages and dialects arrive at the United States from around the world. This demographic change shifts US classrooms toward super-diversity as the new norm or mainstream in all grade levels (Enright 2011; Park, Zong and Batalova 2018; Vertovec 2007). In super-diverse classroom contexts, students come from varied migration channels, immigration statuses, languages, countries of origin, and religions, which contribute to new and complex social configurations of the classroom. Super-diversity thus encourages educators and researchers to draw on nuanced understandings of the complexity that it brings to bear in educational settings and reconsider instructional approaches that we have believed to be effective. This chapter provides an insight into the complexity of teaching science in linguistically super-diverse classrooms with the case of Riverview High School. Riverview High is located on the outskirts of a metropolitan city in the Midwest. In the past decade, Riverview High has been a popular destination for many immigrants, many of whom are former refugees, from various countries, including but not limited to Myanmar, Congo, Syria, and Honduras, among others. As a result, students at Riverview High speak more than 30 different languages to include languages of Myanmar, such as Burmese, Hakha, Zomi, Zophei, Falam, and Lautu, Spanish, Kurdish, and Arabic. Over an academic year, we collected ethnographic data through interviews of emergent multilingual students who are classified by the school as limited English proficient, teachers who teach science and English as a New Language (ENL) classes, and school administrative personnel, as well as participant observations of science and ENL classrooms. In this chapter, we first review the literature on science education for emergent multilingual learners to provide a knowledge base as to which instructional practices and curricular features are recommended in supporting their science learning. Then, we present findings of our data collected from Riverview High focusing on (1) what are instructional practices that science teachers implement to facilitate emergent multilingual students' science learning, (2) how those implemented instructional practices support or do not support their learning, and (3) what are new challenges that existing literature does not sufficiently address. Our findings show that teachers at Riverview High adopted several research-recommended teaching practices to provide linguistic support for emergent multilingual students; however, some students reported needing additional or different forms of support, especially those who use languages not commonly spoken in the United States. Additionally, some classroom practices intended as support had unintended or negative impacts on students' sense of belonging. By juxtaposing research recommendations and a case of super-diverse classrooms, we aim to address a gap that exists in the science education literature and provide a nuanced understanding of the complexity that super-diversity may bring to science classrooms. Based on our findings, we suggest several directions for curricular and school cultural reforms. These reforms should include developing curriculum, assessments, and activities that center students' sense-making and a nurturing school culture in which all students view their emergent multilingual peers from asset-oriented perspectives. In addition, we call for more research on science teaching practices that facilitate emergent multilingual students' learning and empower them in multilingual and multicultural classrooms.

Keywords

Multilingual science classroom · Multicultural teaching · Emergent multilingual learners · English learners · Super-diversity · Ethnography

Introduction

American schools are becoming more linguistically diverse as immigrants and resettled refugees who speak varied languages and dialects arrive in the United States from around the world, shifting US classrooms toward super-diversity as the new norm or mainstream in all grade levels (Enright 2011; Park et al. 2018). In super-diverse classroom contexts, students come from varied migration channels, immigration statuses, languages, countries of origin, and religions, which contribute to new and complex social configurations of the classroom (Vertovec 2007). Super-diversity thus encourages educators and researchers to draw on nuanced understandings of the complexity that it brings to bear in educational settings and reconsider instructional approaches that we have believed to be effective.

Our chapter provides insight into the complexity of teaching science in linguistically super-diverse and multicultural classrooms with the case of Riverview High School (RHS). Figure 1 indicates how RHS's student population has changed significantly over the last decade as immigrants and refugees from countries such as Myanmar/Burma, México, Honduras, Syria, and the Congo have relocated to the metropolitan Midwestern United States city where RHS is located. At the time of our study, 65% of RHS students spoke English only; 17.6% were fluent in multiple languages, including English; and the school district classified 17.4% as *English learners* (ELs) based on their beginning levels of English proficiency. More than 30 different languages were spoken by RHS students, including many Burmese and central African languages, Spanish, and Arabic.

In this chapter, we first review the literature on science education for multilingual learners to provide a knowledge base as to which instructional practices and curricular features are recommended in supporting science learning within a multicultural classroom. Then, we present the findings of our data collected at RHS, focusing on (1) the instructional practices teachers use to facilitate EL students' science learning, (2) how EL students experience these instructional practices, and (3) new challenges that existing literature does not sufficiently address. By juxtaposing research recommendations and a case of linguistically super-diverse and multicultural classrooms,

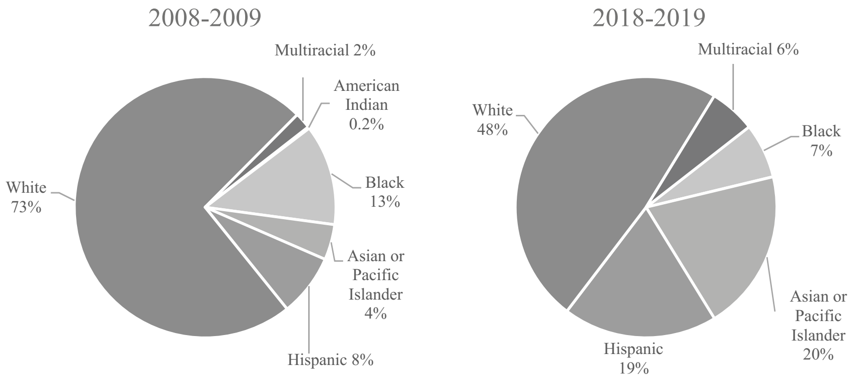

Fig. 1 Shifts in RHS Enrollment by Ethnicity. (Note. Data from State Department of Education website)

we aim to address a gap that exists in the science education literature, provide a nuanced understanding of the complexity that super-diversity may bring to science classrooms, and suggest a future direction for research and practices that specifically respond to the teaching in multicultural settings.

We use two different terms in this chapter: *emergent multilingual learners* and *English language learners*. Both terms refer to students who attend schools where the language of instruction is different than their native language(s) and who are in the developing stages of acquiring proficiency in the language of instruction. The term English learners refers specifically to emergent multilingual students who attend schools where English is the language of instruction. Neither term refers to multilingual students who are fluent in both their native language(s) and the language(s) of instruction. We support recent calls for moving away from deficit-oriented terms, such as English language learners, toward more asset-oriented terms, such as emergent multilingual learners (González-Howard and Suárez 2021). Thus, in our synthesis of literature review and discussion, we use the term emergent multilingual learners. However, when citing literature, we reflect the term used by the authors in the original source. Thus, *English language learner* (ELL) is used in some cases. Please note that in American schools, EL is generally interchangeable with ELL. We refer to the student participants in our study as ELs to reflect the language used by their particular school district.

What the Literature Says

This review of the literature focuses on strategies broadly recommended for teaching science to emergent multilingual students. To identify relevant literature, we used databases such as Web of Science and Google Scholar and keywords, including science education, language education, bilingual education, multilingual education, super-diversity, and English language learners (ELLs). We also searched directly in researcher- and practitioner-oriented literature focused on science education (e.g., *Journal of Research in Science Teaching, Science Education, International Journal of Science Education, Cultural Studies of Science Education, The Science Teacher*), language education (e.g., *Language and Education, Language Teaching Research, TESOL Quarterly, TESOL journal, Linguistics and Education, International Journal of Bilingual Education and Bilingualism*), and general education research (e.g., *American Educational Research Journal, Review of Research in Education*). We included studies of both elementary and secondary schools, and we ended our search process when we reached a saturation point of recommended strategies. Because we used ELL as one of our keywords, much of the literature we found was set in American schools, but this chapter also includes studies set in linguistically diverse schools in South Africa, Luxembourg, Colombia, Sweden, and Catalonia. Within this literature, we identified four themes: teacher dispositions toward emergent multilingual students, engaging students in authentic sense-making practices, designing classroom assessments, and utilizing human resources. We organize this section accordingly.

Teacher Dispositions Toward Emergent Multilingual Students

Teachers' dispositions toward emergent multilingual students have important implications for their science engagement and learning. For example, in a large-scale study, Johnson et al. (2016) found that ELs' improved performance on a state science assessment was attributed, in part, to a transformational shift in teachers' attitudes toward their ELs which was facilitated by their participation in a Transformative Professional Development program. Thus, it is essential for teachers to maintain an asset-based view of emergent multilingual students and their ability to learn science (National Academies of Sciences, Engineering, and Medicine, NASEM 2018).

Science education researchers have uncovered several important dimensions of teachers' asset-based views of emergent multilingual students (Bianchini 2018), including holding high expectations for emergent multilingual students' success (Buxton 2005; Johnson and Bolshakova 2015), seeing emergent multilingual students as willing and able to learn science and the language of instruction (Kang and Zinger 2019; Suriel and Atwater 2012), and valuing emergent multilingual students' experiences and knowledge (Moore 2008; Rivera Malucci 2009). Furthermore, teachers who hold an asset view of ELs recognize that as a group, ELs are heterogenous in many ways (Smetana and Heineke 2017; Buck et al. 2005).

Engaging in Scientific Sense-Making Practices

Recent consensus documents in science education emphasize the importance of engaging students in science practices (e.g., National Research Council 2012).

Engaging in these practices authentically requires students to use language in demanding ways such as engaging in evidenced-based science. Teachers may worry that students with emerging English proficiency will not be able to successfully participate in these language-intensive practices. However, a growing body of research in both science education (e.g., NASEM 2018) and second language acquisition (e.g., Swain and Deters 2007) has demonstrated that during the period when emergent multilingual students are still developing proficiency in the language of instruction, they can indeed engage in rigorous science sense-making (Rosebery et al. 1992; Maerten-Rivera et al. 2016). Lee et al. (2019) further concluded that "language learning occurs not as a precursor but as a product of using language in social interaction" such as in science learning settings (p. 318). Thus, engaging students in science practices with appropriate scaffolds provides a context for emergent multilingual students to use language for a specific purpose, thereby providing opportunities for their science and language learning. That being said, simply including ELs in classroom activities that are designed to engage students in science practices will not in itself support EL's participation or science learning, nor their English language development. Instead, teachers need to use a repertoire of pedagogical strategies designed specifically to support ELs' participation in language-intensive science practices, in a number of different contexts, using a variety of linguistic resources (NASEM 2018; Buxton et al. 2018).

To engage students in language development and science learning simultaneously, science teachers should provide explicit opportunities to engage emergent multilingual students in partner, small group, and whole group talk (Lee et al. 2019). Engaging in a variety of participation structures requires emergent multilingual students to use different registers such as specialized versus informal, which helps them understand how to use various forms of language to meet the demands of different contexts (Lee et al. 2019). Emergent multilingual students also need opportunities and encouragement to use multiple modalities for engaging with science ideas, including linguistic aspects such as speaking, listening, reading, writing, and non-linguistic modes to include gestures, drawings, symbols, and graphs (Grapin 2019; Tang et al. 2011). In science, non-linguistic modes such as graphs, tables, and charts "are not simply scaffolds or supports; they are the essential semiotic tools" of the discipline that all students (including emergent multilingual students) should learn to use strategically based on their particular affordances and constraints (Grapin 2019, p. 34). Teachers, too, should use multiple modes of communication, including every day and scientific discourse (Zhang 2016), drawings, visualizations, videos, and technology (Buck Bracey 2017; Ünsal et al. 2018; Ryoo et al. 2018; Márquez et al. 2006) to make input more comprehensible for emergent multilingual students (Echevarría et al. 2017; Krashen 1988).

Moreover, emergent multilingual students should be encouraged to use all of their language resources, including everyday talk, home language(s), and cultural practices (Gómez Fernández 2019; Karlsson et al. 2018; Moore et al. 2018; Msimanga and Lelliott 2014; Siry and Gorges 2019). For example, Josiane Hudicourt-Barnes (2003) found that Haitian Creole students were able to draw on their common cultural practice of bay odyans to engage in scientific argumentation successfully.

Furthermore, Pierson and Clark (2018) found that emergent multilingual students' reflective use of translanguaging (García 2009), or moving fluidly across languages, provided "resources for meta-representational thinking that could be leveraged as they engage in modeling" (Pierson and Clark 2018, p. 4). As discussed above, teachers can only leverage students' multilingual and multicultural practices if they recognize them as assets.

Finally, while engaging emergent multilingual students in scientific practices, teachers must attend to the specific ways in which language functions in science (Tolbert et al. 2014). This attention to language includes instruction on the specialized vocabulary used uniquely in science which is sometimes referred to in the literature as "tier-three words," such as electronegativity and acceleration, and should strive to build science "word consciousness" by examining prefixes, suffixes, roots, cognates, and nominalizations (Buxton et al. 2018; Gebhard et al. 2014; Snow 2008). Vocabulary instruction should also include "tier-two" words "those that are encountered in academic discourse but are not specific to any particular field or discipline." Examples of "tier-two" words are compare, exemplify, characterize, therefore, thus, and conceivably (Snow 2008, pp. 72).

However, vocabulary instruction alone is simply not sufficient for supporting ELs' use of language to engage in science practices, comprehend science texts, or re-construct science knowledge (NASEM 2018; Buxton et al. 2018). Emergent multilingual students also need opportunities to analyze scientific text, attending to scientific uses of every day non-scientific words such as organic, as well as the tone, purpose, goals, and perspective of the author (Buxton et al. 2018; Tolbert et al. 2014). In turn, emergent multilingual students need opportunities to apply what they learn from this analysis to construct authentic scientific texts of their own, including lab reports, explanations, and arguments (Tolbert et al. 2014). In general, science teachers, especially in secondary classrooms, will need to consider both science- and language objectives in their planning (Bautista and Castañeda 2011), view themselves as teachers of both content and language, and develop the pedagogical language knowledge necessary to support emergent multilingual students' use of language in science class (Bunch 2013).

Classroom Assessment

Classroom assessment plays an important role in supporting ELs in science, by providing both teachers and students with important feedback about teaching and learning (NASEM 2017). When assessing emergent multilingual students in science, the challenge for teachers is to provide an opportunity for students of all levels of language proficiency to demonstrate what they have learned (Lyon et al. 2012). To this end, teachers are urged to use frequent, flexible, and culturally valid formative and summative assessments that use a variety of task formats with built-in language support (Buxton et al. 2019; Turkan and Liu 2012). Formative assessment for emergent multilingual students can include informal methods such as observations of student behavior and student-teacher or student-student interactions (Heritage and

Chang 2012) or asking students to draw their ideas and explain them in their own words. Assessment involving verbal interaction is particularly suited for emergent multilingual students (Siry and Gorges 2019), as it provides opportunities for teachers to "modify their own language as well as scaffold their students' language comprehension and production," as needed, in real-time (NASEM 2018, p. 227).

Formative assessment can also take a variety of performance-based forms, especially those with built-in language support. For example, Kopriva (2014) described a set of high school science assessments known as ONPAR that used "computer-interactive novel presentation and response formats designed to communicate challenging content to and from students" (p. 2). Buxton et al. (2019) designed a middle school science assessment that included text in multiple languages and included a variety of text formats. For example, the text within single item clusters began with concrete contexts and used less condensed language and then shifted to more abstract, generalizable statements, using more condensed and symbolic language. They found that these intentional language formats served as scaffolds for students' responses, as students used language directly taken from the question in their constructed responses. The authors note that some students were not yet able to include the more abstract language to demonstrate generalizable understandings and pointed out the importance of attending to these kinds of shifts or "semantic waves" in classroom instruction.

Although multiple-choice tests are not particularly endorsed in the science education literature, they are still commonly used in schools, and teachers sometimes modify these tests for emergent multilingual learners. To that end, Castañeda and Bautista (2011) point out that, "Modifying for ELLs does not mean compromising or lowering the content of the lesson or the difficulty of the assessment task; it requires making the content or the task comprehensible and attainable" (p. 43). Noble et al. (2016) identified four concrete strategies for adapting assessments to make content more accessible to ELs, including adding visuals (to questions and to answer choices), removing forced comparison terms (e.g., best, least likely), replacing vague references to previous sentences (e.g., "these conditions") with more specific terms (e.g., "the lights on"), and avoiding non-technical words that do not appear routinely in grade-level texts and are unlikely to be explicitly taught in science class. They also note that interviewing ELs about individual test items can uncover challenges not otherwise perceived by test writers.

Utilizing Human Resources

Depending on the human resources available in a school or district, there may be opportunities for science teachers to collaborate with colleagues (such as ESL teachers, aides or coaches, and home language interpreters) to support emergent multilingual learners better. This collaboration could take many forms, including co-planning and coteaching, as well as pull-out services, in which emergent multilingual learners leave the mainstream classroom for small-group or one-on-one instruction. In the multilingual education literature, inclusive (or push-in) services during which emergent multilingual learners remain part of the mainstream classroom are preferable over pull-out models because pull-out models can result in "a disconnected instructional experience, lack of increased achievement, and no sense of belonging" (Dove and Honigsfeld 2010, p. 9).

While coteaching between language and science teachers may hold promise for supporting student learning, it is a complex process that often generates multiple challenges (Arkoudis 2003; Valdés-Sánchez and Espinet 2020). In addition to logistical limitations such as insufficient staffing or incompatible teaching and/or planning schedules between potential co-teachers (Tan 2011), collaboration can also be limited by power differentials in which ESL teachers have less agency and authority to significantly impact the pedagogical practices of content-area teachers (Arkoudis 2003), especially in content areas of high status, like science (Arkoudis 2006). Furthermore, science teachers (especially at the secondary level) often do not identify as language teachers (Tan 2011). They may not have had sufficient pre-service education or professional development around the functional use of language in science that would support their collaboration with ESL teachers (NASEM 2018; Rutt et al. 2021). To mitigate such contextual variability, Dove and Honigsfeld (2010) propose seven different models that can be used flexibly, depending on the goal of instruction and the needs of the particular learners. Regardless of specific coteaching models, a clear conceptualization of the task is crucial, including explicit roles and responsibilities of each educator, explicit goals for language development in the curriculum, and explicit mechanisms for monitoring, evaluation, and feedback (Davison 2006).

Gaps in the Literature

While the existing literature provides a wide variety of research-based recommendations for supporting emergent multilingual learners in science, we noticed two critical gaps. First, most of the studies and recommendations we found were situated within classrooms where most emergent multilingual learners spoke the same native language. Some studies from Europe (e.g., Siry and Gorges 2019), South America (e.g., Garzón-Díaz 2018), and Africa (e.g., Msimanga and Lelliott 2014) do report on classrooms where students spoke a few different native languages. However, these studies do not sufficiently address the complexity of super-diversity and multiculturalism brought by students who have a wide variety of migration stories, languages, and countries of origin. Second, we noticed a surprising lack of students' voices. That is, existing studies tend to center on teacher's dispositions and practices or limit student data to measures (or observations) of student performance. Only a few studies centered on the experience of the students themselves, as told in their own words (e.g., Garzón-Díaz 2018). In the few studies that do focus on emergent multilingual students' experiences in science class, those students tended to speak the language of instruction at higher levels of proficiency, giving little voice to newcomers and/or students with beginning fluency. Our study attempts to address these important aspects of the literature around supporting the science learning of emergent multilingual students within multicultural classrooms. Most importantly, we aim to give voice to multilingual students of all levels of language proficiency who are learning science in linguistically super-diverse schools, especially where their teacher does not share their native language(s).

Our Study

Given this literature backdrop, we ask the three following research questions (RQ):

RQ1: What instructional practices do RHS teachers use to facilitate EL students' science learning?
RQ2: How do EL students experience teachers' implemented instructional practices?
RQ3: What are the challenges of linguistic super-diversity that existing literature does not sufficiently address?

The current study is part of a larger research project that aims to design and provide science teachers' professional learning focused on improving their support for ELs in linguistically super-diverse and multicultural classrooms. To design professional learning experiences supported by an ethnographic understanding of RHS, we visited RHS once per week over one school year during the first year of a 4-year project. In our visits, we engaged as participant observers (Spradley 1980) in 88 class periods in science and English as a New Language (ENL) classrooms, writing field notes (Emerson et al. 2011) for each class period. We included ENL classrooms to observe any potential differences in student engagement compared to the science classes. We also conducted ethnographic interviews (Spradley 1979) with 11 science teachers, 4 ENL teachers, 2 school tutor/translators, 2 school administrators, 2 district personnel in the department of English Learners, and 23 multilingual students who were classified by the school as ELs. Students' English proficiency levels included Level 1, Entering (2 students); Level 2, Emerging (7); Level 3, Developing (7); and Level 4, Expanding (7). Student participants included speakers of 20 different languages, including several Burmese languages (Hakha, Burmese, Zomi, Zophei, Falam, and Lautu), Spanish, Kurdish, Arabic, Swahili, Kibembe, and Kinyarwanda. Twelve students spoke three to six languages, and five students utilized interpreters to facilitate their interviews.

We analyzed our data thematically (Braun and Clarke 2006). We inductively generated codes to analyze the raw interview data with respect to answer RQ1 and RQ2, resulting in 11 codes (e.g., translanguaging, peer interactions). We then organized those codes into four categories, driven by the themes from the literature review (i.e., teacher dispositions, engaging in authentic sense-making practices, classroom assessment, and utilizing human resources). We then looked across preliminary findings of the various data sets (student interviews, teacher interviews, admin/staff interviews, classroom observations) for connections between teacher practices and student experiences. The original codes that were not addressed by the literature such as the complexities of grouping in a super-diverse setting were included in the findings of RQ3.

Our Learning

We present our findings to the three research questions. While we drew on all of the different data sources we collected (teacher/staff interviews, student interviews, classroom/school observations, especially in answering RQ3), the primary source of data is interviews with teachers (RQ1) and students (RQ2). In answering RQ1 and RQ2, we organize the findings within the four areas of practice recommended in the literature: teacher dispositions, sense-making, assessment, and utilizing human resources. Our answer to RQ3 reports some aspects of teaching science in linguistically super-diverse classrooms that have not been adequately addressed in the literature, focusing on using materials written in students' home language(s) and peer collaboration.

Research Question (RQ) 1: What Instructional Practices do RHS Teachers Use to Facilitate EL Students' Science Learning?

Teacher Dispositions. Science teachers at RHS implemented instructional practices grounded in positive dispositions toward teaching ELs, such as building relationships, connecting to students' personal experiences and interests, and challenging EL students in science. Many teachers at RHS were supportive of the linguistic super-diversity and multiculturalism in their school. As Ms. Lanza shared, "You can hear multiple languages in the hallway just standing on hall duty. And so, that's really neat and I think it adds just worldliness to the building that's really cool." Accordingly, Ms. Zurskey stressed the importance of interpersonal relationships with students, saying, "I think that what it all boils down to is having a good relationship with kids no matter where they are, who they are, where they come from." Some teachers tried to connect to students' experiences to further their learning. For instance, Ms. Lanza explained that in her life science class, she chose ecosystem examples from countries that some of her students came from, such as Burma and Guatemala. This practice of drawing from students' experiences recognizes that EL learners have different and useful knowledge that would be meaningful to include in science discussions. Finally, RHS teachers recognized ELs' potential and held them to high standards. Ms. Sharp explained, "I'm like, 'I know you're able to do more than you're doing right now. I've seen you write; I've seen you answer questions. You can do a little bit more than you're doing right now." Challenging ELs cognitively appears to help them gain a sense of responsibility that does not patronize and essentialize them to their EL status.

Scientific Sense-Making. Science teachers at RHS supported students' sense-making by utilizing peer interactions and promoting multimodal expressions. For instance, science teachers sometimes paired/grouped students in their classrooms to foster students' peer interactions. Ms. Shale extensively employed students' group work to create a cooperative learning environment in her classroom where students could leverage any student in the space to support science learning: "All my classes are pretty active, and we work in groups all the time. My kids understand what the expectations are, and they understand that they're here to help one another." In particular, she built a cooperative learning environment by setting norms (i.e., expectations) that students are there to help one another accomplish learning goals. In assigning students to groups, Ms. Lanza considered students' English proficiency, saying, "I would make sure that their [ELs'] partner was a native speaker [of their shared home language]. When one doesn't understand it in English, the other one really quickly says it in their native language, and they're like, 'Oh, okay good.'"

Moreover, science teachers talked about how students use visuals and multiple languages to communicate scientific ideas. For example, Ms. Shale explained that in her physical science course, she allowed students to draw ideas if they could not write about them, "I think [ELs are] totally capable of drawing it and showing what it means. So, I [let students draw] a lot for new concepts." In one class, we observed Ms. Lanza encouraging a student to use a term from the student's native language (Spanish) on a written assignment when she could not recall the word in English. Ms. Lanza explained that she took the responsibility to look up these words when reading the students' responses. Here, Ms. Shale and Ms. Lanza share the multimodal labor with the students by allowing them to present their sense-making in different ways.

While we acknowledge that RHS teachers supported ELs' sense-making by utilizing peer interactions and promoting multimodal expressions, we also recognized that their classroom practices (as represented in our field notes, collected curricular artifacts, and student interviews; see below) did not always align with recommendations from the literature for engaging students in scientific practices, wherein students share the responsibilities of knowledge co-construction. In RHS science classrooms, scientific knowledge was generally provided by the teacher to the students, with the teacher positioned as the primary evaluator of student knowledge. For example, we observed PowerPoint presentations that included mainly Initiation-Response-Evaluation discourse (Mehan 1979), verification labs (see Herman 1998), and classwork that involved rote problem-solving.

Classroom Assessment. Science teachers at RHS commonly used multiple-choice summative assessments (e.g., chapter tests) and, in many cases, created alternative (modified) versions for ELs. In particular, the biology teachers collaborated to create an EL version of every chapter test over the course of the school year. In addition, science teachers sometimes made these modifications in "real time" if a student expressed confusion over wording, while they were completing the assessment. Most often, the modifications included reducing the number of answer choices, simplifying the language of the questions and/or answer choices, and/or allowing more time. A few teachers, however, incorporated multimodality in assessing students' learning by allowing students to use verbal rather than written responses. Ms. Shale explained, "A lot of times it's trying to figure out are they better at putting it down on paper, or are they better at speaking it to me? There are students that I know can come up to the board and do a problem, and explain it, but then when they sit down for their tests, I can see that they're struggling with actually getting those thoughts out on paper. So, sometimes I'll just ask them, and have like a verbal [conversation] then I know if they know it. It's like, okay, I can kind of assess them in different ways." Overall, most assessment practices at RHS did not necessarily align with practices recommended in our literature review, as RHS teachers had not yet received any professional learning support specifically targeted at designing assessments for ELs. Several teachers explicitly expressed a desire for support in this area.

Utilizing Human Resources. To better support its many ELs, RHS utilized educators in two main roles: English as a New Language (ENL) teachers (licensed to teach English as a Second Language as a content area) and tutor-translators. ENL teachers taught ELs who were assigned to ENL classes according to their English proficiency level (World-class Instructional Design and Assessment [WIDA] level 1–4). They engaged their students in real-world language use, such as creating an event flier (ENL 1) and writing college applications (ENL 4). They also served as resources to content area teachers whose classes included ELs and collaborated with them through co-planning and coteaching. For example, Ms. Pratt co-designed and taught a lesson with social studies teachers in which students represented their immigration stories using large world maps. However, such coteaching was infrequent and limited to social studies and English language arts teachers. RHS employed three tutor-translators who are fluent in English and one or more languages spoken by RHS students. While multilingual oral proficiency was a hiring criterion, tutor-translators were not required to have formal post-secondary preparation in education or any particular core content area. Tutor-translators supported ELs in a number of different ways. Instructionally, they provided one-on-one or small group support to ELs, either in core content classrooms or in the tutor-translators' office. They frequently supported ELs taking classroom assessments by reading the questions (and, if applicable, answer choices) aloud in the students' native language. They also served as language interpreters during meetings between school staff and parents. In some cases, they served as cultural brokers, helping both parents and staff understand each other's cultural practices and ways of knowing. For example, Htet, fluent in English, Burmese, Hakha, and Falam, explained that on one occasion, she mediated a conversation between a school counselor and Chin parents regarding how to perceive their different cultures and respond to students' mental health issues in very different ways.

While ENL teachers and tutor-translators played a critical role in supporting ELs in their own capacities, a collaboration between science teachers, ENL teachers, and tutor-translators was limited by a number of factors, including logistics and lack of explicit structure or support. For example, RHS's teaching schedule did not allow co-planning or coteaching between many ENL and science teachers. Moreover, the ENL department chair Ms. Pratt was told by the school's administration, "Don't go beating people [content area teachers] over the head. Let people come to you." As a result, the interactions between ENL and content area teachers tended to be somewhat superficial and limited to exchanging information about particular EL students (e.g., their English proficiency level), as opposed to discussing instructional strategies for ELs. Similarly, tutor-translators had limited interactions with teachers. Htet explained, “the only time the teacher will contact us will be if they need the students to take a test in the [Tutor-translators’] office.” Neither ENL teachers nor tutor-translators had been offered professional learning support to expand their collaboration with science teachers in the service of supporting ELs’ science learning.

RQ2: How do EL Students Experience Teachers’ Implemented Instructional Practices?

Teacher Dispositions. Student responses emphasized the importance of having a caring teacher who intentionally attempts to connect with them, makes them comfortable to ask questions, and assumes that they want to learn, even when they are silent. Aung described Ms. Zurskey in this very way, saying:

> When I struggle, and I don’t want to say [that I am struggling], I stop doing anything, and I just sit still, [even though] I still have a question that I need help. She come to me and ask me, ‘What do you need help with?’ She just really kind, she look every student if they’re on the right track and if they’re like, left behind.”

Alongi argued that teachers should make more efforts to connect with students to help their learning. When asked what he wants science teachers to know to help English learners, he said, “First, for them [teachers] to know that there’s a barrier. . .a language barrier. Like, he [an EL] doesn’t speak English, will not get up or talk too much and would just stay quiet and just doing his own stuff. Maybe he wants to learn something.” Alongi’s response emphasizes that teachers of ELs should not mistake ELs’ silence in the class for a lack of wanting to learn. He further suggested, “So you [teachers] have to make him [an EL] a plan to discuss it. To make him more comfortable. Like, to work with him, to discuss with him more often.”

A few students’ responses also reminded us of the importance of teachers being familiar with their students’ cultures and understanding how multicultural assumptions and practices can interact with science learning at school. For example, Aung, a Burmese student, explained how some aspects of the RHS biology curriculum made her feel uncomfortable, especially when taught by a teacher of a different gender: “In biology, the sex cell, those stuff, it’s uncomfortable. When he say it, he’s a guy, and then when he talks, it, like – I don’t know. In Burma, we don’t really talk about [that]. It would be inappropriate and disrespectful to talk about it.” Aung suspected that her teacher was not aware of her discomfort or the potential discomfort of her Burmese peers.

Scientific Sense-Making. When asked about their classroom learning experiences, students talked about the general instructional routines of their science classrooms, the multimodal affordances of science labs, and working with other students. When describing their typical experiences in science class, students talked mostly about taking notes, reading, doing worksheets, and taking quizzes/tests, which aligned with our own observations of science classroom practices. Dominic summarized this routine by saying, “She [my science teacher] gives us worksheets to work on, two to three papers a day, and we just look on the book that she gives us and look up the answers in there for tests and things. So, pretty much the same thing every day.”

Two exceptions to this routine that students described included lab work and class partner/group work. Overwhelmingly, students appreciated opportunities to learn in the science lab, often citing the visual affordances that the lab offers. As Adnan described, “Here in America, he [my science teacher] show me everything. Like, if he’s talking about DNA, he show me DNA, what is it. But in my country, he just like explain. Just words, and that’s it.”

In addition, students generally appreciated opportunities to work on class assignments and activities with partners or a small group (as opposed to working alone). For example, Nibban explained, “I want to work with others, because they help me sometime... one of the white boys, he is so good in Physics, so he help me a lot. Everything I don’t know, ... he explain and show the work.” When working with newcomer students who speak the same language, ELs often helped them by providing translations in class. Mereyem shared, “an Arabic girl, she kind of need a little bit help. And I speak to her in Arabic and told her, like, what to do. And how, like, to finish her homework.” While Mereyem liked to translate for other students, Dominic pointed out the drawbacks of working with peers in this way. He explained, “Last year, there was a kid that didn’t speak English, so [my teacher] told me if I could help him, and I was translating for him and everything. I was like, ‘Hm. I’m not doing my work because of this.’ I understand that he needs help and all that, but I’d rather do my work. Last year, I didn’t really had time in class when I had to translate.”

We highlight that a closer look at students’ interviews suggests how they perceived the nature of learning. For example, in Jacques’ description of partner work, he notes, “if you feel like this [answer] is supposed not to be like this, then we’d get to ask a teacher.” Here, his description suggests that he might view teachers as having the sole authority to evaluate knowledge. Similarly, Mereyem explained that she would ideally like to do a lab, “like every three weeks, but not, like, all the time. Because it would be good if we have a little bit of time to kind of learn about words, definition, and how things work. And then just do an experiment to see how it look like in real life.” Mereyem seemed to perceive that science learning is mastery of definition and declarative knowledge through teachers’ lectures, and lab activities are opportunities to verify science content previously introduced in class. We note that this transmission approach to learning and teaching (Cohen 1988) is consistent with our observation of classrooms (as discussed in the RQ1 findings above). Furthermore, we argue that students’ perception of learning as knowledge transmission is also shown in how they often described peer collaboration as “helping” (e.g., Nibban, Mereyem, and Dominique). That is, the purpose of peer collaboration is to deliver knowledge from more knowledgeable (often native English speakers or ELs with advanced English proficiency) to less knowledgeable students (ELs in all proficiency levels, but particularly in lower proficiency levels), as opposed to collective engagement in authentic sense-making practices and co-construction of knowledge.

Classroom Assessment. The students had varying experiences with RHS science teachers' assessment practices. For example, Meryem expressed appreciation for her teacher's willingness to provide assessment support on-the-fly, saying, "She does not just give you the answers. She asks, 'What do you remember of this?' So it's still me, the one who is doing it, but it's better when someone kind of explains to me, and asks me." While many students appreciated having an EL version of an assessment, a few students reported that being given the EL version of a test made them feel "othered" (MacQuarrie 2010), especially when the EL version was printed on a different color than the unmodified tests their peers were given. Aung explained, "One time my teacher would give Test A and B, right? I'm the only one B, and the color's different. Why do I have to have a different color?"

Utilizing Human Resources. While coteaching is highly recommended in the literature, none of the students we interviewed experienced any coteaching and other types of collaboration between their science and ENL teachers. However, many students described a wide variety of perceptions of and experiences with the school's tutor-translators. Some students regularly visited the tutor-translators' office for language support on homework and especially for assessments or expressed a desire for a tutor-translator who spoke their language (e.g., Kinyarwanda, or Zomi) at RHS. Other students reported that they had no desire for a tutor-translator who speaks their language at RHS, never visited the tutor-translators' office, or did not wish that a tutor-translator would visit their science classroom. They offered multiple explanations for these dispositions. For instance, Nin explained, "I don't have time to go there" [the tutor-translators' office]. Even in their science class, San pointed out, "[If] I'm going to ask [my teacher] that, then the interpreter would have to explain to me, so it kind of takes long [time]." Suu expressed a different perspective, in terms of valuing his personal freedom at school. He explained that while he might utilize the tutor-translator during a test, he would not visit their office during his study hall, because, "Study hall's my free time, so I relax and I sleep." He also explained his resistance to in-class support in terms of feeling surveilled, saying, "If he [the tutor-translator] come in every time in the class, I don't want someone who is always watching me." Nin explained that he would not utilize a tutor-translator in his science class, "because I get more understanding point from teachers than by asking [a tutor-translator]." Perhaps, this is because the tutor-translators are not necessarily trained in content areas.

Some students described their resistance to utilizing the tutor-translators in terms of not wanting to feel othered, especially if they were the only EL or the sole speaker of their native language in the class. For example, Mar contrasted his previous (positive) experience with in-class support at a previous school versus his reluctance to utilizing an RHS tutor-translator's support:

> So in my old school, the difference is we are about five students who has very limited English. So we all are in the same class and I feel better, and then we have a special teacher for us. But here, every classmate that I have are good in English. So the reason why I don't like being helped [in class by a tutor-translator] here is because I don't have other friends that would be with me.

One of the tutor-translators (Htet) corroborated Mar's experience, saying:

> A lot of kids, they don't want to ask for help because they feel different from the other students. Even if they have questions they won't really talk because they are sitting with other students and we have to go beside them and talk to them in their own language. They won't ask questions. They're just trying to fit in.

RQ3: What Are the Challenges of Linguistic Super-Diversity that Existing Literature does not Sufficiently Address?

Using materials written in students' home language. The research literature recommends that teachers of emergent multilingual learners use multilingual curricular materials written both in the language of instruction and students' home languages, to fully utilize students' literacy proficiency (Buxton et al. 2019; García 2009). At RHS, this recommended practice is complicated by a number of considerations. From a practical standpoint, the sheer volume of languages spoken by students at RHS, in this case over thirty, creates obstacles to translation and interpretation. For example, the school and district employed only a few tutor-translators; thus, they did not speak all of the students' various home languages. Furthermore, the head of the district's English learners department made clear that the tutor-translators were hired based on their oral but not their written language expertise and should not be asked to translate written materials from English to other languages.

Another issue of translated materials that surfaced during student interviews is the degree of linguistic difference between English and some students' home languages. For example, when asked whether they would prefer to use instructional and/or assessment materials written in their home language(s), Kinyarwanda speaker Luc replied, "Yes but not everything. 'Cause there's some words in English that there's not [in Kinyarwanda]." Other students pointed out that translated materials would not be helpful to them, because they do not read or write in their home language(s). As Nyein shared, "Zophei, we don't know how to write it."

Taken together, these issues complicate the notion of using instructional or assessment materials written in students' home languages (see Buxton et al. 2019 for an example). It would be practically challenging and a costly undertaking for the district to provide materials in all of the home languages spoken by RHS students. Furthermore, translation of content materials can be useful if the target languages are closely linguistically "related" to English (e.g., Germanic or Latin-based languages), and Western science is practiced in that target language. Otherwise, a simple translation of materials might not be adequately supporting student learning. Even with the best translations, students whose schooling and thus home-language literacy have been delayed, disrupted, or altogether nonexistent would have little use for such materials. While we do concur with the existing literature that providing students with materials written in their home language can support their science learning, our study sheds light on the constraints to this approach in linguistically super-diverse and multicultural contexts.

Peer Collaboration. While literature recommends intentionally assigning students to pairs/groups in ways that engage them in collaborative science sense-making and develop English proficiency, our study highlighted complexities around this recommendation. Our student participants talked in detail about pair/group work, highlighting that *with whom* they worked was critical to their experience. Namely, (1) speakers of their home language(s), (2) monolingual, native English speakers (NESs), and (3) English learners with whom they did not share a home language such as a native Hakha speaker working with a native Spanish speaker. Although most students agreed with the importance of the linguistic background of partners, their preferences varied widely.

For example, many students prefer to work with fellow speakers of their home language, because they can best communicate with them about challenging science concepts. Hakha speaker Nyein shared:

> They [NESs] say English, they explain it really hard. They understand [the science], but if they're [explaining] to somebody else it's really hard to say that. But a Hakha person, if she speaks to me in Hakha, it's more easier to understand what's [explained].

In contrast, Luc explained that he would not feel comfortable speaking Kinyarwanda to fellow native speakers in class, "Cause every time I speak Kinyarwanda, everyone being like, 'What you saying? What? What?'" He suspected that students' reactions stemmed from the relative novelty of Kinyarwanda at RHS, as well as "how we speak" – referring to the enthusiastic gestures and volume typical of Congolese language practices.

Students also talked about a wide range of experiences in working with NESs. They explained that she prefers working with NESs because "I get a lot more done." Other students talked about leveraging opportunities to work with NESs to develop their English skills. Meryem explained, "he [a NES] would talk to me even though it was really hard for me to understand. But it kind of helped me because he was helping me to learn English. He was benefiting me." However, not all students enjoyed working with NESs for a variety of reasons. A number of students reported being laughed at by NESs when trying to speak English with them in the past and thus were now hesitant to work with them in general. Other students attributed their reluctance to the ways in which White, native English-speaking students interacted with them. Phan explained, "I'm strange about White people, I'm not racist or something, but I kind of think, like, they're bossy or something… We [Zomi-speaking students] don't talk to each other like that."

Finally, the students generally reported positive experiences working with fellow ELs who do not share their home language. For example, Yavin shared:

> It's easy to talk to someone that English is not his first language. You know? 'Cause he can understand you and you can understand him, 'cause it's not his first language. So the accent going to be like, not perfect and like, he would get it.

When asked about their preferences for working with others, several students pointed out that relationship between students is more important than their native languages or English proficiency. Mar explained his pairing preferences, referring to his relationship with a particular native English speaker (versus students who share his home languages):

> It all depends on whether we get along, because the guy who helped me with my English, he's really nice and he's always willing to help me. So, whether they speak Burmese or Zomi, if they're not willing to help, it doesn't work.

These students' responses remind us of the delicate and complicated nature of intentionally pairing and grouping students. On the one hand, students must have opportunities to use their home language(s) with others in the service of engaging in science class more meaningfully. On the other hand, students also need opportunities to use the language of instruction for this engagement and to hear the language of instruction language modeled by people other than just their teachers. Moreover, students' responses suggest that some students might have experienced discrimination and micro-aggression on the basis of language (Lippi-Green 2012). Beyond language considerations, successful pairing/grouping also depends on interpersonal relationships and cultural norms both in and out of the classroom. Thus, a teacher's "intentional" pairing/grouping of students is likely to have both pros and cons for individual students, requiring teachers to consider the various affordances of pairing/grouping choices and to be flexible with those choices.

Points of Interest to Consider

The faculty and staff of RHS and its school district have worked very hard to support the school's rapidly and constantly changing student population over the last decade, as immigrants and refugees from all over the world have resettled in the Riverview area. Such multicultural support includes creating an ENL department, providing a daily planning period for ENL department chair to support content area teachers, and hiring tutor-translators in several most commonly spoken non-English languages. However, teachers' and students' experiences at RHS highlight the importance of understanding the nuances and complexity that linguistic super-diversity and multiculturalism bring to bear on science instruction. Here, we discuss the challenges and opportunities for supporting science instruction in linguistically super-diverse and multicultural learning environments.

Challenges of Implementing Instruction in Multilingual and Multicultural Settings

Linguistic and cultural super-diversity make it challenging to adopt some instructional practices recommended for teaching emergent multilingual students. As we articulated in the previous section, providing translated materials to students is not only impractical but also questionable in terms of its usefulness when students' home languages and countries do not practice Western science. Publicly available translation services such as Google Translate do not contain the vocabulary and linguistic nuances necessary for accurately translating Western science concepts to language dialects like Hakha, Zomi, Zophei, Falam, and Lautu. Some students within our study even identified that they do not read or write in their home language(s), making translated materials completely ineffective.

Furthermore, Fredholm (2019) found that overall using translated materials did not lead to long-term vocabulary development for students, negating positive pedagogical effects. Because learning is a product of using language within social interactions rather than a precursor (Lee et al. 2019), providing translated materials is not the ultimate solution for supporting emergent multilingual learners in science learning and language acquisition. As a field, we are in urgent need of identifying teaching practices that engage emergent multilingual students in learning science and English while also maximizing their linguistic resources in linguistically super-diverse and multicultural classrooms.

Linguistically Super-diverse and multicultural classrooms can also complicate the facilitation of peer-to-peer interactions. While teachers may want to group students to maximize the use of students' linguistic resources, other factors such as language proficiency, home language, and social identities play a role in determining the success of peer collaboration. For example, teachers may be eager to pair students with similar national origins as a good classroom management solution, but this could only be successful if they realize, and plan for, the influence of language proficiency and home dialect on peer collaboration. Emergent multilingual learners are not a monolithic group, so even when students share the same native language or dialect, they can differ on migration channels, immigration statuses, countries of origin, and religions. Differences in migration histories and educational backgrounds also tend to influence how students are perceived by their peers in the classroom. Often peers' perceptions as well as students' understanding of how they are positioned in the classroom shape how they engage in their classes and interact within peer collaborations. There can be tensions between students from different ethnic or religious groups that would make peer collaborations become contentious if not properly facilitated by teachers.

Within our study, teachers like Ms. Shale encouraged their science students to actively move around the classroom, setting expectations that students need to work together to learn. Ms. Shale did not restrict students to a set group; instead she allowed emergent multilingual learners the flexibility to make decisions based on their own preferences. Learning environments like those fostered by teachers like Ms. Shale conceptualize group work as a collaborative, co-constructive endeavor.

However, the majority of the group work at RHS in science classrooms did not appear to support knowledge co-construction, but rather served as another channel of knowledge transmission from self-perceived “more knowledgeable” students to “less knowledgeable” students and more English-proficient to less English-proficient students. In some cases, this channel of transmission reinforced differential power dynamics between and among ELs.

In addition, our observations and interviews suggest that science teachers at RHS often take traditional science teaching approaches wherein teachers deliver knowledge to students as the sole authority. Some teachers found it challenging to draw out emergent multilingual students’ experiences of scientific phenomena, as they did not have knowledge about the rich experiences students bring from their home countries. Specifically, many of the experiences which emergent multilingual students bring to the classroom may differ from the examples teachers typically use in less diverse classrooms. Science teachers’ lack of knowledge with the experiences which emergent multilingual students bring with them can greatly affect participation in laboratory experiments to a point that the purpose of labs to explore and investigate becomes confined to replication or confirming learned knowledge. Despite the efforts of science education policy makers, scholars, and district-level specialists to incorporate science and engineering practices in K12 science education, it appears that such efforts are not yet translated into regular practice in many science classes. Limited curricular resources and professional learning opportunities constrain teachers’ abilities to facilitate their students’ engagement in authentic sense-making through laboratory experiments and to foster students’ epistemic agency.

Opportunities for Encouraging Multiculturalism

School-wide and classroom-wide culture are crucial in successfully supporting emergent multilingual students and newcomers. While teachers at RHS appreciated the diversity in the school and demonstrated positive disposition to EL students, our student participants reported feeling othered when the support provided intentionally or unintentionally marked them as different. Such feelings of othering appear to be more severe for students who use infrequently spoken languages, especially when they are the sole speakers of the language in a classroom such as Kibembe. As described above, well-meaning instructors within linguistically super-diverse and multicultural settings may feel inclined to just group them with other non-native English speakers without realizing the specific needs of their emergent multilingual learners.

Our study shows that emergent multilingual learners have their own preferences when collaborating with peers that teachers may not be aware of. If flexible collaborative groups like those found in Ms. Shale’s classrooms cannot be achieved, we encourage science teachers to involve emergent multilingual learners in the designing of their learning environments. For example, some students like Nyein mentioned that they enjoy working with fellow Hakha speakers because they can translanguage while learning challenging science topics. However, some students like Luc do not feel comfortable speaking Kinyarwanda because other students are always curious about what they are saying. Most importantly, students like Meryem explained that they actually prefer working with native English speakers because they are able to get more work done and practice their English. Although it may not be possible to fulfill all their preferences, by involving them in the designing of their learning environments, teachers and students can have opportunities to learn about the concerns and perspectives of students and find ways to improve the activity structures to facilitate everyone's learning.

Meryem's insights, as noted above, illustrate two additional points: (1) emergent multilingual learners often serve as informal translators for less English-proficient students, which can become burdensome for the more English-proficient students, and (2) learning English is a major goal, not just a means to an end, for some emergent multilingual learners. Leveraging emergent multilingual learners' languages and multicultural practices as assets should not include using other EL students merely as supplemental instructors. While students supporting one another's learning are highly encouraged, multilingual learners with higher English proficiencies should not be held *responsible* for the learning of their peers with lower English proficiencies. Instead, it is the responsibility of instructors to support the development of intercultural competence to foster cultural awareness and collaborative practices within their classrooms.

Intercultural competence refers to "the ability to communicate effectively and appropriately in intercultural situations based on one's intercultural knowledge, skills, and attitudes" (Deardorff 2004, p. 184). Schwarzenthal et al. (2020) argue that the presence of a diverse group alone does not automatically promote intercultural learning. Encouraging intercultural learning can be accomplished through explicitly incorporating cultural content in the course curriculum. For example, Mensah (2021) found that by developing professional learning communities within an intensive science methods course, preservice teachers learned to "see the benefit of teaching science as Transformation and Social Action not only for their students but also for themselves as multiculturally-minded science curriculum developers" (p. 25). Although Mensah's study has direct implications for preparing future science teachers, it also illustrates how teachers who are working within linguistically super-diverse and multicultural settings can position themselves as a professional learning community (PLC) that is committed to supporting emergent multilingual learners. Such PLCs could include the expertise of both science teachers and English as a New Language (ENL) teachers to integrate more cultural content within science curricula.

Conclusion

We are not yet at a place to offer concrete answers to these concerns as science teaching in linguistically super-diverse and multicultural contexts has not been much researched. Yet, drawing on literature, we would like to suggest a few pedagogical and cultural reforms within a school, with caution. First, we believe that supporting emergent multilingual students' science learning requires high-quality curricula and assessments designed to center student *sense-making*, combined with intensive, long-term, job-embedded professional learning support for teachers. Thus, teachers' professional learning should go beyond tips and tricks of teaching emergent multilingual students, supporting teachers to reconceptualize teaching and learning as co-construction of knowledge that engages students of all backgrounds. Second, successful students' interaction (including the use of multiple languages for sense-making) requires the design of more group-worthy tasks, with embedded supports and explicit training for students to communicate and evaluate ideas within the group (Cohen and Lotan 2014). Third, we believe that while it is important for teachers to hold asset-based dispositions toward working with emergent multilingual students, it is equally important for *students* (especially native English speakers) to view their emergent multilingual peers from an asset perspective, to maximize partner/group work. Finally, providing supportive mechanisms for emergent multilingual students as they transition from emergent to proficient multilingual learners would be helpful. These supports could include (1) providing individualized guidance that considers learner's strengths and needs beyond English language proficiency when assigning them to a defined cohort; (2) creating formal and informal peer mentorship structures; and (3) engaging with students' families and other local support networks to learn about more about students' cultural funds of knowledge (Moll et al. 1992).

Having reviewed our existing data, we have many remaining (and new) questions about supporting emergent multilingual students in linguistically super-diverse and multicultural science classrooms. For example, which strategies work best for teachers to build relationships with students who speak little of the language of instruction in class? How can teachers best pair/group students to maximize emergent multilingual students' participation in collaborative sense-making and to develop their literacy skills in multiple languages? What kinds of classroom community-building activities support asset-based views of emergent multilingual students, especially among White, native-English speaking students? How might science teachers and ENL teachers best leverage each other's expertise, and what supports would that collaboration require? How might the tutor-translators (or other classroom paraprofessionals) be best utilized to support emergent multilingual students' science learning? How can science learning itself be understood multiculturally? How can the school, teachers, and fellow students accommodate the needs of emergent multilingual students in ways that do not make them feel like "others"? What kinds of curricular materials and assessments best support emergent multilingual students' participation in authentic science sense-making, and what kinds of professional learning opportunities best support teachers in leveraging these resources?

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