OpenSciEd and Emerging Multilingual Learners

Who are emerging multilingual learners (EMLs)?

We intentionally use the term emerging multilingual learner (EML) because it is asset-oriented, highlighting students' multiple resources and knowledge of languages in addition to English (Garcia, 2009). Nearly 5 million students, or 10% of the total student population in the United States, are EMLs (NCES, 2019)[1]. EMLs are not a uniform student group. The term EMLs captures an extremely diverse group of students that vary amongst many factors, including (but not limited to) race, family and schooling backgrounds, immigration circumstances, generational status, languages they know and speak, English language proficiency, and the types of programmatic supports they might be receiving (or have received) in school to address their English language development (NASEM, 2018). Most importantly, EMLs bring into our classrooms multiple resources, as well as rich lived experiences and ideas about how our natural world works. As a student group who has historically received unequal access and inadequate instruction in science (Hakuta, Santos & Fang, 2013; NASEM, 2018), it is critical that teachers learn to notice, value, and leverage their EMLs' contributions in the classroom.

Why is it important to focus on EMLs when considering the instructional shifts called for by the Next Generation Science Standards (NGSS)?

The vision set forth by the NGSS calls for major shifts in the teaching and learning of science, where students learn in the context of puzzling phenomena and engage in authentic science and engineering practices (SEPs) as they seek to make meaning of these phenomena (NGSS Lead States, 2013). The emphasis on SEPs builds on prior reforms that used the concept of "inquiry" to highlight that students should actively generate knowledge (Schwarz, Passmore & Reiser, 2017). Adding specificity to what inquiry entails, SEPs more clearly articulate the ways students ought to collaborate with peers to develop understandings of natural phenomena, or to solve design problems (National Research Council [NRC], 2012). To meaningfully engage in these SEPs, students must use language in increasingly complex ways (Lee, Quinn & Valdés, 2013). For example, when engaging in argumentation through talk, students must employ various linguistic functions (e.g., listening and speaking) in real time as they take in their peers' ideas, make sense of them in light of their own thinking, and respond in ways to further the groups' understanding of the topic being debated (González-Howard, McNeill, Marco-Bujosa & Proctor, 2017). These language demands present opportunities for EMLs to tap into their language resources and assets, but could also bring about potential challenges if certain English language needs go unaddressed.

How is language used for scientific sensemaking?

A major function of language is to provide a way for us to make sense of the world and to share that sensemaking with others. In science, we make sense of phenomena using both linguistic (e.g., speaking, writing) and non-linguistic forms of communication (e.g., graphs, models, charts), which provides learners of science with many different ways to access new content and share how they are making sense of these phenomena (NASEM, 2018). When considering what these language demands mean for EMLs, the tendency has been to focus on students' English language development first, believing a certain threshold of English is needed to learn science. However, science learning and language development mirror and support one another (Lee, Grapin & Haas, 2018), and should not be viewed as two separate processes.

Phenomenon-driven science instruction provides EMLs with authentic contexts and purposes for which to use their developing language(s) and supports students with making sense of the phenomenon being explored (Spycher, González-Howard & August, in press). Moreover, as the content students learn becomes more sophisticated, so do the ways students end up using language to make sense of it (Lee et al., 2018). It is of utmost importance that teachers deeply understand the ways language is used for scientific sensemaking to ensure that all students, particularly EMLs, have equitable learning experiences in the science classroom. Understanding the role of language in sensemaking includes valuing the assets EMLs have, as well as identifying and attending to the challenges they might encounter when engaged in reform-oriented science instruction (González-Howard, Andersen & Mendez Perez, in press). EMLs have many meaning-making resources, which teachers can learn to see and acknowledge in their classrooms (Lee et al., 2018). Focusing on these assets can allow teachers to leverage students' prior conceptions and knowledge about science concepts being covered. This helps make learning experiences more meaningful to EMLs, positioning them as valuable contributors to the classroom community's knowledge construction work. Furthermore, thinking about potential challenges that EMLs might face can allow teachers to come up with solutions to better support their students' needs.

How does OpenSciEd support EMLs?

There are two primary ways that OpenSciEd supports EMLs: 1) through the curricular design and pedagogical routines that are at the heart of its instructional model, and 2) through educative features embedded in the teacher materials. The curricular design and routines of OpenSciEd grounds students' learning experiences in real-world phenomena. For instance, a 6th grade unit on thermal energy is anchored in students figuring out - *how can containers keep stuff from warming up or cooling down?* In this approach to science learning, students are not just learning canonical science ideas, but instead are working with peers to figure out their own understanding of - and even designing their own solutions for - real problems that occur in our natural world. When the phenomena are relevant and accessible, EMLs are better able to contribute and build from their previous understandings about the phenomena (Spycher et al., in press). As mentioned earlier, engaging in phenomena-driven science instruction also simultaneously supports EMLs' science learning and language development (Lee et al., 2018). Furthermore, the various pedagogical routines embedded in the OpenSciEd instructional model - including, the Anchoring Phenomena Routine, Investigation Routine, Problematizing Routine, and Putting the Pieces Together Routine - encourage EMLs to use their multiple meaning-making resources, and provide students with numerous opportunities to make their ideas public through both linguistic and non-linguistic modes of communication. OpenSciEd teacher materials also include educative features focused on EMLs. These educative features support teachers in considering whether particular learning moments might be spaces where they can leverage their EMLs' assets and/or address potential challenges their students might encounter. Often appearing as supplemental text on the margins of lesson plans, these features help teachers provide additional in-time support and explain why these instructional moves are important for EMLs. These educative features range greatly, from suggesting particular ways to group students to unpacking the meaning of certain words in the context of science.

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[1] This is likely an underestimate because these numbers only reflect students who have been legally identified as English Language Learners (ELLs) and thus entitled, through state and federal laws, to academic coursework with specialized support to help them reach certain thresholds for English proficiency.

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