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Ting, Tang, Tong: 3rd Grade Emerging Bilingual Students Explaining Sounds

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OVERVIEW: We study how emergent bi/multilingual 3rd grade students investigated a guitar-like instrument and created and used onomatopoeias to unpack the physics of why the strings produced specific sounds.

AUDIENCE: Administrators (K-12); Assessment developers; District science coordinators; Grant funders; Instructional designers; K-12 science teachers; Professional development providers; Researchers/Research supervisors; Science education leaders; Secondary science teachers; Teacher educators; Physics educators; STEM educators; Elementary science teachers

KEY POINTS

- Multimodal and multisensory semiotic resources, such as onomatopoeias, support bi/multilingual students' sense-making.
- Third grade students constructed mechanistic explanations that connected the physical attributes of the strings of a guitar and the pitch of the sounds they made.
- Using different semiotic resources to refer to the same concept does not impede reaching consensus.
- Justice-oriented science education must transcend narrow definitions of "science talk" that are rooted in white English supremacy.

INTRODUCTION When it comes to emergent bi/multilingual students, science education has favored narrow definitions of what ways of communicating are seen as productive for figuring out natural phenomena, privileging English-based academic vocabulary. Leveraging the theoretical constructs of conceptual and semiotic resources, we argue that bi/multilingual students come to science classrooms with productive ideas, as well as multimodal and multisensory semiotic resources, which are essential for investigating the physical world. In this study, we investigate how a group of emergent bi/multilingual 3rd graders in a Sheltered English Immersion classroom investigated a guitar and created/used onomatopoeias to unpack the physics of why the strings produced specific sounds.

FINDINGS Through analyzing a discussion between emergent bi/multilingual 3rd graders who investigated the sounds a string instrument produced, we found that students created mechanistic explanations that identified how changes to the physical features of strings affected the pitch of the sounds. Specifically, they attended to how the length, the tension, and the frequency with which the strings vibrated affected the pitch – for instance, shorter, tighter strings made *ting* sounds (i.e., high-pitched). Additionally, students created and laminated multiple semiotic resources, such as onomatopoeias and gestures, when sharing their observations and offering their explanations. Finally, students proposed and used multiple words to describe the tension on a string, and this did not in any way prevent them from agreeing on a common explanatory model that accounted for the string's length, frequency of vibration, and tension – namely, students adeptly navigated both semiotic convergence and divergence as they worked towards a common idea.

TAKEAWAYS Justice-oriented science educators must work to identify, reflect on, and leave behind ideologies and pedagogical practices aligned with deficit-oriented models, which position emergent bi/multilingual students as having rudimentary communication skills that supposedly hinder them in figuring out phenomena. Science units that foreground three-dimensional learning as specified in the NGSS provide powerful experiences for emergent bi/multilingual students, especially when students can develop meaning-making practices, conceptual understanding, and languaging practices through investigating the natural world. For these reasons, we argue that – contrary to most literacy and/or biliteracy teaching practices – students do not need so-called science/academic vocabulary to engage in complex collective thinking. And the longer we hold on to the myth that there is one "correct" way or language for sharing ideas about the world, the more we will perpetuate injustices against bi/multilingual students and scientists.

Full Title: Ting, Tang, Tong: Emergent Bilingual Students Investigating and Constructing Evidence-based Explanations about Sound Production