

"How Are Acorns Equitable?": Teacher Candidate Perceptions of Immersive Multilingual Experiences

Sarah J. Lee, Vanderbilt University, sarah.lee@vanderbilt.edu
Bethany Daniel, Vanderbilt University, bethany.r.daniel@vanderbilt.edu
D. Teo Keifert, University of North Texas, danielle.keifert@unt.edu
Ashlyn E. Pierson, Ohio State University, ashlyn.e.pierson@gmail.com
Sophia Jeong, Ohio State University, jeong.387@osu.edu
Heather J. Johnson, Vanderbilt University, heather.j.johnson@vanderbilt.edu
Andrea Henrie, Vanderbilt University, andrea.henrie@vanderbilt.edu
Skye O'Beollain, The Ohio State University, obeollain.1@osu.edu
Mutia Syifa, The Ohio State University, syifa.1@osu.edu

Abstract: Multilingual learners are often marginalized in science learning environments due to deficit-oriented assumptions about their language and sense-making abilities. This paper explores how an immersive multilingual experience in undergraduate science methods courses supported anti-deficit noticing for teacher candidates. Teacher candidates participated in immersive French and Korean science lessons where multilingualism and multiculturalism were centered as resources for learning. Analyzing post-course interviews with participants who referenced the experiences showed how the immersive experiences supported teacher candidates to recognize multilingual learners' assets that support scientific sense-making. What participants recognized differed based on the language of instruction, facilitation style, and content of the activity, suggesting implications for equity-oriented research and course design.

Motivation and theoretical framing

Multilingual students are often excluded from complex science learning in schools (Lee & Stephens, 2020), usually as a result of English-only instruction that privileges academic vocabulary (Buxton & Caswell, 2020). However, recent research has shown that multilingual students bring expertise that benefits all learners and supports rich scientific sensemaking (Pierson et al., 2021, Rosebery et al., 2010). When multilingual students are marginalized, the whole learning community misses out on heterogeneity, or diversity of perspective, as a key resource for learning (Warren et al., 2020). Teachers play a role in reproducing or resisting the exclusion of multilingual learners. Supporting teachers toward greater inclusion of multilingual learners requires them to view diverse cultural and linguistic resources through anti-deficit lenses that reframe multilingual students in science (Louie et al., 2021). By developing anti-deficit perspectives of students, teachers can play a role in ensuring multilingual learners' ways of knowing and perspectives are integral to classroom learning. Anti-deficit noticing has been shown to be an effective pedagogical strategy to cultivate with teacher candidates in education methods courses (Jilk, 2016; Louie et al., 2021). One way to develop anti-deficit frames is to engage teacher candidates in immersive experiences, where they learn about scientific phenomenon from the perspective of learners (Loucks-Horsley et al., 2009). By taking the perspective of multilingual learners, teachers may see differently the assets they bring to science sensemaking. This paper asks: How do designs for immersive multilingual experiences support teacher candidates' anti-deficit noticing of multilingual students' expertise?

Equity-oriented scholars have pointed to deficit narratives around marginalized learners, especially multilingual students in science (Daniel et al., 2023), due in large part to canonical framings of the discipline. Western Modern Science (WMS) promotes science as empirical, objective, and purely rational—narrowing what “counts” as legitimate scientific sense-making (Bang et al., 2012). WMS frames science as White property, belonging exclusively to adult White men (Mensah & Jackson, 2018). Individuals with (multiply) minoritized identities, including women, children, and racially and linguistically diverse learners have less rights to enjoy science, resulting in deficit narratives about their scientific capabilities. This limited access to science is further aggravated in school contexts because a hyper-focus on academic vocabulary as prerequisite to engaging in science sense-making often precludes meaningful participation for multilingual learners. In response to this reality, Lee and colleagues (2019) suggested that language learning is inherently social and is a product of using language in context. Thus, allowing multilingual learners to use their full cultural and linguistic resources results in expansive science sensemaking (e.g., Pierson et al., 2021). However, due to assumptions about what modes of sense-making are considered “appropriate” for academic settings (Flores & Rosa, 2015), classroom science often promotes consensus to settled science rather than fostering epistemic heterogeneity (Warren et al., 2020). For example, Jonathan, an African-American student, was framed by his teacher as a troublemaker for troubling

settled notions of the sun as non-living because his view challenged canonical framings of classroom science despite aligning with non-dominant and professional scientific perspectives (Rosebery et al., 2010). Similarly, multilingual students' cultural resources are often taken up as resources only when they reinforce canonical scientific understandings (Bang et al., 2012).

Recent work in science education has begun to make visible and contest these dominant narratives about what counts as science, instead framing heterogeneity as a resource to reimagine the discipline (Pierson et al., 2021; Warren et al., 2020). To do this work, teachers engage in anti-deficit noticing about multilingual learners to disrupt dominant narratives. Teacher noticing has proved a valuable frame in improving teacher learning and practice (e.g., van Es & Sherin, 2008; 2021). However, often, a focus on noticing results in teachers reproducing deficit views of students (e.g., Jilk, 2016). Louie et al. (2021) built upon work on teacher noticing by attending to and challenging deficit discourses that marginalize and exclude individuals. One way to accomplish the aims set forth by Louie and colleagues is through immersive experiences (e.g., Crawford, 2012). Such experiences can be intentionally designed to upend traditional power structures and disrupt settled expectations, allowing teachers to see and notice from new perspectives resources that multilingual learners bring to scientific learning.

Methods

The data for this paper come from a larger project on equitable science sense-making with undergraduate elementary teacher candidates in semester-long science methods courses at two institutions. Throughout the course, teacher candidates engaged in lessons as learners about acorns as an anchoring phenomenon to illustrate equitable science instruction. Our analysis focuses on immersive French and Korean science lessons that were a part of this broader sequence. The immersive language lessons were designed to elicit anti-deficit noticing about multilingual learners and were implemented in three methods classrooms. The first course (C1) was located at a private university in the southeastern United States. For that course, Bethany (Author 2) a White, second language French speaker and former French teacher, led an embodied simulation about how oak trees reproduce, taught entirely in French. The other two classes (C2 & C3) were two sections of the same methods course taught at a large public university in the midwestern United States. In those classes, Sarah (Author 1), a Korean-American speaker of both Korean and English, focused on the Korean cultural practice of making acorn jelly. The Korean lesson took place in Korean with some English translation support from the course instructors. While there was some linguistic diversity in each of the classes, teacher candidates had limited, if any, experience with either French or Korean, respectively.

To understand how teacher candidates perceived the immersive language lessons, our data analysis focused on end-of-semester interviews where teacher candidates reflected on their experience in the course. After interviews were transcribed, we coded transcripts for segments where the French and Korean lessons were mentioned. Teacher candidates were not directly asked about these lessons; if they chose to mention it, it was of their own accord. Using this subset of the full corpus, we open coded the transcripts to characterize the content of the interviews (Saldaña, 2021). We then engaged in an iterative process of content analysis, where we looked for patterns and collapsed codes into key categories (Morse, 2012). Below, we discuss patterns from across contexts (C1, C2, C3) as well as differences within each setting (C1 v. C2 & C3).

Findings

Across all three classes, teacher candidates referenced the French or Korean lessons in their end-of-semester interviews as something that supported their learning in the course. In C1, 13 out of 18 students referenced the French lesson. The Korean lessons came up in C2 (6 out of 18 students) and C3 (5 out of 15 students) as a significant experience in the course. We first consider patterns that appeared across all students, followed by a consideration of distinct patterns unique to the French and Korean lessons respectively.

Across the interviews, experiences with the French and Korean lessons included patterns related to affect, perspective-taking and perspective-shifting, multimodality, and the appearance of assimilationist framings side-by-side with anti-deficit frames. We highlight key findings from some of these patterns here. Affect was a key trait that teacher candidates identified. Participants identified many positive emotions and feelings related to the French and Korean lessons (e.g., “so stinking cool,” “fun,” “eye-opening”), and their affective engagement with lessons may have played a role in the most common pattern of perspective-taking. Nearly every teacher candidate who referenced the French or Korean lessons in their interviews described some kind of new insight that they gained from the experience, marked by phrases such as “that’s something I was unaware of.” Often, insights were linked to either perspective-taking or a perspective shift. For example, Ryan, a teacher candidate who experienced the French lesson, shared: “I’ve learned a lot about what it means to teach an English language learners class...[but] I don’t think I really understood what it’s like to be trying to learn things [in another language].” Ryan’s experience being taught in French helped her take on the perspective of what it might be like for a

multilingual learner in an English dominant classroom. Similarly, a student from C2 commented how at first experiences related to acorns in the methods course were “hard because. I would think okay, well how are acorns equitable?” However, she described a shift in her perspective after the Korean lesson when Sarah “came in and shared that her family creates a jelly and they eat it. Never anything I would have considered. I wouldn’t even thought to have googled do people eat acorns?” This response suggested that this C2 student became aware of and willing to take on the challenge of incorporating learners’ cultural expertise into designing science lessons through the Korean immersive experience, disrupting exclusionary norms for multilingual learners. Despite evidence of perspective shifts and teacher candidates taking up anti-deficit framings, these views also appeared side-by-side with more assimilationist framings of language and culture. For example, language was still occasionally framed as a problem to be solved (“I feel like that was a really important learning moment for...everybody in the classroom to see that, like there could be a barrier, but there’s just you have to make sure that you have the resources to make sure that you get across that barrier”) or as a required prerequisite needed to access science content. Students in C2 and C3 who experienced the Korean language play described how learners “who don’t have English yet” might be “very confused” when they come into their English-only science classrooms.

We also recognized patterns unique to whether the teacher candidates experienced the French immersive lesson or the Korean immersive lesson. We attribute these differences to the fact that the lessons were not the same, nor were they intended to be comparable. Instead, the French and Korean lessons differed not only in terms of language of instruction, but also in terms of facilitation style (the French lesson was taught as a “typical” lesson by Bethany as the teacher in French while in the Korean lesson, Sarah was positioned as a newcomer student with Korean language and culture expertise) and content of the lesson (oak tree reproduction in French vs. Korean acorn jelly cultural practices). Here we offer a key pattern that emerged unique to each context. A pattern specific to the French lesson was how teacher candidates who referenced it in their interviews often focused on the pedagogical practices that they noticed Bethany using during the activity. Teacher candidates referenced strategies such as using gestures (“using gestures to try to communicate what we’re doing”), visuals (“we were drawing, we were looking at pictures, we were reading a book”), simulations, and repetition that supported participation for all students regardless of their language background (“a lot of active student engagement...even though a majority of the teaching is still in a different language”). They connected these practices to things they could do in their own classrooms to be more inclusive of multilingual learners and support their science learning. One pattern unique to the Korean lessons was a focus on expanding what participation in science classrooms could include. The teacher candidates recognized how even though the experience was in a language many of them did not speak, “a lot of the students still participated” even if that participation was through listening or through gestures rather than through verbal contributions. They acknowledged how making space for Sarah’s cultural experiences would allow “newcomer students...[to show] more about their culture” and to [create] a[n] open community”. The teacher candidates who experienced the Korean lesson expanded what might count as participation in science to center multilingual learners’ expertise, but they did express concerns over what it might look like to engage in a similar co-teaching lesson design in their own classrooms.

Conclusion and implications

The findings suggested that these immersive multilingual experiences supported teacher candidates to think about equitable, asset-oriented, and anti-deficit noticing in a science teaching context. While anti-deficit frames appeared side-by-side with more assimilationist views of multilingual learners across teacher candidates’ interview reflections, this reality is to be expected as disrupting these deficit narratives is a process that unfolds over time (Daniel et al., 2023; Philip, 2011). Differences in language of instruction, facilitation style, and lesson content also demonstrated that teacher candidates took away unique insights from each experience. In French, perhaps because it is a more similar language to English, teacher candidates more readily saw direct implications for their pedagogical practices with their multilingual learners. With Korean, perhaps because it is a more unfamiliar language to many students, teacher candidates recognized opportunities for increasing participation, but they were also more hesitant to take on as daunting a challenge as co-designing a lesson with a newcomer non-native English speaker of a non-European language. These differences are important for educators and curricula designers to keep in mind when implementing such activities in multilingual classrooms. The focus on language versus culture could be a false dichotomy, and we hope in future studies to see if both can be emphasized as important to science learning. Designers should also continue to consider the benefits of immersive lesson experiences, affect, and multimodality for enhancing teacher candidate anti-deficit noticing about children’s sensemaking abilities. We hope these findings can inform future immersive language experiences in both pre-service and in-service teacher’s work.

References

- Bang, M., Warren, B., Rosebery, A., & Medin, D. (2012). Desettling expectations in science education. *Human Development*, 55, 302-318. DOI: 10.1159/000345322
- Buxton, C. A., & Caswell, L. (2020). Next generation sheltered instruction to support multilingual learners in secondary science classrooms. *Science Education*, 104(3), 555-580.
- Crawford, B. A. (2012). Moving the essence of inquiry into the classroom: Engaging teachers and students in authentic science. In K. C. D. Tan & M. Kim (Eds.), *Issues and challenges in science education research* (pp. 25-42). Springer. DOI: 10.1007/978-94-007-3980-2_3
- Daniel, B., Pierson, A., & Keifert, D. T. (2023). Ideological sensemaking in an elementary science professional development community. *Journal of the Learning Sciences*, 1-49.
- Flores, N., & Rosa, J. (2015). Undoing appropriateness: Raciolinguistic ideologies and language diversity in education. *Harvard Educational Review*, 85(2), 149-171. DOI: 10.17763/0017-8055.85.2.149
- Jilk, L. M. (2016). Supporting teacher noticing of students' mathematical strengths. *Mathematics Teacher Educator*, 4(2), 188-199. DOI: 10.5951/mathteduc.4.2.0188
- Lee, O., & Stephens, A. (2020). *English learners in STEM subjects: Contemporary views on STEM subjects and language with English learners*. *Educational Researcher*, 49(6), 426-432.
- Lee, O., Llosa, L., Grapin, S., Haas, A., & Goggins, M. (2019). Science and language integration with English learners: A conceptual framework guiding instructional materials development. *Science Education*, 103(2), 317-337. <https://doi.org/10.1002/sce.21498>
- Louie, N., Adiredja, A. P., & Jessup, N. (2021). Teacher noticing from a sociopolitical perspective: The FAIR framework for anti-deficit noticing. *ZDM-Mathematics Education*, 53, 95-107.
- Loucks-Horsley, S., Stiles, K. E., Mundry, S., Love, N., & Hewson, P. W. (2009). Designing professional development for teachers of science and mathematics. Corwin Press.
- Mensah, F. M., & Jackson, I. (2018). Whiteness as property in science teacher education. *Teachers College Record*, 120(1), 1-38.
- Morse, J. M. (2012). The implications of interview type and structure in mixed-method designs. In A. Marvasti, K. McKinney, J. F. Gubrium, & J. A. Holstein (Eds.), *The SAGE handbook of interview research: The complexity of the craft* (2nd ed., pp. 193-204). SAGE Publication.
- Philip, T. M. (2011). An "ideology in pieces" approach to studying change in teachers' sensemaking about race, racism, and racial justice. *Cognition and Instruction*, 29(3), 297-329.
- Pierson, A. E., Clark, D. B., & Brady, C. E. (2021). Scientific modeling and translanguaging: A multilingual and multimodal approach to supporting science learning and engagement. *Science Education*, 105(4), 776-813. DOI: 10.1002/sce.21622
- Saldaña, J. (2021). *The coding manual for qualitative researchers* (4th ed.). SAGE Publication.
- Rosebery, A. S., Ogonowski, M., DiSchino, M., & Warren, B. (2010). "The coat traps all your body heat": Heterogeneity as fundamental to learning. *Journal of the Learning Sciences*, 19(3), 322-357.
- van Es, E. A., & Sherin, M. G. (2008). Mathematics teachers' "learning to notice" in the context of a video club. *Teaching and Teacher Education*, 24, 244-276. DOI: 10.1016/j.tate.2006.11.005
- van Es, E. A., & Sherin, M. G. (2021). Expanding on prior conceptualizations of teacher noticing. *ZDM*, 53, 17-27. DOI: 10.1007/s11858-020-01211-4
- Warren, B., Vossoughi, S., Rosebery, A. S., Bang, M., & Taylor, E. V. (2020). Multiple ways of knowing*: Re-imagining disciplinary learning. In N. S. Nasir, C. D. Lee, R. Pea, & M. McKinney de Royston (Eds.), *Handbook of the cultural foundations of learning* (pp. 277-294). Routledge.

Author statement and acknowledgments

Authors 1 and 2 contributed equally to the analysis and the writing; authors 3-9 provided support for the design and implementation of the French and Korean multilingual experiences. Funding provided by the National Science Foundation, grant #2213127. Views expressed here do not necessarily reflect the funder. Special thanks to the ESSE project team and the teacher candidates.