

Supporting Equitable Noticing in Elementary Science Methods

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Abstract: In the past two decades, science education researchers have increasingly attended to equity as a priority. However, in science teacher preparation programs, equity in STEM is often addressed peripherally. When equity is not a central focus in science methods courses, teacher candidates (TCs) have few opportunities to surface and challenge deficit and assimilationist ideologies. In response, we analyze artifacts from an elementary science methods course developed to foreground equitable noticing.

Introduction and literature review

In the past two decades, educational researchers across disciplines have increasingly attended to equity as a priority (e.g., Hess & Noguera, 2021). However, few undergraduate teacher candidates (TCs) have been exposed to this form of science teaching and learning. Furthermore, in science teacher preparation programs, equity in STEM is often addressed peripherally (Mensah, 2021). When equity is not a central focus in science methods courses, TCs have few opportunities to surface and challenge deficit and assimilationist ideologies that constrain science learning (Pacheco et al., 2019). Therefore, TCs often take additive approaches to equitable science teaching rather than “desettling” what counts as science learning (Bang et al., 2012). In response, in this paper, we analyze artifacts from an elementary science methods course developed to foreground equitable noticing.

The Attending-Interpreting-Responding (AIR) framework has been widely used to understand teacher noticing (Jacobs et al., 2010). But, Louie et al. (2021) showed the cognitive perspective typically applied to the AIR framework obscures “the fundamental ways in which noticing is shaped by social, cultural, and political processes” (p. 2). In response, Louie et al. (2021) proposed adding “Framing” to the AIR framework to build a new “FAIR” framework. By including framing as a component of teacher noticing, the FAIR framework emphasizes the sociopolitical ideologies that influence teacher noticing (Louie et al., 2021). Because they are so dynamic, frames can be rearticulated through discourse and interaction (Hand et al., 2012)—an important focus for teacher preparation programs. Our design explores how explicit and collaborative reflection can support TCs in noticing and imagining multiple pathways for science sensemaking.

Method

We designed a 14-week elementary science methods course that was implemented with a total of 54 participating TCs. The following high-level conjecture guided our design: surfacing and challenging deficit ideologies can help TCs shift toward expansive perspectives of science teaching and learning. In this paper, we analyze a few reflection activities, focusing on: the “who stands out as smart” reflection (Week 9) and the student interview assignment (Week 12). We focus on these two assignments to analyze opportunities created for TCs to surface and challenge deficit ideologies and to recognize and value students’ assets, connecting “framing” (ideologies) to noticing (what TCs attend to, how they interpret, and how they respond). Of the 54 participating TCs, 48 completed the “who stands out as smart” assignment and 52 completed the “student interview assignment.” We used grounded coding (Charmaz, 2006) to identify evidence of noticing, using TCs’ language as codes.

Findings

We found that the assignments enabled TCs to explicitly consider deficit ideologies and, in some cases, that they supported TCs to notice students’ assets (Table 1). In the “who stands out as smart” assignment, TCs articulated the role that systems play in constructing students as “smart” (54% of TCs, for example, one TC wrote: *There are certain privileges for certain groups that go into being able to be perceived as ‘smart’ in this classroom. For example, the instructional language largely overlaps with the Anglo-American or European middle-class cultural practices, such as known-answer questions, strict turn-taking, taxonomic thinking*). TCs less often noticed bias or privilege at an individual level (20% of TCs; for example: *having attended a gifted and talented school...I think my bias leads me to subconsciously view “smart” as when students pick things up quickly and “less smart” students to be those who struggle to grasp concepts*). TCs connected these framings to ways that they had seen students as “smart,” either using dominant-discourse definitions of “smartness” or by using asset-based definitions of “smartness.” While the majority of students named dominant-discourse attributes of smart students, like “fast” or “correct” (100% of TCs), some also included attributes that might be overlooked (38% of TCs), such as helping

others and social-emotional intelligence, for example: *He is usually able to articulate another student's question in a way that make sense to everyone if a student or teacher are having a disconnect and makes friends easily.* In this way, the “who stands out as smart” assignment created opportunities for TCs to actively seek out “ways of being smart” they may not have previously noticed. While dominant-discourse ways of being smart were most common, we see this activity as having planted a seed for TCs’ continued growth in equitable noticing. Moving forward, we are exploring ways to better support TCs in recognizing specific strengths of students.

Table 1
Codes and Frequencies by Assignment

Who Stands Out as Smart Assignment		Student Interview Assignment	
Code	Frequency	Code	Frequency
Notice individual bias	10/48 TCs (20%)	Prior knowledge	25/49 TCs (51%)
Notice systemic bias	26/48 TCs (54%)	Experience	22/49 TCs (45%)
Seeing students as smart (dominant-discourse)	48/48 TCs (100%)	Ideas, practices	14/49 TCs (29%)
Seeing students as smart (asset-based)	18/48 TCs (38%)	Family	1/49 TCs (2%)

Following the “who stands out as smart” assignment, TCs interviewed students in their field placements using a modified “rapid survey of student thinking tool” that focused on students’ assets in terms of ideas, ways of knowing, language, and experiences. Rather than focusing only on knowledge represented in state science standards, this tool supported TCs in noticing other resources that students shared. Once again, TCs were more likely to notice canonical resources, which they typically described as “prior knowledge” (51% of TCs). However, they also recognized assets that might otherwise be overlooked in science (e.g., experiences, 45% of TCs; non-canonical ideas or practices, 29% of TCs, for example: *When I asked [student] what sorts of things he might want or need in a storm, he replied with: “I would have a sword. Actually, I would have a shield because there might be dangerous things that could hit us and we could block it.” Although I hadn’t been preparing for this answer, I think that this response is actually a great one that could be used to support instruction. Shields can take many different forms and that was essentially what he was trying to get at- a shield could be an umbrella, a house, a jacket, etc.).* For TCs, identifying family knowledge as resources during the interviews was more challenging. For instance, only one TC identified a student’s family as a knowledge source: *Honestly, I was very surprised at how much [student] was able to explain the glass-breaking phenomenon.... He responded by saying he has a “chemistry dad.” After touching base with his teacher, she explained how his father is a science teacher.* In this example, the TC noticed family knowledge; however, it was valued in part because the “chemistry dad” shared canonical science knowledge with his child. These data suggest TCs may need more support in noticing and valuing family knowledge, but also in helping students feel comfortable sharing such resources and creating an environment where students believe these resources will be valued and seen as relevant. In summary, our analysis demonstrates that explicitly engaging with framing (deficit ideologies) supported TCs in expanding their definition of what counts as “smart” and as a resource for science learning. These activities, along with other course activities, enabled TCs to notice students’ attributes and resources and see them as assets. However, further research is needed to better support noticing of non-canonical resources.

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