



Teacher noticing from a sociopolitical perspective: the FAIR framework for anti-deficit noticing

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Abstract

In this paper, we respond to the continued harm of deficit discourses in mathematics education, focusing on discourses that systematically devalue the knowledge and abilities of students of color in classrooms in the United States. We specifically aim to (1) develop a sociopolitical framework for conceptualizing mathematics teacher noticing and (2) conceptualize and illustrate the enactment of noticing that challenges deficit discourses about these students and their communities—anti-deficit noticing—through the lens of our framework. We address our first research aim by introducing the FAIR framework, which foregrounds the role of sociopolitical Framing as an essential component of noticing that shapes and is shaped by Attending, Interpreting, and Responding, processes that have frequently been discussed in studies of teacher noticing. We show how an analysis using FAIR can contribute to understanding deficit noticing. We then conceptualize and illustrate anti-deficit noticing using the case of Oscar, a college mathematics instructor who worked with many Black and Hispanic students and himself identified as Hispanic. We discuss the local context that supported Oscar’s anti-deficit noticing and conclude with implications for future research and practice.

Keywords Mathematics education · Teacher noticing · Equity · Framing

1 Introduction

In this paper, we respond to the continued harm of deficit discourses in mathematics education, focusing on discourses that systematically devalue the knowledge and abilities of students of color in classrooms in the United States (US).¹ We specifically aim to make two contributions. First, we develop a sociopolitical framework for conceptualizing and analyzing mathematics teacher noticing, building on sociopolitical theories of mathematics education (Valero 2004; Gutiérrez 2013) that have yet to be broadly engaged in research on teacher noticing. Second, we conceptualize and illustrate the enactment of noticing that challenges deficit discourses about these students and their communities—*anti-deficit noticing*—through the lens of our

framework. Although our work is focused on the context of racism in the US, readers may note parallels along other axes of oppression; certainly, deficit discourses based on race, ethnicity, gender, class, and other social markers have been well-documented in settings around the world (Frade et al. 2013).

We treat deficit discourses as systems of meaning that circulate across society, exercising a pernicious influence even on teachers who consciously wish to counter them (Adiredja and Louie 2020). One site for this influence is teacher noticing. Deficit discourses may give rise to *deficit noticing*, wherein teachers attend almost obsessively to the errors and shortcomings of students of color; interpret errors and shortcomings as evidence of deficiencies in students, their families, or their cultures; erase students’ assets; and disregard schooling practices and social structures that limit students’ opportunities to learn and thrive.

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¹ In this paper, we use “students of color” and “people of color” to refer to Black, indigenous, Hispanic, and Asian people, in solidarity as scholars who identify as people of color. We recognize the limits of this term in relation to varied patterns of historical marginalization and the social construction of race in the US. We use “Hispanic” (rather than, for example, Latin@ or Latinx) following participants’ terminology.

Our approach to understanding both deficit and anti-deficit noticing in this paper draws on a sociopolitical perspective informed by Critical Race Theory (CRT; Delgado and Stefancic 2001; Ladson-Billings and Tate 1995). We outline this perspective in the next section, then use it to discuss and critique existing literature on mathematics teacher noticing. In subsequent sections, we address our first research aim by introducing the FAIR framework, which foregrounds the role of *framing* in noticing, and show how an analysis using FAIR can contribute to understanding *deficit noticing*. Turning to our second research aim, we conceptualize and illustrate *anti-deficit noticing* using the case of Oscar, a college mathematics instructor who worked with many Black and Hispanic students and himself identified as Hispanic.² This leads into a discussion of the local context that supported Oscar's anti-deficit noticing. We conclude with implications for future research and practice.

2 A sociopolitical perspective

As the term *sociopolitical* implies, our perspective is both socially and politically oriented. The “social” aspect emphasizes the role of situated interaction in the construction of knowledge, in contrast to approaches that focus on processes that are decontextualized and presumed to occur inside individual minds (Valero 2004). Thus, rather than locate deficit views primarily within biased individuals, we focus here on deficit discourses as socially, culturally, and historically produced. The “political” in *sociopolitical* involves a critical analysis of power, i.e., of “the capacity of some people—or groups of people—to keep others ... excluded” (Valero 2004, p. 10).

The political aspect of our sociopolitical perspective here is grounded in Critical Race Theory. CRT centers racism as an organizing feature of American life that mediates and interacts with other systems of oppression (e.g., sexism and classism) to maintain social and material exclusion (Dixson and Rousseau Anderson 2018). A defining element of CRT is its skepticism toward claims of neutrality, objectivity, and meritocracy (Ladson-Billings and Tate 1995). This perspective prompts the interrogation of seemingly neutral discourses with racialized impacts, for example, discourses that treat particular student behaviors as normal and acceptable (i.e., behaviors associated with White, middle-class norms) and other kinds of behavior as deviant, inferior, or wrong (i.e., all other behaviors).

A sociopolitical perspective driven by CRT also emphasizes activism “toward the end of eliminating racial oppression as part of the broader goal of ending all forms of

oppression” (Matsuda et al. 1993, p. 6). Within mathematics education, this entails efforts “to transform [the field] in ways that privilege more socially just practices” (Gutiérrez 2013, p. 40). One mechanism for transformation suggested by CRT is the telling of “counterstories,” which challenge “the dominant narrative about the inherent inferiority of people of color and the normative superiority of white people” (Dixson and Rousseau Anderson 2018, p. 122). Counterstories privilege the experiential knowledge of racism that people of color possess. They also embody the unique capacity of people of color to reimagine social relations that support them to flourish (see also Martin et al. 2019). Here, we accordingly elevate the knowledge and strengths of a Hispanic instructor and his Black and Hispanic students in order to interrogate dominant discourses in mathematics education and to reimagine a more humanizing alternative.

3 Existing frameworks for conceptualizing and analyzing noticing

To date, research has largely taken a cognitive perspective on mathematics teacher noticing. This perspective is clearly represented in the frameworks used to analyze noticing. We focus here on the **Attending-Interpreting-Responding** framework, which we refer to here as AIR.³ Use of AIR is widespread (e.g., Jacobs et al. 2010; Ding and Domínguez 2016; Jessup 2018; Shah and Coles 2020), and like others, we find that this framework decomposes elements of noticing in ways that facilitate analyzing and supporting teachers' noticing. However, typical uses of AIR center “individuals and their internal mental processes,” obscuring the fundamental ways in which noticing is shaped by social, cultural, and political processes (Louie 2018, p. 59).

The full AIR framework consists of three components. The first and most universally used is *attending*—“identifying what is important” amidst the hum of classroom life (van Es and Sherin 2008, p. 245). Some studies focus exclusively on this element of noticing (e.g., Huang and Li 2012; Star and Strickland 2008). Others have complemented analyses of attending with investigations of how teachers *interpret* or assign meaning to objects of their attention (e.g., Fernandez et al. 2013; Goldsmith and Seago 2011; van Es and Sherin 2008). And some have further examined how teachers draw on their attending and interpreting in order to *respond* (or plan to respond) (e.g., Ding and Dominguez

² All names are pseudonyms.

³ Jacobs et al. (2010) seminal work refers to the third component of teacher noticing as “deciding to respond” (p. 169). Others have used “planning to respond,” “formulating responses,” or simply “responding” (e.g., Shah and Coles 2020, p. 3; Wager 2014, p. 316). Here we use “responding” to capture the shared essence of these various terms.

2015; Jacobs et al. 2010; Jessup 2018). Conceptualizations of noticing that include all three parts of the AIR framework have been used to examine teacher noticing with various foci, with particular attention to noticing children's mathematical thinking (e.g., Jacobs et al. 2010).

Studies of teacher noticing for equity and social justice indicate that the light the AIR framework sheds on such noticing is useful but limited. For example, Wager (2014) supplemented her use of AIR with an analysis of teachers' "positionality toward equitable mathematics pedagogy" (p. 312), showing how their histories, identities, and dispositions shape teachers' noticing. Shah and Coles (2020) investigated how preservice teachers' "racial noticing" (p. 1) in their elementary mathematics methods course and field placements was connected to their "background experiences with race" (p. 6) in a highly racialized society. And Louie (2018) examined how one teacher's noticing of her students' mathematical "smartnesses" was connected to the meanings of mathematical activity, mathematical ability, and race that circulated in the teacher's networks. All of these studies used AIR to decompose complex noticing processes into manageable parts, while drawing attention to social, cultural, and political aspects of noticing that are not part of AIR. Along with other studies on equitable teacher noticing (Hand 2012; Mercado 2017; Roth McDuffie et al. 2014), these studies indicate a need for a sociopolitical perspective to illuminate how culture and power shape teachers' attending, interpreting, and responding. We articulate and apply such a perspective in this paper, using *frames* and *framing*.

4 Framing as a component of noticing: a sociopolitical framework for conceptualizing mathematics teachers noticing

Frames provide interpretive contexts that support participants in a given situation to understand what kind of task they are engaged in, what kinds of knowledge are relevant or valuable, and what sort of behavior they and others are expected or entitled to engage in Goffman (1974), Greeno (2009). Similar to Hand et al. (2012), we are interested in how "frames guide ... attention within, interpretation of, and response to situations" by creating "expectations for how the emerging activity should unfold and for the roles that different individuals will take within it" (p. 251). We also highlight *framing*, the interactive process of co-constructing a particular frame and coordinating activities around it. We thus turn from frames—which may seem to be static precursors to attending, interpreting, and responding—toward dynamic actions. Prior studies have argued that framing and noticing are intimately and bidirectionally linked (Lau 2010; Russ and Luna 2013); here,

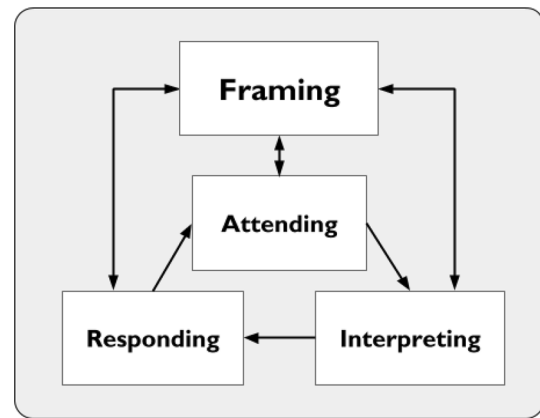


Fig. 1 Four components of teacher noticing and the relationships between them

we locate framing *within* noticing, as an integral process that both shapes and is shaped by other noticing processes (as shown by the bidirectional arrows in Fig. 1). We thus utilize aspects of AIR with Framing to build a new framework: FAIR.

We emphasize that culture, power, and (in)justice are implicated even in apparently neutral framing. In articulating FAIR, our goal is not merely to paste a recognition of these issues onto AIR, but to radically recast conceptualizations of noticing processes from a critical, sociopolitical perspective. This entails shifting how we understand both *what* teachers notice (e.g., classroom power dynamics and students' racialized identities, as well as mathematical thinking) and *how* their noticing is shaped by its embeddedness in racist systems that make certain ways of framing automatic. Critical Race Theory directs our attention to how frames that seem apolitical or even progressive may reinforce racial hierarchies. For example, a teacher who organizes her work around "closing the racial achievement gap" implicitly frames Black, Hispanic, and indigenous students as mathematically lacking and White students' achievement as the standard by which they should be measured (Gutiérrez 2008; Martin 2009). (She also potentially reproduces the harmful and dehumanizing discourse of Asians as a "model minority"; see Shah 2019.) This framing makes her more likely to attend closely to Black, Hispanic, and indigenous students' errors without attending to their knowledge or strengths, to interpret these errors as evidence of misconceptions and failures, and to reify her interpretation in deficit stories (Adiredja 2019)—i.e., to engage in *deficit noticing*. These stories take on authority as they are told and retold, and they influence their tellers' and others' subsequent framing. The cycle of framing, attending, interpreting, and responding can be "self-sustaining" (Adiredja 2019, p. 401), creating a feedback loop that makes it difficult to change frames or notice differently.

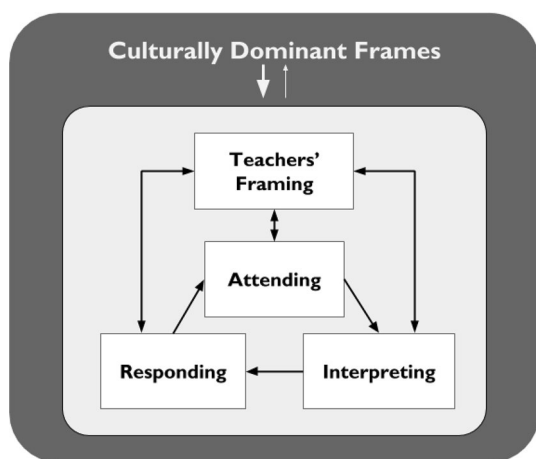


Fig. 2 The embeddedness of teacher noticing within culturally dominant frames

Additionally, frames that are culturally dominant are supported by “a durable and extensive network of reified tools and institutionalized social practices,” such as standards documents, local and national assessment practices, and cultural norms that define how someone who is mathematically proficient should look and act (Hand et al. 2012, p. 259). The “largely invisible power” of dominant frames is such that they may subliminally guide attention and behavior even for people who consciously want to disrupt them (Hand et al. 2012, p. 253; see also Louie 2017). Frames and framing are thus distinct from beliefs and their enactment. A teacher may believe that all students are capable of learning mathematics, for example, and at times enact frames consistent with this belief. But at other times, the same teacher may unconsciously default to framing Black, Hispanic, and indigenous people as mathematically inferior to Whites and Asians, because this way of framing is deeply ingrained in US schools and in American culture more generally (exemplified by the trope of the “racial achievement gap”). To engage alternative frames therefore takes substantial and ongoing work, including work at the level of individual teachers *and* work at the level of systems and institutions. This is reflected in Fig. 2, with a large arrow indicating the strong influence of culturally dominant frames on teachers’ framing and a smaller arrow reflecting a weaker but existing influence in the opposite direction—and possibilities for resistance.

Despite the power of dominant frames, intentional *reframing* is possible, as we describe below (see also Hand et al. 2012). But first, we outline the deficit framing that makes reframing necessary. In the process, we illustrate the utility of the FAIR framework for understanding deficit noticing. We acknowledge that there are many grey areas between deficit and anti-deficit noticing (e.g., noticing that is responsive to student thinking but does not foreground

students’ assets, or noticing that foregrounds students’ assets in a race-evasive way), and that in practice, teachers are more likely to blend these than to enact a purely deficit or anti-deficit approach. However, we find the sharp contrast between deficit and anti-deficit noticing useful for underscoring how consequential framing can be, in interaction with other noticing processes.

5 Deficit noticing in mathematics education

A wealth of research demonstrates that the dominant culture of mathematics education in the US systematically denies Black, Hispanic, and indigenous students opportunities for advancement (e.g., Darling-Hammond 2010; Larnell 2016). Here, we focus on the role of teacher noticing in reproducing this racialized exclusion. Drawing on CRT, we make explicit three culturally dominant frames which may appear race-neutral but contribute to this exclusion: (1) framing mathematics learning as absorption of a universal, objective, fixed body of knowledge; (2) framing students primarily as receivers of mathematics; and (3) framing interactions between students as relatively inconsequential for learning and secondary to individual behavior and achievement. Although they are not the only frames that enact racialized harms, we select them to set the stage for anti-deficit reframing using the contrasting case of Oscar’s noticing.

In the next three sections, we argue that these frames represent long-standing norms in mathematics education in the US—norms that continue to permeate even the classrooms of many mathematics teachers who are known as innovative, student-centered, and equity-oriented, as recent research has shown (e.g., Davis et al. 2020; Louie 2017; Mehta and Fine 2019). Furthermore, we argue that they enact racialized harms on students of color. We describe each of the frames and connect them to implications for how teachers attend to, interpret, and respond to students, especially students of color, in mathematics classrooms. Figure 3 provides a summary.

5.1 Framing mathematics learning as absorption of a universal, objective, fixed body of knowledge

Mathematical knowledge is frequently understood as universal, objective, and fixed, and learning in mathematics classrooms is often framed as absorbing this knowledge (Hand et al. 2012; Louie 2017). Framing mathematics learning in this way positions particular language, symbols, algorithms, and conventions as standard, right, and best; other ways of thinking and knowing are positioned, explicitly or implicitly, as irrelevant or inferior (Adiredja 2019). Students are “authorized and required simply to recall and/or obtain

Fig. 3 Dominant, deficit noticing

Mathematics	Framing mathematics learning as absorption of a universal, objective, and fixed body of knowledge		
	Attending to accuracy and correctness	Interpreting mathematical work either correct or incorrect	Responding by exposing and correcting errors, praising accuracy and correctness
Students	Framing students primarily as mathematical receivers		
	Attending to the mathematical progress of individual students	Interpreting students as deficient, sufficient, or superior	Responding by labeling students “remedial,” “regular,” or “advanced”
Interactions	Framing interactions between students as relatively inconsequential for learning		
	Attending to students as individual units	Interpreting student-to-student interactions as unnecessary	Responding by discouraging collaboration

correct mathematical procedures” (Hand et al. 2012, p. 256). The version of mathematics that is typically treated as the universal standard is cast as Western and white, with little to no acknowledgement of contributions to mathematics from other cultures (Gutiérrez 2017; Pateman and Lim 2013).

Within this frame of mathematics learning, it makes a great deal of sense for teachers to understand their role in terms of *attending* to students’ mathematical work; *interpreting* how well each student’s thinking meets the standards; and *responding* by affirming correct answers and remediating errors (as in the well-known Initiate, Respond, Evaluate [IRE] pattern; Cazden 2001). It makes comparatively less sense to attend closely to ways of thinking that vary from conventions and seek to understand them, and even less sense to invite or value divergent approaches. Instead, a focus on the faithfulness with which students have applied prescribed procedures and the correctness of their answers may seem logical.

Research has shown that instruction that frames mathematics learning as the absorption of a fixed body of knowledge is harmful to students’ mathematical understanding, agency, and identities (e.g., Boaler and Staples 2008; Aguirre et al. 2013). The effects on Black, Hispanic, and indigenous students are especially damaging, because this framing hides racialized exclusion beneath the veneer of meritocracy. When teachers interpret students of color as struggling, failing, and deficient—as many teachers do even when presented with evidence of the same individuals’ excellence (Jackson et al. 2018)—they can justify these judgments by referencing standards that are ostensibly neutral. Framing

mathematics learning as the mastery of a purportedly universal and objective fixed mathematics, the same for all students, masks how all judgments of success and failure are embedded in discourses and structures that are fundamentally unequal and racist (Cobb and Russell 2015).

5.2 Framing students primarily as receivers of mathematics

Framing students primarily as receivers of mathematics has two aspects that contribute to deficit noticing. First, this frame reduces students to mathematical machines, such that students are expected to set their identities, experiences, interests, goals, and lives beyond school walls aside. Second and related, in positioning students as receivers of knowledge, this frame erases students’ personal and cultural resources, making it difficult to perceive and build on them.

Frames of students primarily as receivers of mathematics works in concert with narrow frames of mathematics learning to promote deficit noticing. Together, these frames direct the bulk of teachers’ *attention* to students’ mathematical performances. Other aspects of students’ humanity are positioned as secondary if they are attended to at all. To the extent that teachers do attend to students beyond their mathematical performances, these frames make it sensible to *interpret* what they observe as separate from and largely irrelevant to mathematics learning. Thus, a teacher might learn that a student excels in basketball and ignore this information, or perhaps draw on their own interest in basketball to build a personal relationship with the student. But it

would not make sense for a teacher engaging these frames to *respond* by adapting their curriculum or instruction to build on connections between the student's knowledge of basketball statistics and the mathematics to be learned in the class, because these frames treat mathematics as already fixed and students as receivers of it.

Furthermore, these frames support teachers to *interpret* students in relation to ability hierarchies, based on the distance between mathematics standards and each student's performance. The prevailing *response* to these interpretations is to rank, label, and group students based on how quickly and consistently they produce correct answers and follow prescribed procedures. Students who are deemed "high" performing are offered richer, more rigorous learning opportunities than those deemed "low" (Louie2020; Schweig et al. 2020). This process of interpretation and response does particular damage to Black, indigenous, and Hispanic students, as the hierarchies it creates are mapped onto racial hierarchies (as reflected in and reproduced by the narrative of racial achievement gaps; see Martin 2009). This mapping interferes with teachers' capacity to notice the resources that Black, indigenous, and Hispanic students bring to mathematics learning, making it easy to instead attend to and interpret these students in ways that construct them as mathematically deficient and problematic (Adiredja and Louie 2020; Jackson et al. 2018).

5.3 Framing relationships between students as unnecessary or undesirable for learning

School mathematics learning is typically framed as a largely individual accomplishment. For example, a teacher in Davis et al. (2020) study summarized his practice: "I'm going to tell you what we're going to learn, I'm going to explain it, I'm going to show you an example, you're going to do some examples on your own, and then ... you'll do some worksheets" (p. 416). Within this frame, it makes sense for teachers to *attend* to each student as an isolated unit, working above, at, or below the standard. They may *interpret* interactions between students as distracting or even disrespectful. Reasonable *responses* within this frame include discouraging student talk or tolerating it as long as it is "on task," while penalizing students for talk that is "off task."

Social interactions support learning for all people (Cazden 2001), but framing interaction and relationships as unnecessary can be especially harmful for students of color. Teachers routinely read and respond to students differently based on students' race (Jackson et al. 2018; Varma et al. 2006), and it is more likely for teachers to interpret interactions between students of color than between white students in ways that are damaging. For example, a teacher might attend to two Black students looking at one another's papers and talking, interpret them as cheating, and respond

by punishing them. Alternatively, a teacher might interpret the students' talk as an indicator that they are incapable of doing the work on their own (Varma et al. 2006) and respond by pulling them aside for reteaching. Meanwhile, the teacher might attend to white students engaged in the same behaviors and interpret them as productively collaborating.

6 Reimagining noticing: an illustration of anti-deficit noticing

In the previous section, we connected framing to attending, interpreting, and responding in the context of deficit noticing. In this section, we further demonstrate these connections and also illustrate anti-deficit noticing as an alternative to deficit noticing. We define *anti-deficit noticing* as noticing that deliberately challenges deficit discourses, intentionally attending to and elevating the humanity, intelligence, and mathematical abilities of marginalized people, not in speeches or statements but in routine instructional interactions. Anti-deficit noticing thus goes beyond a blanket commitment to seeing the assets that all students bring to learning (see also Adiredja and Zandieh 2020). We use Oscar's case to imagine and illustrate anti-deficit noticing.

6.1 Context

Oscar was a university mathematics instructor who identified as Hispanic. For several years, he worked with Adiredja (the second author) in a summer calculus workshop at a public Hispanic-serving institution (HSI) in the US Southwest.⁴ The five-day workshop was part of a bridge program that recruited students from high-need high schools, predominantly Hispanic, first-generation college students. In 2018, Oscar's section had five students. Four identified themselves as Hispanic women, and one as a Black man. Oscar said he could "relate a lot" with them "because I was a Hispanic student, I came from a background where no one went to college. ... When we talk about challenges, their challenges, I see that and it's like, I know what you're feeling."

Oscar was the most experienced of the five workshop instructors in 2018. He was also the only instructor to give explicit attention to countering deficit discourses through his teaching (as revealed in group debriefs and in written reflections that all of the instructors completed). We therefore chose to focus on his noticing, as expressed in a retrospective noticing interview (Sherin et al. 2011) after the workshop ended. Whether or not the interview represents

⁴ HSI is a US government designation for institutions of higher education where at least 25% of full-time undergraduates identify as Hispanic.

Oscar's typical noticing is less important for our purposes than the extent to which it provides an "instrumental case" (Stake 1995, p. 3) that illuminates anti-deficit noticing.

The first part of the two-hour interview addressed Oscar's history as a mathematics learner and his development of inquiry-based teaching methods. In the second part, we asked Oscar to tell us which students "stood out to you" in the workshop (he said all of them) and what stood out about each one. In the third part, we focused on specific student work, presenting Oscar with pictures he had taken and proudly shared with Adiredja and other instructors. The "Calculus Masterpieces," as he called them, showed thinking his students had presented to Oscar and their peers.

6.2 Applying FAIR to conceptualize anti-deficit noticing

To conceptualize anti-deficit noticing, we applied the FAIR framework to Oscar's noticing. In terms of *attending*, we identified what Oscar highlighted as important (e.g., "[Paulina] was very willing to experiment with her ideas"). Statements that went beyond highlighting to provide an evaluation or explanation were coded as *interpreting* (e.g., "that ability ... is a really kind of powerful skill to have"). Statements that described actions Oscar took (or decided not to take) as a result of his attending and interpreting were coded as *responding*. We then grouped statements about attending into thematic categories, coming to consensus around three: students as individuals, mathematical rigor, and students' interactions with one another.

To theorize the interrelation between sociopolitical framing and other aspects of noticing, we highlighted the interpretive contexts—i.e., frames—that explained Oscar's attending, interpreting, and responding. We considered deficit frames documented in the literature (including those discussed in Sect. 5), as well as frames identified as equitable in prior research (e.g., Hand et al. 2012; Louie, 2017). Contrasts and similarities between those frames and Oscar's helped us to identify frames he employed—i.e., his framing—more precisely.

We found that Oscar's anti-deficit noticing involved: (1) framing students as full human beings who bring many resources to their learning, (2) framing mathematics learning as a creative exploration of ideas, and (3) framing interactions and interpersonal relationships as integral to learning (see Fig. 4). Note that while the rows in the figure correspond to the rows in Fig. 3, the order is different. In Fig. 3, mathematics comes first; in Fig. 4, students do. This reflects the way that anti-deficit noticing centers students, particularly students of color, in comparison to deficit noticing's centering of mathematics and mathematical performance.

We reiterate that our purpose is to begin to conceptualize anti-deficit noticing by examining how these ways of

framing interact with other noticing processes, not to create an exhaustive list of anti-deficit frames. Additionally, although we separate frames of students, mathematics learning, and interactions for clearer exposition, they are inherently interrelated. We highlight some connections in the following sections.

6.3 Framing students as full human beings with many resources

As we have described, dominant frames of school mathematics deny students of color their full humanity, making it counterintuitive to attend to their diverse personalities, participation styles, and ways of knowing, let alone interpret these qualities as essential resources for mathematics learning. Countering this dehumanizing tendency requires recognizing and rejecting deficit frames, including those implicit in assimilationist efforts at inclusion. It requires deliberately reframing students as full human beings and who they are as worth honoring and nurturing. Such reframing encourages very different kinds of attending, interpreting, and responding than the attending, interpreting, and responding that is made sensible (though not fair or correct) by deficit framing.

In Oscar's practice, reframing students as complete human beings entailed *attending* carefully to each one. For example, he noticed that while Paulina was an "extrovert" who did not hesitate to "put things out there," Damian liked to "work independently" before "sharing certain tidbits" with his classmates. Even with Julia, a "very, very quiet" student who was something of a mystery to her peers, Oscar attended to more than the reticence on the surface, noticing that in the midst of a jumble of calculations, she could "put it all together" to get at the conceptual core.

Oscar actively *interpreted* students' ways of being as assets for mathematics learning. This is not a given; Paulina's willingness to "just kind of put things out there" could be interpreted as careless, and Isabel's tendency to "talk to everyone" could be interpreted as distracting. But Oscar's framing interacted with his interpreting, so that he treated these student attributes not as problems to be managed but as resources to be leveraged. Moreover, Oscar was able to interpret very different qualities as strengths; there was no one way of being or thinking to which he expected every student to conform. He prized Paulina's "ability to just kind of put things out there and sort through them," characterizing it as "powerful skill to have." But he did not value Gabi any less, even though "she definitely wasn't always willing to kind of just, put out her ideas in trying to solve the problem." In fact, Gabi had a skeptical attitude that another instructor might have interpreted as oppositional (for example, when she wrote "STUPID MATH!" on her "Calculus Masterpiece" below her equations for velocity and acceleration). Oscar said that a few years earlier, he himself would have seen

Fig. 4 Anti-deficit noticing

Students	Framing students as full human beings with many resources		
	Attending to students as unique individuals, with their own personalities and participation styles	Interpreting individual students' ways of being as resources	Responding by giving students space to be themselves <i>and</i> leveraging their ways of being to support their and their peers' learning
Mathematics	Framing mathematics learning as a creative exploration of ideas		
	Attending to diverse ways of working and making sense of mathematics	Interpreting students' work as sensible and as a valuable resource	Responding by giving students space to develop their own ideas and approaches <i>and</i> leveraging them to advance mathematics learning
Interactions	Framing interactions and interpersonal relationships as integral to learning		
	Attending to the nature of students' bonds with their peers	Interpreting strong, egalitarian bonds as resources for learning	Responding by giving students space to build relationships with one another <i>and</i> leveraging those relationships for learning

her as wasting time, drawing on dominant, deficit frames of mathematics learning. Now, however, he linked Gabi's habit of not "tak[ing] anything too seriously" to her ability to "formulate good questions, or good ideas, good thoughts that might provide more exposition of the problem," and he interpreted this as a strength that was just as valuable as Paulina's.

Oscar's *responses* to students enacted and reinforced his framing of students as full human beings who bring many resources to learning. As we describe below, he often leveraged students' resources to advance their mathematics learning (integrating anti-deficit frames of students and mathematics). He also made space for students to be themselves and to participate in ways that made sense to them. This contrasts with approaches that admit only one way of performing a student identity, ignoring or policing students who do not fit the mold. In making this space, Oscar respected

students' humanity; he also created opportunities for his own continued noticing of their strengths.

There were thus cyclical relationships between Oscar's framing, attending, interpreting, and responding. By attending to students as individuals, he was able to see traits that he could then interpret as strengths; in interpreting traits as strengths and responding by giving students space to be themselves, he reinforced framing students as complete human beings, valuable for "who they are." This in turn supported him to continue to attend to students' personal qualities.

6.4 Framing mathematics learning as a creative exploration of ideas

Reframing students as full human beings works in tandem with reframing mathematics learning. When mathematics

learning is framed as acquiring a fixed, universal, and certain body of knowledge, there is little space to attend to diverse ways of thinking and knowing or to interpret divergent thinking as a resource. Indeed, Oscar reported that prior to his work with the summer calculus workshop, he operated within a narrow frame of mathematics learning in which his role was to get students to “follow one prescribed path” toward solutions, understanding, and success. Through his engagement with the workshop, Oscar began to reframe mathematics learning as a process of “exploring ideas, and all the possible routes that you have” to develop one’s own understanding. Aligned with this reframing, Oscar began to attend to how students “organiz[ed] their ideas,” “formulat[e] good questions,” and explained their thinking in relation to “bigger conceptual issues that we were trying to make sense of,” in addition to the correctness and precision that are often the primary focus of mathematics classrooms.

How Oscar attended to and interpreted specific students demonstrates the impact of his reframing of mathematics learning. For example, Oscar *attended* to the fact that in her willingness to share emergent thinking, Paulina said a lot of “incorrect things.” Within a framing of mathematics learning as acquiring objective knowledge, Paulina’s behavior could seem puzzling or wrongheaded. Oscar instead *interpreted* it as evidence of a “powerful skill,” as noted above. What allowed him to interpret it this way was his reframing of mathematics learning as a creative exploration. As he said, “That experimentation, that ability to just kind of put things out there and sort through them, is a really kind of powerful skill to have ... *when you’re exploring things, and trying to make sense of the concepts and how to actually use them*” (emphasis added). Without reframing mathematics in terms of “experimentation” and “explor[ation],” this kind of attention to Paulina’s ideas and interpretation of public mistakes as evidence of a strength would not make sense. Similarly, Oscar saw Gabi’s skeptical questioning as an important resource that pushed the class beyond points of confusion or more “mechanical” approaches, into deeper understanding. Within a deficit frame, it would have been more reasonable to interpret such questioning as disrespectful. The student attributes and ways of working that can be interpreted as strengths thus depend on how mathematics learning is framed. Oscar’s reframing made it sensible to attend closely to what students were doing and interpret “completely different and very creative way[s]” of thinking as “deserv[ing] just as much merit” as more conventional thinking.

A *response* that logically flows from the framing, attending, and interpreting described above is to give students space to pursue their own paths toward understanding, even when the ideas they share are unconventional or incorrect. As Oscar said, “[A student’s] mind is a completely different universe to me. ... I shouldn’t shut them

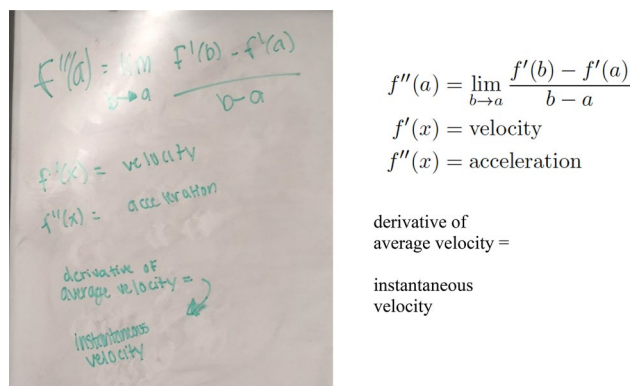


Fig. 5 Paulina’s summary of the “Big Concepts” from a day in the calculus workshop

down just because they’re not learning it the way I want them to learn it.” He actively resisted “shutting down” students when their work did not match normative procedures or his own thinking, instead encouraging his students to “put it all out there,” because “we can use anything” that they “bring to the table.”

To be clear, framing mathematics as creative does not mean abandoning high standards; rather, such framing can support rigor, as we show using Oscar’s analysis of a specific example of Paulina’s work. Students were to summarize a class discussion of the relationship between average and instantaneous velocity on a small whiteboard, then each present their whiteboard to the class. There was a mistake in what Paulina wrote; instantaneous velocity is not the “derivative of average velocity,” but the limit of average velocity as the time elapsed approaches zero (see Fig. 5).

Instead of honing in on her mistake as the most relevant feature of her work, however, Oscar attended to the quality of the connections she made between limits, derivatives, and their physical interpretations as velocity and acceleration. And he attended not only to her written work (which is often privileged in classrooms) but also to her oral presentation. This broad attention supported him to interpret Paulina’s work as demonstrating a clear understanding that “derivatives are limits.” He responded by celebrating her work alongside that of her peers, noting that the class had done “a bunch of calculations ... a bunch of grunt work,” and that in “connect[ing] it all together [to] get a sense of how these big concepts were [related],” he was thrilled with how students “expressed this, these ideas, in their own way. And it was right.” Oscar’s push for students to explain core concepts in their own ways, not only execute computations or regurgitate what they had been told, shows how framing mathematics as creative and personal can go hand in hand with a high level of rigor.

6.5 Framing interactions and interpersonal relationships as integral to learning

Anti-deficit frames of students and mathematics are closely connected to reframing interaction as central to learning. In contrast to frames that separate students and rank them against each other, reframing learning as collaborative entails recognizing that meaningful mathematics learning is not an individual achievement but occurs “by being who you are, by contributing something to the people around you, and by allowing them to give you something in return” (as Oscar put it), in relations of equality and mutual dependence. Oscar’s analysis of students’ participation in the summer workshop further reflects this perspective:

It wasn’t one student [who] somehow made it all happen for everybody else. Everybody ... offered something special, like very special about themselves to that community, and that made that community stronger and better than what any one of them individually would have been.

This reframing supports anti-deficit noticing by disrupting hierarchies among students, acknowledging differences but positioning every student as an equal contributor. This shapes noticing in two ways: highlighting students’ sense of connection to one another, and highlighting equal status between students.

Framing relationships as essential for learning shaped the way Oscar attended to, interpreted, and responded to students’ “bonds.” Because he viewed these bonds as the foundation for grappling with challenging mathematical concepts and building deep understanding together, he organized his classroom to foster them. During discussions, he *attended* to the way student talk would sometimes “steer a little bit away” from mathematics into “chitchat like how’s your dog doing.” In the past, he said, he did not see “allowing people to just talk, and be themselves” as having any “value”; now, he *interpreted* it as “the bedrock” of “a very strong bond between students.” His *response*, then, was less often to intervene than to deliberately allow “students to develop their own relationships with each other,” knowing that these relationships facilitated the co-construction of mathematical knowledge.

Another way that reframing relationships shaped Oscar’s noticing was by highlighting the importance of positioning students as equals. He did *attend* to differences between students, including differences that could easily have been interpreted in terms of hierarchies. For instance, Oscar observed that Damian “had some mechanical advantages” and “remembered a lot of the basics” that other students struggled with. But rather than take these features as indicators of Damian’s superiority to other students, Oscar *interpreted* them as part of what Damian had to offer, on par

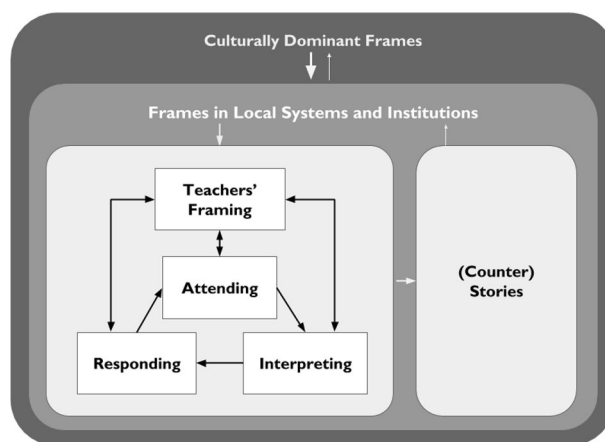


Fig. 6 Situating teacher noticing within local and extra-local contexts

with Paulina’s “ability to just kind of put things out there and sort through them” and Gabi’s skeptical questioning. He described *responding* to Damian’s strengths by coordinating them with others’ to support collective learning. For example, he would turn to Damian for his insights, and then “we could pivot off what Damian said and maybe explore some questions say like for example, Gabi had.” Students’ generative responses further reinforced Oscar’s framing of interactions as integral to learning and supported him to continue to employ this framing in the future.

Thus, reframing interactions and integral to learning contributes to anti-deficit noticing by fundamentally reframing relationships between students, moving away from ranking and sorting and toward honoring their needs as human beings: to be themselves, to connect with others, and to grow by being themselves in connection with others. Within this frame, it is logical for instructors to attend not only to individuals’ mathematical performances but also to things like the bonds between students. Furthermore, framing learning as interactive supports teachers to interpret and build on students’ diverse ways of being as resources not only for individuals’ learning but also for collective advancement, thereby disrupting hierarchical, deficit discourses that harm all students, especially students of color.

7 Situating anti-deficit noticing in multiple layers of sociopolitical context

Oscar’s anti-deficit noticing was not an automatic extension of his commitment to students of color. He described seeing his students as “strong” and “weak” prior to his engagement with the summer bridge program, and assuming that when their thinking did not match his own, they did not understand and needed to be re-taught. That is, culturally dominant deficit frames played a significant role in his earlier noticing, in

spite of the fact that he always cared deeply and even identified with his students of color. The shifts he described in his noticing highlight the deliberate resistance against these default frames that anti-deficit noticing requires.

We highlight a layer of local context that mediated shifts in Oscar's noticing (the middle layer in Fig. 6; see also Adiredja and Louie 2020). Developing and sustaining anti-deficit noticing requires changes not only to individual teachers as isolated actors, but also changes to the systems that make deficit framing seem normal or necessary. For example, the leaders of the summer bridge program in which Oscar taught carefully designed the program to counter deficit discourses and support Oscar and his colleagues to learn and practice anti-deficit noticing. First, the program positioned students as future leaders in STEM fields, not as at-risk youth who needed remediation. This shaped their participation in ways that facilitated anti-deficit noticing. Second, the program provided all instructors with substantial professional development (PD) that engaged them with student-centered, inquiry-based pedagogies and curriculum. PD explicitly problematized deficit narratives (e.g., "these students have weak algebra skills") and taken-for-granted values in mathematics (e.g., overemphasis on algebraic manipulation and other formalisms). When workshop classes began, instructors continued to receive support for reframing students, mathematics, and interaction via in-classroom coaching, one focus of which was identifying different students' mathematical contributions. Finally, instructors participated in constructing anti-deficit frames as the norm in their local professional community, sharing stories about their students' strengths and successes (like Oscar's "Calculus Masterpieces") during instructor meetings (the inner right box in Fig. 6; see also Adiredja 2019).

8 Conclusion

We conclude by revisiting the two research aims we articulated in the beginning of our paper and drawing implications for future research and practice.

8.1 Theorizing noticing from a sociopolitical perspective

In foregrounding framing in our articulation of the FAIR framework, we highlight the sociopolitical nature of noticing and the need to actively challenge deficit discourses. This entails making deficit frames explicit, understanding the tacit ways they may affect teachers' noticing, and engaging in intentional reframing. We emphasize that the work of anti-deficit reframing must be ongoing for everyone (including Oscar), because dominant deficit discourses have a tenacious hold on our field and will continue to influence all

of us. Labeling some teachers "deficit noticers" and others "anti-deficit noticers" is counterproductive. As Oscar's case shows, it is essential that change occur not only for individual teachers, but also at the systems level. The local system of the workshop enabled and supported Oscar to capitalize on his personal resources and experiences—and in a sense, Oscar's framing and noticing were not only his but were co-constructed with the workshop system and the students.

Future research and practice should further explore how to create and sustain systems that enable anti-deficit noticing. Research is also needed to examine how students, teachers, and others co-construct (anti-)deficit frames. Although we have not emphasized this co-construction in this paper, it was certainly present in Oscar's instruction. For example, he described how one student put her peers' intellectual contributions in dialogue with one another and thus participated in framing interaction as essential, both reinforcing and being reinforced by Oscar's framing. Investigations of how students' framing interacts with teachers' would further illuminate processes of teacher noticing and how noticing can reproduce or resist deficit discourses.

8.2 Conceptualizing anti-deficit noticing

In naming both deficit frames (which are usually tacit and unnamed) and anti-deficit frames (which can be difficult to imagine), we hope to support teachers, teacher educators, and researchers to identify moments when deficit frames are in play and purposefully shift toward anti-deficit frames. We have also been deliberate in centering Oscar as an educator of color to conceptualize and exemplify anti-deficit noticing. This centering goes beyond simply involving educators of color as study participants (which itself is rarely done) to more radically elevate and build upon the knowledge, wisdom, and experiences of teachers from marginalized groups. Oscar's personal experiences (like the experiences of other teachers of color) were resources for engaging in anti-deficit noticing, helping him to resist dehumanizing frames, make sense of his students as human beings, and see strengths in them that others might not have noticed. His example indicates that the practices and experiences of teachers of color can provide critical insights into teacher noticing and expand our collective capacity to imagine equitable, anti-deficit noticing.

One way that Oscar's case expands our understanding is by raising the practice of *not responding* (see also "not-doings"; Ball 2017), which we underscore alongside reframing. The strategic choice to not respond gives students space to be themselves, to make sense of mathematics, and to build relationships that are important for their mathematics learning. This space is essential for challenging deficit discourses and revealing strengths that are obscured by constant teacher intervention. In addition, common responses such

as correcting students' errors or disciplining their behavior reproduce deficit frames and deficit interpretations of students of color (e.g., Jackson et al. 2018). This suggests that scholarly attention should expand beyond teachers' active, externally visible responses as the only ones that count, particularly for equitable noticing.

We have also been deliberate in highlighting the abundant and varied strengths that Black and Hispanic students bring to learning, countering deficit discourses. Some might wonder whether Oscar's students were exceptional, making anti-deficit noticing possible in ways that other students do not. This question itself manifests deficit discourses by implying that most Black and Hispanic students do not have a variety of intellectual and mathematical strengths, as these students did. It also overlooks the importance of context. These students were able to reveal and leverage their strengths in the workshop setting because the program and Oscar's class were intentionally designed to support them to do so.

We have presented the FAIR framework to support the examination of sociopolitical dimensions of noticing, and to highlight opportunities for teachers to intentionally challenge deficit discourses through anti-deficit noticing and framing in particular. More generally, we have argued that all noticing is embedded in sociopolitical contexts. Attending to how these contexts shape noticing is necessary to advance mathematics teacher noticing that recognizes and builds on the humanity of all students, particularly those whom mathematics instruction and society more broadly tend to dehumanize.

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