

## “I UNDERSTAND THAT THEIR MINDS MAY BE ELSEWHERE”: TOWARDS A CULTURALLY RESPONSIVE MATH PEDAGOGY

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*This brief research report examines the discursive shifts of a secondary mathematics teacher participating in a collaborative learning community centered on culturally responsive mathematics teaching. We draw on two frameworks to analyze the teacher’s discursive moves. The first framework comes from Lefstein et al. (2020) on generative discourse practices in learning communities. The second framework — FAIR (Louie et al., 2021) — offers noticing practices for deficit versus anti-oppressive mathematics teaching. Through these lenses, we found that the teacher’s initial discourse practices were marked by deficit framing and noticing. The teacher’s discourse practices begin to shift towards a culturally responsive pedagogy in response to a particular artifact that captured student noticing and reframed the teacher’s problem of practice.*

Keywords: Professional Development; Culturally Relevant Pedagogy; Discourse; Teacher Noticing.

### Introduction

Professional development initiatives for secondary mathematics teachers are increasingly focused on learning to teach mathematics in a culturally responsive way. Yet, learning to become a culturally responsive mathematics teacher has been complicated by teachers’ participation in dominant discourses practices around deficit ideologies of students of color, their communities, and families. These dominant discourse practices are stitched into the fabric of mathematics teaching and learning and are often invisible to mathematics teachers from dominant backgrounds.

Recently, teacher professional development has taken place in learning communities, where teachers come together to share artifacts and dilemmas from their instructional practice. Teacher learning communities are more likely to be more deeply grounded in teachers’ everyday work and to support teacher collaborative conversation and reflection. Teacher learning communities focused on culturally responsive mathematics teaching may be more likely to support teachers in rejecting deficit ideologies in moments of everyday classroom life.

This study examined the discursive practices of one secondary mathematics teacher as they participated in a collaborative learning community that brought teachers and researchers together to learn about and build culturally responsive teaching practices. The teacher’s discursive practices in this collaborative learning community were of particular interest since they appeared to shift over time in relation to the goals of the professional development to help mathematics teachers learn to see and respond to issues of equity and justice in their schools. We sought to explore the relation of these shifts to specific aspects of the collaborative learning community and in relation to anti-deficit ideologies.

Lamberg, T., & Moss, D. (2023). *Proceedings of the forty-fifth annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (Vol. 1). University of Nevada, Reno.

## Theoretical Framework

Lefstein et al., (2020) define discourse as “an essential medium through which members of a community of practice coordinate their work, make meaning, and negotiate roles and identities,” while also being “constitutive of practitioners’ professional vision: how they gaze upon and make sense of phenomena in their domain of work” (p. 2). In their review of empirical research on teacher collaborative discourse in professional learning activities, Lefstein et al., (2021) identified five discourse practices that were essential to productive shifts in practice. The first discourse practice, *revealing and probing problems of practice*, what we will refer to as Revealing, relates to the ways that teachers take risks with others in sharing aspects of their teaching with which they are grappling. The second practice, *providing reasoning and evidence*, or what we call Reasoning, refers to the ways that teachers support their claims about their practices, classroom, or other aspects of their teaching. In this case, providing concrete evidence was shown to hone teacher discourse toward problem-solving. The third practice, *making connections to general principles*, or what we call Generalizing, relates to moving beyond particular events and situations to general patterns and principles. The fourth practice, *building on others’ ideas*, or what we call Building, refers to the ways that teachers’ discourse reflects dialogue and elaboration. The final practice, *offering different perspectives*, or what we call Contrasting, reflects the ways that perspectives in the discourse provide points of contrast and challenge. Taken together, these five aspects of teachers’ collaborative discourse practices, Revealing, Reasoning, Generalizing, Building, and Contrasting provide markers of generative opportunities to learn.

Research on how these generative discourse practices support secondary mathematics teachers in learning to teach mathematics in culturally responsive ways is less prevalent. One framework that seems particularly promising for understanding these shifts is the FAIR framework (Louie et al., 2021). The FAIR framework is conceptualized as a sociopolitical perspective on mathematics teacher noticing, or the social and political lens through which teachers frame, attend to, interpret, and respond to everyday moments of classroom life. Research on mathematics teacher noticing has revealed that teachers often attend to moments of classroom life through interactional frames guided by deficit or colorblind perspectives (Author, 2022; Louie, 2018). Louie et al. (2021) argue that anti-deficit noticing is marked by: (1) framing students as human beings instead of simply math learners, (2) framing mathematics learning as a vibrant and creative process instead of a fixed way of knowing, and (3) framing both informational and interpersonal aspects of interaction as central to mathematics learning, instead ignoring the latter. Studies of teachers’ development of critical consciousness reveal similarly that teachers’ discourse remains persistently deficit in nature. As a result, supporting shifts in teachers’ discourse practices towards ones that are anti-deficit, asset-based, and relational has been challenging.

One of the ways that teachers can become aware of deficit ideologies through which they perceive of students is through the perspectives of the students themselves. Students’ perspectives are often ignored in classroom teaching (Dominguez, 2019), apart from what teachers perceive in ongoing social interaction. While soliciting students’ perspectives on teaching is not new, it is often through formative assessment around the subject matter or classroom practices. In contrast, students can also be invited to share their perceptions of what their teacher seems to be noticing about them. Teachers might believe they are noticing and responding to students in caring ways, for example, while students might perceive this noticing

as deficit or oppressive. This disconnect can spark deep reflection for teachers around their assumptions about students.

This study examines how one secondary mathematics teacher responded to the noticing of students in her classroom in the context of a professional development on culturally responsive mathematics teaching. Our research questions include:

1. In what ways did the teacher's initial discourse practices in relation to students, mathematics teaching, and broader sociopolitical systems reflect deficit ideologies?
2. What was the nature of the shifts in teachers' collaborative discourse around the noticing prompt?
  - a. How did the teacher begin to frame, attend to, interpret and respond to students' noticings in ways that were aligned with culturally responsive mathematics teaching?

### **Methods**

This qualitative case study was conducted on a one-year collaborative learning community focused on culturally responsive mathematics teaching and anti-racist noticing practice. The learning community was guided by the authors of this study, who met with secondary mathematics teachers on a bimonthly over Zoom. Data collection included a baseline and final interview, recordings of the Zoom meetings, teacher artifacts, and two noticing interviews. The participants of the PD each created their own action research plan in which they applied their learning from the PD in a meaningful way for their own school and teaching practice.

### **Subjects**

The case study focuses on Carrie, a mathematics teacher at a middle school in a metropolitan area. Carrie identified as a white woman who had been teaching mathematics for approximately eight years. The demographics of the high school at the time were: 64% white, 14% Hispanic, 11% Black, 8% two or more races, 2% Asian or Pacific Islander, and 1% Native American. Carrie was chosen as the focal teacher for this study due to significant shifts in discourse revealed during initial open coding.

### **Positionality**

The authors of this paper designed and facilitated the teacher learning community. The first author identifies herself as a white, woman. She taught middle school mathematics for three years and is a fifth-year PhD candidate. She studies culturally sustaining pedagogies in math classrooms using an Indigenous epistemological framework. The second author also identifies as a white woman and is the advisor for the three other authors. She studies issues of equity in mathematics education and has found it challenging to untangle from dominant deficit discourses. The third author identifies as Latina, international graduate student. She is a third-year PhD student who for the last two years has been working as a facilitator and researcher of learning spaces that promote Political Conocimiento for mathematics teachers. The fourth author identifies as a first-generation Latino graduate student. He is a second-year PhD student who has spent the last two years working with math and science teachers in professional learning communities around equitable teaching practices and inclusive pedagogies.

### **Data Collection**

In a preliminary analysis, we identified one artifact in particular, the student noticing survey (SNS), to be particularly supportive of shifts in teachers' deficit discourses. The SNS was

designed by the authors, who then presented it to the teachers for their review and editing. It was designed to prompt students in the teachers' classes to describe what they think their teacher pays attention to about them (the student), and to other students in the class.<sup>7</sup> The SNS was then turned into an online format (found [here](#)). The teachers distributed the SNS to one or two mathematics classes of their choice. Following the collection of completed surveys, the teachers and authors engaged in a discussion about the survey results. Carrie continued to refer to the SNS in her discursive practices throughout and beyond the professional learning community.

To analyze Carrie's discourse practices before, around, and after the SNS, we examined transcripts of her initial interview, her utterances during the professional development meeting, transcripts and notes from her action research plan meeting, the action research plan, and her final interview.

### Analysis

To analyze the data, we first transcribed recordings of all PD sessions and participant interviews. Following the transcription, we reviewed our field notes, teachers' artifacts, and the transcriptions for themes in teachers' discourse practices. We proceeded to develop hypotheses about these shifts. Data was thematically coded in Dedoose by the first author based on key elements of the PD. The initial coding process generated ten codes (e.g., positioning, tools, collaboration, culturally responsive, and deficit). The second author re-coded the data to seek interrater consensus. Following the initial coding, we honed our analysis on one particular teacher, Carrie, due to her significant discursive changes throughout the PD, and her strong response to the SNSs responses from her students.

The second round of coding focused on Carrie's discursive moves over time and employed codes based on the two frameworks from Lefstein et al. (2020) and Louie et al. (2021) (e.g., generalizing, contrasting, deficit, anti-deficit, framing, building, reasoning, revealing, interpreting, and reflection). The analysis revealed particular patterns in Carrie's discursive moves over time. For example, deficit discourse was coded 7% across the data at the start of the PD, and 3% across the data towards the end. Similarly, anti-deficit discourse was coded 0% at the start, and 21% at the end. Themes emerged based on these patterns in Carrie's discourse and around aspects of the collaborative learning community

### Findings

This study explored the extent to which Carrie engaged in productive discourse practices in the professional development, and how this engagement related to the SNS, and to shifts in her noticing of themselves, students, mathematics, and society. Our results show that as Carrie interacted with the results of the survey in a collaborative way, Carrie also worked through the practices of generative discourse, and in doing so experienced shifts away from her initial discourse practices and towards discourse practices aligned with culturally responsive teaching. Carrie also took up the discourse practices in circular ways, meaning that her noticings and discourse practices continually evolved as they generated questions and problems of practice through new orientations. Here, we describe their discursive activities around the survey in detail. Students were not participants in the research; therefore we focus on Carrie's comments and reflections about the survey rather than direct student responses.

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<sup>7</sup> Students were not participants in the research study, so researchers did not analyze the survey results.

Carrie's perspective of her students at the beginning of the professional development indicated a deficit perspective. At the beginning of the school year, she framed students as being non-compliant with her requests and described them as "lacking stamina and lacking grit" when it came to mathematical tasks. In this framing, Carrie employed deficit discourses that locate educational problems with students and their families. She complained that she was experiencing many disruptions in class, saying, "...[students were] constantly talking and over each other and over me and if one thing happens that's interesting everything gets lost". In this utterance, we note that Carrie was providing evidence about what was occurring in her classroom to position the students as "non-compliant." It is interesting to note what Carrie is attending to, that students are talking over each other and that they get distracted, which again stems from a frame of deficit ideologies and behavior management, rather than one of relationality or engagement.

Carrie also remarked about her students' perceived lack of care about their education, stating, "I feel frustrated when students don't try. I tell them all the time that I care about their education but I don't understand why some don't." In this utterance, Carrie is interpreting students' behavior as 'not trying', and that lack of effort as 'not caring' about her class. From a fair perspective, reasonable responses to these interpretations often revolve around trying to motivate or punish students toward new behavior.

PD sessions began with mindful moments or reflective journaling to encourage and invite all attendees to come into the learning space intentionally. In a session prior to distributing the SNS, Carrie journaled: "I make the assumption that they don't care about their education when it could be something else entirely. ... I should ask what their actions really mean." This statement indicates early recognition of the disconnect between students and the teacher, preempting the SNS. This disconnect was troublesome for Carrie, and she showed in this statement awareness that she must attend to and respond to different issues than those she had prioritized. As Carrie reflected on her perception of students' lack of care for education during and between PD sessions, she decided to give the SNS to this "challenging" class, mindful of the fact that she knew she needed to change something in order for the disconnect to become a connection, for her pedagogy to be more culturally responsive, and focused on improving the dynamic with this class. Before distributing the survey, she had tried other ways of connecting with and celebrating her students in her "challenging" class, including taking notes of what students were doing well and sending those to the students' home adults. After several sessions of the PD, she decided to distribute the SNS to this class to glean further information about what she could do to improve.

When Carrie first viewed the results of the SNS, she noticed a disconnect between what she believed she was noticing about her students, and how the students perceived what she noticed about them. Her initial response was "I am sorry about the results." Aligned with prior discourse about how challenging she felt this class was for her, she continued, "I felt like I've made improvements, but their survey results say otherwise." In collaborative discussions, Carrie began to wonder about this disconnect, turning it into an informal problem of practice. She reasoned, "my students largely felt like I didn't care about them as people. They felt that I cared only about their mathematical understanding and improvements. In reflection, this is probably true." In this discursive move, Carrie has shifted her framing. She acknowledges that her framing (and noticing) has largely been guided by a focus on her students' mathematical development, which Louie et al. (2021) describe as a deficit, dominant framing in which teachers attend to students' mathematical progress, interpret students as either on track, gifted or behind, and respond by labeling them as accordingly. Here, Carrie is beginning to examine this framing, as

her students tell her in the survey that she is not noticing them as human beings. The generative discursive contrast pushes Carrie to reconsider the way she is making sense of her instruction.

This discursive turn is further reflected in another utterance Carrie made during the PD, in which she stated, “What is most important to them [the students] in the moment may not be the math that I am trying to teach them.” While this discursive move continues to be framed from a colorblind perspective, it indicates that Carrie is becoming curious about what is going on for her students, apart from her interpretations of them. Carrie also began working on a topic for a culminating action research project at this time, including who her community partner would be. The requirements of the PD included partnering with someone outside of the participant’s own classroom for initial conversations about her action research plan involved bringing in support from outside the school, from a local youth action and advocacy group. This proved to be complicated for various reasons, including a strict requirement around adherence to the school-designed and provided curriculum.

Ultimately, Carrie arrived at a focus for her action research project, which we view as discursively revealing a new problem of practice: “What do I need to notice about myself as a white woman, my mathematics instruction, and my largely BIPOC students to be able to develop relationships of trust and a supportive learning environment?” In this question, Carrie’s discourse has shifted dramatically. Instead of asking why BIPOC students in her class do not care about learning mathematics, she is probing herself as a noticer. The new framing here is of mathematics learning as a relational and racialized activity. As a white woman working with largely BIPOC youth, Carrie interprets this kind of learning as only taking place in a space of trust. Thus, she needs to attend to her students as humans, not just math learners.

Carrie herself attributed this new framing as a result of the disconnect between her perception of her teaching and how students received it. She described how this new framing shifted how she noticed and responded to her students:

I made a big change in how I see my students. Instead of just seeing the mathematicians inside of them, I learned to focus on who they are as individuals. I began to notice when students weren’t themselves for a day and let me know that I see them, that I understand that their minds may be elsewhere. This compassion turned a whole classroom culture from one that was very negative to one that was much nicer to be a part of.

The SNS provided a tool for Carrie to learn from her students, so she could attend to issues that her students saw and felt, not just ones that she observed, as she leaned into culturally responsive mathematics teaching. Through generative discourse during PD sessions and reflective practices on her own, Carrie shifted her teaching practice toward a culturally responsive pedagogy.

## Discussion

Supporting shifts in the discourse practices of secondary mathematics teachers towards ones that are critical, asset-based, and relational has been challenging for the field of mathematics education. In this study, we focused heavily on a specific artifact, the student noticing survey, as a tool for generative discourse to promote a shift in one teacher’s discursive practices. This study combined the FAIR framework and discourse practices that research indicates are generative in teacher learning communities to provide insights into how one teacher’s interactions around a student noticing survey within a learning community shifted her discursive practices, from colorblind and deficit towards relational and asset-based.

At the beginning of the PD, Carrie was upholding deficit perspectives, consistent with framing as described in the FAIR framework (Louie et al., 2021). We found that reframing and shifting attention were supported by the generative discourse practice of revealing. Carrie revealed multiple problems of practice throughout the PD, which shifted as she began to see herself and her students differently. The shifts were also supported by building and contrasting, in which she brought evidence of her problem of practice to the learning community, which was interpreted differently by different members. This enabled Carrie to attend to different aspects of the survey and to generate new questions. The most prevalent generative discourse principles were generalizing and contrasting. Generalizing helped Carrie continuously attend to, interpret, and respond to her problem of practice as it evolved, while contrasting was supported by the discourse of the learning community, as previously mentioned. Generalizing and contrasting discourse practices supported the cycle of interpretation and responding as Carrie shifted her own discourse around her teaching and her students.

### Conclusion

This study investigated how a specific tool can be used to facilitate generative discourse among teacher learning communities and support a shift in one teacher's classroom practices toward culturally responsive pedagogy. This work confirms extant research on mathematics teaching around the persistence of dominant, deficit ideologies. This study contributes to the literature on culturally responsive teaching by providing deeper insight into how directly attending to students' perspectives of teachers' attention can result in a shift in the teacher's classroom practices and ability to create and sustain a culturally responsive learning environment. In practice, this study informs professional development for mathematics teachers, focusing on the significance of generative discourse as a tool for supporting teachers in framing and re-framing problems of practice consistent with anti-deficit and anti-racist ideologies.

### References

- Author. (2022).
- Dominguez, H. (2019). Theorizing reciprocal noticing with non-dominant students in mathematics. *Educational Studies in Mathematics*, 102(1), 75–89. <https://doi.org/10.1007/s10649-019-09896-5>
- Lefstein, A., Louie, N., Segal, A., & Becher, A. (2020). Taking stock of research on teacher collaborative discourse: Theory and method in a nascent field. *Teaching and Teacher Education*, 88, 102954. <https://doi.org/10.1016/j.tate.2019.102954>
- 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(1), 95–107. <https://doi.org/10.1007/s11858-021-01229-2>
- Louie, N. L. (2018). Culture and ideology in mathematics teacher noticing. *Educational Studies in Mathematics*, 97(1), 55–69. <https://doi.org/10.1007/s10649-017-9775-2>