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Mathematics Teachers' Interpretations of Students' Perceptions of the Classroom Learning Environment: Opportunities for Inquiry and Insight into Pedagogical Commitments

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Abstract: This paper reports on a study of nine middle-grades mathematics teachers' interpretations of a novel representation of practice that featured students' perceptions of the classroom learning environment for a given lesson. Based on a sequential qualitative analysis of interview data, we found that teachers' interpretations of students' perceptions (1) tended to open opportunities for future inquiry about instructional decisions and (2) provided insight into teachers' current pedagogical commitments, specifically their current instructional visions and views of the students' capabilities. Implications for professional learning are discussed.

Introduction

In ambitious and equitable mathematics teaching, instructional decisions are centrally shaped by students' current understandings and experiences in the classroom (Franke et al., 2007). Representations of practice, such as student work samples, video-records of instruction, and narratives about teaching play a critical role in providing teachers with windows into students' current reasoning, and in prompting analysis of the relationship between instructional decisions and the understandings students develop (e.g., Ball & Cohen, 1999; Kazemi & Franke, 2004). In this study, we explore teachers' interpretations of a novel representation of practice intended to support generative inquiry: brief, student-facing surveys that elicit *students' perceptions of key aspects of the mathematics classroom learning environment* that research suggests matter for students' learning and mathematical identities (Jackson et al. in press). Specifically, we examine how nine middle-grades mathematics teachers' interpretations of their students' perceptions opened, and, in some cases, closed opportunities for future inquiry into instruction (Little, 2002). Furthermore, we explore how a focus on students' perceptions of the classroom learning environment provides insight into teachers' pedagogical commitments (Erickson, 2011), which is especially valuable for professional development design and facilitation.

Theoretical concepts

Although constructing and investigating representations of practice appears to be necessary to engaging in analysis of teaching, doing so does not guarantee generative inquiry (Horn, 2020). An important distinction concerns whether teachers' interpretations open or close teachers' opportunities for future inquiry about instructional decisions (Little, 2002). *Openings* are characterized by teachers posing questions (van Es & Sherin, 2021) or offering tentative or multiple, possibly "conflicting" explanations of an observation's meaning (Mason, 2011). Conversely, *closings* are characterized by "explaining away" evidence that could have otherwise been used to raise important questions (p. 40). Once an opening has been established, another critical distinction concerns whether and how teachers investigate relationships among the three vertices of the instructional triangle: teacher, students, and content (e.g., mathematics). "The extent to which [teachers consider] issues of teaching, students, and mathematics as independent or interdependent aspects of instruction" distinguishes the potential of teacher inquiry to support the development of ambitious teaching (Horn, 2020, p. 329).

While the surveys were designed to enable inquiry into instruction, how they function is an empirical question. This is because making sense of a representation of practice is necessarily an interpretive act (Coburn & Turner, 2012). On the basis of existing literature, we conjectured that mathematics teachers' *pedagogical commitments* (Erickson, 2011), including their *instructional visions* (Munter et al., 2015) and their *perspectives on their students' current capabilities* (e.g., Horn, 2007; Jackson et al., 2017), would shape how they interpreted students' perceptions of the classroom learning environment.

Methods

This study was guided by the following research questions: (1) How, if at all, do teachers' interpretations of students' perceptions of the classroom learning environment open or close possibilities for inquiry? (2) How do

teachers' interpretations provide insight into their current pedagogical commitments?

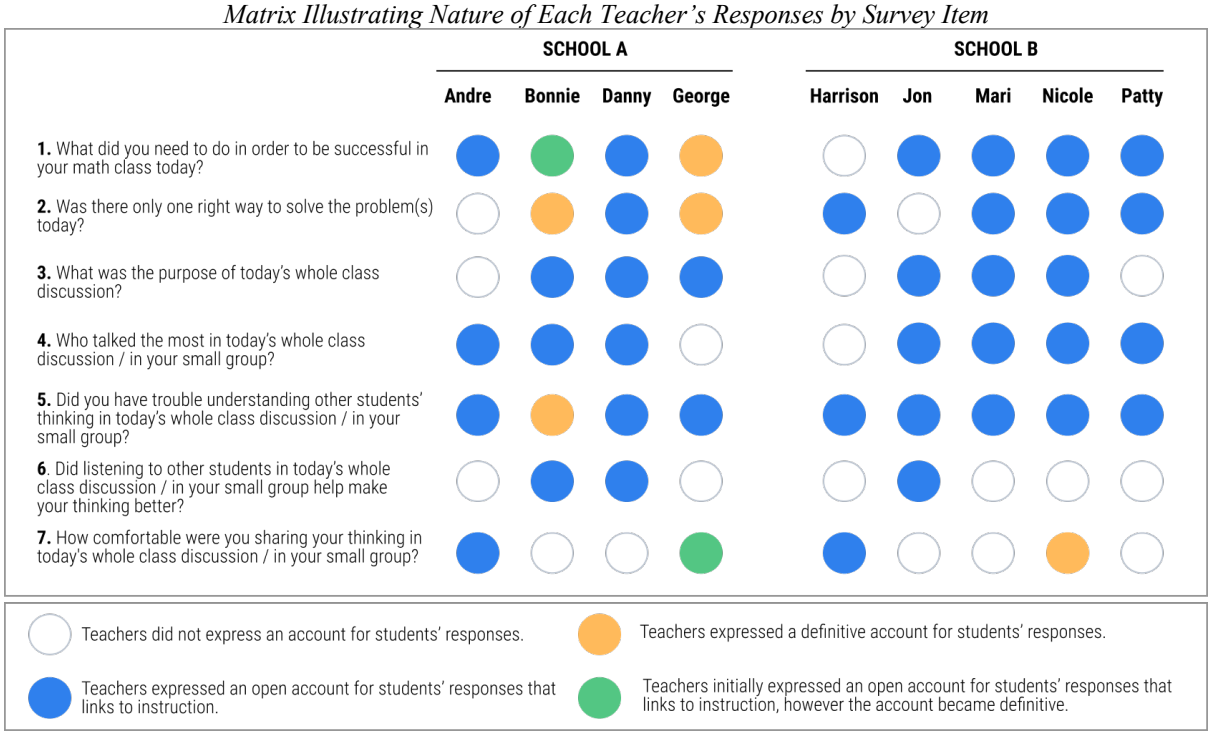
In the 2017-2018 and 2018-2019 school years, the first two authors and other members of the research team spent extensive time in nine middle-grades mathematics teachers' classrooms (located in two schools in one district) to understand the value and challenges of using the surveys in instructional improvement efforts. The primary data source for this analysis is one approximately 45-minute interview with each of the teachers, in which the teacher made sense of students' survey responses from a lesson they had either taught that day or the prior day. Secondary data sources include another 45-minute introductory interview, in which we directly asked about teachers' current pedagogical commitments, and field notes from classroom observations. Analysis took place in four phases: (1) an inductive, descriptive analysis of the sensemaking interviews in which we iteratively developed a coding scheme to characterize each teacher's interpretations of students' responses; (2) a finer-grained analysis of teachers' interpretations, in which we applied codes for whether teachers interpretations of students' responses to each item opened and/or closed opportunities for future inquiry (see Figure 1); (3) an analysis of how pedagogical commitments were expressed in teachers' interpretations; and (4) triangulation of the pedagogical commitments made visible in the sensemaking interviews with additional data sources.

Teachers' interpretations of students' perceptions of the learning environment

Figure 1 provides an overview of our assessments of each teacher's interpretation of students' responses to each of the survey items, in terms of opening or closing opportunities for future inquiry.

Figure 1

Matrix Illustrating Nature of Each Teacher's Responses by Survey Item



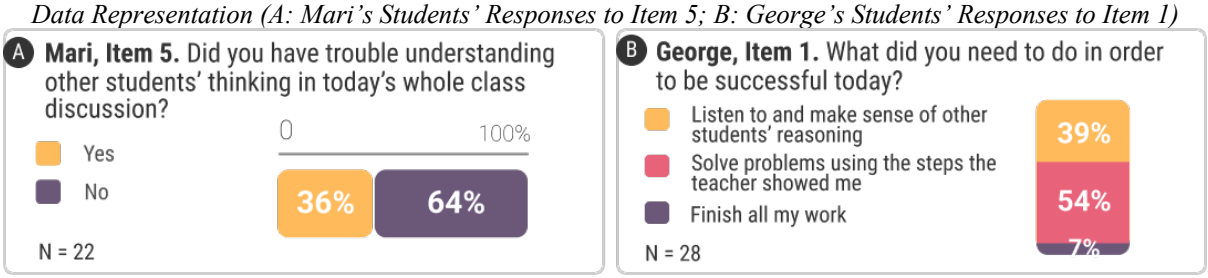
As illustrated in Figure 1, overall, teachers' interpretations of their students' perceptions of the classroom learning environment tended to open opportunities for future inquiry into issues of instruction. However, there were seven instances in which teachers provided definitive accounts that "explained away" students' responses to the survey item, and ultimately closed possibilities for future inquiry. Regardless of whether teachers' interpretations opened or closed possibilities for future inquiry, their interpretations provided insight into their then-current pedagogical commitments. To substantiate these claims, given space limitations, we briefly discuss three teachers' interpretations (Mari, Jon, and George), who represent a range of pedagogical commitments.

Mari, a second-year teacher, gave the survey to a class of sixth graders after their discussion of a number talk focused on whole-number division. As evidenced in Figure 1, Mari's interpretations consistently provided openings for future inquiry. For example, in response to Item 5 (see Figure 2a), in which eight students indicated they had trouble understanding their group members' explanations, and 14 chose no, Mari reflected on her role in supporting students to understand one another's ideas: "When kids explain themselves and I see that someone

doesn't understand I really try to be like, 'Can someone else explain?' or, 'You might need to say it louder,' so they know that they have to understand each other." She also commented on the importance of the classroom environment in relation to students' willingness to share ideas: "I don't think [discussion] would work if they didn't feel safe." In Mari's interpretations, we consistently found evidence of her commitment to a *dialogic vision of instruction* (Munter et al., 2015). For example, she voiced her intent to use discourse to support students' understanding ("they have to understand each other"). Further, her interpretations suggested that she was actively considering her role in supporting students' understanding of one another's ideas ("I really try to be like: 'Can someone else explain?'"). Mari's interpretations were consistent with how she described her commitments in interviews and what we observed in her classroom instruction.

Figure 2

Data Representation (A: Mari's Students' Responses to Item 5; B: George's Students' Responses to Item 1)



Jon was in his first year of teaching in a general education setting after 16 years as a paraeducator. He administered the survey to a class of eighth graders after discussion of a task focused on factoring polynomials. Like Mari, Jon's interpretations consistently provided openings for future inquiry into instruction. Different from Mari, Jon's interpretations provided insight into how his instructional vision was in *transition*, reflecting both aspects of direct and dialogic visions. For example, when interpreting students' responses to item 2, "Was there only one right way to solve the problems today?" Jon was intrigued by the fact that half said yes and half said no. Jon indicated that he was focused on providing students steps to follow in his lesson on factoring polynomials ("I'm looking at the overall picture of there's only one way to factor polynomials"). However, he also said, "That would be interesting to hear [students'] thoughts and if they come up with a different way." Indications of Jon's transitioning instructional vision was consistent with what he expressed in interviews and classroom observations. Jon's responses also highlighted his view that students' perspectives are reasonable and worth learning from.

George had been teaching mathematics for 15 years and gave the survey to a class of eighth graders after a discussion of common errors on a recent end-of-unit assessment. As shown in Figure 1, different from Mari and Jon, George's interpretations of students' perceptions both *opened* and *closed* opportunities for inquiry into instruction. We found that, overall, his interpretations reflected a deficit perspective of his students' capabilities. Further, while he indicated that he aspired to a dialogic vision of instruction, his assumptions about his students resulted in him enacting a direct vision of instruction. For example, consider George's interpretation of students' responses to Item 1, "What did you need to do in order to be successful today?" (see Figure 2b). George focused on the students who chose "solve problems using the steps the teacher showed me" (15 students) and "finish all my work" (two students): "…it's what they're accustomed to. Whenever we give them work that they have to talk to each other and reason things out, it takes them so long to do it … they get so easily distracted." He next identified a few students in the class who he suggested would engage in reasoning, and then characterized "the rest of them": "they want to be spoon-fed." He elaborated: "That's what I'm trying to get away from, but maybe I'll do it next year, because it didn't happen this year." Different from Mari and Jon, George's interpretation closed off possibilities for future inquiry into instruction. From George's perspective, the students' responses reflected their current dispositions and traits – students who "want to be spoon-fed" and the few exceptions who "try to figure it out." Here, George also indicated that in response to these perceived traits of the students, he enacted a pedagogy of direct instruction, which was consistent with what he shared in his introductory interview.

Discussion and conclusion

In this paper, we reported on an exploration of teachers' interpretations of a novel representation of practice that features *students' perceptions of key aspects of the mathematics classroom learning environment*. It is rare to bring students' perceptions to bear in making sense of instruction in professional learning, yet this exploratory study suggests the potential value in doing so (alongside evidence of student reasoning) for two reasons. First, we found that, overall, these teachers tended to interpret their students' perceptions in ways that opened possibilities for future inquiry into instruction. Second, teachers' interpretations of their students' perceptions often provided

insight into their then-current pedagogical commitments, specifically their instructional aspirations and perspectives of their students' capabilities. Teachers' pedagogical commitments shape what teachers do in their classrooms and how they engage in professional learning; however, their commitments often remain out of view in professional learning (Horn, 2020). The incorporation of students' perceptions of the classroom learning environment could help surface and make instructional aspirations and views of students explicit objects of inquiry in professional learning. That said, interpreting a representation of practice can result in the reification of unproductive commitments regarding teaching and students (Little, 2003). This could very well be the case with George. Cases like George's suggest the importance of supporting professional development facilitators to learn how to respond productively to the insights gained into teachers' commitments.

A limitation of this analysis is that the sensemaking interviews took place with researchers, outside of a formal professional learning context. Future research will involve investigations of the use of surveys in professional learning, including when and how to introduce the tool, given teachers' current commitments and goals, and how to respond to a range of interpretations in ways that are supportive to teachers as learners. Of course, teachers' commitments do not develop in a vacuum; they are shaped, in part, by the discourses that circulate about teaching and students in the workplace, administrative expectations, and norms of interaction (Little, 2003). We will therefore also attend to features of the organizational context that undoubtedly shape how teachers interpret students' perceptions.

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