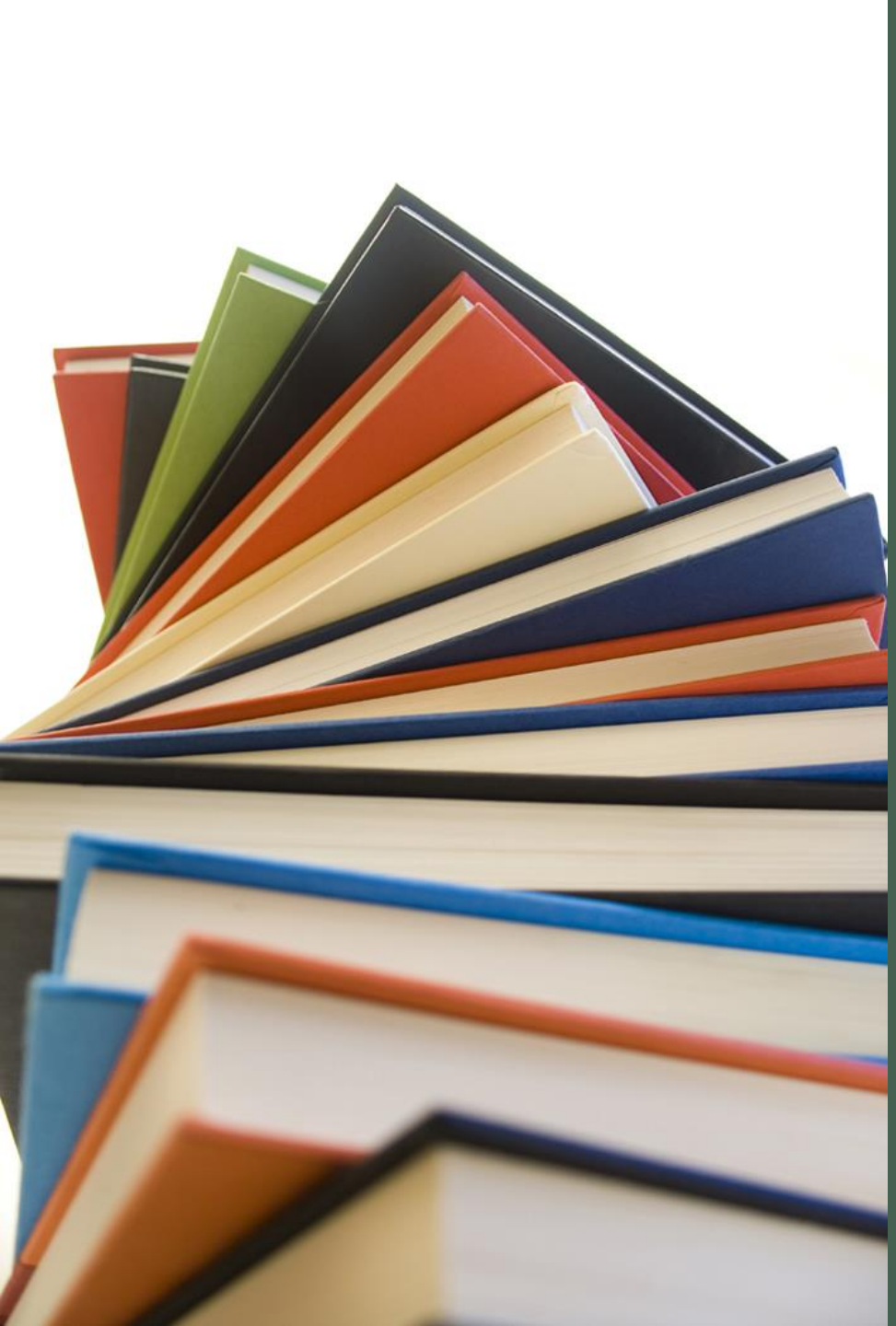

Untangling Classroom Positioning in Mathematics Education: Examining the Key Shifts of Teachers' Discourse and Interaction

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Overview

- This session is based on our recent manuscript accepted for publication in *Investigations in Mathematics Learning*. In this session, we ground our discussions in a classroom-based instrumental case from a fifth-grade mathematics lesson. We illuminate examples of how students are positioned within their mathematical experiences to understand some of the factors that affect how students exist within mathematical spaces and how classroom-based positionings impact students' opportunities to engage in learning.

- We offer key insights for how shifts in our own discourse and interactions can offer better positionings for students. We will offer implications for methodology and positioning theory through an ethnographic perspective. Our session goals are as follows: (1) Engage in the positioning of students and the implications for the learning of mathematics; and (2) Present insights to demonstrate how mathematics teachers can shift the positionings of students to offer more equitable opportunities for engaging in classroom discourse, collaborative endeavors, and making sense of mathematics.

Edelen, D., Bush, S.B., Schmidt, A., Fulton, T., Kebreab, L., Rutledge, T. (In-press). Untangling classroom positionings: An instrumental case study unpacking positioning theory in mathematics education. *Investigations in Mathematics learning.*

What is Positioning Theory?

- In this session, we use positioning theory as a tool to illuminate specific classroom interactions. Positioning theory is a reflexive tool used to make sense of social situations (Van Langenhove & Harre, 1999).
- Positioning theory is used to have a better understanding of the ways in which people come together to socially construct their realities.
- Positioning can refer to the physical arrangement of people in relation to those around them but most often is a metaphor of the relationships of people as actors in their daily social structures (Wagner & Herbel-Eisenmann, 2009).
- Positions are what people come to act out and positionings are how they come to be.

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Positioning and Student Mathematical Identity

- According to positioning approaches, identity is formed through social interactions that make claims about who a person is in reference to those around them in social settings (Davis & Harre, 1990).
- As students socialize with one another they position themselves in their desired capacity and roles (Langer-Osuna, 2017).
- How a student positions themselves contributes to but does not solely have the capacity to determine their own identity (Langer-Osuna & Edmonde, 2017).
- In mathematics education, learners constantly position themselves with respect to the doing of mathematics, their sense of self, futures, and interactions with peers and their community.

Edelen et al. (In-press)

Positioning and Authority in Mathematics Classrooms

- Authority is established not only within the identity of the teacher or an individual student but also across teacher-student relationships (Wagner & Herbel-Eisenmann, 2014).
- The use of first and second person pronouns in discourse are indicative of a classroom where the teacher's authority is without question.
- Within positioning theory, teachers and students are viewed as coparticipants. However, their positions are not always equal.
- Ultimately the goal is to position students as doers and thinkers of mathematics.

Edelen et al. (In-press)

Instrumental Case Study

Our session is based upon a case captured from an observation in a fifth-grade classroom during a unit on fraction operations. The case was selected because it is representative of typical instruction in this fifth-grade classroom.

The following case captures the introduction of a lesson that was approximately 10 minutes of the roughly 70 minutes of mathematics instruction for that day. At the time of this case, the researcher had been observing the classroom for approximately six weeks.

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Vignette Part 1

Researcher notes: I sat in the back of the classroom next to a student as the teacher began the lesson. As I watched, Mr. Jay placed his red mathematics notebook under a document camera and in turn each student pulled out their red notebooks as well.

1. Mr. Jay: Ok folks, you know the drill, let's turn to a fresh page and get to it.

Researcher notes: Each student flipped through their pages until they reached an unmarked page.

2. Mr. Jay: Alright everyone, today we are going to continue to work on multiplication of fractions, which is so much easier than adding or subtracting fractions, don't you think? Because when we multiply we don't have to worry about that messy common denominator stuff… bluh. *(He made a disgusted face and stuck out his tongue – several students mirrored his facial expressions).* Someone remind me. What do we have to remember? Anyone?

Researcher notes: Several students raised their hands and the student I sat next to flipped back through their notebook.

3. Mr. Jay: Ah yes, Mr. Richard.
4. Richard: All we have to remember is to *stay in your lane.*
5. Mr. Jay: Class we have to do what?
6. Students in unison: Stay in your lane.
7. Mr. Jay: That is right. We just stay in your lane. It really is that easy. So when you get to this part on the big test, you don't have to worry, just draw out your lane and multiply right across. We can all multiply and we got this. Let's try one. But first, date the page and write down *stay in your lane* at the top, so you don't forget.

Researcher notes: Mr. Jay wrote at the top of his notebook the date and then "STAY IN YOUR LANE" at the top of the page. Underlining it twice and then pointing to the class. He paused as students wrote in their notebook. The student next to me underlined their statement twice as well.

8. Mr. Jay: Ok let's work one out before I turn everyone loose today. Let's do a nice and easy one for us (*as he spoke he wrote the multiplication fraction problem* $\frac{3}{4} \times \frac{2}{5}$ *in his notebook using the lined notebook to aid in representing the fractions by placing the numerators above one of the lines in the pages and the denominators below*. Alright remember to place them in their rows here folks. See, look 3 and 2 are in the same lane *(he then drew a series of dashed lines between 3 and 2).* And 4 and 5 are in the same lane (he drew more dashed lines between 4 and 5).

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Vignette Part 2

Researcher notes: Mr. Jay tapped his notebook twice with the reverse side of his pen and then stepped to the side of the document camera. During this time, the students copied from the board. The student next to me looked up several times in the process of writing the problem the same as what was displayed on the board.

9. Mr. Jay: Alright. So what do I do now? (He pointed his pen to the students).
10. Students in unison: Stay in your lane.
11. Mr. Jay: Stay in my lane. Ok so that means that our top lane is 3 and 2 (He drags the reverse side of his pen between 3 and 2). And 3 and 2, oh that's an easy one. Anyone got it?

Researcher notes: Several students raise their hands.

12. Mr. Jay: Yes Aaron.
13. Aaron: it is five
14. Mr. Jay: Ah, not quite, remember we are focusing on multiplication of fractions today. Anyone else? (He points to a student at the front).
15. Michelle: 3 times 2 is 6.
16. Mr. Jay: That's right, easy peasy folks. We did the top lane, what about our bottom lane? (He wrote in 6 to the right of an equal sign). Anyone. Uhh yes (he pointed the reverse side of his pen towards a student seated in the back of the room).
17. Casey: That one is easy. It is 20.
18. Mr. Jay: Very nice sir. Very nice.

Researcher notes: Mr. Jay drew the fraction bar under the numerator of 6, directly over the line of his notebook page. He then drew 20 under the fraction bar. He then flipped his pen and tapped the reverse side twice. He then walked to the side of the document camera and watched as the class copied down the problem. The student next to me took care to draw the fraction bar over the notebook line, erasing once when it was not drawn exactly over the line.

19. Mr. Jay: But wait, there's more. Am I done yet? (He points his pen towards the class).
20. Students in unison: No.
21. Mr. Jay: Well why not. I got the correct answer, didn't I? (Several students raised their hand, he called on the student next to me).
22. Jaden: You got to simplify it.
23. Mr. Jay: You are right. Can I do that here? (He gestured back to the fraction with his pen. Several students raise their hands). Ah yes, Emma.
24. Emma: Yeah you can. That one is 3 over 10.
25. Mr. Jay: Very good. Can you walk us through that one Emma?
26. Emma: Yup. Well that one was easy. I just started with dividing the top and the bottom by 2 and got 3 over 10. I knew that I can't divide anymore because 3 can't be divided anymore so I could stop.
27. Mr. Jay: Yes. Very good. Well that one was easy peasy (points his pen to the class).
28. Students: Lemon squeezy.
29. Mr. Jay: Alright folks. I am going to turn you loose. Work through the practice problems on page 67 of your workbook. You can choose to work alone or with a partner of your choice. You shouldn't have any problems with these, just remember to stay in your lane and you will be good to go. And go.

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Shifting Mathematics Instruction to Attend to Positionings

In following slides, we outline several key moments in which a shift in the social act might offer a more equitable opportunity for students. Building from the notions of NCTM (2020a) "teachers and their instructional practices have strong influences, often far greater than one realizes, on children as they learn mathematics" (p. 45). We further investigate this assertion by noting key moments in the case where small changes could have provided more meaningful opportunities to engage students in the learning of mathematics. Each discussion point offers an opportunity to demonstrate how positioning theory might be used to make sense of and arrive at these common storylines and specific acts that might offer more equitable approaches for students. We also offer a table to outline how shifts in social acts can offer different positions for students.

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Shifting Mathematics Instruction to Attend to Positionings - 1

Teachers As Sole Content Experts- Mr. Jay is positioned at the class podium and document camera in front of the class. Students follow a behavioral pattern of copying everything down from someone who is in the position of authority.

- In the I Do, We Do, You Do model, Mr. Jay shows them exactly how to solve the problem in the I Do stage.
- This positions Mr. Jay as the sole content expert and judge of correctness.
- Instead, give students time to work first on their own strategies and explorations and allow them to present their strategies to the class.

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Shifting Mathematics Instruction to Attend to Positionings - 2

Mathematics Procedure as Easy-In turn 8, Mr. Jay states, "let's do a nice and easy one."

- Through this social act, students are left to think the problems that follow are easy.
- If students have difficulty with the "easy" problems this could have a negative impact on their mathematical identity.
- Instead of identifying specific math problems as easy, hard, or difficult, the teacher remains neutral and gives students the opportunity to engage without being positioned based on how the teacher feels about the difficulty level of the problem.

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Shifting Mathematics Instruction to Attend to Positionings - 3

Moving away from **I Do, We Do, You Do-** model in which the teacher provides examples, the class or small groups practice a couple together, and then the students practice independently. This model is teacher-centered in nature and showcases the teacher as the holder of all the information with the expectation of students to blindly follow.

- Mr. Jay states "Which is much easier than adding or subtracting fractions, don't you think." This is teacher-centered language and could lead to a disdain for mathematics.
- Instead, Mr. Jay might say, "which is a bit different than adding or subtracting fractions." Here, the tone remains neutral for students, and they are not positioned to think either positively or negatively about experiences with such procedures.

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Shifts in Social Acts and Positionings

Mr. Jay's Social act	Suggested Social Acts	Suggested Positioning Opportunities
"It really is easy" "Oh that's an easy one"	"I am confident that each of you can explore this " "What an interesting problem for us to explore"	Alleviate teacher authority by encouraging student exploration and presentation of self-invented strategies.
"You should not have any problems with these"	"It's okay if you don't have it yet, you will get it"	Position students as mathematical experts. Attend to localized student status so that students do not position each other as incompetent.
"That's right" "Very nice" "Ah, not quite"	"Student B what do you think about what student A just said." "Did anyone come up with a similar answer or approach" "Who can build on their thinking here?"	Remain neutral as a teacher. Instead encourage students to critique the reasoning of their peers.
"Stay in your lane"	"What might be an approach we can use to solve this?" "What strategies can we build on to better understand this problem?" "What patterns do you notice? How can we use those patterns to develop a strategy for solving this problem?"	Position students as the experts of the content. Encourage students to display and share their thinking using document cameras or as anchor charts in the classroom. Consider naming strategies after student authors to encourage mathematical agency. Pay close attention to which students author certain mathematical ideas, then attend to unequal statuses if certain students author strategies more often than others.

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Implications for Positioning Theory in Mathematics Education

- Positioning theory offers a unique perspective for mathematics teacher educators. Through this lens, teachers can identify specific social acts that led to equitable or inequitable opportunities for students.
- Teachers can examine the implications of their social acts and the subsequent consequences for student identity, agency and positioning of doers of mathematics.

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Positioning Theory Through an Ethnographic Lens

- In this session, ethnography was used as a guiding lens when approaching positioning theory. In using this approach, we identified small, somewhat nuanced moments that may have otherwise been overlooked.
- In attending to an ethnographic perspective, the over time construction of storylines, positions and social acts are made visible for researchers.
- Within mathematics education, positioning theory is routinely used to make sense of small moments in time; the attention to the ethnographic perspective allowed us to incorporate social significance as was observed over multiple days and interactions with students.

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Concluding Thoughts

Positioning theory has great potential for examining students' opportunities to engage in with the content, the materials, and each other in collaborative learning. As our field continues to call for approaches to teaching mathematics that moves "the power and authority from the teacher, textbook, and tools to the students" (NCTM, 2020a, p. 51), we must critically examine the socials acts involved in such a move being possible for our students. Attention to the ways in which our students are positioned, in what context, and through what means, allows for a greater understanding of the moves that would be required to position our students with a high level of autonomy, authority, and agency in mathematical spaces.

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