NCSM Journal

of Mathematics Education Leadership

SPRING 2015 VOL. 16, NO. 1

National Council of Supervisors of Mathematics www.mathedleadership.org

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Norms for Teachers' Discussions of Students' Mathematics in Professional Development Settings

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Abstract

In this paper, we share our experiences using student work to engage teachers in learning about students' mathematical thinking and the need to develop norms for talking about students' mathematics in professional development settings. In such settings, it can often be challenging to maintain productive perspectives that focus on students' mathematics. We describe our experiences facilitating a professional learning task designed to support teachers' participation in discussions about students as mathematics learners. We share discourse norms that can be used by teacher leaders to focus teachers' discussion on students' mathematical thinking and a set of questions that teachers may use to reflect on their students' mathematical thinking as they engage in discussions with colleagues about students' mathematics.

Introduction

Consider two contrasting statements from teachers' discussions about their students' mathematical work:

"He's in the low group, so I thought this task is way too hard for him."

"He started counting from six. He used his fingers to show 'seven, eight, nine.' So I think he can count on."

What might each statement reveal about the student's understanding? What knowledge and opportunities can teachers leverage? What information does each statement provide about the student's prior knowledge that teachers can use in responding to the student? Further, how does each statement portray the student as a doer of mathematics?

Students' mathematical work is often a central focus of discussions in professional development settings, grade level meetings, and professional learning communities (Sowder, 2007; van Es & Sherin 2008). Student work in the form of video cases, classroom videos, and written work is often used to foster teachers' discussions about teaching and learning by reflecting on specific aspects of students' mathematical thinking (Kazemi & Franke, 2004). Though these discussions can lead to insights into

students' successes and struggles, maintaining a productive perspective that focuses clearly on the mathematics of the student can be challenging (Battey & Chan, 2010). In this paper, we consider norms that can be used when teachers are engaged in discussions about students' mathematical thinking.

We share the statements above to illustrate the challenge of focusing professional discussions on students' mathematical thinking. Both statements come from a professional development project in which elementary teachers learned about students' learning trajectories in mathematics. These trajectories, which served as the basis for development of the Common Core State Standards for Mathematics (Common Core State Standards Initiative, 2010), represent levels of students' mathematical thinking as they progress from less to more sophisticated over time (Daro, Mosher, & Corcoran, 2011).

Throughout our professional development, teachers watched a variety of videos of interviews with children. As the project unfolded, we learned that explicit norms for talking about students supported teachers' participation in productive discussions about students' mathematical thinking. For example, discussing students in ways that mask their mathematical understanding by focusing on non-mathematical factors, such as classroom management, ability grouping, or grade-level expectations, promoted an image of students as mathematics learners that was not based on their mathematical thinking. This way of talking about students left teachers with little recourse in supporting students' mathematical development. Alternatively, describing what students can do and making hypotheses about their thinking based on evidence contributed to an image of students as doers of mathematics, where the role of the teacher is to design instructional experiences that build from students' current conceptions to move learning forward.

In this paper, we share our initial experience facilitating a professional learning task designed to engage teachers in discussions about students' mathematical thinking represented in student work. We discuss how the task unfolded and how we altered the task to support teachers in participating in productive discussions about students as mathematics learners. We conclude with a set of questions that teachers may use to reflect on their students' mathematical thinking and to engage in discussions with colleagues about students' mathematical thinking. These questions support both teachers' individual reflections and their professional discussions in learning communities.

Professional Norms

Those who design and study professional development have noted the importance of teachers' studying the practice of teaching (Sowder, 2007). As a consequence, there is increased attention to utilizing practice-based professional learning tasks (Ball & Cohen, 1999) to support teachers' development of their mathematical knowledge for teaching (Ball, Thames, & Phelps, 2008). Professional learning tasks also foster a "disposition of inquiry" (p. 27) for teachers to learn in, from, and around their practice. In particular, professional learning tasks that utilize student work samples, video, and narrative cases bring the work of teaching into a setting that allows teachers opportunities to inquire about their practice. The use of classroom videos and students' written work in these professional learning tasks has been connected to improvements in teachers' classroom instruction (Kazemi & Franke, 2004; Sherin & van Es, 2009).

The use of artifacts from practice in professional development settings for teachers has resulted in increased awareness of the norms necessary to cultivate teacher learning (Nemirovsky, DiMattia, Ribeiro, & Lara-Meloy, 2005; Van Zoest & Stockero, 2012). Seago, Mumme, and Branca (2004) proposed the idea of *professional norms* — a set of norms needed to support teacher learning from practice. They recognized that teachers talk about mathematics teaching as much as they talk about mathematics itself, and explained that professional norms were patterns of behaviors specific to talking about teaching. Seago and colleagues (2004) developed a set of professional norms in conjunction with their video cases to help teachers learn to analyze instructional decisions. These norms included: listening to others' ideas, adopting a tentative stance towards practice (i.e., wondering versus certainty), providing evidence, and being critical yet respectful.

Van Zoest and Stockero (2012) incorporated the norms outlined by Seago et al. (2004) into their work with teachers to help foster teachers' mathematical knowledge for teaching. Although they did not explicitly discuss these norms with the teachers, they purposefully worked to develop the norms in professional discussions. For example,

when examining student thinking and teaching in videos, facilitators encouraged participants to provide specific evidence for the claims they made. According to the researchers, introducing such norms early in the teachers' discussions supported teachers' learning of mathematics with understanding and learning from practice.

In our professional development, we fostered similar professional norms regarding the use of practice-based artifacts. However, we focused not only on the ways teachers talked about mathematics teaching, but also attended to the ways teachers talked about students. Just as teacher learning can be supported by norms for discussions about teaching, we argue that similar learning can result from constructive discussions about students as mathematics learners.

In what follows, we describe how we revised a professional learning task we used in the Learning Trajectory Based Instruction project with the goal of promoting norms for talking about students' mathematical thinking in ways that attend to their current mathematical understanding instead of pre-determined, fixed expectations based on factors such as grade level or achievement.

The Learning Trajectory Based Instruction Project

Learning Trajectory Based Instruction (LTBI) is a professional development project that engages teachers in learning about students' mathematical thinking and an instructional model in which student thinking provides guidance for teachers' instructional decisions. Our work is based on the concept of learning trajectories, which use research on student learning to clarify the intermediate steps students take as learning proceeds from informal understanding to more sophisticated concepts over time (Clements & Sarama, 2004; Confrey, Maloney, Nguyen, Mojica, & Myers, 2009). LTBI utilizes professional learning tasks that emphasize students' mathematical thinking, the use of open instructional tasks, and pedagogical practices that build on and centralize student thinking. As we considered the practice-based artifacts used in the professional development, we prepared to address norms for talking about teaching by emphasizing the need to be critical yet respectful when talking about videos that share teaching and interactions with students. Yet, as we discuss in this paper, we found that these norms concerning mathematics teaching were insufficient to keep discussions of mathematics learners productive and focused.

A Professional Learning Task Focused on Students' Mathematical Thinking: An Example

The initial professional learning task we used in LTBI engaged teachers in discussing when they were surprised by the mathematical thinking a student displayed. Our goal was to encourage teachers to consider the need to listen to students in order to understand their mathematical thinking. We used videos of interviews of three students engaged in fair sharing problems. We first described the problem students were solving, which involved sharing 24 coins fairly among three pirates and sharing a round birthday cake fairly among six friends (Wilson, Edgington, & Confrey, 2010). We asked teachers to anticipate how the students would likely solve the problem, and asked them to make notes as they watched the videos using the following guidelines: 1) monitor what the children were doing as they solved the tasks, 2) compare the students' strategies and solutions to what was anticipated, and 3) think about what was surprising about the students' mathematical thinking.

After viewing the videos, teachers discussed their observations in whole group. As this discussion progressed, we noted that despite our efforts to focus on students' mathematics, most of the discussion attended to the ways the questions were posed in the interviews or the materials the students were using. Little attention was given to teachers' speculations of the students' current mathematical understandings using evidence from the videos. The following quotes summarize the discussion that emerged during this professional learning task.

> *Yeah, at first I thought she was guessing. Oh, she just got lucky, you know? And then she explained it. But with the 3rd grader, the proctor, she said, "Well, why don't we put these back together and then divide them." And I wonder what would have happened if they stayed in those four groups and she said, "What if one of these pirates went away, how could you share these?" I thought the results could have been a lot different.*

> *I think she was told to because she didn't know how to get started.*

I expected the third grader to maybe, initially my thought would have been that at least she would have been putting them over in groups of two. So I was really surprised that she was just one, one, one.

My last thought was that the interviewers . . . these hands would come into the field of vision and he's like doing stuff. And I was just wondering if [the student] is going off her intuition and a little, you know, not sure of herself, how much that particular factor might have thrown her? Just like in her case, that might have been a big influence.

These comments indicate that the discussion of the video focused on the wording of questions, grade level expectations, luck of the student, or the influence of the interviewer as opposed to the mathematical understandings exhibited by the students in the videos. The discussion was not as focused on the students' mathematical thinking as originally intended in the professional learning task. Although teachers adhered to professional norms put in place, further norms were needed to guide discussions about students' mathematical thinking. It is this set of norms that we aim to share. As we revised the professional learning task, we sought to be more purposeful about setting norms to guide teachers' conversations about students' mathematical work.

Norms for Discussing Students' Mathematical Work

Building from professional norms used for teachers to talk about teaching, we developed four guidelines for teachers to consider as norms for talking about students (Figure 1). While these are similar to other professional norms (Seago et al., 2004; Van Zoest & Stockero, 2012), they are specific to discussing *students' mathematical thinking*. Moreover, these norms can be purposefully shared with teachers in the context of analyzing students' written work or watching videos of students engaged in mathematical tasks. They aim to encourage teachers to use evidence from representations of students' work to consider the students' mathematical understandings, focusing on what the students can do as opposed to what they cannot do. In the sections that follow, we describe each norm, including its purpose towards supporting teachers' focus on students' mathematical thinking.

FIGURE 1.
Norms for discussing students' mathematical thinking

- Describe what students can do
- Provide evidence for your claims about what students do or do not know
- Develop hypotheses about the mathematical reasoning for the work students do
- Recognize when statements are speculations or judgments

Describe what students can do. To focus on students' mathematical thinking, it is important to describe what students are doing, withholding any judgments or expectations. This is in contrast to statements that speculate about a student's capabilities based on what is known about the student's grade level, achievement, or previous work. Since student-centered instruction builds from students' prior knowledge and current understandings, identifying and articulating what students are doing mathematically may lead to building meaningful instruction.

Provide evidence for claims about what students do or do not know. When discussing students as mathematics learners, providing evidence for claims is key. Stating evidence assists in avoiding unwarranted speculations or judgments that detract from a focus on the mathematics. Moreover, evidence provides details about students' mathematical thinking that can be leveraged when considering future instructional moves.

Develop hypotheses about students' mathematical reasoning. Once what students are doing is identified, more accurate hypotheses about students' possible understandings or alternate conceptions can be made. It is important, however, to remember that when discussing videos or samples of student work, what we have are hypotheses, not certainties, about students' understandings. We can consider what instructional experiences might provide us with opportunities to confirm or revise our hypotheses.

Recognize when statements are speculations or judgments. Often, when discussing students' mathematical work, we may speculate what students are or are not capable of doing. Recognizing when statements are speculations or judgments allows for the examination of assumptions or expectations one may carry about students as learners

of mathematics. Such recognition focuses on children as mathematical thinkers rather than other factors such as behavior, race, or gender.

Discussion

We have continued to use the same professional learning task described earlier with teachers in order to support them in focusing on students' mathematical thinking. However, we share the norms for discussing students' mathematics as shown in Figure 1 with the participants prior to watching the videos. As teachers examine students' mathematical thinking, we explicitly encourage them to focus on what students are doing, provide evidence for their claims, make hypotheses instead of certainties, and understand when statements are speculations. During professional discussions, when teachers discuss students using predominantly non-mathematical characteristics, or are unclear about evidence or expectations, we openly challenge them to apply these norms to focus their discussion in productive ways. Though occasionally the use of language and expectations associated with students' grade level or perceived ability occurs, we are finding that teachers recognize when these labels are not useful for considering students' mathematical thinking. As one teacher commented:

> *I think more about where they are in their learning as opposed to 'we're at the end of third grade and this is what you should be doing.' It's more so, at the beginning of third grade, he was doing things on this level or this level, but look at the progress he's made. He's now dabbling in place value and he's really strong in counting on.*

Further evidence of teachers' use of the norms to describe students' mathematical thinking from subsequent iterations of the LTBI professional development can be found in the following quotes.

> *Her understanding right now is that you take the smaller numbers from the larger numbers, so she was moving from the top number, you know…I think she would get it but she is missing that link. But that's just something she hasn't been taught yet.*
>
> *She knows she can't take something away from zero.*
>
> *She could look at the rod and cover up 3 and see it was 7 and say, "Oh, this is 47."*
>
> *I am speculating that maybe she has never been taught, she doesn't have the language to describe what she just did. Basically, she regrouped…she didn't know that's what she was doing…I wonder if she just has never been officially taught regrouping.*

Conclusion

Based on these experiences and the positive outcomes of the norms for discussing students as mathematics learners, we conclude by offering a set of questions that may assist teachers and teacher leaders in agreeing upon productive ways to carry out professional discussions of students' mathematical thinking.

1. What is the student able to do mathematically?
2. What evidence do I have?
3. What does this reveal about the student's understanding?
4. What are some potential instructional moves based on the student's current understandings?

Author's Note: *This report is based upon work supported by the National Science Foundation under grant number DRL-1008364. Any opinions, findings, conclusions, or recommendations expressed in this report are those of the authors and do not necessarily reflect the views of the National Science Foundation.* ✪

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