Building Powerful Climates for Mathematics Teaching and Learning

inside + × = ÷ mathematics

Supporting the Learning Community Mia Buljan, 2nd Grade

Desiree H. Pointer Mace, David Foster, and Audrey Poppers with Mia Buljan

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Appreciations

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With deep gratitude,

Desiree Pointer Mace, David Foster, and Audrey Poppers

Overview

How thoughtful teachers start their year off, and how you can do the same, no matter what day it is.

Introduction: Happy new year!

If you have already read other Mia guides, please skip to page 9.)

When is Day One for you?

Teachers have unique rhythms and timelines in their profession. There are multiple times when it makes sense to reconsider the way you approach your teaching. For you, it might be the beginning of the school year. You might have a new group of students, a new grade level or content area, or a new context. After the winter holidays might also be a time of renewal and reconsideration of your teaching practice. Or it might be at the beginning of a new semester or trimester. Or after required standardized testing is completed.

It doesn't matter when that Day One is for you-- what's important is that we all arrive at times when we resolve to try something new, to recalibrate the way we've been approaching the teaching and learning in our setting. This set of guides is for you.

In this guide, Inside Mathematics invites you to explore the teaching practice of an engaging elementary practitioner, Mia Buljan (2nd grade). Like most teachers, Mia would never describe her teaching as "best practice," but she is someone who continues to learn from and with her students each year. Through the documentation of her classroom, we open up new conversations-- around the daily work to help children begin to see themselves as mathematical thinkers who can draw on their own strategies and those of others to understand and find solution pathways in various problem settings.

Mia: I love my job! I don't know why. I think elementary school is where the action is. I think that kids are still... I think that kids are not fully formed? And so you have a high level of impact on the choices that you make, you see immediate results. They start to ... mimic you, they start to talk like you talk, they start to care about things that you care about... Teaching is the best job I ever had... I've had other jobs, they're not interesting, they're not creative. When there's a kid in front of you who doesn't understand something, the creativity and passion it takes to figure out what they need to know and help them learn it, is the single most satisfying thing about teaching. That this kid, right in front of you, needs you to work tirelessly, is very satisfying compared to other jobs that I have had.

Video reflection: Why do you love teaching?

No matter what day it is when you read this, for you, it is Day One. Today, you're deciding to explore some other teachers' practices so you can rethink your own. Welcome!

☞ ***Throughout these guides, you will find occasional questions formatted like this for individual or small group reflection. We encourage you to use these questions to deepen your engagement with the video excerpts.***

Connections to Research and Standards

Building Mathematically Powerful Students

Our focus in creating these guides is to invite you into classrooms so that you can consider different ways to approach your teaching. In Mia's classroom, though her school context and students may differ from yours, she and her students are engaged in practices that are strongly supported by research on teaching. Mia is working to challenge students to become mathematically powerful. Ruth Parker's landmark 1993 volume *Mathematical Power* reinforces the need for students to "do mathematics: to conjecture, invent, play, discover, represent, apply, prove, experiment, and communicate" (p.212). Our representations in these guides show second grade students doing math in just this way.

We also draw on the Teaching for Robust Understandings in Mathematics framework (aka TRU Math Dimensions, Schoenfeld & Floden 2014). In it, the authors set forth characteristics of "mathematically powerful" classrooms.

The Five Dimensions of Mathematically Powerful Classrooms:

The Mathematics	Cognitive Demand	Access to Mathematical Content	Agency, Authority, and Identity	Uses of Assessment
The extent to which the mathematics discussed is focused and coherent, and to which connections between procedures, concepts and contexts (where appropriate) are addressed and explained. Students should have opportunities to learn important mathematical content and practices, and to develop productive mathematical habits of mind.	*The extent to which classroom interactions create and maintain an environment of productive intellectual challenge conducive to students' mathematical development. There is a happy medium between spoon-feeding mathematics in bite-sized pieces and having the challenges so large that students are lost at sea.*	*The extent to which classroom activity structures invite and support the active engagement of all of the students in the classroom with the core mathematics being addressed by the class. No matter how rich the mathematics being discussed, a classroom in which a small number of students get most of the "air time" is not equitable.*	*The extent to which students have opportunities to conjecture, explain, make mathematical arguments, and build on one another's ideas, in ways that contribute to their development of agency (the capacity and willingness to engage mathematically) and authority (recognition for being mathematically solid), resulting in positive identities as doers of mathematics.*	*The extent to which the teacher solicits student thinking and subsequent instruction responds to those ideas, by building on productive beginnings or addressing emerging misunderstandings. Powerful instruction "meets students where they are" and gives them opportunities to move forward.*

image from Schoenfeld & Floden 2014, p. 2

To be sure, daily life in classrooms is complex. No one teacher ever feels like all aspects of teaching is exactly in place. But if we think about these characteristics, we can then begin to align them with the moments when things are clicking, when students are making connections, when teachers are challenging learners to follow a line of reasoning or defend their thinking.

This framework asks us to keep in mind the math itself, how cognitively challenging the climate and task are, how learners are all equitably engaged in the task, how students balance and negotiate mathematical understandings among themselves, and how the teacher (and the students) evaluate and assess the learners' developing understandings.

Connections to Standards and Practices

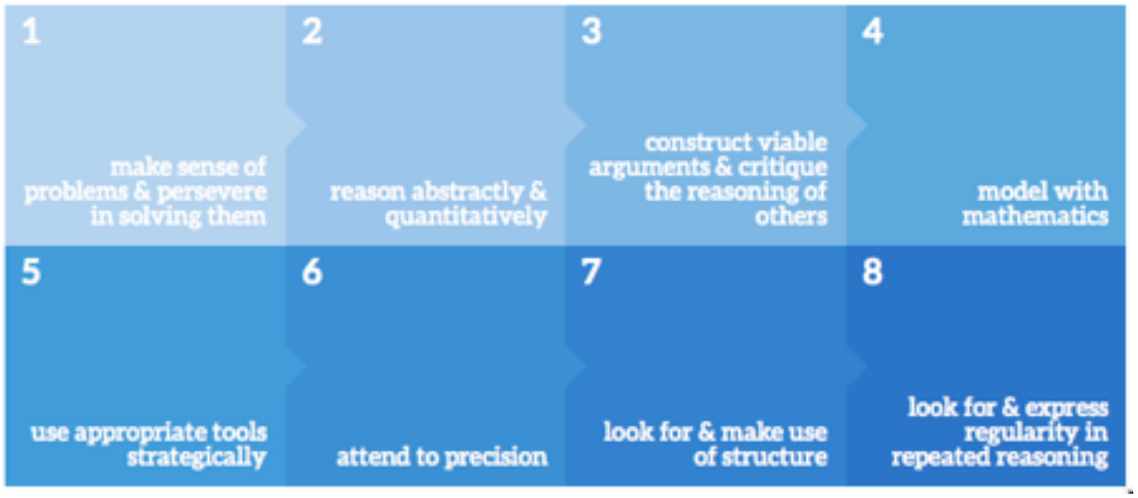
Depending on your school setting, you are also challenged to show how your instructional decision-making aligns with local or national frameworks for mathematics teaching. The National Council of Teachers of Mathematics (NCTM) has recommended eight Mathematics Teaching Practices as part of their "Principles to Actions: Ensuring Mathematical Success for All" series of documents.

Mathematics Teaching Practices
Establish mathematics goals to focus learning. Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.
Implement tasks that promote reasoning and problem solving. Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and allow multiple entry points and varied solution strategies.
Use and connect mathematical representations. Effective teaching of mathematics engages students in making connections among mathematical representations to deepen understanding of mathematics concepts and procedures and as tools for problem solving.
Facilitate meaningful mathematical discourse. Effective teaching of mathematics facilitates discourse among students to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.
Pose purposeful questions. Effective teaching of mathematics uses purposeful questions to assess and advance students' reasoning and sense making about important mathematical ideas and relationships.
Build procedural fluency from conceptual understanding. Effective teaching of mathematics builds fluency with procedures on a foundation of conceptual understanding so that students, over time, become skillful in using procedures flexibly as they solve contextual and mathematical problems.
Support productive struggle in learning mathematics. Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.
Elicit and use evidence of student thinking. Effective teaching of mathematics uses evidence of student thinking to assess progress toward mathematical understanding and to adjust instruction continually in ways that support and extend learning.

NCTM, 2014 http://www.nctm.org/uploadedFiles/Standards_and_Positions/PtAExecutiveSummary.pdf

Like the TRU framework, the PtA practices focus on active engagement in mathematics by teachers and students alike. There is no passive or receptive stance if students are being supported in productive struggle. There's no lecturing for sustained periods if practitioners are facilitating meaningful mathematical discourse. Active exchange of ideas undergirds all of these practices.

The Common Core State Standards also highlight eight standards of mathematical practice, which Mia uses in her home state of California.



Standards of practice are distinct from content standards in that they not only address what students should *know*, but what mathematically powerful students *do* when they are engaged in thinking and reasoning. Creating the conditions for mathematical practices in students takes time and careful creation of a learning environment and interactive norms to support students in increasingly assuming responsibility for their own mathematical learning.

Building Cultures of Thinking

While we have highlighted teachers' practices during math instructional time, you don't have to be a math teacher to draw from these insights and work to engage learners. The teachers' classrooms we've documented open up conversations about what it takes to create cultures of thinking and make thinking visible. Elements of the work of Harvard University's Project Zero on Visible thinking are evident in Mia's classroom. Ron Ritchhart's 2015 book *Creating Cultures of Thinking* describes ways in which teacher expectations, language, use of time, modeling and apprenticeship, routines, structured opportunities, interactions, and environment all contribute powerfully to student learning. From day one, Mia establishes and reinforces the expectation that learning is an active process and that engagement with the math and with other learners is continuous. Ritchhart distinguishes "learning-oriented" from "work-oriented" classrooms; in the latter, teachers are concerned with compliance and completion of tasks, in the former they are "listening for the learning" (p.45) and use questioning to scaffold and extend students' understandings.

Powerful Assessment Outcomes

This is not just a story about great teaching (though the people with whom we've collaborated certainly are strong practitioners!) We want to reinforce the powerful outcomes of approaching teaching in an authentic way that develops students' agency, authority and identity as mathematicians. Each year since 1999, students in districts in the San Francisco Bay Area have taken a performance assessment test called the Mathematics Assessment Collaborative (MAC) exam. The design and architecture of these performance tasks were developed by the Shell Centre at the University of Nottingham. The exam assesses not only math content, but also the Standards of Mathematical Practice. All the tasks must be hand-scored. The test

is given in grades 2 through Algebra 2 or Integrated Course 3 in high school. Prior to adopting the Common Core State Standards in Mathematics, students in middle school underperformed on the performance assessments. In 2013, only 21% of eighth graders met standards on the MAC exams. In 2015, eighth grade students showed significant gains in student achievement. The percentage of students meeting standard almost double with 40% of the students meeting standard. This dramatic gain is due to more effective instruction and de-tracking students. By engaging all learners in interesting tasks, students' assessment data rise dramatically.

Thinking about Content, Structure, and Strategies

In all of the guides in this series, we want to underscore that teachers are considering multiple dimensions of mathematics learning as they teach. They think about the content outcomes (like understanding place value and "ten-ness"), they make explicit to students the structure of a problem (Is this a put-together or a take-apart problem? is this a constant rate of change problem?), and they present and refer back to strategies for problem solving (Do you count all? Count back? Think about a part/part/whole relationship?). Your students will benefit most if you consider how they will respond to these dimensions in any given problem or learning opportunity.

This takes time. It's important to be patient with ourselves as learners, just as it's important to be patient with our students.

Mia: One of the things that's really obvious when you're teaching reading is... you don't do that by getting a brand new book. You go get a book with a character that they already love, like Chrysanthemum, or Pete the Cat. Lo que sea... Whatever it is, right? You take that book that they know and love, and you say, let's look at the character. If you had two books, you could probably teach everything you need to teach, by the lens with which you're looking at the book today...When I started thinking about a math story problem as an actual story, that made a lot of sense to me, to think about it as 'This is my mentor text, and this is the problem where my kids are going to learn about combining things.'" (play video for more)

Mia on "Mentor Problems"

The Power of Re-engagement

The teachers represented on Inside Mathematics frequently make use of re-engagement to surface misconceptions or identify stronger approaches. Inside Mathematics has several resources related to this approach at (http://www.insidemathematics.org/classroom-videos/formative-re-engaging-lessons) . This approach frequently presents two

or more different approaches to solving a problem (e.g. “Learner A” and “Learner B”) and then invites students to evaluate the learners’ approaches and make recommendations to them. Often these exemplar learners’ work are selected directly from a teacher’s own group of students. Though students may recognize work as their own, what’s critical in formative re-engagement is that the emphasis is on advising and recommending changes to the learner rather than simply engaging in peer correction of the answers.

Supporting the Learning Community

How teachers can create a climate to support student mathematics learning.

2

Supporting the Learning Community

Concepts

1. **Polite Talk and Listening**
2. **Supporting Others**
3. **Sharing and Working Cooperatively**

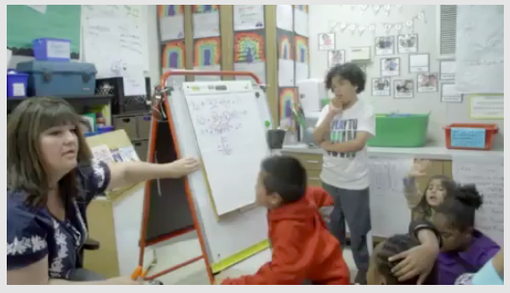
Introduction

Mia expects that all of her students actively support their own learning and that of others.

By the end of the year, Mia's second graders have practice supporting each other's thinking, and looking at each other's ideas; however, she still reinforces behavioral expectations for their listening behavior.

Mia: Hold on, hold on, let's make sure that everybody is listening to Afoa's idea... What it looks like when you're watching someone's idea, is you're facing them and you're not blocking anybody.. Same goes for you, you are facing him and sitting flat. In your head, when you're watching someone, is "Do I get it? Do I understand them, and do I agree with them?" First you have to understand before you can agree or disagree. So right now, we're just trying to understand him. Got it? Listen to Afoa's idea.

Video (Day 158): Reinforcing expectations for listening and attending to peers



She challenges students to think while they listen, asking themselves "Do I get it? Do I understand them? Do I agree with

them?” In so doing, she emphasizes how critical it is for them to listen attentively, engage with each other’s ideas, so that everyone’s understanding increases and deepens.

☞ ***How do you reinforce expectations for listening and attending to peers?***

Polite Talk and Listening

In the beginning of the year, Mia engages her elementary students in understanding what it looks like and feels like for them to talk with and listen to each other.

Mia: Can you remind me what happens on carpet? Where are you supposed to sit? Does anyone remember?
Mia (reflecting): I use the carpet quite a bit, maybe more than I should. At their desks, they're just so far away... and there's no good place to stand for everybody. They're far away, and they hide. They hide behind the book, or they hide under their desks. There's something about gathering them in, in this sort of, almost like a pow-wow feeling. We're gathering in on this idea, or we're gathering in on this activity. So if I need their full attention, I'll often do it on the carpet.
Mia: Natalie?
Student: At the same spot that you sit at yesterday.
Mia: The same spot that we've been sitting in. Can everyone remember their spot?
Students: Yes.
Mia: And what about my friends in the back row. Do you have a spot?

Video (Day 2): Making the purpose of gathering together clear

Students: Yes.
Mia: Okay. What else do we know about sitting on the carpet? What does it look like when we sit on the carpet? What does it look like? Picture it in your head. What are you doing?

She challenges them to "activate themselves as a community of learners," reinforcing the physical expectations of listening: "we might need to turn to each other as we're listening."

☞ *What is your purpose for gathering your students? Do they understand that purpose?*

Mia challenges her students to meet high expectations, recognizing that they are capable of making calm transitions that support the learning community's norms. During the first week of school, she asks her students to practice making transitions between different learning spaces in the classroom.

Mia: So I'm not super excited about the way you came down to the carpet. We're gonna put that aside for a minute. Raise your hand if you know how to come quietly to the carpet. Raise your hand if you know how to tuck in your chair, and leave your desk clean. And walk quietly to the carpet. Raise

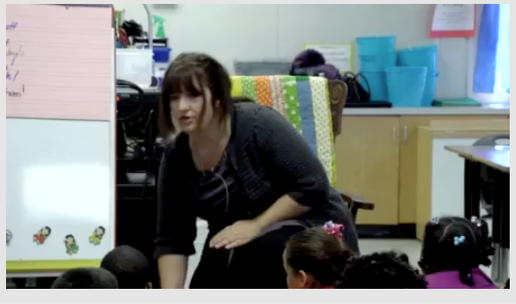
Video (Day 3): Reviewing behavioral expectations for transitioning between spaces for learning

your hand if you know how to sit on the carpet without rolling around and hitting other people. And raise your hand if you can sit on the carpet without screaming in the classroom.
Mia: So since you know what I expect you to do, I expect you to do it. Does everybody understand that?
Students: Yes.
Mia: Okay.

In those first weeks of school, Mia understands that she has to learn what her students look like and sound like when they're listening, and recognizes that they have their own ways of talking to each other and sharing their thinking.

Mia: What's going to happen to my idea if someone very helpfully cleans it up for me? You know when it's clean up time? What's going to happen if someone comes over and cleans up my idea?
Student: They pick it up...
Mia: And they do what with it?
Student: They put it in the basket or they put it somewhere.
Mia: And then, do I have my idea anymore? Or did it go away?
Students: Go away.
Mia: It went away. And I'm still thinking! Lots of times in math we have to think for many days, like 10 days, or two hours. We don't know!
Student: 11 days.
Mia: So I'm gonna write this down, you guys, because we talked yesterday about what it looks like when we're taking care of things, and today we're going to talk about what it sounds like. So here's something you might say. Eyes up here. One thing you might say during math is you might say, "Are you done with this?" Because it's really polite to help people clean up, isn't it? Isn't it nice to keep our room clean and nice, especially our math tools? But before we clean anything up, we're going to ask this question. Ask it with me:
All: Are you done with this?
Mia: And what would I tell you?
Student: Yes or no.
Mia: Yes or no! What would I say for this? Do I want you to clean this up or do I want to still think about it?
Student: Think about it.
Mia: So I could say "Thank you, thank you, but I'm still thinking about it." So we're always going to be mannerful, we're always going to be polite, we're going to say please and thank you, but I'm also going to protect my math and my ideas. Okay? (play video for more)

Video (Day 2): Helping students check in with each other before cleaning up tools or work



She also gives her students various ways to check in with each other's progress: "Do you want me to share my answer? Do you want me to help you clean that up?" Mia gives her students ways to ask for the tools they need: "Could I borrow that?" Her

students then have an understanding about what help looks like, what it sounds like, and what they can ask and answer to help their learning. She also reinforces the students' agency, authority and identity through the importance of "protecting their math and their ideas."

☞ *How do you elicit students' ideas about how to check in with each other before cleaning up tools or work?*

As her students progress in understanding how to support the learning community-- their own learning as well as that of their peers-- the begin to show a generosity with their ideas, helping each other when they struggle with confusion or imprecision.

By the middle of the year, students in second grade are able to work effectively together and share their thinking as well as their access to materials. In one pair interaction, Mia engages a student in understanding the structure of a problem, then explaining her thinking to another student, then engaging the other student in helping combine like quantities for a more effective strategy. She asks "Do you see where her tens are? Which ones are her tens? Which ones are her ones? Ariel knows that she wants to put those together but she's a little confused about how to count them." The partner is able to use Ariel's strategy and her materials to help her check her approach.

Mia: Is this a put-together or take apart?
Student A: Put together.
Mia: All right! So show me how you put those together.
Student A: 10, 20, 30, 40, 50, 60, 70, 80. Wait, no. 10, 20, 30, 40, 50, 60, 61, 62, 63, 64, 65, 66, 67.
Mia (laughing): And count that one for her.
Student A: 10, 20, 30, 40, 50, 60, 70, 80. 81, 82, 83.
Mia: Diva, do you see where her tens are? Which ones are her tens?
Student B: Those ones?
Mia: Mmm hmm! And which ones are the ones.
Student B: The blocks.
Mia: And Ariel knows that she wants to put these together? But she's a little bit confused about how to count them.
Student B: Instead, she could take these away and put ten sticks.
Mia: But let's say she doesn't. Do you understand that those are her tens and those are her ones? So what I want you to do, Ariel, what's she's going to do is show you how to count these all together. And she's counting these as tens, so <u>you</u> go ahead and count these as tens, also. Okay? Go down to the carpet.

Video (Day 110): Pairing students to share and extend each other's thinking.

In order to pair students in developing each other's thinking, Mia needs to formatively assess each student's understandings

of the problem, and pose questions so that they can begin to work with each other on the math (rather than, as in this case, using a particular tool over another to represent the quantity of 10.)

☞ *How does students' peer engagement change and deepen over time?*

With more experience supporting each other's learning, Mia's students can challenge each other's ideas without becoming defensive or negative.

Supporting Others

Mia works to connect her students with each other. Mia observes how students work together in groups, as she's seen that sometimes students can get stuck, "they don't have any traction." She helps them look for something in common, posing a question and then sending them off.

Mia (reflecting): A lot of what we do during this time is just getting them to talk to and listen to each other. That idea of activating themselves as a community of learners is a big part of it. So they're not always looking for me to explain it. A lot of times my job is like "This might be an interesting idea for you to hear! Why don't you guys go do that?" They may need to hear it 10, 15, 20 times, and I can't be there to say it 10, 15, 20 times. So learning to listen to each other, and intuit each other, is a big part of it.

Video (Day 2): Attuning one's teaching to what your students already talk about

She often plays matchmaker, either having students support each other's thinking, assist or ask questions, or compare different strategies.

Student A: 10 ten-sticks for 100, and I was gonna put (counting)
Mia (reflecting): I feel like sometimes I put them in groups and then they can't get any traction. They're all thinking differently, they don't really have anything to talk about. So looking for something in common, or posing a question and then sending them off can be really helpful. I feel like I do that a lot, like, pair kids up to talk to each other.
Mia; Can you guys count together? Watch her count.
Janiya, I want you to watch her count, and then I want her to watch you count. See if you guys can work that out.
Mia (reflecting): So I think maybe I'm a curious matchmaker.

Video Reflection: Observing students to pair them for shared thinking

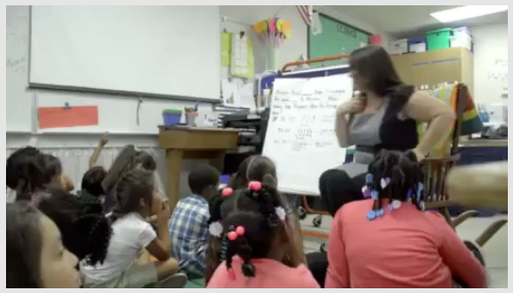
In this way, students become more used to supporting each other's thinking, and even early on in the year respond well to Mia challenging them to help each other.

☞ How do you group your students for paired problem-solving?

Mia: Are you listening? So come show us. 60 and 30. Who wants to be Aisea? Cindy's Aisea and Ashley's Krishnil.
Students: Awww!
Mia: Oh my gosh! So let's watch what they do. Who's Aisea? What should she do first? Think about what you think she should

be doing, and let's see if she does it....
Student A: (selects 6 ten-sticks out of container)
Mia: So how many do you have in your hand?
Student A: 60.
Mia: So let's count with her.
All: 10, 20, 30, 40, 50...
(Student A selects one more stick)
Mia: Let's count again.
All: 10, 20, 30, 40, 50, 60.
Mia: And how many is she going to give to Krishnil? Kalea?
Student B: 3.
Mia: 3 of those. Let's count while she does it. 10, 20, 30!
(Student A hands them to Student C)
Mia: How many does Krishnil have now?
Students: 30.
Mia: And is that answering our question?
Students: No.
Mia: No, we want to know how many Aisea has now. So let's count Aisea's. How many?
Student A: 10, 20, 30.
Mia: So how many does he have now?
Students: 30.
Mia: So the question was, when Aisea gave away his Legos, did he get them from here? (indicating the bucket) Or from in his hand?

Video (Day 14): Modeling presenting and listening



After the first few weeks of school, Mia is able to call on students to model their thinking for the group, and ask the other students to support them in doing so.

By mid-year, Mia's students are able to reflect on their own behavior as learners as well as that of the class. She uses a scale: "Four: it was great for me; three, I was able to work with it; two, I need some people to change; or one, I have some serious problems with what happened."

Mia: Is this 17 here?
Student: Yeah.
Mia: You sure?
Student: Yeah.
Mia: You don't sound sure.
Student: 1, 2, 3, (continues counting)
Mia (to another student): Is this independent? Who could you ask instead of me? Who can help you? Are you having a problem with someone in your group? So you're going to have to find somebody that you trust outside of your group.
Student: 8,9,10,11,12 (continues counting)
Mia: Natalia, come here. It's okay, you're learning. So who do you trust that you could talk to about a problem? Not in your group, someone outside your group. Go look at the other groups and

Video (Day 110): Students self assess their performance in pair and group work

come back with a name.
Student:...17.
Mia: You sure?
Student: Yeah.
Mia: Okay, so how many parachuted out?
Student: 1,2,3,4,
Mia: Off you go.
Student: 5,6,7,8,9,10,11,12
Mia: I have to say Rehaan, I found it very helpful the way you kept this, the ones that parachuted out over here and the ones that were in the helicopter here. So how many are left on the helicopter? I'm convinced, that was really helpful for me.
Mia: Class, what I want you to do is leave everything where it is. Leave everything where it is and come to the carpet. I had you leave a big mess back there because I wanted to ask you something. So, I want you to think about these 3 things,look up here. Sharing, doing math, and being independent. I want you to think about what just happened. Mm-hmm (affirmative), I know right? So turn and face, turn and face.
Mia: There's 4, 4 is my very best. 3 is, I did good. 2 is, I can do better. 1 is I had a major problem. So I want you to close your eyes, close your eyes and think about sharing. Close your eyes. Show me on your fingers, Ciao, close your eyes. Show me on your fingers for sharing. Were you a 4,3,2, or a 1. (play video for more)

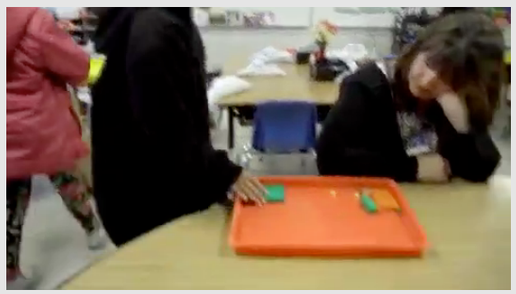
She invites her students to find their group and look at their fingers, and then talk with each other about the problems they faced in supporting each other's learning.

☞ *How can you prepare students to ask each other to change and improve their small group behavior?*

By February, Mia's students are also able to identify similarities between their strategies.

Student A: I agree with Diva too!
Mia: You like the way she counted also? What were you doing before?
Student A: I was... when it was up to 100 I accidentally counted by the .. um, ones.
Mia: Ah, but you think you should keep counting by ... tens instead? Diva, you've been very convincing today and very helpful! Can you guys go get whiteboards?
Student A: Sure!
Student B: Ms. B, I'm confused!
Mia: What about?
Student B: Because I got 500, and everybody else got 100.
Mia: Show me! Sit down here. I'm waiting for Diva to get her number. Janiya, go get a whiteboard. Looks good, La'Nya!
Student B: Because I got 800, and..
Mia: 800? Count it.
Student B: I mean, 80,
Mia: And then 83? Where's your 83. I see it. And then 60...67? Okay! So is this a put together or a take apart problem?

Video (Day 110): Supporting students in recognizing their own errors



Student B: Put together.
Mia: So show me!
Student B: 50, 60, 70,80, 90, 100, uh, 200, 300, 400, 500.
Mia: You know how some kids were counting it? 50, 60, 70, 80,90, 100, 101, 102, 103, 104. Is that right?
Student B: (Shakes head)
Mia: Why?
Student B: Because those are not ones.
Mia: What are they?
Student B: They are ten sticks.
Mia: Okay. So this is how you're counting it. 10, 20, 30, 40, 50, 60, 70, 80, 90, 100, 200, 300, 400, 500. How are you counting it?
Student B: By tens, and then I think I counted by 100?
Mia: Okay, so go back and count it by tens and see what happens.

They have taken up sentence stems from the beginning of the year ("I agree with _____"; "What's your answer?") as well as name when they are stuck or confused. Through engagement with Mia and with other students, they can redirect their own thinking when they realize an error in their process.

☞ ***How do you establish an expectation that students will connect their ideas to others'?***

Sharing and Working Cooperatively

All teachers consider how to provide equitable access to materials and group configurations. In the beginning of the year, Mia distributes "math bags" to her students, into which they place various kinds of tools in sufficient quantities to support multiple tasks. She uses the distribution of materials to reinforce content objectives; even in counting out 40 cubes for their materials bags, she attends to the ways in which they approach the counting task (by ones, by fives, by tens.)

In those first days of school, Mia reinforces with her students how to take care of their learning environment, ensuring that their tools and materials are put away at the end of a lesson.

Mia: Clean quietly! You've got one minute.... We're done cleaning! 4! You're in your seat!
Mia: Excellent work. One of the things that we talked about was making sure we have all of our pieces. So, quick like a bunny, look at the floor and see if there's anything we need to pick up.
Mia: If you're in group 2, come sit on the carpet quietly. Do you see what happened?
Student: I found another one!
Mia: So we have what we call the "I found this!" bucket. Every time you pick something up and you want to tell me you found it? If it's math. Look at all the stuff we found! I found this! Only math pieces go in here. But when you find it? You can put it in the I Found This! bucket. So go ahead and put it in there for us. And then, we can put them back where they belong. But if you find something on the floor, can you put it in the I Found This! bucket?
Students: Yes.
Mia: Is that something that you can do?
Mia: Friends, you did a really good job with your cubes. I was super interested in your ideas. I have a sad face, though. Do you want to hear about my sad face?
Students: Mmm hmm.
Mia: My sad face is that some of your great ideas, I couldn't even hear them because it was so loud. Oh my goodness, it was so loud. And I know it's exciting, and it's easy to get excited, but you're still inside and it's still math. So I'm going to ask you next time to remember that number 2 voice. (play video to continue)

Video (Day 2): Setting expectations for accountable and supportive sharing and cooperative work

Her "I found this!" bucket reminds her students to gather cubes, counters, and other materials. She also addresses concerns about how students can maintain a productive noise level: "I'm going to ask you next time to remember your number two voice."

☞ ***What expectations for accountability support sharing and working cooperatively?***

Mia reinforces cooperative norms by praising specific ways in

which students collaborate and explore alternate ways to find a solution with their partner. She highlights ways in which students can "have an idea, and test it" with their partner.

Mia: Today, you did so much work with your tools. And I saw, with my eyes, all of you checking the floor, taking care of the pieces, I didn't see one person lick or chew on a tool! That was great! Remember how we talked about we don't want that? I saw people being responsible and putting them back in your bag carefully, and I saw people stopping themselves before they stepped on anything. Great job! I also heard some things that made me really happy. Ciao and Rehaan had a little bit of a disagreement about whose cubes they were, Rehaan said, "Can I use it please?" and Ciao said "Yeah!" and he handed him some that he could use. I also saw people using their number 2 voices, show me your number 2 voice? Excellent. People were doing a much better job with that today. And I heard Kalea's group saying "Are you done with this?" when they built, they asked if they were done with it before they borrowed more. So great job on using your tools today!

Video (Day 3): Naming, recognizing and reinforcing expectations for collaboration and mathematical engagement.

After reinforcing the ways in which the students had met the norms and expectations for group work, Mia also names and praises the ways in which students were engaging in mathematical thinking:

And also today, we did our very first problem solving workshop, where you got to figure out a problem all by your...
Students: self.
Mia: And I saw some really interesting strategies. First of all, was this a put-together or a take-apart?
Students: Put together.
Mia: And I saw people counting them together. And what were our two numbers again? How many stickers did Diva have? How many did we build back at our desks?
Student: 18.
Mia: 18. And then how many did she go to the store and buy, Josie?
Student: 7.
Mia: 7. And there were lots of ways you showed those. Can I show you a couple of things I saw? ...
Students: WHOA!
Mia: I know, right? I saw people building 18. Like Natalie did this: she used one 10-stick, and all of these cubes. So she counted like this, watch her count. Natalie, do you remember how you counted? You went like this, what was this?
Student: 10.
Mia: And then...does everybody see the 10 and the 8? And how much is 10 and 8 together?
Students: 18.
Mia: Yeah! So, see how she made her 18 with a 10-stick and some 1s? And then I saw some other people who made one long

train with their cubes.
How many people made one long train with their cubes? Excellent. So let's count and see if we did it right.
All: 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18
Student: 19.
Mia: Which is it, Bibi, 18 or 19?
Student: 18. 19. 18.
Mia: You sure? Let's count one more time, just to be sure.
Mia: I also saw people using cubes to make the 7 part and blocks to make the 7 part. So let's make sure we have 7 here, count with me!
All: 1,2,3,4,5,6,7
Mia: and these weren't stuck together, but let's count them: 1,2,3,4,5,6,7. Did everybody get the same answer, or did some of us get different answers?
Some students: Same!
Some students: Different!
Mia: And remember, in math class, all we can do is get an idea, and test it. So how many of you had to test your idea by counting it with someone?
...
Mia: Does everybody see their answer up here? You can give me a "me too." All right! So tomorrow, when we do math, you guys get to PROVE to me which one is correct!

☞ How do you connect tools and strategies?

After the first few weeks of school, Mia's students are able to work as a group on a silent task putting cards in reverse order from 99 to 0 in a pocket chart, communicating nonverbally.

Mia: First, put them in order and read them to your partner. Your cards are your cards. You're responsible for putting them in order... your job is to put the right cards in the right pocket. You cannot pick up your cards, lay them flat in front of you. And you cannot talk to each other! ...You can point, if you see that your neighbor can play their card. You can point to it, but you can't tell them where it goes, and you can't talk to them. Do you understand?
Students: Yes.
Mia: It's a silent game, which means it's a silent star game. So when the silent star is up, <u>nobody</u> can talk. That includes me! So right now, go ahead and start talking, until you see the silent star.
...
Mia: I need to know, who thinks they have the one that goes right here? Bibi and Sayana, come on up, they both think they have the one that goes right there. I want you guys to decide for them.
....
Mia: Bibi's goes here, Sayana decided that she made a mistake, she has a different idea now. Are you ready? Oh, and by the way, we're timing this. I want to see how fast you can go.

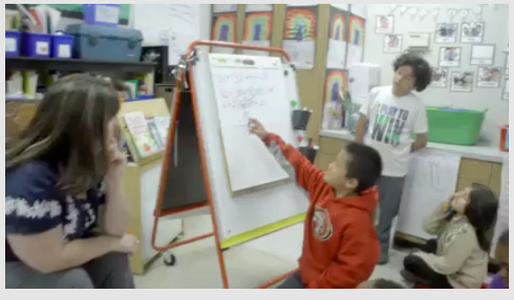
Video (Day 14): Building group norms through math "games"

Mia sets a challenge with the “silent star” norm; when the star is on the board, no one in the room can speak, even the teacher. She invites students to place their cards in the pocket chart in reverse numerical order. Framing it as a game charges the students’ silence with enthusiasm instead of dread.

After setting these conditions early on in the year and reinforcing them over time, moving into the last weeks of the school year, Mia’s students individually and collectively support the learning community.

Student A: Giancarlo put that 10 with that 8. If [another student] put that with this, he connected this 10 with this 8. But I saw that [the second student] didn’t see this 10 to go with this 6, but he did see this 10 to go with this 6.
Mia: Do you agree with him?
Some students: Agree.
Mia: Or you don’t agree.
Student B: I agree.
Mia: Ariel agrees,
Student C: I totally agree.
Mia: What’s going on, Sayana?
Student D: I had a ... I was looking at the problem, ‘cause at first I had a question for Giancarlo and [the other student] and I said, if you matched it, this... it’s much easier... if you just matched the 6 and the 10 together?
Mia: Mmm hmmm?
Student D: You would already have the 8 and the 10 together already. But I see the way that they needed.
Student B: So this is why I put this 10 here, because there was already a 10 here. So I put this 10 over here.
Mia: Is there something magical about where the 10 lives and where the 6 lives? Is there something magical about it?
Student: Yep.
Mia: Does it matter if we put this 10 with this 6 or this 10 with this 6? Do we still have 16?

Video (Day 158): Students formulate and ask their own questions of each other



By the end of the year, then, students are able to ask respectful questions of each other and then answer with detail about their thinking. Mia’s students have learned to value each other’s strategies, naming them and describing alternate strategies with respect and authority.

☞ ***Mia pairs students to share and extend each other’s thinking. What does she need to find out about their mathematical understandings in order to do so?***

Future Directions

03

What else might we mine from these classroom documentations?

Future Directions

Concepts

1. **Connections to Teacher Learning**
2. **Teachers as Sense-Makers**

Connections to Teacher Learning

This guide is part of a series, focusing on two teachers: Mia Buljan (2nd grade) and Patty Ferrant (8th grade).

One powerful component of these guides is the coaching conversations throughout our documentation of Mia's and Patty's classrooms. Both teachers are experienced with both sides of a coaching dynamic, and recognize that engaging with a colleague in reflection on practice is enormously generative for our development as teachers. Others can see strengths and growth areas that we miss when we're in the middle of teaching.

Reflection: "I'm a very collaborative person by nature."

Reflection: "I get that opportunity to work with my colleagues and do the math together."

The Dana Center at the University of Texas, Austin, has created helpful tools for evaluating effective coaching (Dana Center

2011). Within the dimension of **facilitating adult learning**, coaches engage in building relational trust, developing capacity to improve student achievement, providing collaborative opportunities for faculty reflection, authentic listening, and supporting teacher efforts and needs. Within the domain of **planning and collaboration**, coaches use research-based resources, support standards, encourage and advocate for collaboration, maintains collegial partnerships, and links administrators to teachers with a focus on student achievement. Within the domain of **data support and analysis**, coaches use cyclical processes embedded in collaborative planning that provide ongoing evaluation of student learning, support teachers' focus on student learning, and maintains sustainable assessment systems. Lastly, in the dimension of **strategic competence**, coaches maintain a vision of excellence in teaching, balance content and pedagogical knowledge in context, work continuously to establish routines and trust, engage teacher groups in collaboration around key outcome questions, and consistently refine her or his knowledge of and practices for facilitating adult learning (Dana Center 2011).

The coaching conversations supporting both teachers' classrooms address many of those dimensions.

Teachers as Sense-makers

It's obvious that teachers are sense-makers too, but it was powerful to accompany Mia and Patty as they sought to understand their own teaching through a documentary lens. Too often, the complexity of teaching goes un-noticed because the practitioners are in the middle of the action. Engaging with thinking partners, looking at footage, examining student work samples to try to help external audiences understand children's thinking-- all of these are powerful and deep practices. We are fortunate for the generosity, investment, and time given to this project by both teachers, and hope that these guides will help even more

practitioners deepen their own approaches to math teaching and learning!

Resources

4

Resources

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