2019 FOCUS ISSUE

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Learning to See Students' Mathematical Strengths

A teacher shares her journey toward disrupting her conditioning to create more humanizing math learning experiences for her students, incorporating strategies that every educator can use.

Abbe Skinner, Nicole Louie, and Evra M. Baldinger

One of the most important jobs we have as teachers of mathematics is supporting our students to develop confidence in their own capabilities as mathematical thinkers (Boaler 2016; NRC 2001). Children who do not believe in themselves are unlikely to share their ideas, persevere through challenges, or take risks that lead to new insights. Yet many students have no sense of their own mathematical strengths. They are conditioned to see themselves as the dust of the mathematical universe and see others as the stars. As their teachers, we are also conditioned to see some children as "bright" or "gifted" and others as "struggling" or having "special needs." Our conditioning shapes whom we call on to speak in class discussions, whose thinking we carefully scaffold, whom we provide with open-ended challenges, and whom we provide with basic practice—in sum, who gets opportunities to engage with rich, rigorous mathematics and see themselves as mathematically capable (Louie 2017).

But we can disrupt our conditioning to open new possibilities in our classrooms. In this article, we describe a lesson that changed how one of us, Abbe Skinner, understood her students and herself as a teacher. The lesson was taught in Skinner's fourth-grade classroom by co-author Evra M. Baldinger, a math educator and parent of one of Skinner's students. In Skinner's words,

> I witnessed my students feeling smart, enthusiastic, and challenged, embracing mathematical strengths that I had not known they possessed. I saw ways that privilege had been playing out in our everyday interactions, making certain strengths obvious and others invisible. And I began to find my capacity to create more humanizing math learning experiences.

Strategies to look for and try

As you read about the lesson, notice the references to five numbered strategies (see **fig. 1**). These strategies weave together to help us see many ways of being mathematically "smart"—a word we often use because it is powerful for students to hear that this is what they are. This list emerged from our discussions of aspects of the lesson that were especially powerful for Skinner's learning. They are grounded in Complex Instruction (Cohen and Lotan 2014; Featherstone et al. 2011; Nasir et al. 2014), and they overlap with the Mathematics Teaching Practices identified by NCTM (2014).

The first two strategies we name might seem fairly straightforward. If we want to be able to see students' smartness, we have to give them opportunities to show it. This requires (1) providing them with tasks that are rich enough to invite diverse ways of exercising creativity and strategy (see the sections on "group-worthy tasks" in Featherstone et al. 2011) and (2) grouping students in ways that do not carry assumptions about what students will be good at or what they will need (e.g., randomly drawing their names from a hat) (Cohen and Lotan 2014). In addition to these outwardly directed behaviors, we must also inwardly trust that our students are capable of genuine problem solving, countering the many voices that repeat, "But they just cannot." We are used to treating those voices as common sense; they can be so dominant that we do not even recognize them as obstacles, locating the problem in our students' supposed deficits instead of in the limitations of our own imaginations.

The other three strategies in **figure 1** intertwine to support us with both technical and emotional challenges. Having explicit, inclusive conversations—with colleagues, parents, and students themselves—that expand what it means to be smart in math (strategy 3) gives us new perspectives about how mathematical strengths can look, sound, and feel. In illuminating strengths that we have not noticed, these conversations can also illuminate students whose strengths have been invisible to us (Featherstone et al. 2011). This dovetails with strategy 4. Power and privilege make it easy to see some students as smarter than others. For example, stereotypical images of mathematicians as White or Asian men create barriers to seeing girls and African American, Latinx, and indigenous students as mathematically capable. Actively working to notice and disrupt societal views of what it looks like to be "good at math" is essential for seeing all students' mathematical strengths and for nurturing positive mathematics identities for all students. Readers who are new to these ideas may find a useful starting point in the Access and Equity section of *Principles to Actions: Ensuring Mathematical Success for All* (NCTM 2014). Another NCTM publication, *The Impact of Identity in K–8 Mathematics* (Aguirre, Mayfield-Ingram, and Martin 2013), provides additional teacher-friendly analysis and resources. Finally, seeking out critical friends (strategy 5) is necessary to expand our own limited perspectives and to keep our learning going (Nasir et al. 2014). Falling back into old habits is easy; working with other people can help to remind, motivate, and inspire us to push ourselves in the long-term project of learning to see every student as smart.

We now turn to the lesson to illustrate the strategies in action, from Skinner's perspective.

Strategies in action

Baldinger began the lesson by asking students to talk about different ways of being smart in math, linked to times when they themselves had done something mathematically smart. Together, they made this list:

- Explain how you are thinking.
- Listen to new ideas.
- Visualize in lots of ways.
- Represent (show) your thinking.
- Make connections.
- Try ideas.

Hearing my students and Baldinger describe this variety of strengths (strategy 3) challenged me to expand my definition of "good at math." Previously, my tacit definition had consisted of what I was praised for when I was young: knowing mathematical formulas, arriving quickly at correct answers, and working quietly and independently.

From there, Baldinger randomly assigned partners (strategy 2) and the following task:

> With your partner, find as many different ways as you can to represent or draw 50 ÷ 4 (strategy 1).

My students had worked with division, but never with quotients that were not whole numbers. I assumed that some students (those I saw as "good at math") would use strategies that we had previously discussed to arrive at an approximate answer and that other students would need guidance from their partner or a teacher. Relatedly, I was concerned about the partnerships Baldinger had created. She had told the children that every pair would be powerful, because "you are all smart in your own ways." But Luna (a Latina) and David (an African American boy) both had IEPs, and they had ended up together. Would they be able to engage with the task without a lot of teacher support? And Nasira (an African American girl) and James (a White boy) had strong personalities that I expected to clash. James—the only White student in the class, widely seen as the smartest child in the room—would probably try to take over. Although Nasira was hesitant when it came to mathematics, she was confident and assertive in many areas, and she would probably resist any efforts by James to control their partnership. I wondered, would they need constant monitoring to prevent conflict?

The work I saw my students do—and how I saw Baldinger react to it—showed me that even my most mathematically timid students were capable of taking social and emotional risks to engage in deep mathematical thinking and experience real success with mathematical challenges, without math help from me. Take, for example, Luna and David. They created a diagram (see **fig. 2**), arranging fifty circles into four equal groups (as Luna explained). They checked their results by adding 13 + 13 + 13 + 13, which they found equal to fifty-two, not the desired fifty. Initially, Luna was disappointed, saying "It's wrong." As we later discussed, Baldinger noticed that Luna—a girl with an IEP and Latinx heritage—was very ready to interpret her mathematics as invalid (strategy 4). Many teachers might interpret her work that way, too; we are trained to look for students' weaknesses so that we can help fix them. But Baldinger leaned on inclusive ideas about what it means to be smart in math (strategy 3) to affirm the pair's work, saying that it reflected a deep understanding of division (making groups of equal value) and noting that the relationship between division and addition that they had captured was especially smart.

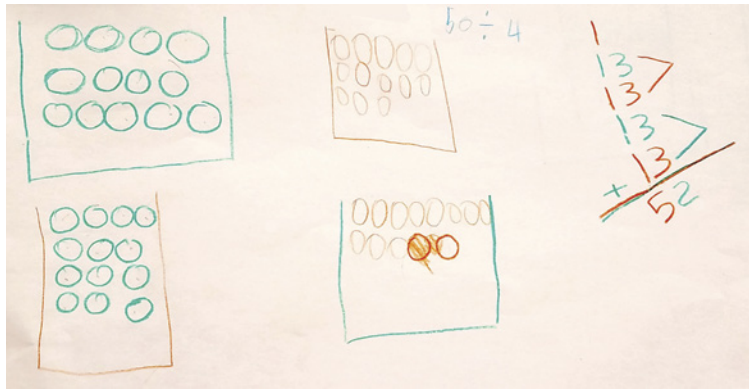
FIGURE 1

Here are five strategies for seeing students' mathematical strengths. As you read about the lesson, consider what it could look like for you to try out these strategies. Which ones seem easy? Which ones seem hard? How could they help you see mathematical smartness in each of your students?

1. Trust students with open-ended, multidimensional, challenging tasks.
2. Randomly assign students to partners or groups (and check your assumptions about who is successful).
3. Have explicit, inclusive conversations with students, parents, and colleagues that broaden what it means to be smart in math.
4. Work to notice power and privilege as they play out in classroom interactions.
5. Seek out critical friends to challenge and support you.

FIGURE 2

Luna and David's solution was to arrange fifty circles into four equal groups, which they checked by adding 13 + 13 + 13 + 13. Luna was disappointed that their solution was wrong when the sum was 52 and not 50.



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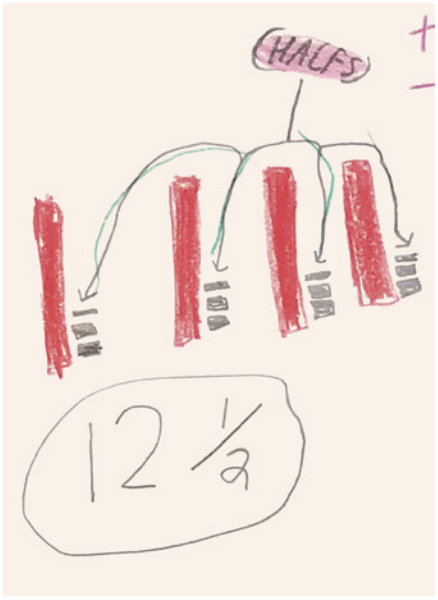
Later she called on Luna to present to the class, reiterating that she and David had done impressive thinking. A look of disbelief crossed Luna's face, followed quickly by pride. The shift in her body language and her facial expression as she stood to make her presentation opened a new possibility for me: Luna could believe in herself as a mathematical thinker with important ideas.

At another table, James immediately dove into the task, leaving Nasira behind. (His approach closely matched Luna and David's.) But when Baldinger approached the pair, she did not ask James to help Nasira or otherwise position Nasira as deficient (again mindful of racialized and gendered power dynamics

FIGURE 3

Nasira's strategy was to put base-ten blocks into four equal groups. She had an aha! moment when she realized she could cut the remaining two blocks in half.



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inside and outside my classroom—strategy 4). Instead, she suggested that Nasira "choose a representation" that might help her. In doing so, Baldinger gave Nasira authority over her own thinking process and an opportunity to show her mathematical strengths. Nasira responded by getting base-ten blocks from our supply shelf and arranging them into four groups, each containing a ten-block and two one-blocks. Staring at the two remaining one-blocks, she had an amazing breakthrough: She could cut the blocks in half to make four groups of twelve-and-a-half (see **fig. 3**).

When it was time for presentations, Baldinger told the class that Nasira's use of base-ten blocks was "super smart" and worth sharing. James exclaimed, "That was my idea!" Contrasting James's confidence in owning a brilliant mathematical idea (even one that he had not generated) and Luna's doubt helped me see how racialized and gendered dynamics of power and privilege mattered in my classroom (strategy 4). Baldinger replied gently yet firmly that although both students had done solid mathematical work, the idea was definitely Nasira's. Nasira squealed, clearly pleased that Baldinger had stood up for her, and went on to explain the idea she had authored. As with Luna, I saw Nasira through fresh eyes. I was accustomed to seeing her as lively and vibrant in her social interactions but fidgeting and discouraged in math. During this lesson, I saw that she too could experience engagement, confidence, and joy in her own mathematical thinking.

Finding critical friends (strategy 5) has been invaluable to me in learning to see my students' mathematical strengths. I teach at a school where faculty share a commitment to equity and social justice, where we are supported to have routine conversations about how to translate that commitment into our instruction, and where it is not unusual for teachers to share the problems we are facing and ask for help. I have also reached out to others under some unconventional circumstances (e.g., bringing up with Baldinger challenges that I was experiencing in my classroom during a parent-teacher conference).

Working with others has helped me notice things that I was not seeing on my own. Having the opportunity to observe my students while Baldinger took responsibility for instruction was powerful. I realized afterward that I had been treating Nasira and Luna differently than I treated James, and that those differences were not just a matter of individual idiosyncrasies but were related to our positions within systems of privilege and oppression. As a middle-class White person who was successful in school, my unconscious tendency had been to view James as a model of how children should operate and achieve in math. Other ways of participating and succeeding were invisible to me. This limited perspective affected my teaching in concrete ways. For example, without really thinking about it, I provided Nasira and Luna with feedback that was less open-ended and more directive than the feedback I typically gave James. In doing so, I gave them less room to explore, to create, and to shine. During this lesson, I had a chance to see James decentered, which made much-needed space for Nasira and Luna to demonstrate their strengths and share them with our classroom community.

Ongoing conversations with critical friends also play dual roles of accountability and affirmation. They hold me accountable by helping me step back and notice when I fall back into old habits. They affirm that the work of transformation is worthwhile simply by being there with me, and they affirm me personally by naming the strengths that I bring to the work—whereas on my own, I sometimes get stuck in

the guilt and shame of what I have not done or do not yet know how to do. Reconnecting with critical friends helps me redirect some of my negative feelings into the positive energy of creating an action plan and following through. This experience has had an ongoing influence on my thinking and teaching. I am working on looking at my students through a strengths-based lens, reminding myself and them of ways besides getting the right answer to be smart in math. I am working on encouraging them to notice and celebrate the brilliant math things that they and their peers do. I am noticing them feeling success in exploring rich tasks, asking questions, listening to others' ideas, and inventing and testing new strategies.

I have also continued to notice assumptions I make about student ability, about what constitutes "good" mathematical work, and about what my students' relationships to math should be. I generated a list of questions about how power and privilege are playing out in my practice, and I keep asking myself these questions, both on my own and with critical friends who give me access to different perspectives and insights. I have realized that I have a responsibility to disrupt inequities in my classroom—and that I have the power to do it.

Privileged or not

Regardless of anyone's beliefs or intentions, power and privilege are constantly at work in our classrooms. In the story we have told here, Skinner's beliefs that were racist, sexist, classist, or otherwise prejudiced were not obvious, and her efforts to work against such beliefs predated the lesson we discuss. Yet her students' and her own racial, gender, and class backgrounds affected their interactions and how she understood them. Additionally, the dynamics in all our classrooms are shaped by the privilege that different students are afforded—or not—both inside and outside schools, which are structured by race, gender, class, disability status, and other social categories (evident in, for instance, James' readiness to claim mathematical authority and competence versus Luna's readiness to view her work as "wrong"). When we ignore these differences, we are much more likely to miss their effects, unknowingly centering some students while pushing others to the margins, denying some students chances to shine, and limiting all students' opportunities to learn with and from one another. In contrast, recognizing power and privilege at work can help us recognize possibilities for change that are imperceptible if we think only in terms of individual students' personalities, inclinations, and needs.

⇢ reflect and discuss

Learning to see students' mathematical strengths

Reflective teaching is a process of self-observation and self-evaluation. It means looking at your classroom practice, thinking about what you do and why you do it, and then evaluating whether it works. By collecting information about what goes on in our classrooms and then analyzing and evaluating this information, we identify and explore our own practices and underlying beliefs.

The following questions related to "Learning to See Students' Mathematical Strengths," by Abbe Skinner, Nicole Louie, and Evra M. Baldinger, are suggested prompts to aid you in reflecting on the article and on how the authors' ideas might benefit your own classroom practice. You are encouraged to reflect on the article independently as well as discuss it with your colleagues.

Prompts for noticing and disrupting power and privilege in classroom interactions (strategy 4)

- Name aspects of students' backgrounds (and your own)—race, ethnicity, socio-economic status, personality quirks, disability status, and so on. Think about particular students and ask yourself, How is their background similar to/different from mine? How could our backgrounds shape how we interact in the classroom? How could they shape how I interpret their actions?
- Seek evidence and alternative interpretations. Why do I think a student did something? What evidence do I have for reaching that conclusion? What other reasons or intentions might they have had that I could consider?
- Notice what students are doing instead of what they have not done yet. What smart things do I see happening that I can explicitly name?
- Reflect on your own feelings and how they shape your interactions with every individual student. Why might I be feeling frustrated, indifferent, or excited about this student? How am I communicating with this student? What am I saying, how I am saying it, and how often am I saying it?
- Consume media from diverse authors/creators. Which students and families do I feel the least similar or least connected to? How can I access authentic voices from their community to broaden my awareness as well as connecting with them personally?
- What does being "good at math" look like and sound like to you? How could you expand your definition to include more of the diverse strengths that support mathematics learning—and to include more students?
- When you think about assigning your students to random groups, what possibilities worry you? What unintended consequences might our efforts to carefully control student groups have?
- Look at a math task you plan to use in your classroom. How could you adapt it to make more space for students to create their own strategies and representations, as Luna, David, and Nasira did here?
- Who could you recruit as critical friends? Who shares your commitments and is likely to offer you perspectives different from your own? How can you nurture your relationships and make changes if they are not support your learning?

Learning to see differently than we have been taught is demanding and potentially uncomfortable. It requires that we inspect ourselves, and that we try things that might not go smoothly the first, second, or third times. Giving students a task that we have not shown them how to solve and then watching them struggle without stepping in to share our way of doing it is risky. Reaching out to people who could become critical friends but are not yet and revealing the flaws in our practice is risky. However, the learning that such risks can spark and the relationships they can foster are crucial for creating environments that celebrate and nurture all students, especially those whom our society typically positions as inferior.

Acknowledging our own embeddedness in systems that privilege some of our students and marginalize others may put us in a vulnerable place, too. But blaming ourselves for the way things are is not required to take responsibility for disrupting the culture into which we have been socialized.

We hope the strategies we have described give other teachers some ideas to experiment with and some encouragement in the hard work of learning to see every student's mathematical strengths. Ultimately, the point is not the strategies. The goal is to support all of our students to experience mathematics as a humanizing and empowering activity, in which their brilliance is celebrated.

Common Core Connections

3.OA.5
4.NBT.6

REFERENCES

Aguirre, Julia, Karen Mayfield-Ingram, and Danny Bernard Martin. 2013. *The Impact of Identity in K–8 Mathematics: Rethinking Equity-Based Practices*. Reston, VA: National Council of Teachers of Mathematics.

Boaler, Jo. 2016. *Mathematical Mindsets: Unleashing Students Potential through Creative Math, Inspiring Messages, and Innovative Teaching*. San Francisco, CA: Jossey-Bass and Pfeiffer Imprints.

Cohen, Elizabeth G., and Rachel A. Lotan. 2014. *Designing Groupwork: Strategies for the Heterogeneous Classroom*. 3rd ed. New York: Teachers College Press.

Featherstone, Helen, Sandra Crespo, Lisa M. Jilk, Joy A. Oslund, Amy Noelle Parks, and Marcy B. Wood. 2011. *Smarter Together! Collaboration and Equity in the Elementary Math Classroom*. Reston, VA: National Council of Teachers of Mathematics.

Louie, Nicole L. 2017. "The Culture of Exclusion in Mathematics Education and Its Persistence in Equity-Oriented Teaching." *Journal for Research in Mathematics Education* 28, no. 5 (November): 488–519.

Nasir, Na'ilah Suad, Carlos Cabana, Barbara Shreve, Estelle Woodbury, and Nicole Louie, eds. 2014. *Mathematics for Equity: A Framework for Successful Practice*. New York: Teachers College Press.

National Council of Teachers of Mathematics (NCTM). 2014. *Principles to Actions: Ensuring Mathematics Success for All*. Reston, VA: NCTM.

National Research Council (NRC). 2001. *Adding It Up: Helping Children Learn Mathematics*. Edited by Jeremy Kilpatrick, Jane Swafford, and Bradford Findell. Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academies Press.

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Empowering Algebraic Thinkers

with Cassandra Turner and Allison Coates

Thursday, April 4th
11:00 a.m.
Room 32B

Experience how mental math strategies build confidence and understanding for future algebra students. Fill up your teaching toolbox with Singapore math strategies that prepare elementary students for advanced math. *This session is designed for grades 4-6.*

Problem Solving: Dimensions Math

with Bill Jackson

Thursday, April 4th
1:30 p.m.
Room 32B

Dive straight into the heart of Dimensions Math, the newest Singapore math series in this problem solving workshop. Get a sense for the style and content of Dimensions Math while covering the use of reasoning, proof, communication, representation, and connections. *This session is designed for grades K-5.*

Using Mental Math to Deepen Number Sense

with Beth Curran and Cassandra Turner

Thursday, April 4th
3:15 p.m.
Room 31AB

Participants will actively explore mental math strategies used through fifth grade. Engaging in mental math activities develops a relational understanding of numbers and their magnitude and gives meaning to calculations. Sharing and evaluating strategies through discourse deepens students understanding of number and builds a solid foundation. *This session is designed for grades 3-5.*

Ready, Set, Play: Practicing Number Sense with Games

with Cassandra Turner and Beth Curran

Friday, April 5th
9:30 a.m.
Room 32B

Learn effective games and activities that support the development of number sense and place value. Dimensions Math was developed by Singapore math teachers and trainers to create a deep understanding of math from the early grades. Teachers will leave with practical ideas and materials to take back to classrooms. *This session is designed for grades 1-3.*

Counting On Play in the Classroom

with Tricia Salerno

Friday, April 5th
1:30 p.m.
Room 32B

Come experience how Dimensions Math, the newest Singapore math series, builds conceptual understanding through the use of games and activities carefully aligned to content. Play, learn, and return to your school with useful ideas to implement immediately. *This session is designed for grades PK-K coaches, administrators, and teachers.*

I can't wait!

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