Lesson Study, Cycle 1, Fall 2021: Literature Synthesis
Carrie Geremia

How can students use a variety of ways to show their mathematical thinking so that all students experience success in showing and replicating a mathematical strategy?

Every time I supervise recess, my roles as a classroom teacher and joyful observer get to meet. I am brought back to memories of my youth to see kids playing the same recess games I grew up with. They chant, bounce, count, and strategize their way around the playground, and I am reminded how the work of play can create joyful puzzling both in and out of the classroom. In play, children learn to problem solve, imagine new possibilities, and creatively grapple with challenges. However, as anyone who has watched a class at recess can tell you, children have very different ways of playing. In the same class of learners, some will be huddled around a circle as they talk through a social scenario. Others will be building up a sweat as they yell and jostle around the basketball court, and some will prefer to methodically walk the perimeter while matching steps with a friend. Any way they play, they are accessing key elements of learning. As Whitebread et al. (2012) finds, play highlights the four principles for an effective pedagogy promoting self-regulation: "emotional warmth and security, children's initiation and feelings of control, cognitive challenge through problem-solving and creativity, and talk about learning (including private speech and collaborative talk)" (Whitebread et al., 2012, p. 50).

When students come into the classroom after recess, they don't transform into rigid thinkers, and our methods of instruction should meet them at the access points they've already shown us. In order to reach the playful brains of mathematics students, a successful lesson should give children the opportunity to play in their learning through these same four principles. Teachers must establish and actively foster an emotionally safe and warm learning environment,

children should lead the learning, be cognitively challenged and given the opportunity to talk through problems in many different ways. Our lesson study focused on highlighting each of these, and we kept a particular focus on talking about learning. Our study team then honed in on refining our teaching practice to focus around the three following themes:

1. Helping students see and access multiple modes of participation
2. Providing links between mathematics and literacy through play, with relevance to students' real world experiences
3. Positioning ourselves (teachers) as access-builders rather than the keepers of knowledge

Helping students see and access multiple modes of participation

One of the biggest takeaways from this research was the importance of including multiple modes of participation for students to use in order to express their thinking. When kids feel comfortable enough to share their thinking, they commit more to the task. Their thoughts add insight, interest, and inspiration to the class dialogue, and they are pushed to show evidence for their own individual learning. Our study team of elementary educators reflected first on our students' experience of mathematics. We conducted empathy interviews with students in each of our classrooms, and were able to speak with kids who love math and those who find it frustrating and boring. Our interviews with and observations of students illuminated the same differences that we have come to expect on the playground. Students, we found, are eager to share their brilliance, but first they need to be convinced of the truth of their brilliance. Often a student's identity as a brilliant mathematician can be shaped by whether they are seen as an active participant in class. Some students may stay silent day after day, avoiding eye contact and hiding

their papers (full of brilliance) in their laps rather than speaking any of their misconceptions out loud. Participation in discussions is not only an important element of play, but also "student achievement [in mathematics] is best predicted by the combination of teacher practices and student participation" (Ing, 2015, p. 341).

Keeping in mind the different ways that children play, we theorized that increasing the methods of participation would then naturally increase the access points for students to reach the material. In addition, providing multiple routes to express thinking allows us to apply the Universal Design principles of engagement, representation, and action & expression (CAST, 2011). In a teacher-directed lesson that requires students to volunteer answers, we knew that we were missing those students who may be more comfortable with written or performed expressions of their thinking. Although student participation in mathematics classes has not been tied to an increase in understanding or mathematics concepts (Gottler, 2010), it is only when students are able to make their thinking public that they are able to collaborate and access the ability to talk about their learning.

Providing links between mathematics and literacy through play, with relevance to students' real world experiences

The integration of literacy and mathematics may well be an apt description for life on the playground. Numbers, beats, shapes and measurements really matter in the world of elementary children, and they must negotiate those fine points with their peers through both tense and joyful communication. I'll never be the line judge in a kickball game again, because I'd rather listen to the discourse. Hearing children argue about angles and inches is like educator music. An

environment in the classroom which incorporates these disciplines together in happy exploration is able to remain responsive to the needs and lives of students.

As Mistle (2020) writes, “the connection between reading and mathematics supports equity because the ability to read with understanding provides students’ access to mathematics” (Mistele, 2020, p. 29). Crossing these disciplines creates a place where students can solve real world problems, and this framework is discussed again and again in educational research using different terms. Joseph et al. (2018) frame this culturally responsive framework as a “cultural democracy”, where students feel like they are socializing and having fun while engaging in important work that relates to their real lives. The construction of this framework, they posit, is only possible when teachers are vulnerable enough to give up the idea that they always have the right answer. Harding-DeKam (2014) found that in a culturally responsive mathematics classroom, teachers had knowledge of students’ home and community life, integrated math learning through existing culture, believed in their students as capable mathematicians, and used this prior knowledge to build on and enforce student learning. Our lesson study team took care to craft word problems that were relevant to real life problem solving, and we decided to illuminate all of our students as capable mathematicians through encouraging their participation in class.

Teachers as Access-Builders

This lesson study cycle highlighted the importance of play in a student’s learning process, and I was particularly struck by the concept of play being student-led and collaborative. Of particular interest, Langer-Osuna (2020) notes that “the movement toward student-centered mathematics classrooms is anti-authoritarian”(Langer-Osuna, 2020, p. 334). Stepping away from

the need to have and deliver the correct answers frees our students to see themselves as brilliant authorities in the classroom. Particular care can be taken to help our students manage this authority, as Langer-Osuna (2020) reminds us that "peer authority relations also position students with the power to marginalize one another's participation, especially in group work". Our lesson was crafted so that students could take the lead in discussion, because they had been provided access to participate in various ways.

This lesson study has reminded me that in stepping to the front of the class, I must continually position myself behind my students. My role as an educator is to empower, scaffold, and carefully position students to create productive and rigorous discussions in community, not to direct their learning in linear and uniform ways. In simpler terms, I now see that I'm on "recess duty" both in and out of the classroom. What joyful possibilities.

CAST (2011). *Universal design for learning guidelines version 2.0 [graphic organizer]*. Wakefield, MA: Author.

Gottler, R. M. (2010). Passive or Passionate Participation in Mathematics: Diagnosing and Improving Student Participation in Mathematics. *Online Submission*

Harding-DeKam, J. L. (2014). Defining culturally responsive teaching: The case of mathematics. *Cogent Education*, 1(1), 972676.

Ing, M., Webb, N., Franke, M., Turrou, A., Wong, J., Shin, N., & Fernandez, C. (2015). Student participation in elementary mathematics classrooms: the missing link between teacher practices and student achievement? *Educational Studies in Mathematics*, *90*(3), 341–356.

Langer-Osuna, J., Munson, J., Gargroetzi, E., Williams, I., & Chavez, R. (2020) "So what are we working on?": How student authority relations shift during collaborative mathematics activity. *Educational Studies in Mathematics*, 104(3), 333-349.

Mistele, J., Hilden, K., & Jones, J. (2015). Math and reading connections: Analyzing the comprehension strategies needed to solve third grade math problems, *Reading in Virginia*, 38, 29-40.

Whitebread, D., Coltman, P., Jameson, H., & Lander, R. (2009). Play, cognition and self-regulation: What exactly are children learning when they learn through play?. *Educational and Child Psychology*, *26*(2), 40.