MENTOR AND NOVICE TEACHER CO-LEARNING TO PROMOTE STUDENT ENGAGEMENT AND PARTICIPATION

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This design research study describes how one mentor teacher-teacher candidate dyad co-learned to promote student engagement and participation through using a "Collaborative Learning Structure" (CLS) tool that we are developing. We share how the dyad used the CLS, with support from a professional development facilitator and fellow teachers, to better identify student assets (a critical component of promoting student engagement and participation). Our analysis demonstrates that (1) co-noticing is a productive means of supporting dyad co-learning to promote student engagement and participation and (2) teachers need to co-learn across time while using tools supportive of their learning. We discuss implications for how to support teachers in promoting student engagement and participation.

Keywords: Preservice Teacher Education, Equity, Inclusion, and Diversity, Teacher Noticing

Preparing and supporting teachers to promote meaningful student engagement and participation is an enduring and critical challenge in math education. Our project team is currently in Year 3 of a four-year, NSF-funded, design research (Cobb et al., 2017) study to iteratively design tools to support teacher dyads (teacher candidates and mentor teachers) in collaboratively learning (i.e., co-learning) about ways to promote student engagement and participation. We aim to help dyads develop a vision for math teaching and learning where:

All students, in light of their humanity – personal experiences, backgrounds, histories, languages, and physical and emotional well-being – must have the opportunity and support to learn rich mathematics that fosters meaning making, empowers decision making, and critiques, challenges, and transforms inequities and injustices … equity demands that responsive accommodations be made as needed to promote equitable access, attainment, and advancement in mathematics education for each student. (Aguirre, Mayfield-Ingram, & Martin, 2013, p. 9)

In addition, we aim to help dyads continually seek to understand their students' identities and assets as well as their own implicit biases and deficit perspectives (e.g., Featherstone et al., 2011; İnan-Kaya & Rubie-Davies, 2021; Moll et al., 1992; Paris, 2012, 2016). We also aim to help

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dyads enact practices that celebrate and draw on students' identities and assets, elicit and validate non-dominant forms of math competence, establish equitable participation norms that position all students as capable, and critique and dismantle classroom structures of power and privilege that suppress their students' success (Aguirre, Mayfield-Ingram & Martin, 2013; Aguirre, Turner, & Bartell, et al., 2013; Bartell et al., 2017; Celedón-Pattichis et al., 2018; Gutiérrez, 2013; Ukpokodu, 2011).

We believe that teachers' learning how to promote student engagement and participation is an adaptive, ongoing, deliberate, and collaborative process since teachers must continually respond to the varied needs of their diverse students across their teaching careers as well as to the ever-shifting contexts in which they work. Engaging with people with diverse perspectives and experiences (notably colleagues, students, parents, community members) regularly across time helps teachers notice and analyze parts of their practice that may be "invisible" to them. These interactions support teachers' development by making their intentions explicit and the impacts of their actions (whether they are equitable or not) open to collective inquiry. This aligns with the benefits of collaborative professional learning opportunities within communities of practice (Wenger, 1999). We are investigating how the clinical experience can be a productive site for dyads' co-learning about promoting student engagement and participation. Using mentoring models that position teachers as "critical friends," "co-enquirers," and "partners" (Furlong & Maynard, 1995; Males et al., 2010), our tools aim to minimize power hierarchies between teachers, draw on assets of both teachers, and support teachers in developing the humble and vulnerable stance required of lifelong teacher learners (Feiman-Nemser, 2012).

The tools we are designing, referred to as Collaborative Learning Structures (CLSs), have three key features that support dyads in working in adaptive, ongoing, deliberate, and collaborative ways. First, our CLSs prompt dyads to investigate "enduring questions" (Cochran-Smith et al., 2008) related to student engagement and participation (e.g., recognizing, understanding, and disrupting inequitable patterns of student participation; honoring and making sense of students' diverse ideas; creating opportunities for students to learn collaboratively).

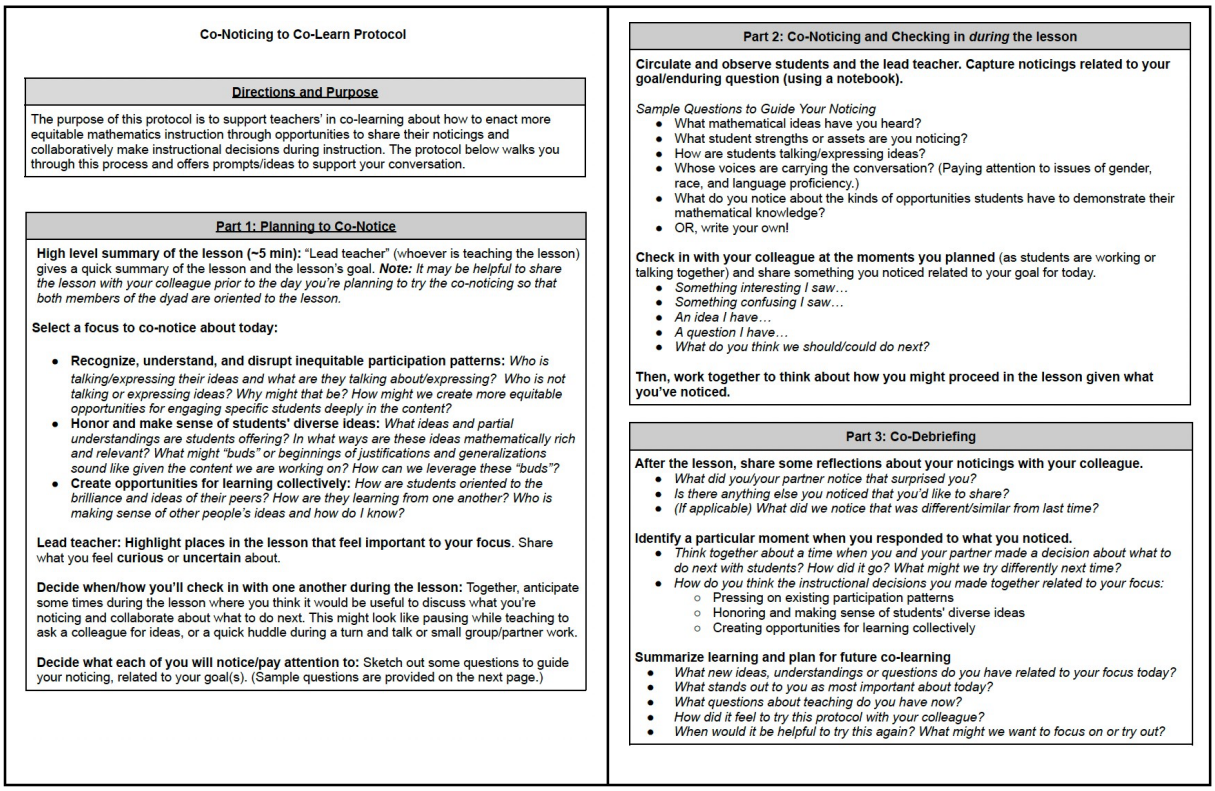
Second, our CLSs prompt dyads to notice (van Es & Sherin, 2008) collaboratively, or "co-notice", salient aspects of their instruction and students' experiences in the classroom that advance or constrain the students' participation and engagement. When co-noticing, teachers identify elements of their practice that might otherwise go *unnoticed* as well as collaboratively generate and experiment with more equitable practices that aim to disrupt features of the classroom and instruction that lead to inequitable participation (Louie et al., 2021; van Es et al., 2017). Third, our CLSs guide dyads' interactions when collaboratively planning, enacting, and reflecting on lessons over time. The CLSs frame these teaching activities (lesson planning, enactment, reflection) as interconnected so that the mentor teachers and teacher candidates continue making sense of and having structured conversations about student engagement and participation during all phases of lesson development and across time.

The research question guiding this study is "How do CLSs support dyads in co-learning about student engagement and participation?" This paper shares one example of teachers' co-learning to promote student engagement and participation while using a CLS.

Methods

The CLS used in this study, shown in Figure 1, is our initial draft of this tool (to be revised in summer 2023 and again after data collection during the 2023-2024 academic year). This tool includes three parts. Part 1 is a protocol for planning to co-notice during a lesson. Here the *lead teacher* (i.e., teacher leading instruction) first *gives a high-level summary of the lesson*[1], then the

dyad selects a *focus to co-notice* (i.e., a co-learning goal related to an enduring question) for their lesson planning-enactment-debriefing cycle and highlights places in the lesson they feel curious or uncertain about related to their focus. Then they decide when/how they will check in with one another during the lesson and what each teacher will notice/pay attention to during the lesson related to the curiosity/uncertainty shared. Part 2 is a protocol for co-noticing and checking in during the lesson. Here teachers circulate and observe students and the lead teacher while capturing noticings related to their goal/enduring question. They check in with each other at the moments they planned and share something they noticed related to their goal in order to work together to think about how to proceed given what they noticed. Part 3 is a protocol for co-debriefing after the lesson. Here teachers share reflections about their noticing, identify a particular moment when they responded to what they noticed, and summarize their learning and planning for future co-learning.



Co-Noticing to Co-Learn Protocol

Directions and Purpose

The purpose of this protocol is to support teachers' in co-learning about how to enact more equitable mathematics instruction through opportunities to share their noticings and collaboratively make instructional decisions during instruction. The protocol below walks you through this process and offers prompts/ideas to support your conversation.

Part 1: Planning to Co-Notice

High level summary of the lesson (~5 min): "Lead teacher" (whoever is teaching the lesson) gives a quick summary of the lesson and the lesson's goal. ***Note:*** *It may be helpful to share the lesson with your colleague prior to the day you're planning to try the co-noticing so that both members of the dyad are oriented to the lesson.*

Select a focus to co-notice about today:

- **Recognize, understand, and disrupt inequitable participation patterns:** *Who is talking/expressing their ideas and what are they talking about/expressing? Who is not talking or expressing ideas? Why might that be? How might we create more equitable opportunities for engaging specific students deeply in the content?*
- **Honor and make sense of students' diverse ideas:** *What ideas and partial understandings are students offering? In what ways are these ideas mathematically rich and relevant? What might "buds" or beginnings of justifications and generalizations sound like given the content we are working on? How can we leverage these "buds"?*
- **Create opportunities for learning collectively:** *How are students oriented to the brilliance and ideas of their peers? How are they learning from one another? Who is making sense of other people's ideas and how do I know?*

Lead teacher: Highlight places in the lesson that feel important to your focus. Share what you feel **curious** or **uncertain** about.

Decide when/how you'll check in with one another during the lesson: Together, anticipate some times during the lesson where you think it would be useful to discuss what you're noticing and collaborate about what to do next. This might look like pausing while teaching to ask a colleague for ideas, or a quick huddle during a turn and talk or small group/partner work.

Decide what each of you will notice/pay attention to: Sketch out some questions to guide your noticing, related to your goal(s). (Sample questions are provided on the next page.)

Part 2: Co-Noticing and Checking in *during* the lesson

Circulate and observe students and the lead teacher. Capture noticings related to your goal/enduring question (using a notebook).

Sample Questions to Guide Your Noticing

- What mathematical ideas have you heard?
- What student strengths or assets are you noticing?
- How are students talking/expressing ideas?
- Whose voices are carrying the conversation? (Paying attention to issues of gender, race, and language proficiency.)
- What do you notice about the kinds of opportunities students have to demonstrate their mathematical knowledge?
- OR, write your own!

Check in with your colleague at the moments you planned (as students are working or talking together) and share something you noticed related to your goal for today.

- *Something interesting I saw…*
- *Something confusing I saw…*
- *An idea I have…*
- *A question I have…*
- *What do you think we should/could do next?*

Then, work together to think about how you might proceed in the lesson given what you've noticed.

Part 3: Co-Debriefing

After the lesson, share some reflections about your noticings with your colleague.

- *What did you/your partner notice that surprised you?*
- *Is there anything else you noticed that you'd like to share?*
- *(If applicable) What did we notice that was different/similar from last time?*

Identify a particular moment when you responded to what you noticed.

- *Think together about a time when you and your partner made a decision about what to do next with students? How did it go? What might we try differently next time?*
- *How do you think the instructional decisions you made together related to your focus:*
  - Pressing on existing participation patterns
  - Honoring and making sense of students' diverse ideas
  - Creating opportunities for learning collectively

Summarize learning and plan for future co-learning

- *What new ideas, understandings or questions do you have related to your focus today?*
- *What stands out to you as most important about today?*
- *What questions about teaching do you have now?*
- *How did it feel to try this protocol with your colleague?*
- *When would it be helpful to try this again? What might we want to focus on or try out?*

[1] In this paper, italicized text indicates words and prompts that are taken directly from the CLS (see Figure 1).

Figure 1: Initial Design of a Collaborative Learning Structure (CLS)

Context, Data Collection, and Analysis

Data were collected in fall 2022 during a two-day professional development (PD) experience for elementary teachers. Day two of the PD included a lesson enactment when participants observed a lesson taught in a focal dyad's classroom. On day one of the PD, the PD facilitator, Aurora, met with the focal dyad to prepare for the upcoming lesson enactment. The focal dyad consisted of Maggie (mentor teacher, 20+ years teaching) and Amy (teacher candidate, graduate student). On day one, Aurora, Maggie and Amy used CLS Parts 1 and 2 to learn about students in Maggie and Amy's 5th grade classroom, refine the plan for lesson enactment, and plan to co-

notice during the lesson. On day two, Aurora and five dyads (including the focal dyad) used CLS Parts 1 and 2 *before* the lesson enactment to plan for co-noticing while the lesson was happening, then used CLS Part 2 *during* the lesson enactment to guide their notetaking and co-noticing check-in discussions, and finally used CLS Parts 2 and 3 *after* the lesson enactment to share observations and reflect on their collective learning. In addition, all teacher candidates used the CLS in a math methods course and dyads used the CLS outside of the PD while teaching in their own classrooms. The five dyads taught varying grade-levels at the same elementary school.

A project researcher observed and took field notes during the entire PD (including lesson enactment), and video recorded all of the PD except the 35-minute lesson enactment. Data for this study is drawn from the field notes and video-recordings collected during the PD. We analyzed data from all conversations/interactions using the CLS to characterize how the CLS supported the dyads in co-learning about student engagement and participation. We narrowed in on teachers' discussions related to student assets, building on the belief that meaningful student engagement and participation can be promoted by identifying and leveraging the assets students bring to classrooms. Our analytic questions included: "In what ways did the CLS seem to support (or not) productive discussions, particularly about student assets?", "What student assets (if any) did teachers identify?", and "How might these findings inform future revisions of the CLS tool?"

Results

The following vignettes demonstrate how the CLS supported Maggie and Amy, with support from Aurora and other PD participants, in co-learning how to identify student assets that were previously unnoticed by them.

Vignette 1: Facilitator (Aurora) and Focal Dyad (Maggie and Amy) Use CLS Parts 1 and 2 to Plan to Co-notice During the Lesson Enactment

In preparation for the PD, Aurora used CLS Part 1 to select a co-learning focus for the entire PD experience. She selected the focus to "Recognize, understand, and disrupt inequitable participation patterns" since it aligned with the teacher candidates' math methods course and with initiatives identified by the elementary school administrators. At the start of day one, Aurora shared this co-learning focus with Maggie and Amy, and the three discussed the roles they each would play as co-learners during the lesson enactment. Using CLS Part 1, Aurora then *gave a high level summary of the lesson* she planned to teach the next day in Maggie and Amy's class and *highlighted places in the lesson that she had curiosities or uncertainties about related to their focus*, specifically students' participation and math thinking since she had spent little time in the focal classroom. Next, the trio refined the lesson plan while keeping in mind the participation of individual students. To do this, Aurora asked the dyad to identify students for focused attention during the lesson. They identified two students they had participation concerns about: Carly, who "thinks her partner is so much smarter", and Lila, who "won't write anything down." Prompted by a question in CLS Part 2, Aurora then asked the dyad what they knew about these students' strengths. Amy described Carly as "super artist and very giving." Maggie added that Carly "is trying… she hasn't shut down" and "she's social." Amy then said, "[Lila] is so capable, but she won't - I don't know what it is." Maggie offered that Lila is "super sweet, very friendly" and "gets along with her tablemates well." In sharing these strengths, the teachers described characteristics of each student that are not typically considered to be mathematical strengths. The trio concluded by making a few final revisions to the lesson plans, incorporating visual models and partner discourse prompts. In doing so, they deferred *deciding when/how they will check in with one another during the lesson* and *deciding what each teacher will notice/pay attention to during the lesson* to day two of the PD session.

Vignette 2: All Dyads and Aurora Use CLS Parts 1 and 2 to Plan to Co-notice During the Lesson Enactment

At the start of day two, the five dyads and Aurora used CLS Parts 1 and 2 to plan to co-notice during the lesson enactment. First, Aurora distributed copies of the CLS to dyads, saying "think about what you're hoping to co-notice and learn." She suggested dyads look at the list of *Sample Questions to Guide Your Noticing* in Part 2 then *decide when/how you'll check in with one another during the lesson* in Part 1. During this time, Maggie and Amy talked about several guiding questions, ultimately deciding to focus on the question *What student strengths or assets are you noticing?* Their conversation, transcribed below, shows how both Amy and Maggie offered ideas during this exchange and seemed to reach consensus together.

Amy: I think whose voices are carrying [the conversation] will be really interesting because- at least with these two- because we're not expecting them to have necessarily equal exchange.

Maggie: Uh-hmm.

Amy: The next one too [What do you notice about the kinds of opportunities students have to demonstrate their mathematical knowledge?]. Like, with- well, with all of them, but specifically with [Lila], like, what if she can represent? You know, instead of just having a blank piece of paper in front of her. I'm really curious if she's gonna actually-.

Maggie: Start using the visual model?

Amy: Yeah. I think that Carly probably will.

Maggie: I think so too… But you know what might be interesting for us to look for too is their student strengths even though we're not really- it's hard. It's hard to tell with Lila in particular and for our kids who are similar to her. Like, they have strengths. They're just not clear to us because they're so quiet. I mean, it might be like a combination of what strengths do they have and what opportunities are they using to show what they know.

Amy: Uh-hmm. Because maybe that is their strength.

Maggie: Right.

Amy: Maybe the visual is their strength or something like that.

Maggie: Yeah. I'd be interested in trying to find more strengths for those two, for Lila for sure.

Vignette 3: All Dyads and Aurora Use CLS Part 2 to Co-Notice During Lesson Enactment

During the lesson enactment on day two, Aurora told dyads to take a few minutes to check in, as directed in CLS Part 2 (*Check in with your colleague at the moments you planned*). Amy and Maggie stepped into the hallway. They started their conversation by talking about how the two focal students were not talking and were not writing anything on their papers. Amy then asked, "But what about their strengths?" Maggie replied, "Yeah, their strengths." They both paused to think, then noted how Carly had participated verbally during the choral response in the beginning of lesson. They were unable to identify any specific strengths for Lila. The initial focus of the dyad conversation centered around what their focal students were NOT doing. Amy then used a question in Part 2 (*What student strengths or assets are you noticing?)* to reorient the dyad. She asked, "But what about their strengths?" Maggie accepted the shift in conversation.

Vignette 4: All Dyads and Aurora Use CLS Parts 2 and 3 to Co-Debrief Their Co-Noticing

After the lesson enactment on day two, Aurora and the five dyads used CLS Parts 2 and 3 to *share something they noticed related to their goal* and *summarize learning* as a group. Aurora prompted the group to think about leveraging student strengths by asking, "Did you see evidence of students engaging in habits that are strengths as mathematicians? We can start to notice ourselves and have other students notice them and use them to engage students." Teachers shared strengths they noticed about the class as a whole, including "students did a really good job of persevering and seeking more," "kids were engaged and excited," and "they were going back and forth, working through tough questions." Aurora then asked Maggie and Amy to share strengths they noticed about Carly and Lila. Maggie shared that Carly's strength was counting orally; Aurora connected that observation to using mathematical structures, patterns, and regularity. The dyad could not initially identify any strengths for Lila, so they invited input from the other teachers, as they examined Lila's work. As demonstrated in the following transcript, through collaborative noticing and reflecting with support from Aurora and another teacher named Nia, Maggie and Amy identified Lila's strength of justifying and explaining her mathematical reasoning, a crucial step in leveraging students' assets to promote meaningful student engagement and participation.

Maggie: [Lila] would look at her partner's work and then start working herself. But again, that's the one who isn't confident.

Aurora: But she's resourceful.

Maggie: But resourceful. Right? So, I don't know, what would you call that one?

Aurora: Hmm. I don't know what she was looking at. Do you know what she was looking at?

Maggie: Well, when you were giving them private reasoning time to write down their initial thoughts about who had more, I mean it was very blatant, she was like, "Ok, what's my neighbor doing?" And then it was like, you know, doing the work.

Nia: Is it cuz she doesn't know how to do it or she lacks the confidence to do it? I'm just curious.

Maggie: Yeah, I think she *could* do it.

Nia: So, do you think maybe she's trying to compare her own thoughts to others?

Maggie: Ummmm ...

Nia: Maybe she's looking to see if she's thinking about it correctly?

Maggie: Yeah. I think Amy is looking for her partner's work right now to compare. But it could be.

Aurora: And we don't know until we ask … what does this mean? What else could it mean? Maggie: Oh, and they have different work, now that we're looking at it too. And she's actual-

She's showing more. But she- she- her explanation is using more-.

Amy: Justification.

Maggie: She has more justifi- more mathematical reasoning in her answer than her partner did. But she just had to know- because they both started out the same way. Lance had less, so they both started out that same way, but then she goes on and is more specific, whereas the partner is not. Or they go different routes. The partner said, "because in the tenths place Lance has 4 and Angel has 5." And [Lila's] says, "Lance has less and Angel has more because in Angel's work she shows that 5 tenths

is equal to 500 thousandths and 500 thousandths is bigger than 485 thousandths." So, they both - they branch off. So maybe she was just like comparing in her head first. And then like, "Ok, we both started off knowing that Lance has less, but now I can explain it in my own way."

Discussion

These vignettes suggest the CLS was useful in helping Maggie and Amy co-learn new ways of promoting student engagement and participation by expanding their conceptions of their students' mathematical assets. The CLS prompts were useful in both orienting teachers to look for student assets instead of deficits and in re-focusing their attention when they shifted toward deficit orientations. Based on these vignettes, we have identified two central claims. Claim 1: teachers co-noticing is a productive means of supporting co-learning since working in partnership provides opportunities for teachers to broaden what they see in their students' thinking and work. Claim 2: learning to promote student engagement and participation is not fast or easy; rather, it requires teachers to engage in goal-oriented activities together across time.

Claim 1: Co-noticing is a Productive Means of Supporting Dyad Co-learning to Promote Student Engagement and Participation

The CLS is designed to support dyads in *co-noticing* aspects of their instruction and students' experiences in the classroom in order to collaboratively make instructional decisions. While initially struggling to identify the focal students' mathematical assets (as demonstrated in vignettes 1 and 3), teachers articulated curiosities about the focal students' participation (as demonstrated in vignette 2) and began noticing the different ways the focal students were participating in the lesson and the diverse assets they offered (as demonstrated in vignettes 3 and 4), with the help of the CLS, Aurora, and other teachers in the PD. A rich body of research in math education suggests that teacher noticing is a central dimension of teaching expertise and has important implications for how teachers attend to students' mathematical reasoning and sensemaking (e.g., van Es & Sherin, 2008) and equity in their classrooms (e.g., van Es et al., 2017). The vignettes show how co-noticing about focal students' participation was an important and necessary precursor for helping the dyad make their unconscious bias and deficit perspectives more visible so that they had the opportunity to disrupt aspects of their instruction that led to inequitable student participation. Further, when focusing their shared work on co-noticing (as demonstrated in all vignettes) both Amy and Maggie had the opportunity to share their individual perspective about their students and salient moments of instruction, thereby drawing on their collective (teacher) assets. Thus, in contrast to collaborative work that elicits and privileges one perspective or interpretation of classroom events, co-noticing invites multiple perspectives and interpretations and presses teachers to understand in new ways how features of the classroom and instruction advance or constrain student participation and engagement.

Claim 2: Teachers need to Co-Learn Across Time While Using Supportive Tools

These vignettes indicate that the work of co-learning and co-noticing is challenging for teachers (ideally a productive struggle) and unlikely to happen without deliberate tools and support across time. As they were continually prompted to focus on student assets while using all three parts of the CLS, the focal dyad appeared to find this work challenging, as evidenced by the struggle they had when identifying and articulating the mathematical strengths of each focal student in vignettes 1 and 3. The teachers used a positive disposition toward the two students, but had limited knowledge of the range of strengths that students bring to and share in the

mathematical work (beyond "traditional" strengths such as getting the right answer quickly) or were perhaps limited by their constrained views of the students and what the students were capable of doing in their class. The CLS prompts were useful in inspiring the dyad's discussion and focus on co-noticing, yet in their initial collaborative discussion (in vignette 1) the focal dyad quickly reverted to identifying and naming what the focal students were not doing instead of focusing on what the students were doing in math. However, after Amy refocused the discussion by asking "But what about their strengths?" (in vignette 3), both teachers began to look for and notice student assets. It is not likely that this re-orienting would be possible, meaningful or productive had the status roles of the mentor teacher and teacher candidate not been flattened in the PD session and CLS use. This reorienting was useful in eliminating and shifting the deficit narrative that the teachers had used on day one, although the focal dyad continued to grapple with noticing authentic mathematical strengths and assets of their focus students. The larger discussion with multiple dyads (in vignette 4) helped the dyad identify more authentic mathematical assets of the focal students. The other dyads posed questions that prompted the dyad to more deeply examine and broaden their conception of their students' participation and assets in ways that helped Maggie and Amy see Carly and Lila in new ways.

Thus, looking across the vignettes shows how teachers must engage in sustained conversations about how to promote student engagement and participation across multiple teaching activities (including lesson planning, enactment, and reflection) with guidance from supportive tools.

Conclusions and Implications

One of our explicit goals in developing the CLSs is to re-frame teacher orientations about equitable math teaching with a specific focus on broadening conceptions of what participation in math classrooms could and should look like. Implicitly, we aim to develop a tool that will a) disrupt deficit perspectives and narratives of students, and b) support teachers with developing new skills by offering replacement practices that leverage an assets/strengths-based perspective. In this way, we anticipate that our CLS will support teachers with both interrupting deficit language and perspectives as well as expanding their skills for noticing the assets and strengths students, especially Black and Latiné students, bring to learning and doing math. We operate from the assumption that teachers have good intentions and are deeply invested in their students' academic success, are committed to their students developing positive learning identities, and have a desire to improve their own practice. We also leverage our own asset-based perspective about teachers in developing the CLS. We believe if teachers have better tools, then they will be better positioned to operationalize their curiosity about students' thinking, their commitments to students' developing positive identities, and their work as equity-oriented math teachers.

Preliminary data from our work suggests that the CLS is promising as a powerful tool for supporting math teachers in recognizing, understanding, and disrupting inequitable patterns of student participation, honoring and making sense of students' diverse ideas, and creating opportunities for students to learn collaboratively as they co-plan, co-notice, and co-debrief in service of continually becoming equity-oriented teachers. The CLS appears useful to dyads by providing a structure for co-noticing and co-debriefing. It also appears useful for flattening power hierarchies between teacher candidates and mentor teachers in ways that created new spaces for co-learning and new opportunities for multiple perspectives and strengths to be used in service of equity-oriented math teaching. Despite early evidence about the usefulness of the CLS, we remain curious about how we can continue to revise the CLS through design research cycles to better accomplish our goals and create a theory of co-learning equity-oriented

instruction. We are also curious about what other types of supports might be needed by dyads for co-learning, co-noticing and co-debriefing, especially as related to disrupting inequitable patterns of student participation and students' opportunities for learning.

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