Project Sigma

The Problem:

How do secondary math teachers take up recommendations and instructional strategies to move toward “ambitious instruction”? Traditionally, committed professionals attend workshops, collaborate with colleagues, read books, and tinker in the privacy of their classrooms. However, when things don’t go as they expect, teachers have few resources to adjust and continue on their path to improvement. Furthermore, the feedback built into the educational system is often insufficient, and teachers invested in their own professional growth are searching for data sources that are helpful for their students’ success and for their own improvement.

What we Know About Effective Professional Development:

- Focuses on content knowledge
- Is organized around materials teachers use in their classrooms
- Focuses on specific instructional practices
- Provides teachers with opportunities for active learning
- Is coherent with other learning activities
- Garners support from teacher
- Is sustained over time

However, absent from many of the related literature is how theories of teacher learning inform the design of professional development.

Critiques to “business as usual” in math teaching and learning:

1) Typical professional development does not adequately support teachers’ learning of ambitious mathematics instruction. Teachers need timely and adequate feedback to make sense of their instruction
2) Teachers’ own questions should be a point of departure for their learning
3) The field knows a lot more about beginning math teachers’ learning but a lot less about experienced teachers

Designing for Teacher Learning

Using these critiques as a point of departure, our study centered teachers’ sensemaking. To design our intervention, Video-Based Formative Feedback (VFF) Cycles, we developed the following design conjectures: (1) address teachers’ existing concepts about and practices for teaching; (2) align learning activities with teachers’ personal goals; (3) draw on knowledge of accomplished teaching; (4) respond to issues that come up in teachers’ ongoing instruction; (5) provide adequate and timely feedback on teachers’ attempts to improve their instructional practice to support their ongoing efforts; (6) provide a community of like-minded colleagues to learn with and garner support from; (7) provide teachers with rich images of their own instruction to minimize the burden of recontextualization; and (8) respect teachers’ autonomy, agency, and experiences by taking a stance of co-inquiry into practice.

Before the lesson, the focal teacher and research team formulated a co-inquiry question. During the lesson, the teacher selected four groups of students to collect audio data on, and the research team recorded the lesson with a whole-class camera and a point-of-view camera, collecting fieldnotes and artifacts. After the lesson, the research team reviewed the recordings with the co-inquiry question in mind. Typically within 24-72

hours, the researchers met with the focal teacher and their colleagues to debrief the co-inquiry question.

Video Representations of Instruction:

The rich video representations of instruction were a tremendous source of learning. For our teachers, many important learning moments happened because they could see and hear their students interacting without them. Sometimes, students affirmed what teachers had hoped in their instructional designs — teachers were delighted to hear students talking about mathematics, debating each other's ideas, and building on each other's arguments. Such affirmations matter, since refining practice should account for aspects of teaching that are working as intended. In these instances, teachers were enthused to see how their instructional practices aligned with their pedagogical commitments. The VFFs could be equally valuable when lessons did not go as planned, since the debrief gave them resources to revisit and probe what happened.

Other times, listening to students' interactions, particularly in groupwork, uncovered surprises. We have instances of teachers pleasantly surprised at students' sophisticated thinking during groupwork or relieved that their lesson went better than they recalled, often with a realization that they were being hyper-critical of themselves. But we also have instances of unpleasant surprises. In addition to uncovering new problems of practice, sometimes the unpleasant surprises yielded different diagnoses for problems they already.

Whether teachers' expectations and interpretations were affirmed or challenged, these rich representations grounded our discussions and had greater credibility than we, alone, would have had as observers. The clips also enabled our co-inquiry stance, as we could present classroom moments without coloring them through the language required to describe them, instead inviting collective interpretation as we watched video together. This allowed us to sustain an emic facilitative stance longer than if we had to continually dig into our own observational records: We could

invite teachers to elaborate on their perspective and sustain our focus on their sensemaking with questions like, “What did you see or hear that made you think that?” With the help of their colleagues, we could then dig into fine-grained lesson details to investigate their practice.

Importantly, this work enabled us to develop a theory of teacher learning, arguing that teacher learning can be productively conceptualized as a process of conceptual and cultural change. To learn more about this work, see our recently published book:

Horn, I., & Garner, B. (2022). *Teacher Learning of Ambitious and Equitable Mathematics Instruction: A Sociocultural Approach*. Routledge.