

## PURPOSE

While research has shown that teachers who engage in formative assessment practices may have the most powerful impact on student learning (Black & Wiliam, 1998; Wiliam, Lee, Harrison & Black, 2004; Hattie, 2012), less is known about the development of teachers' knowledge and use of formative assessment as they plan, enact, and reflect on their practice. Though integrating formative assessment (FA) into day-to-day instruction shows promise for closing the achievement gap, it is a complex and challenging practice for teachers (Coffey et al, 2011; Furtak, 2012; Gotwals et al, 2015), and not enough is known about which practices are most effective in particular contexts.

Our qualitative case study focuses on how in-service middle school math teachers conceive of, plan with, enact, and reflect on specific *formative assessment moves* (FAM) (Author, 2014a) and how FA-focused teacher professional development might foster participants' attention to issues of equity and access in middle school math classrooms.

Drawing upon a learning progressions framework (Heritage, 2008; Corcoran, Mosher, & Rogat, 2009; Black, Wilson & Yao, 2011), that when applied to *teachers as learners* allows for the exploration and mapping of teachers' conceptions of "thinking and doing" formative assessment, we study the differences between novices and experts, with an emphasis on growth in formative assessment practice for all teachers along a continuum (Shavelson, Moss, Wilson, Author, Baron, & Wilmot, 2010).

The study is guided by three research questions:

1. How do in-service teachers take up concepts and language of the *FA Moves* (FAM) and relate them to their own and others' instructional practices?
2. Specifically, how useful is the FA Moves Professional Development (FAMPD) cycle of inquiry when teachers plan, enact, and reflect on their mathematics lessons?
3. How might the FA moves framework for professional development with middle school math teachers foster participants' attention to issues of equity and access in middle school math classrooms?

## THEORETICAL FRAMEWORK AND BACKGROUND

While there is no single empirically validated theory of teacher learning on which we could have designed our model of professional development (Borko et al, 2010), we agree that professional development for teachers should be collaborative, teaching-for-practice focused, and situated in authentic problems of teaching and learning (Lampert, 2003; Ball & Cohen 1999; Borko et al, 2010; Sleep & Boerst 2012). Our FAMPD intervention is built around a cycle of inquiry, with

sessions dedicated to planning, enacting, and reflecting on teachers' FA-driven lessons because we view teaching as a cyclical process and that time spent articulating, unpacking, and reflecting practice holds great potential for improving teaching (Grossman, 2005; Grossman et al, 2009).

Although it may be difficult for teachers to change their assessment practices quickly (Cizek, Fitzgerald, & Rachor, 1996; Stiggins, 2001; Webb & Jones, 2009; Bennett, 2011), we designed the PD to facilitate “moves-based” discourse among participants who shared a common challenge (Ball et al, 2009). Responding to calls for a common grammar of practice (Grossman & McDonald, 2008), we shared with teacher-participants an intuitive language (priming, posing, pausing, probing, bouncing, tagging and binning) for formative assessment moves, in order to invite more productive discussion about the rationale and choices a teacher makes at particular turns of talk with students in her/his classroom.

Our choice to focus on a small group of math teachers at one school for 20+ hours of contact time reflects a research consensus about characteristics of PD that are critical to increasing teachers' practice (Desimone, 2009): content focus, active learning, coherence, duration, and collective participation. Since researchers recognize that teachers' FA practice depends on their content knowledge (Atkin et al 2005; Coffey et al, 2011; Furtak et al 2008; Furtak, 2012), and that rooting FA in pedagogical skills alone is probably insufficient (Bennett, 2011), our team included a math education expert in every aspect of the work. The PD was aligned with the teacher-participants' interests and their school and district's values regarding equity, access and inclusion. We strove to enhance teacher-participant experience of coherence and active learning by making the PD adaptive, iterative, and practice-based (Horn, 2008). Teachers exercised autonomy and made choices (e.g., lesson topic covered, timing of observations, which video clips to analyze, ground rules for feedback) within the FAM framework.

We introduced video-based formative assessment lesson study into the FAMPD to augment the process of unpacking teaching and assessment for learning. (See, e.g., Santagata, Zannoni & Stigler, 2007; Tripp & Rich, 2011; Blomberg et al, 2013). Video allows a community of teachers-as-learners to slow down, unpack, and critically examine classroom interactions and cultural routines while keeping a focus on the guiding content-based questions for the PD. Further, the stop motion nature of personalized, video-based conversation allows the teacher-presenter to *own* the lesson while trusting colleagues to offer advice for improvements based on a well-defined FA moves framework. There are multiple opportunities to observe, analyze, and discuss the nuance of practice from insider and outsider perspectives (Darling-Hammond & Sykes, 1999; Stigler, Gallimore & Hiebert, 2000).

## METHODOLOGY AND DATA SOURCES

We employed case study methods to pursue answers to our research questions (Yin, 2014). Given the emerging knowledge base of a teacher learning progression regarding formative assessment

practices in the classroom (Author et al, 2014b), a case study was the most appropriate method and allowed us to exercise an iterative data collection and analysis process (Creswell, 2013). We relied on qualitative data from focus groups, observations, videotapes of lessons, document review and post-PD interviews gathered over a 15-month period.

Data for this two-case case study were drawn from a larger research project focused on professional development to engage teachers in exploring formative assessment practices in their classrooms. We observed middle school math teachers as they participated in this PD and as they taught lessons they each designed to be formative assessment-driven.

The FAMPD was a 6-session experience for three math teachers and one science teacher at one middle school in a suburban district. Participation was voluntary. Some teachers sought and received district PD credit. FAMPD sessions were conducted at the teacher's classroom during free periods or after school. All sessions were audiotaped and key portions of sessions were transcribed, including critical mathematical context from video clips when sessions included teachers watching and discussing video.

The first author led all sessions except for the session dedicated to discussing the proposed lesson plans of the teachers' FA-driven lessons. The third author, a math education expert, met all teacher-participants to discuss their preliminary lesson plan decisions, provided warm and cool feedback on the lesson design, discussed common student misconceptions in the particular lessons' math content, and insights into the alignment of the lessons with Common Core Standards.

Data sources included teachers' lesson plans, video clips from the teachers' lessons, teachers' self-analysis of own video clips, teachers' reflections, researchers' reflections, and interview transcripts. Field notes were collected after FAMPD sessions.

The data analysis was aimed at answering the research questions and identifying themes and categories (Miles and Huberman, 1994). To verify and compare recurring themes, we triangulated the evidence ensuring we had data from each stage of the inquiry cycle to support conclusions.

## **FINDINGS**

Our empirical study focuses on how in-service teachers take up specific moves (e.g., priming, posing, pausing, probing, bouncing, tagging and binning) associated with formative assessment practice, and attempt to coordinate those skills with other pedagogical goals for the classroom. According to observational data and self-reports, the FAMPD experience led to transformations in both teachers' definitions of FA, and their practices and beliefs about equity and access in middle school mathematics classrooms.

### *“Samuel’s” transformation*

When teacher Samuel began the PD, he defined FA as in-class interactions between teacher and students and was interested in improving documentation of conversations. He believed good instruction required teachers’ careful listening and spoke of “teaching for equity.” Samuel credited FAMPD with increasing his awareness about the amount of academic language (AL) he used (“I had no idea I used so much academic language”). He attributed FAMPD with his discovering student confusions related to AL sooner and with addressing such confusions more equitably and productively than before. Samuel reported the FA moves are effective tools he relies on to increase equity of participation and access to curriculum in his math classes. Samuel contends engaging the FAM framework can make other classrooms more equitable and has voluntarily taught others about the FAM framework.

### *“Michelle’s” transformation*

When PD began, 6<sup>th</sup> grade teacher Michelle defined FA as “tricks” and technology: “tricks” to engage students and make thinking visible (e.g. “touch your elbow if you agree”) and technology (e.g., having students use the app “Show Me”). Michelle credited FAMPD with expanding her definition of FA to include artful probing of student thinking to help “stuck students” by more than “just re-teaching.” Michelle’s customary dichotomous binning (two binary bins, e.g., agree-disagree) became more frequently polytomous (many bins). Her orientation to equity and access in math classes changed too, from “out there” to “my class.” For Michelle, equity went from a concern for students attending less-resourced schools, to a commitment to “using FAM to make my math classes serve students I hadn’t called on before, especially given that “laning” (tracking) begins 7<sup>th</sup> grade.”

We also found the video lesson study approach, when supported by a common grammar of formative assessment moves, changed the dynamic of group reflection. Cross-grade observations by the teacher-participants focused on binning (algebraic v. arithmetic) strategies, and allowed for more targeted, meaningful feedback (“what if you tried...” and “I noticed that when that student...”) on teaching practice.

In addition to supporting teachers’ making explicit connections between specific FAMPD-facilitated insights such as, “I need to pause longer and more frequently,” to assertions that “Improved pausing and bouncing improved the equity of participation in my 3<sup>rd</sup> period and provided struggling students’ access to a curriculum full of academic language”; we documented more growth—from worries about specific FA techniques, to making broader connections to pedagogies of inclusion—over the period of study.

## **SIGNIFICANCE & FUTURE DIRECTIONS**

Our work adds to the existing knowledge base on the use of teachers’ reflective practices to advance the skills required to bring about more powerful classroom mathematics discussions and

make teaching and learning more visible. As Hattie (2012) argues, “when teaching and learning are visible, there is a greater likelihood of students reaching higher levels of achievement (p. 21). Yet making teaching and learning visible requires an accomplished teacher as evaluator and activator (Hattie, 2012).

Our study suggests that the FAM framework for professional development expands mathematics teachers’ notions of what formative assessment is and surfaces new ways of seeing students’ engagement with lesson materials. Because our study focused on mathematics teachers, we cannot say if this would be true for teachers of other disciplines. More research is needed to explore the influence of discipline on the nature of FA practice.

This study also provides evidence of teachers’ benefiting from self-analysis of video clips of their own teaching using an analytic framework for formative assessment-driven teaching *before* engaging with colleagues in critical reflection in light of evidence about their teaching. This aspect of teacher use of video in professional development and pre-service teacher education has not been foregrounded in the literature yet (Blomberg et al, 2013).

This study begins to address the question of how formative assessment-focused professional development might foster teachers’ attention to issues of equity and access in middle school math classrooms. One participant said, “If FA equals listening, the FA moves help you listen *further*. More student voices are heard, and heard better.”

Focused on middle schools grappling with the Common Core Standards and the goals of increasing student listening and talking skills in diverse classrooms, our video-based work is providing a common language for formative assessment that is accessible, useful in a variety of contexts, and contributes to stronger connections across research communities and communities of practitioners.

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