Developing Ambitious Mathematics Instruction through Web-Based Coaching:
A Randomized Field Trail

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Background/Context:

Collectively, public school districts invest tens of billions of dollars annually to improve classroom instruction, typically through teacher in-service training and professional development. However, recent studies are mixed regarding the impacts of professional development programs on instruction and student achievement. Evidence to date suggests that teacher coaching programs may be an exception to these disappointing results. A recent meta-analysis of 60 causal evaluations of teacher coaching programs found that, on average, coaching programs improved instructional quality by half a standard deviation and student achievement by almost one-fifth of a standard deviation (Kraft, Blazar, & Hogan, 2018). However, this evidentiary base is limited largely to studies of literacy coaching programs and programs focused on teachers' general pedagogical practice. There exists a far smaller body of literature on math-specific coaching, and only a single rigorous evaluation, Campbell and Malkus' (2011) study of a whole-school math coaching model.

Purpose:

In this paper, we describe and evaluate a web-based coaching program designed to support teachers to implement Common Core-aligned mathematics instruction. Web-based coaching may solve several challenges faced by site-based models. For instance, site-based coaches' time for working one-on-one with teachers is often diverted to non-instructional duties such as administrative tasks and substitute teaching (Chval et al., 2010). Further, a single site-based math coach may not have the content expertise and experience required to work with math teachers across all grades and courses (Campbell & Malkus, 2014). Our evaluation of a web-based coaching model where coaches are external to schools presents an alternative model that is less susceptible to competing demands on site-based coaches' time and makes it more feasible to pair teachers with coaches that have experience and expertise in their content area and grade level.

Research Design & Participants:

We conducted a randomized field trial to evaluate whether this was the case, examining a range of teacher and student outcomes during both the coaching implementation year as well as a follow-up year, when teachers no longer received MQI coaching. A total of 142 math teachers participated in the study, recruited from the third through eighth grades across two districts – urban and suburban – in a Midwestern state.

Intervention/Program/Practice:

The coaching program used the Mathematical Quality of Instruction (MQI) observation instrument to structure teachers' and coaches' reflections on and conversations about mathematics instruction. These conversations centered on three MQI dimensions: [1] *Richness of the Mathematics*, which captures the presence of disciplinary practices such as mathematical generalizations and multiple solution methods as well as mathematical sense-making activities; [2] *Common Core-Aligned Student Practices*, which captures students' mathematical reasoning, explanations, communication, and the cognitive demand of classroom tasks; and [3] *Working With Students and Mathematics*, which captures teachers' use of student ideas and teachers' remediation of student misconceptions.

Figure 1 provides an overview of the MQI Coaching cycle. During the implementation year, teachers videotaped themselves and shared those videos with remote coaches who watched them and extracted two short clips. Then, the teacher and coach met virtually for a highly structured conversation. During that conversation, teachers reviewed and scored a "stock" clip from the MQI video library, a process designed to help teachers recognize and begin to understand key mathematical and pedagogical practices in instruction that was not their own. Then coaches and teachers moved to a discussion of how the stock video teacher could have "elevated" her MQI score. The coach then asked the teacher to reflect on her own clips, and the process of analysis and elevation repeated itself. Coaches encouraged teachers to take the lead, directing their own learning and solving their own problems of practice

Findings:

We find a pattern of results common to the professional development literature—sizable positive effects on teachers' instructional practices, more modest effects on students' perception of instructional quality, but no detectable effects on student achievement. Consistent with the theory of action behind MQI Coaching, the program approximately doubled the incidence of teachers recognizing MQI-related instructional elements in stock clips. This large effect is sustained even a year after teachers had stopped working with their coach. In the implementation year, coaching also improved students' perceptions about the quality of their teachers' instruction by over one fifth of a standard deviation. Effects on students' perceptions of instructional quality are attenuated and no longer statistically significant in the follow-up year. However, we do find large effects teachers' videotaped instruction that follow-up year. Conditional on teacher characteristics, we estimate that MQI Coaching increased the probability a teacher would score a mid or high on a given segment for *Richness* by 9.6% (p=.001), a 37% increase over the control-group mean of 26%. We saw a 7% increase on *Working With Students* (p=.049), which translates to a 15% increase over the control-group mean of 46%. Finally, we saw a 9.2% percentage point increase (p=.001) for *Common Core-Aligned Student Practices*, or a 35% increase over the control-group mean of 26%.

We also collected student performance data on both state standardized tests and district-administered diagnostic tests in math, including the Measures of Academic Progress (MAP) test developed by the Northwest Evaluation Association. We find that MQI Coaching did not result in increases in student achievement as measured by state standardized tests or the MAP, although because of our relatively small sample size, we can only detect moderate to large effects with certainty. Teachers reported that their efforts to design and deliver lessons that integrated the high-quality practices identified on the MQI rubric were sometimes circumscribed by pressure to cover extensive content or promote single simple solution methods.

Conclusions:

Developing and refining coaching models takes time. Compared to the decades-long history of literacy coaching and its rich evidentiary base, math coaching practice and research is still in its infancy. This study suggests that experimenting with new math coaching models and continuously refining existing models such as MQI Coaching is a worthwhile investment.

References:

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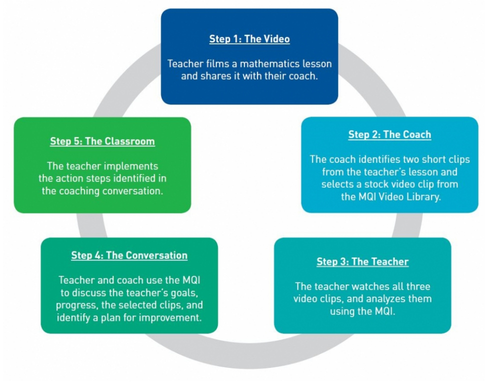

Figure 1: MQI Coaching Cycle