Investigating and Supporting the Development of Ambitious and Equitable Mathematics Instruction at Scale

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Study Objectives and Background

Guiding Research Question: What does it take to support mathematics teachers' development of ambitious and equitable instructional practices on a large scale?

Phase 1 (2007-2011):

•Collaboration with **four large, urban districts**, all of which were attempting *ambitious instruction* in middle-grades mathematics
- 6-10 schools in each district
- 30 middle-school mathematics teachers in each district
- 15-20 school and district leaders in each district

•**Pragmatic Objective: Provided annual feedback** on how each district's theory-of-action for instructional improvement was playing out in their schools and made actionable recommendations about how it might be revised to make it more effective

• **Theoretical Objective: Developed a provisional theory of action** for district-wide instructional improvement in mathematics

What is ambitious instruction? Lampert et al., 2010: Teaching aimed at engaging all students in cognitively demanding tasks, with ambitious learning goals for all students, such as those suggested in the NCTM (2000) Standards. Ambitious forms of teaching are complex and demanding, for both teachers and students. Developing ambitious instructional practices requires sustained support.

Phase 2 (2011-2016):

• Continued collaboration with **two of the districts from Phase 1**
- **Continue to provide annual feedback**
- **Collaborate with district leaders to co-design and co-lead coordinated professional development** for teachers, coaches, and school leaders
  - 12 schools in each of 2 districts
  - 60 middle-school mathematics teachers in each district
  - 25-30 school and district leaders in each district

• Test, revise, and elaborate conjectures inherent in the theory of action for district-wide instructional improvement

Data Sources

Data Collected Each Year:

•Participant interviews & surveys
•Network survey of all mathematics teachers in each school
•Assessments of mathematical knowledge for teaching (MKT; Hill et al., 2004) (teachers and coaches)
•Video-recordings of two consecutive days of instruction (teachers) coded with the Instructional Quality Assessment (IQA; Boston & Wolf, 2006)
•Audio- or video-recordings of teacher collaborative time
•Student achievement data
•Video-recordings of co-designed principal and coach professional development

Conceptual Tools

Theory of Action for Large-Scale Instructional Improvement in Mathematics that consists of testable conjectures and supports that press for improving practice (Cobb and Smith, 2008)

Interpretative Framework that can be used to 1) assess the potential of the districts' designed or intended strategies to contribute to instructional improvement and 2) explain how strategies are actually playing out in schools and classrooms. The framework focuses on 4 broad categories of support:
- New Positions
- Learning Events
- New Organizational Routines
- New Tools

(for additional information see Cobb and Jackson, 2012)

Pragmatic Objective

Annual Cycle of Data Collection, Analysis, and Feedback

Timeline	Activity	Research Tools Used
October	Interview key district leaders to document strategies for instructional improvement	
October - December	Analyze interviews to create District Design Document (DDD) Share DDD with key district leaders and conduct member-checks Create in-house version of DDD	Interpretive Framework, Current iteration of Theory of Action
January	Interview teachers, coaches, instructional leaders, and district leaders to document the implementation of the strategies	
February - April	Analyze interviews Create District Feedback and Recommendations Report (DFRR)	Interpretive Framework, Current iteration of Theory of Action
May	Share DFRR with key district leaders Meet with key district leaders to discuss DFRR	

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Theoretical Objective

When revising the theory of action for instructional improvement at scale we draw on evidence from the following sources:

1) Findings from annual feedback analyses to partner districts

2) Current research literature in Math Education, Learning Sciences, Teacher Education, Education Policy, and Educational Leadership

3) Findings of retrospective analyses being conducted on the five major components of the Theory of Action.

Current Theory of Action

5 components of current Theory of Action:

1) A coherent instructional system comprising:
   - explicit goals for students' mathematical learning, a detailed vision of high-quality instruction, and curriculum compatible with this vision
   - district professional development that is organized around curriculum materials
   - school-based professional learning communities (PLCs) that extend district professional development
   - assessments aligned with the goals for students' mathematical learning
   - additional supports for struggling students to enable them to succeed in mainstream mathematics classes
2) Teacher professional networks
3) Mathematics coaches' practices in providing job-embedded support for teachers' learning
4) School leaders' practices as instructional leaders in mathematics
5) District leaders' practices in supporting the development of school-level capacity for instructional improvement

(for additional information see Cobb and Jackson, 2011)

Some MIST Findings

Principals play a critical role in enabling mathematics coaches to be effective in supporting teachers' improvement of their instructional practices (Gibbons, Garrison, and Cobb, 2011).

Teachers' access to a colleague such as a coach who has instructional expertise is one of the strongest predictors of improvement in the quality of instruction (Smith et. al, 2012).

When educators use student performance data to inform instructional practice, opportunities for professional learning are shaped by (a) how data is represented (e.g., scores vs. distribution of answers, levels of aggregation/disaggregation), and (2) existing workplace cultures and practices. This means "evidence-based practice" is highly situational, which counters the more positivistic notions of data-use in school improvement discourse (Horn et.al, 2013).

Teachers' mathematical knowledge for teaching, vision of high quality mathematics instruction, and beliefs about supporting struggling students are significantly related to their enactment of cognitively demanding tasks (Garrison, 2013).