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

Pls: Paul Cobb, Thomas Smith, Kara Jackson, Erin Henrick, Ilana Horn, and Kenneth Frank

Vanderbilt University, McGill University, Michigan State University

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

Phase 2 (2011-2016):
- Continued collaboration with two of the districts from Phase 1
- Collaborate with district leaders to co-design and co-lead coordinated professional development for teachers, coaches, and school leaders
- 15-20 schools in each of 2 districts
- 30 middle-school mathematics teachers in each district

Pragmatic Objective: 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.

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

Annual Cycle of Data Collection, Analysis, and Feedback

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<tr>
<th>Timeline</th>
<th>Activity</th>
<th>Research Tools Used</th>
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<tr>
<td>October</td>
<td>Interview key district leaders to document strategies for instructional improvement.</td>
<td>Interpretative Framework, Current Iteration of Theory of Action</td>
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<td>October - December</td>
<td>Analyze interviews to create District Design Document (DDD) Share DDD with key district leaders and conduct member checks Create in-house version of DDD</td>
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<td>January</td>
<td>Interview teachers, coaches, instructional leaders, and district leaders to document the implementation of the strategies</td>
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<td>February - April</td>
<td>Analyze interviews Create District Feedback and Recommendations Report (DFRR)</td>
<td>Interpretative Framework, Current Iteration of Theory of Action</td>
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<td>May</td>
<td>Share DFRR with key district leaders Meet with key district leaders to discuss DFRR</td>
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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)
- Video-recordings of two consecutive days of instruction (teachers) coded with the Instructional Quality Assessment (IDA: Boston & Wolf, 2006)
- Audio- or video-recordings of teacher collaborative time
- Student achievement data
- Video-recordings of co-designed principal and coach professional development

Data Sources

Current Theory of Action

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.

Theoretical Objective

Some MIST Findings

Principles play a critical role in enabling mathematics coaches to be effective in supporting teachers’ improvement of their instructional practices (Giibbons, 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/deaggregation), and (b) existing workplace cultures and practices. This means “evidence-based practice” is highly adjusted, which counters the more prescriptive notions of data-use in school improvement discourse (Smith et al., 2012).

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 (Garman, 2013).