Developing Practical Measures of the Quality of the Mathematics Classroom Learning Environment
Nicholas Kochmanski (Vanderbilt University), Hannah Nieman (University of Washington), Paul Cobb (Vanderbilt University)

Abstract

Engaging in district-wide instructional improvement efforts requires ways to quickly and frequently assess the quality of classroom learning environments. We describe a process for the development of practical measures designed to both assess and leverage improvement in the quality of instruction and thus student learning.

Context & Rationale

A collaboration between researchers and practitioners (district leaders, instructional coaches, and teachers) to develop a common set of practical measures assessing aspects of the classroom learning environments that can be used across organizations.

A Shared Vision of High-Quality Mathematics Instruction:

- Lack of quick, easy-to-use measures to assess how instructional improvement is playing out
- Need to improve the quality of classroom discourse, particularly of small-group and whole-class discussions

A Shared Problem of Practice:

- Many teachers, instructional coaches, and district leaders with whom we have collaborated in this work.

We would like to thank Kara Jackson, Erin Henrick, Marco Muñoz, and the many teachers, instructional coaches, and district leaders with whom we have collaborated in this work.

Addressing the Problem of Practice

Initial Design of Student Surveys

- Identify key elements of high-quality classroom discourse.
- Design initial survey items aligned to key elements of high-quality classroom discourse:
  - Small group discourse
  - Whole class discourse

Example:

Multiple strategies for solving a problem
Rationale: richness of discussion and thus student learning opportunities is reduced when most students solve tasks using the same method (Stein, Remillard, & Smith, 2007)

Initial survey item: When students shared their answers with the whole class today, I learned a new way of solving the problem. Y/N

Conjecture: students’ responses conjectured about whether the class solved the task using a single procedure

Analyze

- Analyze cognitive interviews
  - Are survey items sensitive to key distinctions in the quality of classroom discourse?
  - Are students’ interpretations of survey items consistent?
- Identify problematic survey items
- Develop conjectures about why they are problematic

Example:

Conjecture: students are making sense of the survey items.

Analysis of student responses:

- Do students’ interpretations of survey items change when presented in different contexts?
- Do students’ interpretations of survey items change when presented in different formats?

Conjecture: students’ interpretations of survey items change when presented in different contexts and formats.

Improve

- Revise problematic items
  - Adapt the language of the questions
  - Orient students’ interpretations by underlining key words
  - Combine and/or add questions to address focal constructs
- Share revised surveys with practitioners for feedback

Example:

Improved survey item: Were there many new ways to solve the math problems today? Y/N

Rationale: shift the focus from student learning (i.e., learned a new way) to the breadth of potential solution strategies (i.e., many ways to solve)

Next Steps

Develop Data Representations & Routines for Using the Measures:

- Collaborate with practitioners to develop:
  - The platform in which to embed the surveys
  - How to introduce the routine to teachers and students
  - How to analyze the data efficiently
  - How to aggregate data across classrooms and schools
  - How to effectively represent the data for different groups of practitioners (e.g., teachers, district leaders)

Develop a Suite of Measures to Assess High-Leverage Aspects of Instruction:

- Extend our focus to other high-leverage aspects of high-quality mathematics instruction, including:
  - Social culture and norms
  - Richness of discussion
  - Mathematical tools as learning supports

Develop a Suite of Measures to Assess Supports for Teaching Learning:

- Collaborate with districts to develop measures connecting high-leverage aspects of instruction to supports for teacher learning:
  - For example, teacher collaborative time

Developing a Suite of Measures to Assess High-Quality Mathematics Instruction:

- Collaborate with districts to develop measures connecting high-leverage aspects of instruction to supports for teacher learning:
  - Teacher motivation and math knowledge for teaching
  - Support for teaching learning:
    - District curriculum
    - Instructional coaching
    - PD on facilitating rich discussion
    - Regularly scheduled time
    - High-quality professional development
    - High-quality meeting facilitation
  - School culture/peer
    - Formal teacher collaborative time
    - High quality professional development
    - High-quality meeting facilitation
    - Professional development

Addressed by current student surveys
Address with future measures

Develop a Suite of Measures to Assess High-Quality Mathematics Instruction:

- Collaborate with districts to develop measures connecting high-leverage aspects of instruction to supports for teacher learning:
  - Teacher motivation and math knowledge for teaching
  - Support for teaching learning:
    - District curriculum
    - Instructional coaching
    - PD on facilitating rich discussion
    - Regularly scheduled time
    - High-quality professional development
    - High-quality meeting facilitation
  - School culture/peer
    - Formal teacher collaborative time
    - High quality professional development
    - High-quality meeting facilitation
    - Professional development

Addressed by current student surveys
Address with future measures