Fostering Small-Group, Student-to-Student Discourse: Discoveries from a Practitioner Action Research Project

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RME 2015 Conference

Overview

- Process Standards
- Motivation
- Background Literature
- Research Questions
- Action Research Process
- Improving Student Communication
- Take-Home Tool
- Questions

Themes of the RME Conference

- Research to Practice
- Changing Minds: Supporting Students' Engagement with the Mathematical Process Standards

Mathematical Process Standards

- Students will effectively ***communicate*** mathematical ideas, ***reasoning***, and their implications using multiple representations such as symbols, diagrams, graphs, and language.

- Students will analyze mathematical relationships to connect and ***communicate*** mathematical ideas.

- Students will display, ***explain***, or ***justify*** mathematical ideas and arguments using precise mathematics language in written or oral ***communication***.

NCTM and Communication

- The . . . mathematics teacher should strive to establish a ***communication-rich*** classroom in which students are encouraged to share their ideas and to seek clarification until they understand. . . . ***Explaining***, ***questioning***, ***debating***, and ***sense making*** are thus natural and expected behaviors. (NCTM, 2000, p. 271)

Motivation

- **Laura:** The converse, so that's like them flipped around, of the inverse, so it's negative, because the not, and then them flipped around so then it's … yes. Alright, I got it, I think. …does that make sense?
- **Beth:** That makes sense.
- **Kevin:** Yeah, that makes sense.

Theoretical Framework

- Vygotsky
- Zone of proximal development (ZPD)
- Collaborative ZPD

Literature Review

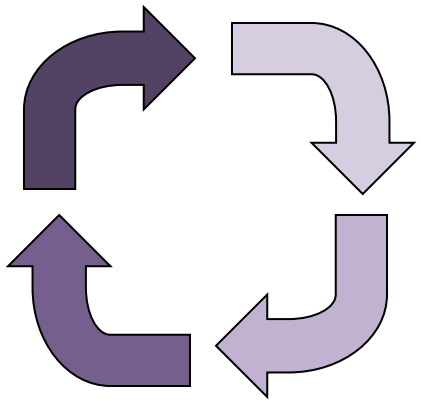
- Metacognition
- Metacognitive training
- Need to study teacher intervention
  - Brodie (2000)
  - Ding, Li, Piccolo, and Kulm (2007)
  - Dekker and Elshout-Mohr (2004)

Research Questions

- What is the nature of the teacher's interactions with the students while they are working in groups?
- How is the evolution of these interactions between teacher and students experienced by the teacher?
- How do students reflect on their experiences with the teacher's interactions with them while they are working in groups?
- How does student communication about mathematics while working in groups change over time?

Action Research

- Practitioner Action Research
- Deliberate and systematic reflection
- Transformation of educational setting
  - Planning
  - Acting
  - Observing
  - Reflecting



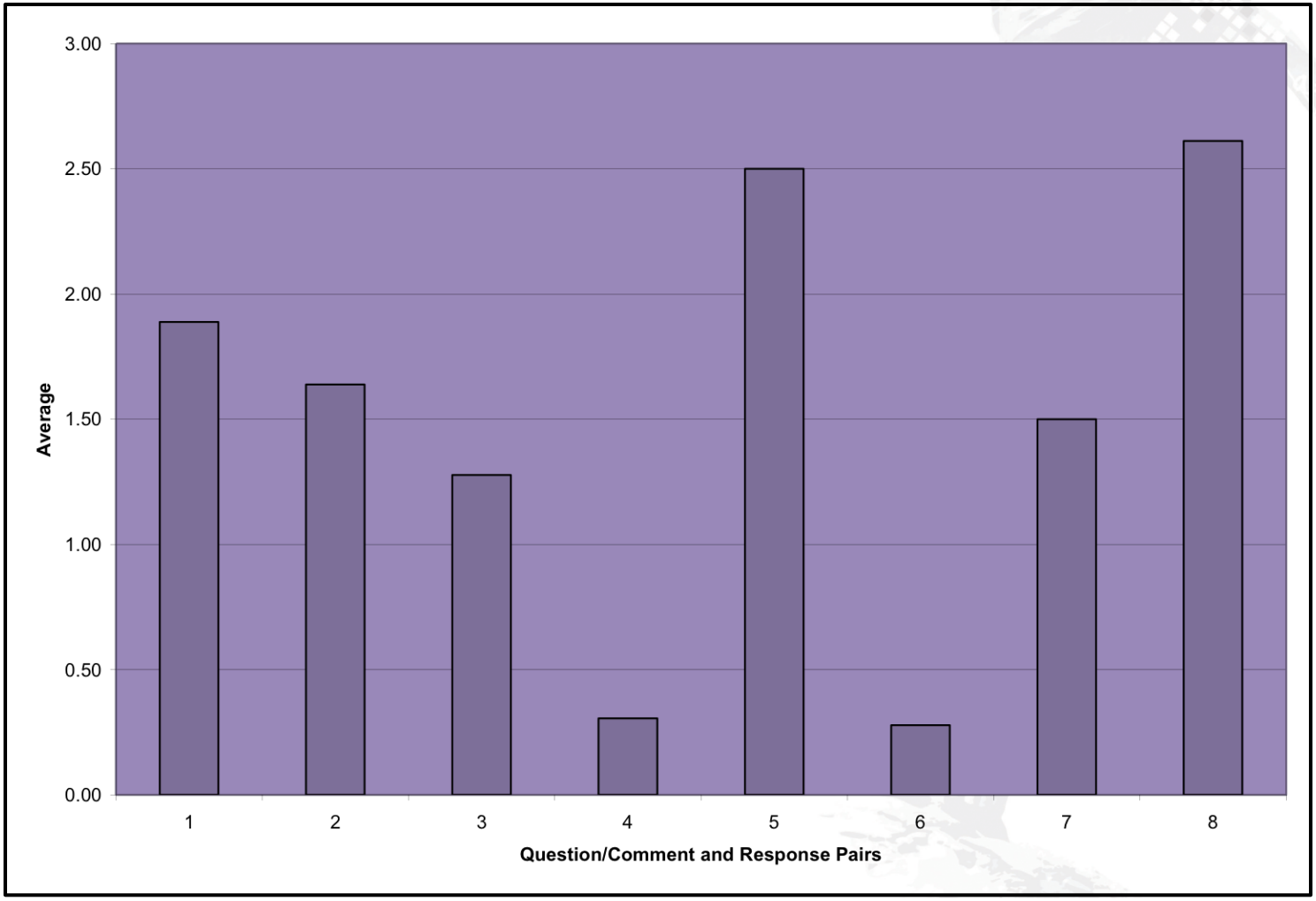
Process and Data

- Beginning (survey)
- Research Cycles
  - Interventions (audio)
  - Whole-class discussions (audio)
  - Questionnaires
  - Fieldnotes
  - Research Journal

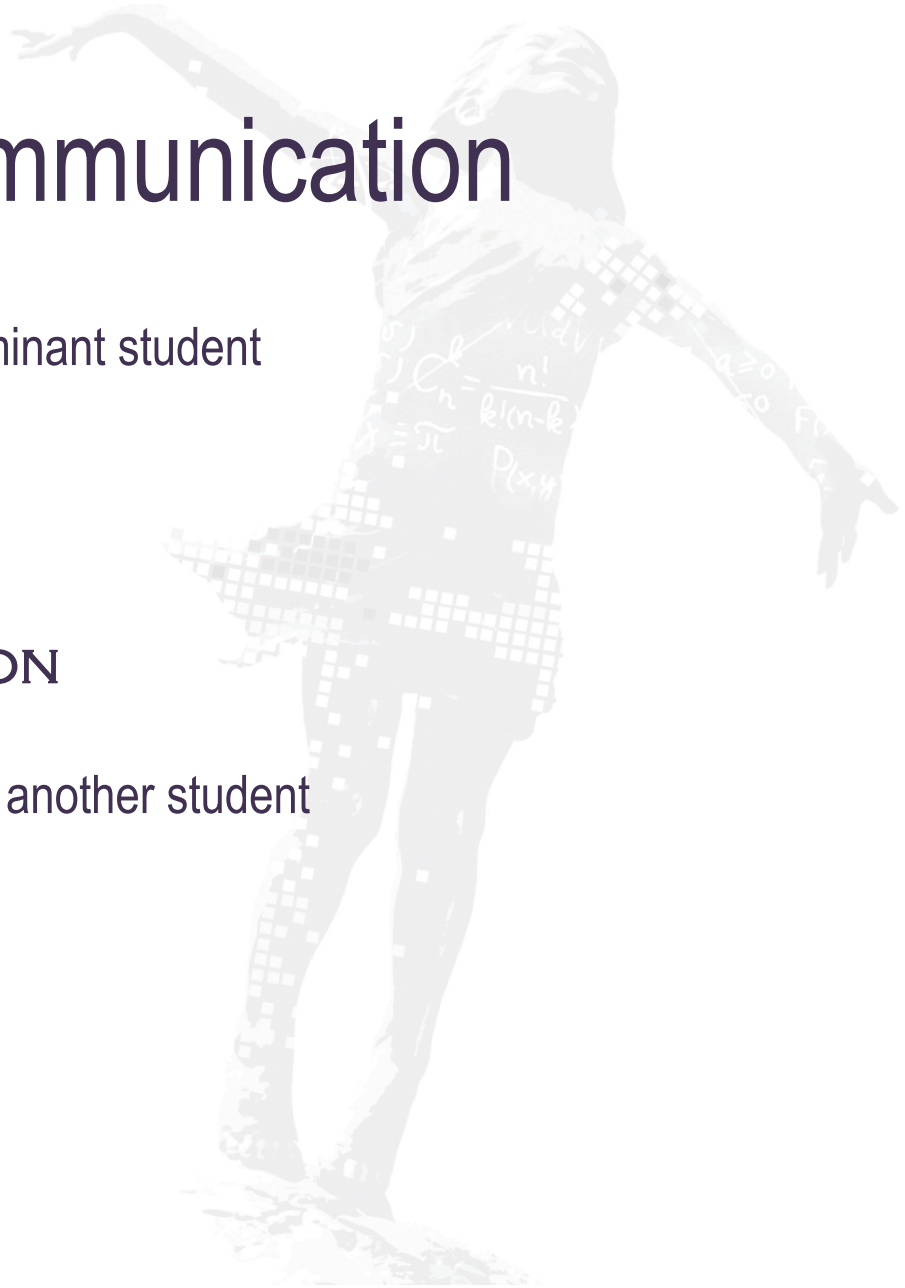
Stage 1:
Evaluate Student Communication

Question/Comment	Response
A asks B to show work	B shows own work
A asks B to explain work	B explains own work
A criticizes B's work	B justifies own work
A rejects B's justification	B reconstructs own work
A asks B to evaluate work	B evaluates A's work
A suggests a strategy to the group	The group tries the strategy
A asks B a content question	B answers A's question
A asks B a clarification question	B answers A's question

My Students' Communication



Stage 2: Evaluate Group Communication

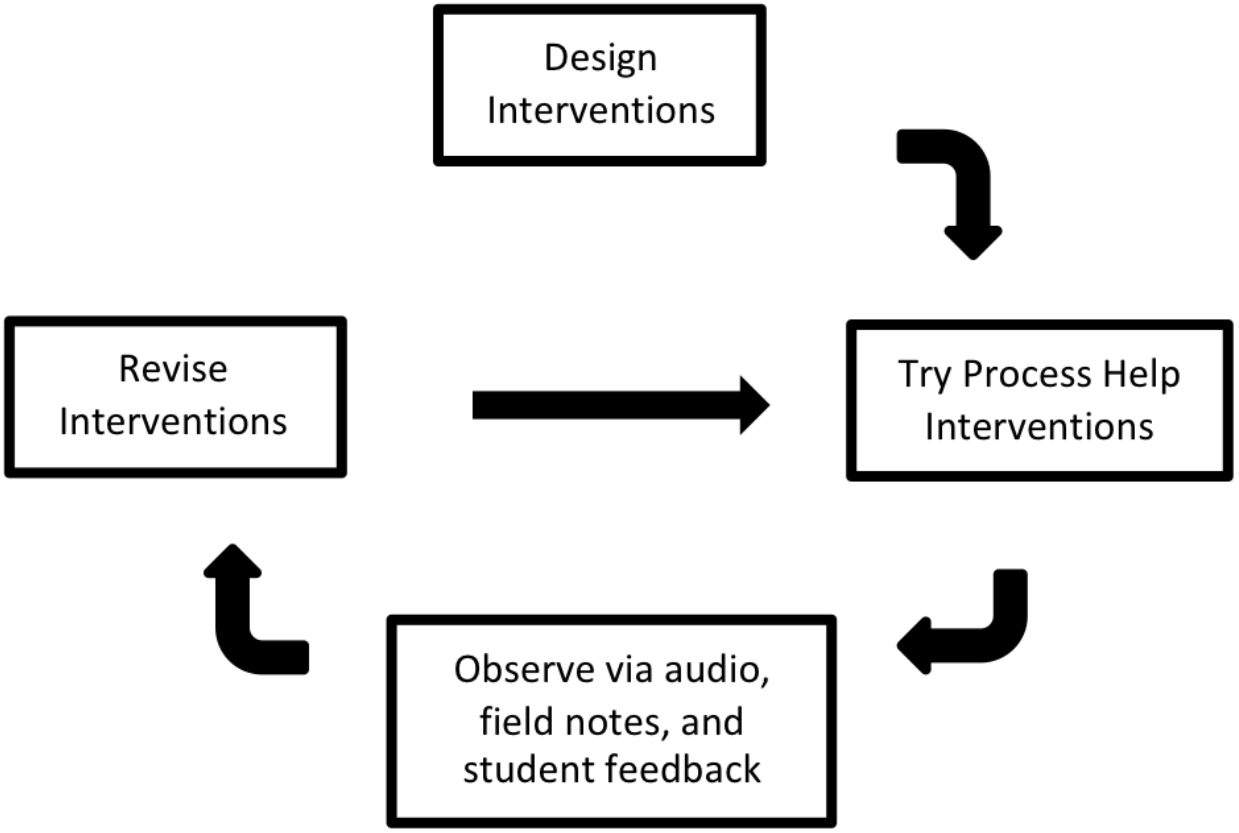


- Communication
  - Cannot work without teacher or dominant student
  - Help/leave/silence
  - Own zones
  - Nonparticipatory student
- Quality of Communication
  - Need appropriate first question
  - Student unsuccessfully tries to help another student
  - Dominant student
- Sociocultural Norms
  - Rush to complete task
  - Teacher as only resource
  - Blindly accept work of others

Stage 3:
Evaluate Teacher Communication

Compare and contrast the
three dialogues.

Action Research Cycle



Stage 4: Research Cycles Helping Students Communicate

- Cannot work without teacher or dominant student
  - What are your questions?
  - Redirect questions to group
  - Direct explanations to group members
  - Refer to other resources
- Help/Leave/Silence
  - *Leave group with a task*
  - *Follow-up on progress*
- Own Zones
  - *Redirect questions*
  - Individual work then compare strategies
- Non-participatory student (strong/weak knowledge base)
  - Explain what has been done
  - *Another student explain*
  - *Restate in own words*
  - Answer another student's question

Stage 4: Research Cycles Improving Student Communication

- Need appropriate first intervention
  - Explain what done so far
  - Errors as opportunity for inquiry (Ding et al., 2007)
    - Model evaluating process
    - Compare and evaluate
- Student unsuccessfully tries to help another
  - *Restate in own words*
  - *Agree with restatement*
- Dominant student
  - Restate in own words
  - Highlight overlooked idea of another student

Stage 4: Research Cycles Changing Socio-Cultural Norms

- Rush to complete task
  - Compare strategies
  - Evaluate work of others
- Teacher as only resource
  - *Redirect question to group*
  - *Ask student to redirect question to group*
  - Explain work to others
  - Ask others to evaluate work
- Blindly accept work of others
  - Restate in own words
  - Evaluate student's ideas

Improved Student Communication

- **Ellen:** Is it the midpoint of A and C, though, isn't it?
- **Laura:** No. Because, look, these two have different measurements. It's not the midpoint. These two are the same,these two are the same but these two aren't the same. So, it's not the midpoint.

Improved Student Communication

- **Laura:** Okay. So conjecture, so that one just write that the sum of …
- **Kevin:** two sides … must be greater than the sum if the third side, right?
- **Laura:** Is it possible … alright, so on one and then, so it's greater in between. Three and 8, greater than 7. And then, 7, 8 and greater than 3, so yes.
- **Kevin:** Because if you were to add on, up any other two sides, no matter in like order, it would also be greater than the third side, right?
- **Laura:** Yeah.

Student Reflections

- Questionnaires/Discussions
- Generic responses
- Lack of reflection
  - Communication
  - Strategies used

Take-Home Tool

- Stage 1: Evaluate Student Communication
- Stage 2: Evaluate Group Communication
- Stage 3: Evaluate Your Communication
- Stage 4: Try the Interventions

Tips: Getting Started with AR

- Identify relevant question(s)
- Make a plan to answer question(s)
  - Who will be involved
  - What are some potential actions
  - What evidence will be collected
  - How and when will the evidence be evaluated
- Start your cycles
  - Planning
  - Acting
  - Observing
  - Reflecting

Questions

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