Developing Writing in Mathematics via an Electronic Pen Pals Project

By Jonathan Bostic and Angela Thomas

Framing our Session

- Share importance of writing during mathematics instruction and learning.
- Explore results from fostering connections between seventh-grade students, preservice teachers, and K-16 faculty across content areas.
- Discuss ways teachers can facilitate more opportunities for writing across the curriculum, especially in mathematics.

Significant factors in teaching students to communicate

- What's known about writing?
  - Students become better writers by writing that is supported by very intentional, personally scaffolded instruction;
  - Students enjoy writing and are motivated to do so when they have an authentic task and audience;
  - Although writing a text is a solitary endeavor, the excitement of knowing that it will be experienced and perhaps valued by authentic audience gives life to the process and encourages students to share content that matters to them (Lapp, Fisher, & Frey, 2012).

Argumentative Writing

- Argumentative writing requires that students use evidence to develop a line or reasoning supporting a claim, that is, “the facts are on my side” (McLaughlin & Overturf, 2013, p. 189).
- It is found in everyday affairs such as in science, where scientists make claims based on observable evidence, in policy-making where decisions are informed by a wide range of evidence supporting a need, and in courtrooms where lawyers present evidence and reasons to support their claims (Hillocks, 2001).
- It differs from *persuasive writing*, which aims to show how one idea is correct or better than another. Persuasive writing was de-emphasized in the Common Core State Standards whereas argumentative writing was emphasized.

Argumentative Writing

- Students engaging in argumentative writing must collect and evaluate evidence while establishing a position on the topic.
- Writing must be concise and formal as they support their claims with clear reasoning and relevant evidence.
- Language arts teachers should provide explicit writing instruction and opportunities for students to express themselves through the written mode.
  - Teachers in other content areas are expected to provide opportunities for students to construct written responses that respond to discipline-specific objectives.

Argumentative Writing

- Students need to practice argumentative writing by working with peers to ensure that they develop and understand argumentation, which is essential knowledge for doing mathematics (e.g., engagement in SMP 3: Construct viable arguments and critique the reasoning of others).
- Thus, argumentative writing offers mathematics and language arts teachers a natural connection in fostering precise communication with their students (National Council of Teachers of Mathematics, 2000).

Connecting Language Arts and Mathematics

- Model-eliciting activities (MEAs) are rich, worthwhile tasks that support students' reading and writing in the content areas, modeling real-life problems or issues, and foster deep interconnected mathematical thinking about mathematics content (Bostic, 2012/2013, 2015; Lesh & Zawojewski, 2007).
  - MEAs are different from typical mathematics word problems (Bostic, 2015; Lesh & Zawojewski, 2007).
  - MEAs may take approximately 2-10 class periods and have been implemented in middle school classrooms for over a decade.

Exploring the impact of an intervention

- Goal #1: Involve seventh-grade students in a rich-mathematics task as a means to learn content and engage in the SMPs.
- Goal #2: Offer preservice teachers practice providing scaffolded argumentative writing instruction to middle school students.

MEAs

- The classroom teacher explored multiple MEAs through online searches to discern one that might connect with the seventh-grade mathematics content standards.
  - The classroom teacher selected one called “Hiring Problem” (Chan,2008) to modify and suit her students’ real-life experiences.
  - She revised the task to address specific seventh-grade mathematics content standards following guidelines suggested by the Bostic (2012/2013). The revised MEA is called “Employing a Workforce”.

MEAs

- The revised MEA addressed several standards within two mathematics CCSSM clusters
  - 7.RP “Analyze proportional relationships and use them to solve real-world and mathematical problems” (CCSSI, 2010, p. 48),
  - 7.EE “Solve real-life and mathematical problems using numerical and algebraic expressions and equations” (CCSSI, 2010, p. 49).

In The Classrooms

- During a twelve-week university course, the preservice teachers learned about argumentative writing, scaffolding writing instruction, and how to provide appropriate feedback to middle school students.
- Instruction fostered understanding that
    1. An argument is a claim that must be supported by evidence from the data.
    2. ,It is necessary to go beyond summarization when constructing an argument.

In The Classroom

- The classroom teacher introduced “Employing a Workforce” and assigned her students to small groups.
- Throughout the project, she assisted students’ learning of new mathematics concepts from the two clusters of CCSS standards addressed by “Employing a Workforce.”
  - The seventh-grade students worked on the MEA in small groups during class.
  - Individually, they wrote and submitted their solutions and arguments about the MEA to their university penpals.

In The Classroom

- Over the course of three months, each set of penpals had a minimum of eight online written exchanges via Edmodo.
- This experience on the platform allowed mathematics students to share their thinking about “Employing a Workforce.”

Findings

- We drew three conclusions from examining the "Employing a Workforce" responses, survey results (about the experience), and online posts.

(1) Students' argumentative writing improved.

(2) Students felt their writing quality improved and that they learned important mathematical concepts.

(3) Students on both ends of the exchange enjoyed the experience.

Ideas for integrating argumentative writing into your instruction

- Start a conversation with your ELA colleagues about collaborating. Reach out to a local college or university with preservice teachers.
- Choose a MEA that fits your students' learning needs. Prepare them for implementing a MEA over multiple days (consecutive or occasional).
  - Remember, you're addressing multiple standards for content and practice!
- Practice writing, revising, and peer-to-peer collaboration.

Thanks for coming!

Feel free to connect with us:

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