Building Partnerships and Resources to Support Mathematical Argumentation

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BPCME Project Overview

Bridging Math Practices Among Connecticut Mathematics Educators (BPCME)
Phases I & II (January, 2014 – September 2015)
Phase III - Continuation Grant (January – September 2016)

Partnership among
- UConn – Neag School of Education
- UConn – Department of Mathematics
- Manchester Public Schools
- Mansfield Public Schools
- Hartford Public Schools

Overarching Goal: Build the capacity of math teachers and coaches (grades 3 – 12) to support students' mathematical reasoning and communication of their reasoning

Project Foci:
- Math Practices: Argumentation (SMP 3)
- Math Content: Proportional & Algebraic Reasoning
- Pedagogical Practices: Supporting inquiry and oral and written communication

Collaborative Work: Development of Tasks & Tools

Mathematical Argumentation

Project Definition:
A mathematical argument is a sequence of statements and reasons given with the aim of demonstrating that a claim is true or false.

Analytic Framework:
Arguments comprise *claims, warrants* and *evidence,* offered both implicitly and explicitly (Toulmin 1958).

Teachers' Initial Definitions:
Initial definitions varied widely, and generally did not indicate that an argument was about determining the truth of a claim.

> [It] is supporting your math thinking with appropriate justification that will be clear to others and can be generalized.

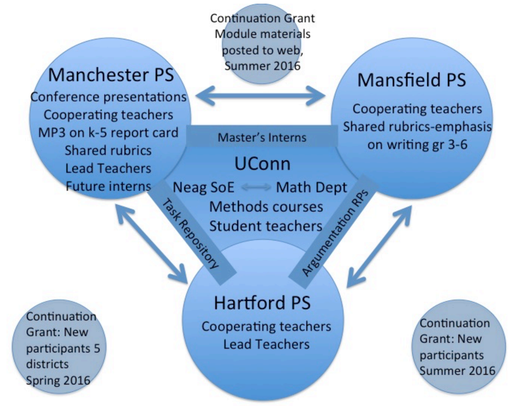
> Students being able to explain how they solved a math problem and the process they used using appropriate math vocabulary.

> It is when you use mathematical concepts, vocabulary, strategies to defend your claim.

Teachers' End-Of-Project Definitions:
End-of-project definitions aligned with the project definition and framework in most cases.

Partnerships

Connections among current and future partners



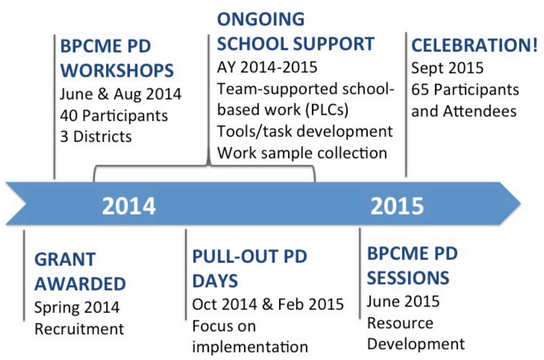
The impact of the BPCME Project follows from opportunities for ongoing relationships with partners, the availability of tools that cut across settings, school-specific efforts by past and future participants, and broad dissemination of refined project materials.

Successes & Challenges

SUCCESSES
- Extensive experimentation at all levels with all content areas
- Development of instructional tasks and tools that can be used across settings, as well as professional development materials
- Significant changes ($p<.01$) in teachers' confidence in their knowledge of argumentation and abilities to develop students' capacity with argumentation
- High levels of integration into practice reported (~65% reported using and adapting and collaborating to develop new strategies)

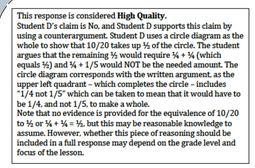
CHALLENGES
- Maintaining focus and continuity in a broader context of multiple district initiatives and demands on teachers' time
- Daily integration –changing the perception that argumentation is added to the curriculum, or done at certain times
- Developing instruments to assess teachers' proficiency with argumentation
- Developing ways for teachers to assess students' growth over time

2014-2015 Grant Activities



Tools and Products

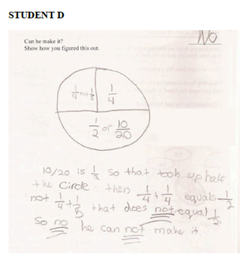
http://bridges.education.uconn.edu


This response is considered **High Quality.**
Student D's claim is No. and Student D supports this claim by using a counterargument. Student D uses a circle diagram as the whole to show that 10/20 takes up ½ of the circle. The student argues that the remaining ½ would require ¼ + ¼ (which equals ½) and ¼ + 1/5 would NOT be the needed amount. The circle diagram corresponds with the written argument, as the upper left quadrant – which completes the circle – includes "1/4 not 1/5" which can be taken to mean that it would have to be 1/4, and not 1/5, to make a whole.
Note that no evidence is provided for the equivalence of 10/20 to ½ or ¼ + ¼ = ½, but this may be reasonable knowledge to assume. However, whether this piece of reasoning should be included in a full response may depend on the grade level and focus of the lesson.

Argumentation Components	
Claim	**Evidence**
The claim is stated (no)	The student offers visually, and in writing, that two halves make a whole. The student also notes that 10/20 is a half, and the fraction ½ would combine with ¼ + ¼ to make a whole.
Warrant	**Language & Computations**
The student's warrant is that ¼ + ¼ is ½, and ¼ + 1/5 does not equal ½, and so is not the needed amount The student assumes the reader will accept (without additional reasoning provided) that 10/20 is ½. The student also assumes the reader will accept that ¼ + 1/5 cannot equal the same value as ½+ ¼.	All mathematical statements are accurate.

Argumentation Resource Packets

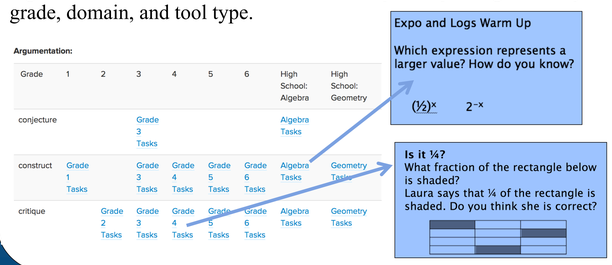
ARPs contain annotated sets of student work samples on one problem. Annotations – created collaboratively by project participants – describe the strengths and areas for improvement of each work sample, holistically and by specific components.



Leapfrog problem and work sample from http://map.mathshell.org

Task Repository

The Task Repository contains over 200 tasks and tools developed by BPCME teachers and interns that can be used to support argumentation in the math classroom. The repository is organized by grade, domain, and tool type.



Self-Paced Learning Modules

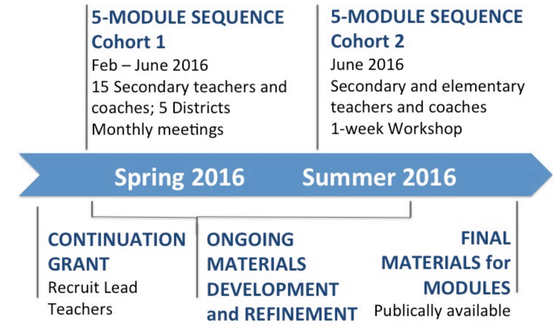
Self-paced modules designed to be explored individually. Supported by classroom video, student artifacts, and focused commentaries.

5-Module Facilitation Materials

Five-module course materials designed to support facilitators and participants to deeply engage with ideas around mathematical argumentation through structured professional development. Includes support for both PLC and workshop formats. Modules titles:

1. What is an Argument?
2. Tasks to Support Argumentation
3. Norms and Routines
4. Classroom Discourse
5. Providing Feedback on Student Work

2015-2016 Grant Activities



Bibliography

Toulmin, S. (1958). *The uses of argument*. Cambridge, UK: Cambridge University Press.