

Professional Development Modules on Mathematical Argumentation: Facilitation Guide Overview

Bridging Math Practices Project - Background

The Bridging Math Practices Project (or more formally, Bridging Practices among Connecticut Mathematics Educators (BPCME)) was funded by a Math-Science Partnership Grant from the Connecticut State Department of Education (CT SDE). Starting in the summer of 2014, the BPCME grant collaborated with 40 elementary and secondary math teachers from Manchester, Mansfield and Hartford Public Schools to consider ways to engage teachers and students in the practice of mathematical argumentation. Our intensive work with our first cohort was then revised and streamlined to produce a five-module sequence that was implemented with two new cohorts (45 teachers) during spring and summer of 2016. The materials and a facilitation guides for the five modules are a product of this grant project and are available on the Bridging Math Practices website (<http://bridges.education.uconn.edu>).

Argumentation Modules: Purpose

The purpose of this set of five modules is to support teachers in advancing their pedagogy of mathematical argumentation. Through these materials, we pursue four questions as overarching across all of the modules as a means to guide your facilitation and participants' consideration of the topics presented:

1. What is a mathematical argument? What “counts” as an argument?
2. What is the purpose(s) of argumentation in mathematics? In the math classroom?
3. How do we organize our classroom to support student participation in the practice of mathematical argumentation, and to support them in developing their proficiency with argumentation (both verbal/interactive and written forms)?
4. What does student argumentation look like at different levels of proficiency?

Argumentation Module Materials

The full set of materials comprises the following set of resources for each module, all of which are available on our website (<http://bridges.education.uconn.edu/argumentation-pd-modules/>):

- **Facilitation Guide** with detailed explanations regarding timing, concepts and enactments
- **Handouts** for all activities – Full set available as PDF; Individual Word documents for easy editing
- **Slide presentation** – Powerpoint file available for updating
- **Templates for Opening Activities** – community building (focusing on norms or doing math together) and/or linking between sessions
- **Bridging-to-Practice Activities** – intended for use in the Workshop Format
- **List of Additional Resources and References**

Facilitation Guide Contents

The purpose of the Facilitation Guides specifically is to support small groups of practitioners or professional development facilitators to make the most of the five module series of professional development sessions focused on mathematical argumentation.

Specifically, you should consult this guide for:

- additional background
- overview of materials needed for the module
- timing tables based on two implementation formats (monthly PLC and week-long workshop*)
- implementation guide for each component of the module, including discussion of each activity or module component, including key points of discussion and common issues that arise
- additional resources and activities and
- references

*As mentioned, we expect the materials to be used in a variety of ways. One way we envision the professional development being structured is as monthly meetings during the school year. We refer to this structure as the “PLC Format.” In the PLC Format, we have plans and activities for about *1.5 hours for each module*. (For shorter PLC meetings, a module could take two meetings.) A second way we envision the professional development being structured is as an intensive, week-long summer workshop, which we referred to as the “Workshop Format.” In the Workshop Format, we have plans and activities for *3.5 hours for each module*, which includes the Bridging-To-Practice activities. The summer workshop model can be readily extended to five 5-hour days with the inclusion of opening activities, breaks, and lunch.

The follow page provides an overview of the full set of five modules.

Overview of Five Modules

The table below provides an overview of the topics and primary learning goals for each of the five modules in this professional development.

Module Title	Module Goals
Module 1: What is Argumentation?	<ul style="list-style-type: none"> • Develop a deeper understanding of argumentation and its potential in the math classroom. • Analyze mathematical arguments within a basic structure. • Establishing community agreements and expectations for a positive professional working environment
Module 2: Prompting and Supporting Argumentation – Focus on Tasks	<ul style="list-style-type: none"> • Select and modify tasks to prompt argumentation for a variety of instructional purposes by using three conceptual lenses. • Evaluate and analyze tasks to determine how they support argumentation in the math classroom • Establish foundation to implement tasks that prompt argumentation to support a culture of thinking.
Module 3: Prompting and Supporting Argumentation: Focus on Implementation – Norms and Routines	<ul style="list-style-type: none"> • Examine norms and routines that can support mathematical argumentation in the classroom. • Develop an understanding of a pedagogy of inquiry to support mathematical argumentation in the classroom.
Module 4: Prompting and Supporting Argumentation: Focus on Implementation - Classroom Discourse	<ul style="list-style-type: none"> • Understand the use of a pedagogy of inquiry to support mathematical argumentation in the classroom. • Understand mathematics classroom discourse interactions that can support students to engage in argumentation • Reflect on current instructional strategies to consider how they will promote discourse and argumentation in the classroom
Module 5: Feedback to Advance Student Argumentation	<ul style="list-style-type: none"> • Further develop strategies to support students in generating, extending and sharing their arguments (and understanding) as a discussion unfolds. • Analyze student verbal and written mathematical arguments, using the structure of an argument, in order to provide feedback (feedforward) to support mathematical argumentation.

Additional Notes About Timing

The format of your professional development

In our work with participants, we found that an intensive workshop format, with at least 25 contact hours, seemed most productive in providing participants with the time and space needed to think deeply about the content and to develop strong, collaborative relationships with their colleagues over the course of the professional development experience. With this in mind, we use the Workshop Format, with 3.5 hour meetings, as the basis for our descriptions and materials for each activity.

The alternate format – the Professional Learning Community (PLC) format – is designed for bi-weekly or monthly meetings, most likely during the academic year. The benefit of this format is the opportunity for ongoing professional development experiences throughout the school year, which are essential to promoting lasting educational change.

If you are working in a monthly PLC format, we recommend you follow the estimated timing listed in the column under “monthly,” with about 1.5 hours for each session. As needed, you can break these into smaller segments, e.g., two 45- minutes meetings per month. We also include suggestions for the Bridging-to-Practice activities that teachers can try in the times in between their PLC meetings in their classrooms.

Additionally, it may be the case that you have chosen to work through these materials on your own. If you are working as an individual, we recommend that you focus on the monthly PLC format, more or less. We also strongly encourage you to seek out conversations with colleagues as you engage this work.

Bridging-to-Practice Activities

In our work with teachers, we have found that some of the most meaningful professional development activities are those that explicitly incorporate opportunities for participants to build connections between the ideas of the professional development with the everyday experiences of their classrooms and schools. As a result, we believe that it is essential for any enactment of these materials to include opportunities for participants to directly bridge the worlds of the PD and their individual practice. We provide suggestions for how you can support participants to make these connections within the Facilitation Guide for each module.

Monthly PLC Format: Bridging-to-Practice

If you are working in a monthly PLC format, you have the advantage of participants having access to students and classrooms between each meeting. In this case, we recommend that at the end of each module (or meeting), participants take ideas from the PD, apply them to their practice, and prepare to bring back some artifact (e.g., student work, a task, reflection) to the next meeting. For example, this could take the form of selecting or modifying tasks from their curriculum, or enacting a new routine or norm in their classroom. Then, upon returning to the PD, participants can share the artifact and discuss what they learned from the experience of applying the new ideas in practice. In the following section, we discuss recommendations to structure opening activities to structure the start of the next module in order to get the most out of participants’ bridging to practice efforts.

Intensive Workshop Format: Bridging-to-Practice

If you are working in an intensive workshop format, the Bridging-to-Practice work will look different as participants are likely removed from their typical work in classrooms and schools. In this case, we recommend an additional 60-to-75-minute activity following each module that provides the opportunity for participants to make the links to their practice (e.g., workshopping tasks, enacting a new routine, planning how to introduce students to argumentation in the first weeks of school). We include timing suggestions and handouts for Bridging-to-Practice activities for each of the 3.5-hour modules in the workshop format.

Opening Activities

For each meeting, we reserved the initial activity or activities for engaging participants in some kind of activity to work on any or all of the following:

- a) support the development of a collegial professional community in which participants feel comfortable and confident to participate and question new ideas;
- b) doing authentic mathematics together to develop participants' mathematical content knowledge and shared experiences of engaging argumentation as a learner in light of ideas surrounding mathematical argumentation;
- c) connecting ideas from the professional development to participants' work in classrooms and schools (PLC-format).

Since each enactment of the professional development will be unique, (e.g., different participants, different timing, different purposes) we chose not to presume to know the most appropriate Opening Activity for each session for your particular group. Therefore, the first item in each Timing and Activity Table includes a slot for marked "Opening Activity." Correspondingly, in the handouts for each module there is a set of templates for the Opening Activity. We often include suggestions based on our implementations. You should select the type of Opening Activity that makes the most sense for your participants and fill in that template. In designing your Opening Activities, we recommend the following two priorities:

- Opportunities to discuss and collaborate
- Opportunities to discuss the successes and challenges of what participants worked on since the last time they met.

We hope you find these materials useful and that they spark productive conversations and changes in practice. Please do not hesitate to contact us with questions, suggestions, or success stories. Best contact email: megan.staples@uconn.edu

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