5 Practices for Orchestrating Productive Mathematics Discussions

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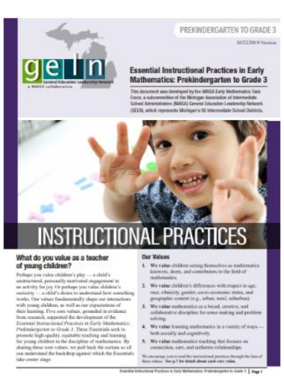
If you're anything like me, you've probably found yourself exhausted at the end of the day sitting in your classroom wondering what shifts to make to the learning environment to actually get students to talk more about mathematics. Reflecting, trying, coaxing and even the occasion pleading were several practices in my toolkit that I employed to try to move further into a student-centered learning space. Luckily, someone in my network had the wherewithal to guide me towards professional learning through the text *5 Practices for Orchestrating Productive Mathematics Discussions* by Margaret Smith and Mark Kay Klein. The first article in this series will describe the necessary conditions, or groundwork, for rich student-centered conversations to take place centered on this book.

As we consider the necessary conditions it is first important to anchor ourselves in why this work is important. Students engaging in mathematical discussions allows them to bring all of their schema and exercise its ability to solve a given situation or context. This not only is the most natural form of learning it also aligns with both state and national research. National Council of Teachers of Mathematics describes the importance of "facilitating meaningful mathematical discourse" and the need to "pose purposeful questions" as two Effective Math Teaching Practices. Furthermore, the Common Core Standards for Mathematical Practices identify students should be able to "Construct viable arguments and critique the reasoning of others" as they integrate mathematical concepts with effective communication practices. Dialogic classrooms are built on the foundations of problem solving, sequencing, and communicating findings in a way others are able to engage in the learning process alongside one another. I encourage you to explore connections to both the [Essential Instructional Practices in Early Mathematics (PK-3)] and [Disciplinary Literacy Standards (6-12)] as they state-level documents further support the need to shift further into creating socially constructed learning spaces.



One element that cannot be understated – and should be read as a cornerstone to this article – is that learning goals and selecting appropriate tasks are at the center of quality conversations. The 5 Practices (outlined later) are significantly less effective if learning goals aren't identified and a task don't allow students multiple-entry points or clear connections to other math concepts. Considering the learning goals, what is it you want students to know or be able to do as a result of the day's lesson? Be explicit – what does it look and sound like for them to meet this goal? Share it with them and allow them to ask questions and draw connection; engage schema. This creates a common target for students to strive towards and teachers to listen for and facilitate towards.

5 Practices for Orchestrating Productive Mathematics Discussions provides a Task Analysis Guide (see right) to provide guidance on evaluating and selecting tasks. Selecting a task must align with the learning goal of the lesson. You should consider tasks that fall within "doing mathematics" or "procedures with connections" when engaging a new concept. These tasks allow students to exercise and apply their current schema to find a solution (albeit less efficient) or recognize a need for new mathematical learning. Allow time for student's to engage in math during these stages, it is what makes mathematicians. Once conceptual understanding is developed it may then make sense later in the unit to select a lower-level demand task if it aligns with your learning goal. It may be worth mentioning here this process aligns with another Math Teaching Practice – "Build procedural fluency from conceptual understanding."

Lower-level demands	**Higher-level demands**
Memorization • Involve either reproducing previously learned facts, rules, formulas, or definitions or committing facts, rules, formulas, or definitions to memory • Cannot be solved by using procedures, because a procedure does not exist or because the time frame in which the task is being completed is too short to use a procedure • Are not ambiguous. Such tasks involve exact reproduction of previously seen material, and what is to be reproduced is clearly and directly stated. • Have no connection to the concepts or meaning that underlies the facts, rules, formulas, or definitions being learned or reproduced	Procedures with connections • Focus students' attention on the use of procedures for the purpose of developing deeper levels of understanding of mathematical concepts and ideas • Suggest, explicitly or implicitly, pathways to follow that are broad general procedures that have close connections to underlying conceptual ideas as opposed to narrow algorithms that are opaque with respect to underlying concepts • Usually are represented in multiple ways, such as visual diagrams, manipulatives, symbols, and problem situations. Making connections among multiple representations helps develop meaning. • Require some degree of cognitive effort. Although general procedures may be followed, they cannot be followed mindlessly. Students need to engage with conceptual ideas that underlie the procedures to complete the task successfully and that develop understanding.
Procedures without connections • Are algorithmic. Use of the procedure is either specifically called for or is evident from prior instruction, experience, or placement of the task. • Require limited cognitive demand for successful completion. Little ambiguity exists about what needs to be done or how to do it. • Have no connection to the concepts or meaning that underlies the procedure being used • Are focused on producing correct answers instead of on developing mathematical understanding • Require no explanations or explanations that focus solely on describing the procedure that was used	Doing mathematics • Require complex and nonalgorithmic thinking—a predictable, well-rehearsed approach or pathway is not explicitly suggested by the task, task instructions, or a worked-out example • Require students to explore and understand the nature of mathematical concepts, processes, or relationships • Demand self-monitoring or self-regulation of one's own cognitive processes • Require students to access relevant knowledge and experiences and make appropriate use of them in working through the task • Require students to analyze the task and actively examine task constraints that may limit possible solution strategies and solutions • Require considerable cognitive effort and may involve some level of anxiety for the student because of the unpredictable nature of the solution process required

If you are using a primary curricular resource, look for tasks within your resource that align with your learning goals by using the Task Analysis Guide. Evaluating the tasks within this resource raises your awareness of how to best use them as assets to meet students' learning needs. Additionally, the selected tasks give students experiences that frame how they see and feel about mathematics and I don't know about you but I would like to hear a few more students say "I like math."

As we build knowledge of orchestrating productive math discussions it's pivotal that we pay attention to our learning goals and tasks. The five practices – **Anticipate, Monitor, Select, Sequence, Connect** – are all built on this premise. Upcoming articles will unpack what is meant by each of these practices and how they might be used in the classroom. I strongly encourage you to consider purchasing a copy of *5 Practices for Orchestrating Productive Mathematics Discussions* as my awareness and skillet has dramatically increased as a result. I now spend fewer days wondering how to get students to talk about math in the classroom.