Teaching and Learning in a Math Workshop

Overview and Description

The Contexts for Learning Mathematics units assume a workshop structure in the classroom. You may be more familiar with a workshop model for literacy than for math. There, children write, revise, share their work with others, and celebrate and publish their stories. Teachers move around the room and confer with young writers, questioning, challenging, and supporting. Children have work folders for pieces in progress. Portfolios are used for selected pieces that document the students' progress as writers.

Math workshops are very similar. Philosophically they are based on the same learning theory—the belief that knowledge emerges in a community of activity, discourse, and reflection. We learn to write by writing and discussing our writing with other writers. Similarly, we become mathematicians by engaging with mathematical problems, finding ways to mathematize them, and defending our thinking in a mathematical community.

When classrooms are workshops, learners (no matter how young) are inquiring, investigating, discussing, and constructing. They put forth their mathematical ideas in the community of their peers and justify and defend their thinking. Teachers encourage students to explore, notice patterns, develop efficient strategies, and generalize ideas. In a very real sense, when classrooms are turned into workshops children can become young mathematicians at work (Fosnot and Dolk 2001a, 2001b, 2002; Cobb 2005; Schifter and Fosnot 1993).

The heart of the math workshop consists of ongoing investigations developed within contexts and situations that enable children to mathematize their lives. As children work, the teacher moves around the classroom, listening, conferring, supporting, challenging, and celebrating. After their investigation, children write up their strategies and solutions and the community convenes for a math congress. This is more than simply a whole-group share. The math congress continues the work of helping children become mathematicians in a mathematics community—it is a forum in which children communicate their ideas, solutions, problems, proofs, and conjectures to each other.

Out of the congress come ideas and strategies that form the emerging discipline of mathematics in the classroom (Cobb 2005). Norms get established: What holds up as a proof, as a convincing argument? What counts as a beautiful idea or an efficient strategy? What does it mean to talk about mathematics and to symbolize it? What makes a good question, one

worth pursuing? (Yackel 2001). All the answers to these questions emerge in the interactions and discussions you facilitate. Throughout the units, sections titled "Inside One Classroom" highlight sample dialogue and supporting commentary to help you envision interactions during conferences, as children work, and in subsequent math congresses when they present and defend their work.

There are five components to the flow of a good math workshop:

- developing the context
- supporting the investigation
- preparing for the math congress
- facilitating the math congress
- integrating minilessons, games, and routines

All five components may not occur every day because some investigations span several days. Many teachers therefore find it helpful to think about the components separately as a way to describe the flow of planning.

Developing the Context

Contexts for investigations are most frequently developed with stories and pictures that are carefully crafted to support the development of big ideas, strategies, and models. Developing the context with your students is like setting the stage or laying out a terrain that will intrigue children and ignite their imagination. Good contexts are situations—either realistic or fictional—that students can imagine, that enable them to realize and reflect on what they are doing, and that will potentially have an effect on mathematical development. Within these rich, imaginable contexts children can make sense of the strategies they try out, explore and generate patterns, generalize, and develop the ability to mathematize their own lived worlds. The context is usually developed in a meeting area with the whole class. It is often helpful to have a large easel with chart paper and/or a large chalkboard or whiteboard nearby.

Supporting the Investigation

After a context is developed, the teacher usually assigns math partners and the children set off in these pairs to investigate. It is important to think about ways to design the classroom so that workshop areas are readily available and conducive to discussion and exploration. Tables work best. Needed materials should be handy and available to the children so they can work autonomously without being dependent on you for every little need. If some children get distracted easily and find it difficult to get started, you might want to ensure that they are settled first and have a way to get started. Then begin to move around the room, observing the strategies that children use

and listening to their discussions. Confer with some children. If you feel it would be helpful to focus reflection or increase the challenge, ask questions. The best questions and comments are designed not to lead children to your answers, but to encourage them to reflect on what they are doing:

- "That's an interesting way to begin."
- "Help me understand your way."
- "What made you decide to start like that?"
- "What will you do next?"

You might want to see if *both* partners can explain what they are doing and have them ask each other questions if they cannot. Keep students grounded in the context if they don't know how to start. For example, when working with the unit *Field Trips and Fund-Raisers,* one teacher commented, "I'm puzzled, too! I'm wondering how we could compare these portions. If you build the sandwiches with these cubes, how long do you want them to be? You want them all to be the same length, right? So it would be fair?" She did not say, "How can you compare $\frac{3}{4}$, $\frac{4}{5}$, $\frac{7}{8}$, and $\frac{3}{5}$? Is there a common denominator you can use?" Instead, she asked about lengths of subs—she stayed grounded in the context.

Preparing for the Math Congress

Everybody needs time to prepare for the math congress—you and your students. Help the children prepare by asking them to talk with their partners about what they want to share. Have them make a poster of the ideas or strategies they want to share and discuss. You might also encourage them to walk around and look at each other's posters during a "gallery walk." They can write questions and comments on sticky notes and place them on the posters. This activity engages children in reading and commenting on each other's mathematics.

As children are preparing for the congress, prepare yourself. Note carefully the various strategies and ideas students are using so that you can facilitate a powerful discussion. Imagine how the conversation in the congress should flow:

- What ideas deserve discussion? In what order?
- Can some of the ideas be generalized? How will you promote this?
- Is there a possible sequence in the discussion that might serve as a scaffold to learning?

How you structure the discussion is very important. For that reason, tips on how to structure congresses are provided throughout the units. Whatever structure you decide on should support the development of the mathematicians in your community. *Don't try to fix the mathematics; work with the mathematician.* The point is not to fix the mistakes in the children's work or to get everyone to agree with your answer, but to support your

students' development as mathematicians. Challenge them to think. Ask them to reflect on inconsistencies and answers that aren't reasonable. Invite them to inquire further. Wonder with them about appearing patterns. Model the joy of mathematical inquiry.

Facilitating the Math Congress

Math congress is not just a whole-class share. First of all, there is not time for everyone to share. Second, many of the children's strategies will be similar; sharing them all would only be redundant. Third, powerful math congresses are structured to push the mathematical development of your community. You need to carefully think out which pieces of student work to use and the order of presentation; you might select only two or three pairs of students to present their work. One possible structure is to begin with a strategy that is inefficient but easy for everyone to understand in order to provide an entry level into the discussion for all. Choosing progressively more efficient strategies next can provide a challenge for the group and an invitation to consider how work can be made more efficient. Another possible structure is to choose pieces of work that are related around a specific big idea. As the work is presented, focus the community discussion on the idea and push for generalization with questions like these:

- Do you agree that this strategy will always work?
- Why is this so?
- Could we prove it?
- When is it helpful? When not?

Yet a third structure might be based on the representations children have used. Which are helpful? Which over time can become generalizable models as tools to think with? The landscape of learning can be a helpful tool as you consider which pieces of work to use to support the development of your community, and, as mentioned earlier, tips are provided throughout the units to help you facilitate powerful discussions.

Often teachers make the mistake of using a piece of work that they want shown so everyone else will use that strategy. If mathematical thinking were a simple case of transmitting ideas, why go through all of this inquiry? Why not just show and tell students the strategy you want them to use and have them practice it? The simple truth is that learning is much more complex. Sharing that strategy will help only if most of the community is at a place developmentally where the strategy will make sense to them. Any decision you make should be conducive to development. For that reason, it can be helpful to have a student share who has struggled with an idea, rather than one who has come by it easily. The process of sharing and discussing the idea, attempting to explain it to the community, can strengthen and clarify the understanding of the speaker.

Throughout the units, the sample dialogues called "Inside One Classroom" will help you envision how the conversation might flow. These sections provide a window into one teacher's math congress. They are not scripts to follow, only sample dialogues that occurred.

Integrating Minilessons, Games, and Routines

At the start of math workshop, teachers often take ten or fifteen minutes to conduct a minilesson to highlight a computational strategy, share a problem-solving approach, or do mental math work. In a minilesson, teachers may take an explicit role in bringing up ideas and strategies for discussion, but the ideas are put forth only for consideration and examination. Games and routines also have a place in math workshop. Games can be very powerful if they are developed in ways that support new strategies and the discussion of big ideas (rather than just for practice and reinforcement). The same point can be made about routines such as taking attendance, preparing for snacks, and distributing materials.

Time Frame

Except for the resource units, each unit includes ten days of plans. It is assumed that the math period in grades 4–6 is 60–90 minutes. Sometimes most of the period is used for a minilesson and the development of the context for a new investigation, with the children working with a partner on the investigation for the remainder of the time. In some cases, a math congress ensues on the same day, but often it follows on the next day to allow children sufficient time to reflect on their work, make posters, and decide on the main ideas they want to prove and discuss in math congress. To help you with the flow of planning for a specific investigation, sections are marked throughout the unit as Developing the Context, Supporting the Investigation, Preparing for the Math Congress, Facilitating the Math Congress, and Minilesson.

The following pages, taken from Day One of *The Mystery of the Meter* unit, have been annotated to highlight the five workshop components, as well as the key features that will help facilitate your use of the materials.