PLANNING A MATH UNIT: LAUNCH-EXPLORE-SUMMARIZE TEACHING MODEL

For Workshops 1, 3, 5 and 7

Mathematical Goals

- What are the big mathematical ideas of the investigation?
- What do I want kids to know when this investigation is finished?
- What mathematical vocabulary does this investigation bring out?
- What misconceptions might arise?

Teaching Model

Launch (5–10 minutes)

This is when you give students the information they need to do the lesson and solve the problem or task. Make sure to clarify your goals and expectations. You want to give students enough information so that they can do the lesson — but don't give too much away at this point. Unless you have to do a mini-lesson to refresh students' memories about a certain concept (see page 124), avoid direct instruction. Questions to consider when planning this phase:

- How will I launch this problem?
- What prior knowledge do my students need?
- Do I need to do a mini-lesson (direct instruction) first?
- What do the students need to know to understand the story and the challenge of the problem?
- What advantages or difficulties can I foresee?
- How can I keep from giving away too much of the problem?
- How can I make it personal and relevant to the students?
- How long will this lesson take?
- What can I do to ensure that the time spent in class matches the scope of the problems and the goals of the investigation?

Explore (15–45 minutes)

This is where students work individually or in small groups to solve the problem. This is their chance "to get messy with the math." The teacher's role is to move from table to table and listen closely. See what solutions your students are coming up with. Help students who are stuck or who are ready to move ahead, mainly through questions to stimulate their thinking (see page 155). Unless the whole class is having the same problem, in which case you'll need to clarify your Launch, avoid a mini-lecture. Don't spend more than a minute and half at each table. Questions to consider when planning this phase:

- How will I organize the students to explore this problem? (Individuals? Groups? Pairs?)
- What materials will students need to encourage diverse thinking and problem-solving?
- What are different strategies I anticipate them using?
- What kinds of questions can I ask:
    - to prompt their thinking if the level of frustration is too high?
    - to make them probe further into the problem if the initial question is "answered"?
    - to encourage student-to-student conversation, thinking, learning, etc.?
- What advantages or difficulties can I foresee?

Summarize (15–25 minutes)

This is where the main teaching occurs. Bring groups back together and have students explain their solutions. The teacher's role is to guide students to the big ideas, to make sure that they have nailed the mathematics. Part of the purpose of the Summarize segment is to allow you to assess how well your students are progressing toward the goals of the lesson. Use the discussion to help you determine whether additional teaching and/or additional exploration by students is needed before they go on to the next lessons. Questions to consider when planning this phase:

- How can I orchestrate the discussion so the students summarize the thinking in the problem?
- What mathematics and processes need to be covered in more depth?
- What needs to be emphasized?
- What ideas do not need closure at this time?
- How can we go beyond this lesson? What rules can we generalize?
- What new questions might arise?
- What will I do to follow up, practice or apply the ideas after the summary?
- What advantages or difficulties can I foresee?

Time

- How long will the investigation take?
- What can I do to ensure that the time spent in class matches the scope of the problems and the goals of the investigation?

Homework — Additional Problems

- What questions or problems are appropriate for my students to do after the investigation?

Source: Yvonne Grant, *Connected Mathematics Project*

A NOTE ON TERMINOLOGY

Throughout this series, we use "problem" or "task" to describe the instructions that teachers provide students during the Launch phase. A "lesson" includes everything that happens in the classroom — the Launch (when students are given the problem or task), the Explore and the Summarize.

LESSON PLANNER TEMPLATE

For Workshops 1, 3, 5 and 7

Topic: _____ **Lesson:** _____

Part One: Goals and Objectives

Mathematical Goals

- What are the big mathematical ideas of the investigation?
- What do I want kids to know when this investigation is finished?

Part Two: Teaching Model

Launch (5–10 minutes)

- How will I launch this problem?
- What prior knowledge do my students need?

Explore (15–45 minutes)

- How will I organize the students to explore this problem? (Individuals? Groups? Pairs?)
- What materials will students need to encourage diverse thinking and problem-solving?
- What are different strategies I anticipate them using?
- What kinds of questions can I ask?

Summarize (15–25 minutes)

- How can I orchestrate the discussion so the students summarize the thinking in the problem?
- What mathematics and processes need to be drawn out and emphasized?

Time

- How long will the investigation take?
- What can I do to ensure that the time spent in class matches the scope of the problems and the goals of the investigation?

Homework — Additional Problems

- What questions are appropriate for my students to do after the investigation?

QUESTIONS TO STIMULATE STUDENT THINKING

For Workshops 1, 3, 5 and 7

A well-timed question often is the best way to stimulate student thinking — and to help move students along. The following are examples of questions that can be used with individuals or small groups. They can be adapted to any topic or problem by filling in the blanks.

Posing the Question

Is there anything you don't understand about _____?

What else would you like to know?

How would you describe the problem in your own words?

What do you wonder about regarding _____?

Starting to Work

What are your guesses about what will happen?

What do you plan to do next?

Pushing Students' Thinking

Can you draw a picture or build a model to illustrate _____?

Can you explain your reasoning?

What do you plan to do next?

What else would you like to know?

Bringing Closure to a Mathematical Idea

How would you explain _____ to a student who doesn't understand?

Could you explain _____ in another way?

What is the most important idea or fact you learned while working on _____?

What do you understand now that you didn't understand before?

Reflecting

What caused you to have a breakthrough in your understanding of _____?

What mathematical connections did you make?

What were your thought processes while you worked on _____?

Where did you get stuck and what helped you get unstuck?

All the Time

What do you think?

What if?

What is your idea?

Specific Questions for Students Who Need a Nudge

How can we start?

What comes next?

What are the main steps?

What was the difficult (or tricky) part?

How is this problem(s) different from yesterday's? From the one in the last section? In the last chapter?

When would you use this?

What are the key steps?

What happens if we change this condition?

Can you describe a strategy we might try to answer this question?

Checklist — How Are My Questioning Skills?

- ❑ Have I been asking good questions — often?
- ❑ Have I fostered an atmosphere that encourages student responses and student questions?
- ❑ Am I allowing enough time for students to think and answer?
- ❑ Have I prepared so that I can field any questions and can think of good leading questions?
- ❑ Do I react in a positive manner to student questions?
- ❑ Am I helping to build my students' self confidence in my questioning situations?

Source: Adapted from Betty Phillips, Michigan State University

GUIDELINES FOR GROUPING

For Workshops 1, 3, 5 and 7

Throughout this series, teachers are encouraged to have their students work in small groups during the Explore section of each lesson. Though teachers should organize their groups based on their knowledge of how each of their classes works, there are some general issues to consider.

If the problem is particularly rich and complex (with multiple solutions or multiple ways of attacking the problem), you might want to group students of different abilities. They are likely to have different approaches, which is good; the more complex the problem, the more heads are needed for success.

It sometimes makes sense to group students of similar ability. On some lessons, your more advanced students really might benefit from working together to extend the lesson and go deeper with the concepts.

At other times, it is preferable to allow students to self-select their groups. This is especially true when you want students to take risks on a problem; they'll feel more comfortable doing so when they're working with their friends.