PROBLEM CYCLE: DELIVERY OF QUANTITATIVE REASONING LEARNING OUTCOMES IN THE CLASSROOM
Quantitative Reasoning Outcomes

- Engage students in a meaningful intellectual experience
- Increase students’ quantitative and logical reasoning abilities
- Improve students’ ability to communicate quantitative ideas
- Encourage students to take other courses in the mathematical sciences
- Strengthen mathematical abilities that students will need in other disciplines
Classroom Behaviors

- Communication
- Collaboration
- Persistence
Deep understanding means forming connections between facts, ideas, and procedures in a social/cultural setting.

Making connections between mathematical concepts should be an explicit focus of students and teachers and is a product of active discourse.

Teachers provide opportunities to learn by allowing students to struggle with grasping important concepts.

Promoting conceptual understanding also means promoting skill fluency.

Hiebert & Grouws (2007)
Lesson Stages/Problem Cycle

1. Introduction to a problem
2. Problem solving by students
3. Whole-class discussion about ways to solve the problem
4. Conclusion facilitated by teacher

Shimizu (1996)
Mock Lessons – Reflect & Discuss

- What did you experience in your mock lessons that compares to the problem cycle framework?
  - Did the lessons use one cycle or multiple cycles?
- In what ways did the mock lessons promote communication, collaboration, and persistence?
Constructing a Problem Cycle

**Introduction to a Problem**
- What pre-requisite math skills do students need?
- What contextual information should students acquire before this lesson?
- How can this context be made relevant for students? How can students develop a purpose for working on it?

**Student Problem-Solving**
- Where will students struggle in this lesson?
- What are your predictions for how students will answer the questions?
- How will students work on the questions? What are your expectations for their communication and collaboration?

**Conclusion**
- What are the key mathematical ideas that students must understand?
- What concepts are still being developed?
- How can you create connections with other mathematical concepts?

**Whole-Class Discussion**
- What will you look for in students’ group work to structure the whole-class discussion?
- Will you be able to explore various ways to answer the questions? If so, how?
- How can you create connections with other mathematical concepts?
Constructing a Problem Cycle

- 3 Mock Lessons
- Handout #1 or #2
- Create your own*
Constructing a Problem Cycle

- Consider the questions in the handout for each stage of the problem cycle
- Outline what the instructor will do and what the students will do in each stage
End

- Reflections and Questions


Givvin, K.B. (July 2013). Learning opportunities and the problem cycle: The aims of Pathways instruction and how we might meet them. National Forum of the Carnegie Foundation for the Advancement of Teaching, Santa Cruz, CA.


