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

Aaron Altose
Cuyahoga Community College

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

Conceptual Understanding via Ongoing Learning Opportunities

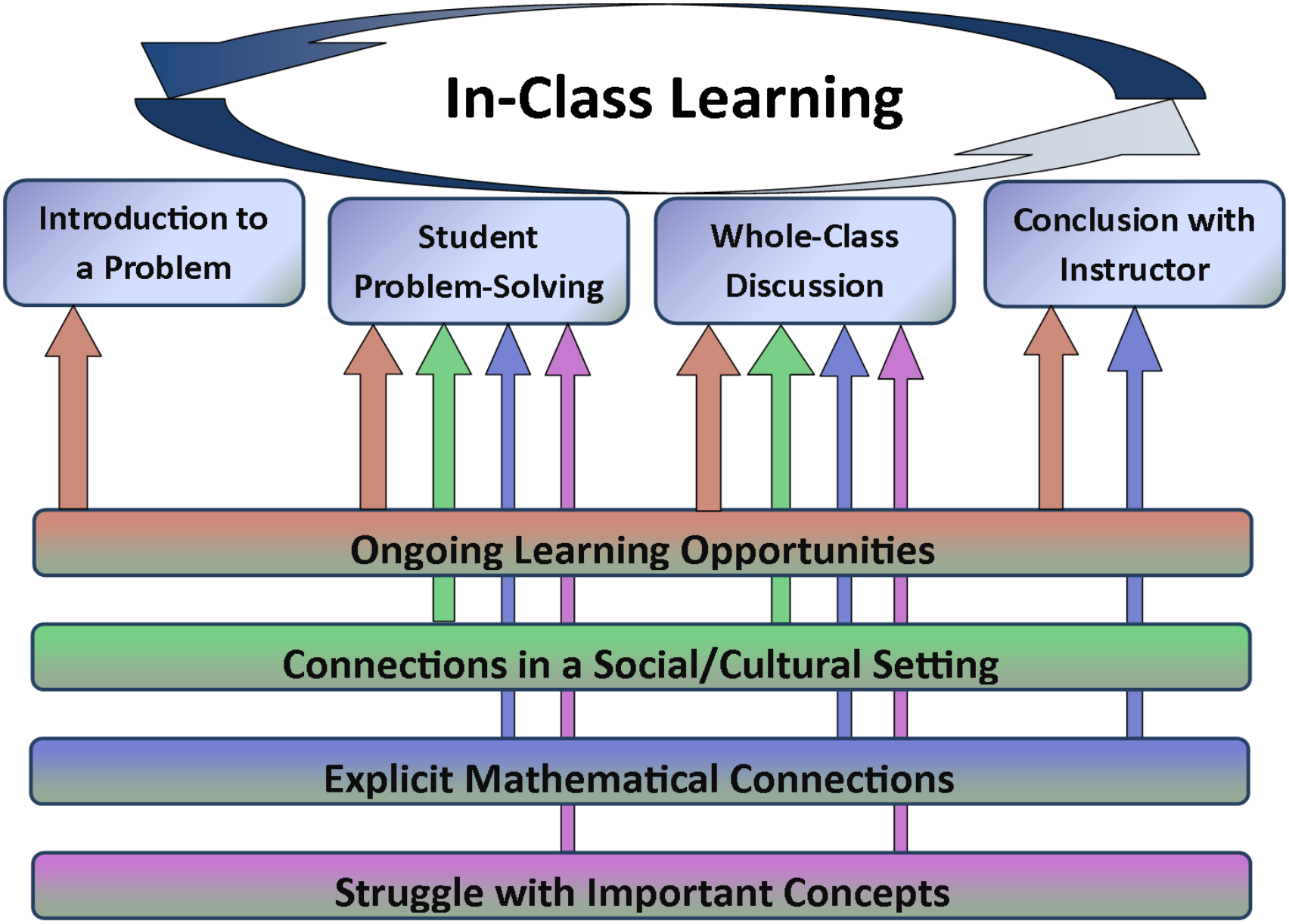
- Deep understanding means forming connections between facts, ideas, and procedures in a social/cultural setting.
- Making connections between mathematical concepts should be an explicit focus of students and teachers and is a product of active discourse.
- Teachers provide opportunities to learn by 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

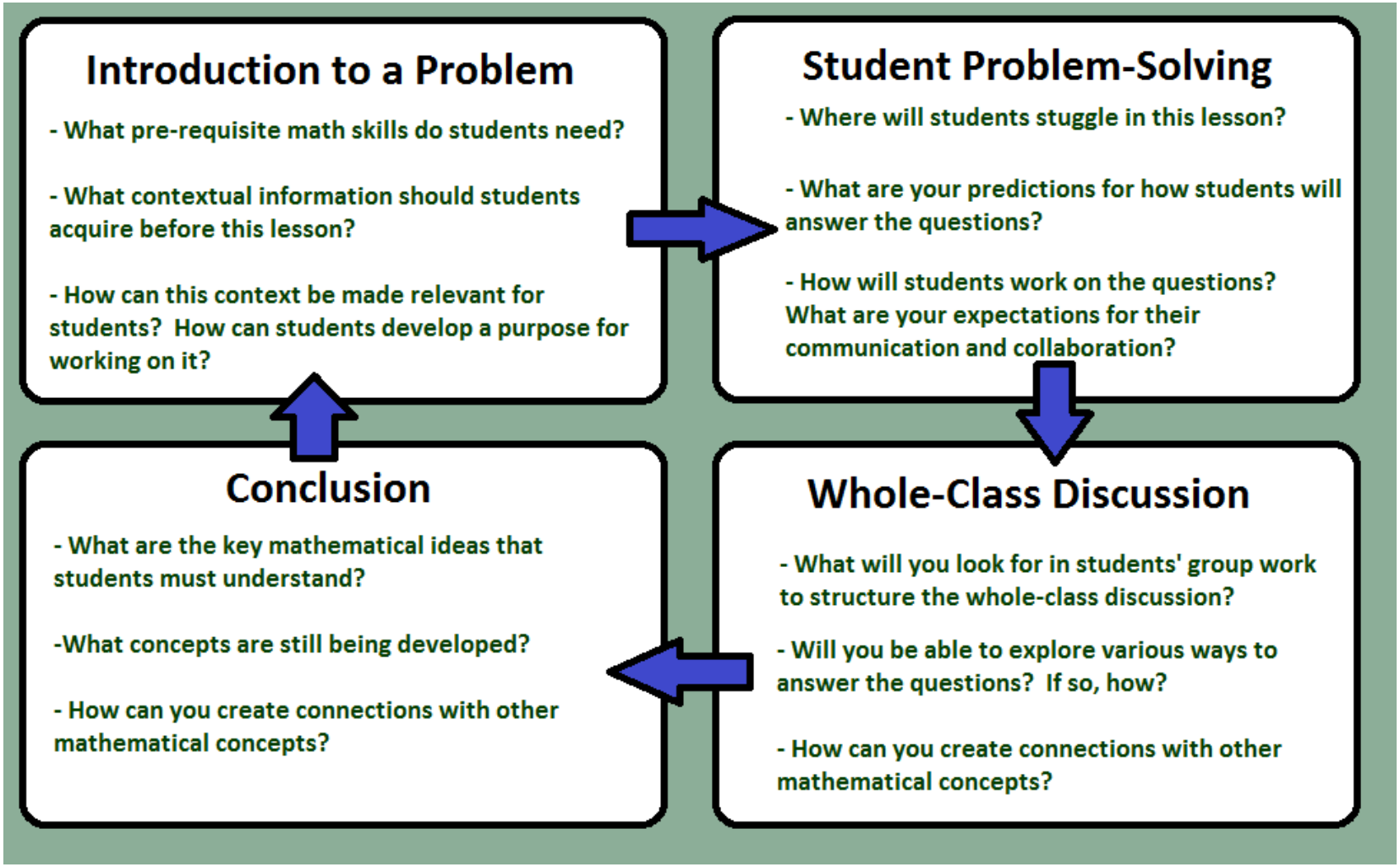
Shimizu (1996)


In-Class Learning
Introduction to a Problem
Student Problem-Solving
Whole-Class Discussion
Conclusion with Instructor
Ongoing Learning Opportunities
Connections in a Social/Cultural Setting
Explicit Mathematical Connections
Struggle with Important Concepts

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



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

References

- Barker, W., Bressoud, D., Epp, S., Ganter, S., Haver, B., & Pollatsek, H. (2004). *Undergraduate Programs and Courses in the Mathematical Sciences: CUPM Curriculum Guide, 2004*. Mathematical Association of America. 1529 Eighteenth Street NW, Washington, DC 20036-1358
- Dingman, S. W., & Madison, B. L. (2010). Quantitative reasoning in the contemporary world, 1: The course and its challenges. Numeracy 3 (2): Article 4.
- Evans, S., & Swan, M. (2014) Developing Students' Strategies for Problem Solving. Educational Designer, 2(7).
- 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.
- Hiebert, J., & Grouws, D. A. (2007). The effects of classroom mathematics teaching on students' learning. *Second handbook of research on mathematics teaching and learning*, *1*, 371-404.
- Shimizu, Y. (1996). Some pluses and minuses of "typical pattern" in mathematics lessons: A Japanese perspective. *Bulletin of the Center for Research and Guidance for Teaching Practice* 20 (1996): 35-42.
- Shimizu, Y. (1999). Aspects of Mathematics Teacher Education in Japan: Focusing on Teachers' Roles. Journal of Mathematics Teacher Education 2, 107-116.
- Steen, L. A. (2004). *Achieving quantitative literacy: An urgent challenge for higher education.* Washington, D. C.: Mathematical Association of America.