M510: Problem solving for teachers
Fall, 2017

Fred Peck

Frederick.Peck@umontana.edu | http://www.fapeck.com   I   406.243.4053

Skype: fredpeck1

Google hangout: frederick.peck@gmail.com

Office Hours: M&W 10:00-11:00 and by apt (schedule at: www.fapeck.com/meeting)

Course webpage (Moodle): http://www.umonline.umt.edu

About the course

Mathematics is often conceptualized as a noun: a set of things to learn. In this course, we'll conceptualize mathematics as a *verb*: The human activity of problem-solving. We'll explore the implications of this perspective as *doers* and *teachers* of mathematics.

As *doers* of mathematics, we'll focus only on the verb. We're just going to do problem-solving. There is no ulterior motive, no content to learn. Just problems to solve. This course is like desert.

But we have to eat our vegetables too. As *teachers*, we live in a world where mathematical content matters. So we'll also think about problem-solving as teachers of mathematics. In this vein, we'll explore techniques for how students can learn content through problem-solving.

Learning outcome

The main outcome of the course is that **participants will *develop* as mathematicians and teachers**. Development involves the acquisition of knowledgeable skill, but it's much bigger than acquiring content knowledge. Development involves *becoming* a member of a community, and thus it affects not simply what we know, but also who we are and how we see the world. Therefore, development cannot be reduced to an enumerated list of learning outcomes nor can it be standardized across participants.

We develop as members of a community as we participate in the practices of that community. Thus, rather than thinking about the course in terms of *outcomes* to be attained, it is better to think about the course in terms of *practices* to participate in. During the course, participants will (a) participate in the practice of mathematical problem solving; (b) participate as a member of a mathematical community, including engaging in mathematical argumentation and critique; (c) participate as a member of a teaching community, including sharing and reflecting on your practices.

Tentative timeline

The course consists of seven, two-week modules. We may adjust the timeline below in response to ideas and issues that surface as we go through the course.

Schedule of modules

Dates	Module	Problem-solving activity	Pedagogy
Thu 8/31 – Sun 9/17 (2.5 weeks)	1. Introduction, history	Reading: • Skovsmose, 2001 • Schoenfeld, 1994 PS investigation #1	Reading: • Primary: Ch. 3 • Secondary: Ch. 4 (the chapters for this module will be provided in PDF form on Moodle)
Mon 9/18 – Sun 10/1 (2 weeks)	2. Why use PS for teaching math?	Reading: Strategy brief 1 Peer review #1 PS investigation #2	Reading: • Primary: Ch. 1, 2, 15 • Secondary: Ch. 1, 2, 3, 16
Mon 10/2 – Sun 10/15 (2 weeks)	3. Implementing PS activities: the five phases	Reading: Strategy brief 2 Peer review #2 PS investigation #3	Reading: • Primary: Ch. 6 • Secondary: Ch. 13 • All ○ Smith et al. 2008 ○ Smith et al. 2009
Mon 10/16 – Sun 11/02 (3 weeks)	4. Implementing PS activities: Selecting activities	Reading: Strategy brief 3 Peer review #3 PS activity #4 Portfolio A (investigations 1-3)	Reading: • Primary: Ch. 5 • Secondary: Ch. 5 • All ○ Stein et al. 2000, Ch. 1 Project: Submit draft lesson plan
Mon 11/6 – Sun 11/19 (2 weeks)	5. Implementing PS activities: Launching activities	Reading: Strategy brief 4 Peer review #4 PS investigation #5	Reading: • All: ○ Stein et al. 2000, Ch. 2 ○ Jackson et al., 2012 Project: Get feedback, revise, submit final lesson plan
Mon 11/20 – Wed 12/06 (2.5 weeks, includes Thanksgiving)	6. Implementing PS activities: Classroom norms	Reading: Strategy brief 5 Peer review #5 PS investigation #6	Reading: • Primary: Ch. 7, 9, TS 7 • Secondary: Ch. 9, 10, 11 Project: Implement / prepare report
Thu 12/07 – Wed 12/20 (2 weeks, incl. finals)	7. Problem posing	Peer review #6 Portfolio B (investigations 4-6)	Reading: • Primary: Ch. 11 • Secondary: Ch. 6 Project: Prepare report

(note that Module 1 is 2.5 weeks due to the beginning of the semester falling on a Thursday. Module 4 is 3 weeks to allow for preparation of Portfolio A. Module 6 is 2.5 weeks to allow time off for Thanksgiving).

Schedule *within* a module

Use the following schedule to help you plan your time

Day	Primary activities	Approx. time (6 hr/wk)
Week one, Mon-Sun	PS activity: Complete peer review, begin PS investigation	2 hours
	Pedagogy: Complete all readings, complete one post on discussion board.	4 hours
Sunday of week one	*Peer review due,* *First post on discussion board(s) due*	
Week two, Mon-Sun	PS activity: Continue PS investigation, complete write-up	4 hours
	Pedagogy: Engage in lively discussion on discussion board. Plan to post daily, or at least every-other-day	2 hours
Sunday of week two	*Upload PS investigation to Moodle and send to peer-review partner* *All posts due on discussion board*	

Texts and other readings

<u>Required text:</u> Choose (and purchase) one of the following, based on the grade levels that you teach.

Primary: Lester, F. K. (Ed.). (2003). *Teaching mathematics through problem solving: Prekindergarten-grade 6*. Reston, VA: NCTM.

Secondary: Schoen, H. L. (Ed.). (2003). *Teaching mathematics through problem solving: Grades 6-12*. Reston, VA: NCTM.

<u>Strategy briefs:</u> These will be short explications of problem-solving strategies. They will be posted in PDF form on Moodle.

<u>Additional readings:</u> Additional readings will be posted in PDF form on Moodle. Tentatively these are:

Jackson, K. J., Shahan, E. C., Gibbons, L. K., & Cobb, P. (2012). Launching complex tasks. *Mathematics Teaching in the Middle School*, *18*(1), 24-29.

Schoenfeld, A. H. (1994). Reflections on doing and teaching mathematics. In A. H. Schoenfeld (Ed.), *Mathematical thinking and problem solving* (pp. 53-69). New York: Routledge.

Skovsmose, O. (2001). Landscapes of investigation. *ZDM Mathematics Education*, *33*(4), 123–132. http://doi.org/10.1007/BF02652747

Smith, M. S., Bill, V., & Hughes, E. K. (2008). Thinking through a Lesson: Successfully implementing high-level tasks. *Mathematics Teaching in the Middle School*, *14*(3), 132–138.

Smith, M. S., Hughes, E. K., Engle, R. A., & Stein, M. K. (2009). Orchestrating discussions. *Mathematics Teaching in the Middle School*, *14*(9), 548–556.

Stein, M. K., Smith, M. S., Henningsen, M., & Silver, E. A. (2009). *Implementing standards-based mathematics instruction* (2nd ed., Ch. 1 and 2). New York: Teachers College Press.

Course activities and deliverables

1. **Investigations:** The primary mathematical activity in the course will be 7 problem-solving investigations. Investigations are in-depth, open-ended problem-solving activities. You probably won't "know what to do"—that's what makes them problems! Plan to spend approximately 4-5 hours on each investigation.

   During modules 1-6, you will complete 1 investigation per module. In modules 2-7, you will provide a peer review on a peer's investigation.

   Deliverable: You will produce a write-up for each investigation, describing your approach and your findings. At the end of each module, you will submit your write-ups to Moodle and to a peer for peer-review. I will participate in the peer review, and will provide detailed peer feedback on two investigations for each person in the course. I will also provide detailed guidelines for the investigations and peer reviews, and I will provide a peer review schedule. Individual investigations will not be graded (portfolios will be graded, see below).

2. **Portfolio**: After completing 3 investigations, you will revise your investigations in response to your peer reviews and assemble a portfolio of your two best investigations to submit for grading. Portfolio A will draw from investigations 1-3, and will be completed during Module 4. Portfolio B will draw from investigations 4-6, and will be completed during Module 7.

   Deliverable: At the end of Modules 4 and 7, submit your portfolios to Moodle. I will provide rubrics for portfolio grading.

3. **Pedagogical readings and discussion:** Each module contains 2-3 pedagogical readings that describe techniques for teaching mathematics through problem-solving. These readings are based on research in mathematics education, but are written for teachers. You should expect approximately 30-50 pages of reading per module. We will discuss these readings on Moodle.

   Deliverable: Participate in the Moodle discussion(s) on the assigned reading

4. **Classroom project:** You will develop one problem-solving lesson using the principles developed in the course, implement it in your classroom, and reflect on the implementation.

   Deliverables:
   Lesson plan: The lesson plan will describe your lesson, using the principles developed in the course. A draft lesson plan is due at the end of Module 4. The final lesson plan is due at the end of Module 5.

   Reflection: After implementing your lesson, you will write a brief reflection. The reflection is due at the end of Module 7.

Grading

You grade is based on the following:

- **Participation in mathematical and pedagogical practices 50%:** This will be assessed using weekly self-assessments. At the end of each week, you will complete a brief self-assessment, in which you assess the extent to which you participated in the class activities that week.
- **Evidence of problem-solving activity and mathematical reasoning 30%:** This will be assessed using your portfolios. Your portfolios should provide your best evidence of sound mathematical reasoning. I will provide a rubric for the portfolio.
- **Evidence of classroom practices 20%:** This will be assessed using your lesson plan and reflection. I will provide a template for the lesson plan, and rubrics for the lesson plan and reflection.

Meeting

If you would like to meet with me, with can do so via phone (406.243.4053), Skype (fredpeck1), or Google Hangout (frederick.peck@gmail.com). Please schedule a meeting using the URL below:

www.fapeck.com/meeting

Other policies

Communicating: Email is the best way to reach me. UM policy states that I must use your UM email account when I correspond with you. Please email me from your UM account—that makes it easy to follow the policy! Even if you don't, I still have to reply to your UM account.

Classroom and testing accommodations: The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students. If you think you may have a disability adversely affecting your academic performance, and you have not already registered with Disability Services, please contact Disability Services in Lommasson Center 154 or 406.243.2243. I will work with you and Disability Services to provide an appropriate modification.

Academic honesty: All students need to be familiar with the Student Conduct Code. You can find it in the "A to Z Index" on the UM home page. All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University.