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Lesson Study on Reasoning in Mathematics Learning
Fall 2014
Saturdays: Sept 6, Oct 4, Nov 1 and Dec 4, 9:50 AM – 12:50 PM
GSE Room 211, CAC

Instructor: Marjory F. Palius	Email: marjory.palius@gse.rutgers.edu
Phone Number: 848-932-0803	Location: GSE Room 232
Office Hours: Mondays 3:00-5:00 PM (Otherwise by appointment)	Prerequisites or other limitations: *Field-based course for mathematics teachers; off-campus activities required*
Mode of Instruction: ___ Lecture ___ Seminar _X__ Hybrid ___ Online ___ Other	Permission required: __ No _X_ Yes Directions about where to get permission numbers: email to Instructor

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentations: hhttps://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: https://ods.rutgers.edu/students/registration-form.

Course Description

Learning goals:

- To gain a practical research-based set of experiences using a modified lesson study approach
- To learn about how students develop skills in mathematical reasoning
- To learn how to foster a classroom culture where sense making, reasoning and justification are expected behaviors (norms)
- To provoke consideration of the way that mathematical topics are introduced through examining students' critical thinking and reasoning by studying video clips
- To build deeper understanding of mathematical concepts, procedures and ways of reasoning in mathematical learning

New Jersey Professional Standards for Teachers (2014)[1]:
Through working towards the learning goals of this course and completing course requirements, students will be addressing several professional standards for teachers, some in greater depth than others. Specifically addressed are the Performances, Essential Knowledge and Critical Dispositions for Standard 1: Learner Development, Standard 3: Learning Environment, and Standard 9: Professional Learning. Also addressed are elements of Standard 4: Content Knowledge and Standard 5: Instructional Strategies. We will do so in light of the CCSS Standards for Mathematical Practices.

Course catalog description:
This course is designed for classroom teachers of mathematics as a practical research-based set of experiences using a modified lesson study approach and focusing on the development of mathematical reasoning and justification. Participants will engage in a variety of activities that include (a) in-person, on-campus meetings on four Saturdays (one per month), (b) classroom implementations of lessons, and (c) continuing discussions between these activities carried out asynchronously online through a course web site.

Additional description of course purposes, context, and methods:
This is a hybrid course with four (4) required on-campus meetings. The on-campus activities include working in pairs or small groups on mathematical problem-solving tasks, discussing possible modifications for specific classroom use, and sharing actual experiences and student work. The required off-campus activities include classroom implementations of lessons. As part of this modified lesson-study approach, when possible, participants are encouraged to request professional leave to observe a peer's implementation and participate in a live debriefing discussion afterwards. Ideally, everyone will be able to obtain such leave at least once; there is no substitute for the genuine experience of observing in another teacher's classroom. Yet no one will be penalized if it is not possible to obtain any professional leave time during the course.

Substantial online course work is required to reach 42 contact hours needed for 3 credits when on-campus contact is limited to 12 hours in this hybrid course. Online work is asynchronous and includes participating in debriefing discussions following classroom lesson implementations, as a supplement to live conversations. Online work also includes (a) reading assignments that relate to both the problem-solving tasks used in the lessons and the overall focus of students' reasoning and justification, (b) video clips of children engaged in solving the same or similar problem tasks as those introduced in the group sessions (and possibly video from a peer's implementation), and (c) responding to discussion prompts intended to elicit teachers' reflection and discussion of the problem tasks, video clips and readings and their relevance to learning and teaching.

The mathematical problem-solving tasks used in this course come from long-term research at the Robert B. Davis Institute for Learning, where many studies have shown how they can be used for eliciting students' reasoning and justification. The tasks focus on algebraic, combinatorial and probabilistic reasoning, and activity cycles emphasize the mathematics, children's learning, and conditions of the learning environment. The cycles thus provide a basis for addressing standards.

Required texts: None – reading assignments are accessible via the course site.

[1] http://www.state.nj.us/education/code/current/title6a/chap9.pdf

Grading Policy

Evaluation of Written Work:
Qualities such as clarity, conciseness, and relevance to the topic or discussion prompt are highly valued in written work, which includes online discussion and a portfolio project in this course. While online discussion is less formal, it is still important to cite the source of ideas to which you refer in your posts. All citations and references in the portfolio project should follow APA style.

Grading Criteria:
Grades will be based on the quality of written work and the thoughtfulness of your contributions as both an active and a responsive member in a learning community engaged in three cycles of modified lesson study activities, which include:

Participation in the on-campus class meetings	30%
Participation in the online discussions and sharing about implementations	50%
Final Portfolio project	20%

Academic Integrity Policy:
Any violation of academic honesty is a serious offense and is therefore subject to an appropriate penalty. Refer to http://academicintegrity.rutgers.edu/integrity.shtml for a full explanation of policies.

Web sites:
https://sakai.rutgers.edu/portal *(Specific course access on Sakai is made available to students who have officially registered for this course.)*

Course Requirements

Successful completion of the course requires that you engage in all activities and complete all assignments. Specifically, you are expected to:

1. Attend and actively participate in all on-campus sessions for mathematical problem solving, discussions, etc.

2. Implement each lesson (potentially with some modification) with your own students Problem statements for the tasks used in lessons will be available as resources on the course web site. Take notes about these implementations and collect written work that records your students' solutions.

3. Based on your observations and students' work during the first portion of the course, select one or two students whose thinking about the tasks is particularly interesting. After you have implemented all of the lessons, plan and carry out an interview with the student(s).

4. Actively participate in online discussions about course assignments (implementations, readings and videos) by responding to guiding questions posted on the course website and to comments of your peers and instructor. Each participant will be expected to make

at least one original response posting per discussion topic and respond to at least two group member postings in that topic. Specific due dates will appear on course website.

5. Be prepared to discuss details of your implementation of the lessons in your classroom at a live debriefing meeting and/or an online discussion. Plan to share samples of your students' work for each lesson implementation.

6. Complete a Final Portfolio. This project should include: (1) A summary narrative of your implementation of each of the problem tasks with your students, accompanied by student work and other artifacts from each of the three lessons, (2) An analysis of an individual task-based interview that you prepare and conduct with one (or more) student(s) toward the end of the term, and (3) A reflective assessment of your work in the course. You should reflect on your knowledge of the mathematics, research on how students learn, and implications for teaching with regard to NCTM and Common Core State Standards. You may review your postings on the course web site and notes from problem solving and sharing of solutions as you develop your reflective assessment. Be prepared to share the first two parts of your portfolio at the last on-campus meeting. The complete portfolio is due as an *electronic submission* by 11:59 PM on Friday, December 12.

Attendance Policy:
Attendance is mandatory at the four Saturday sessions. It is simply not possible to make up for missing any of them. Not only will grade be reduced but also it will become very challenging to proceed with the activities that follow in the cycle. Each cycle builds on the previous one.

Course Schedule and Assignments

Dates	Activities/Topics to be Covered	Assignments & Readings
9/2 – 9/5 Online	• Log onto Sakai site to access the book chapter by Alston et al • Read it and be prepared to discuss in class on Saturday, 9/6	• Alston, A., Pedrick, L., Morris, K. & Basu, R. (In 2011). Lesson study as a tool for developing teachers' close attention to students' mathematical thinking. In L. Hart, A. Alston and A. Murato (Eds.) *Lesson Study Research and Practice in Mathematics Education: Learning Together.* Dordrecht. Springer.
Saturday 9/6 9:50 – 12:50 Class Session	• Introductions • Engage in problem-solving tasks • Discuss the reading by Alston et al and talk about course expectations • Preliminary planning for Lesson 1	• Assignments for LS Cycle 1 appear in the following rows
9/7 – 9/13 Online	• Consider variations / extensions of tasks for accommodating students in your classroom • Read two book chapters about	• Maher, C. A., Sran, M. & Yankelewitz, D. (2010). Towers: Schemes, Strategies, and Arguments. In C. A. Maher, A. B.

	children's work on towers tasks • Watch videos of PUP-Math Towers and PUP-Math Gang of Four (links appear on Sakai site) • Participate in online discussion (prompts appear on Sakai site)	Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 27-44). Springer: New York, NY. • Tarlow, L. D. & Uptegrove, E. B. (2010). Block Towers: Co-Construction of Proof. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 97-104). Springer: New York, NY.
9/14 – 9/20 Online	• Explore binomial expansion (see statement of task on Sakai) • Read journal article • Watch three video clips (see Sakai) • Participate in online discussion (prompts appear on Sakai site)	• Maher, C. A. & Speiser, R. (1997). How far can you go with block towers? Stephanie's Intellectual Development. *The Journal of Mathematical Behavior, 16*(2), 125-132.
9/21 – 10/3 Online and Classroom Field Work (2-week span)	• Read and discuss journal article • Implement lesson in your classroom during Sept. 22-26 or 29-30 • Participate in debriefing discussions • Select examples of students' work to share at class meeting on 10/4	• Jacobs, V. R., Lamb, L. L. C., & Philipp, R., A. (2010). Professional noticing of children's mathematical thinking. *Journal for Research in Mathematics Education, 4*(2), 169-202.
Saturday 10/4 9:50 – 12:50 Class Session	• Share and discuss examples of students' work from Lesson 1 • Talk about the portfolio project • Engage in problem-solving tasks • Preliminary planning for Lesson 2	• Assignments for LS Cycle 2 appear in the following rows
10/5 – 10/11 Online	• Consider variations / extensions of tasks for accommodating students in your classroom • Read one book chapter about young children's work on pizza problems • Watch videos of PUP-Math Pizzas (links appear on Sakai site) • Participate in online discussion (prompts appear on Sakai site)	• Maher, C. A., Sran, M. & Yankelewitz, D. (2010). Making Pizzas; Reasoning by Cases and by Recursion. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 57-72). Springer: New York, NY.
10/12 – 10/18 Online	• Read two book chapters about older children's work on pizza problems • Watch videos of 11th graders working on pizza problems (links appear on Sakai site) • Participate in online discussion (prompts appear on Sakai site)	• Muter, E. M. & Uptegrove, E. B. (2010). Representations and Connections. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 105-120). Springer: New York, NY.

		• Tarlow, L. D. (2010). Block Towers: Co-Construction of Proof. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 121-132). Springer: New York, NY.
10/19 – 10/31 Online and Classroom Field Work (2-week span)	• Read the Ginsburg chapter on interviewing and discuss online • Watch the video of PUP-Math Brandon Interview & discuss online • Implement lesson in your classroom during Oct. 20-24 or 27-29 • Participate in debriefing discussions • Select examples of students' work to share at class meeting on 11/1	• Ginsburg, H. (1997). Not a cookbook: Guidelines for conducting a clinical interview. In H. Ginsburg, *Entering the Child's Mind* (pp. 115-158). Cambridge University Press: Cambridge, U.K.
Saturday 11/1 9:50 – 12:50 Class Session	• Share and discuss examples of students' work from Lesson 2 • Talk about conducting interviews with 1 or 2 students • Q&A (if any) re: portfolio project • Engage in problem-solving tasks • Preliminary planning for Lesson 3	• Assignments for LS Cycle 3 appear in the following rows
11/2 – 11/15 Online and Classroom Field Work (2-week span)	• Read two book chapters that look more deeply at students' problem solving and how tasks tends to elicit certain forms of reasoning across learners of different ages • Watch videos of Guess My Tower (links appear on Sakai site) • Participate in online discussion (prompts appear on Sakai site) • Conduct student interview(s) during Nov 3-7 or 10-14 • Begin working on portfolio project	• Glass, B. (2010). Adults reasoning combinatorially. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 171-184). Springer: New York, NY. • Glass, B. (2010). Comparing the problem solving of college students with longitudinal study students. In C. A. Maher, A. B. Powell, & E. B. Uptegrove (Eds.), *Combinatorics and Reasoning: Representing, Justifying, and Building Isomorphisms* (pp. 185-200). Springer: New York, NY.
11/16 – 11/29 Online and Classroom Field Work (2-week span)	• Read journal article and discuss online (see prompts on Sakai) • Implement lesson in your classroom during Nov. 17-21 or 24-25 • Participate in debriefing discussions • Select examples of students' work from Lesson 3 for portfolio project	• Francisco and Maher (2011). Teachers Attending to Students' Mathematical Reasoning: Lessons from an after-school research program. *Journal of Mathematics Teacher Education, 14*(1), 49-66.
11/30 – 12/5	• Read journal article and discuss	• Maher, C. A., Landis, J. H. &

Online	online (see prompts on Sakai) • Prepare first two parts of portfolio project to share at class on 12/6	Palius, M. F. (2010). Teachers attending to students' reasoning: Using videos as tools. *Journal of Mathematics Education 3*(2), 1-24.
Saturday 12/6 9:50 – 12:50 Class Session	• Share and discuss what everyone has assembled in parts 1 and 2 of their portfolios • Reflect on participating in cycles of Lesson Study on Math Reasoning • Provide access to scanner for making electronic files of materials in portfolios (if can't do elsewhere)	• Work on part 3 of portfolio project
12/7 – 12/12	• Finalize portfolio project and submit electronically	• Due as an *electronic submission* by 11:59 PM on Friday, December 12