Course Information Math 385: Mathematics for Elementary School Teachers

Instructors	Nicholas Vlamis (vlamis@umich.edu) 1859 East Hall Office Hours: M 4-5PM, F 12-2PM	Nina White (whitenj@umich.edu) 1832 East Hall Office Hours: Tu 4:30-5:30PM, F 2-3PM
GSI	Rachel Snider (rsnider@umich.edu) Brandon Center Office Hours: Tu 5-6:30, Th 4-5:30	
Course Assistant	Stephanie Mackey (mackeys@umich.edu) Time and location by appointment	
Class	001: MW 1:10–2:30pm, A863 Chem	002: MW 2:40–4:00pm, 4151 USB
Website	Access through Canvas.	

Course Description

Overview. What does it mean to justify mathematical claims? Why do the standard algorithms you know for addition, subtraction, multiplication, and division give the correct answer? Can one intuitively make sense of the equation $5-(-4)=5+4$? Can different visual representations illuminate different mathematical concepts? Why does dividing by a fraction give the same result as multiplying by its reciprocal? These are examples of the kind of questions we will consider in this class.

Our focus will be on understanding the mathematical structures, representations, and reasoning underlying numbers (whole numbers, integers, fractions) and their arithmetic ($+,-,\times,\div$: strategies, models, and algorithms). The goal is to create the specific mathematical knowledge needed for teaching: the knowledge necessary to create instructive tasks for elementary school students and to understand and effectively utilize student thinking in the classroom. While this is a *content* class, and not a *methods* class, we will make the greatest effort to explicitly connect what we do in our classroom to your own future classroom practice.

Format. This is an Inquiry-Based Learning (IBL) course. In order to support development of problem-solving skills, communication, and mathematical habits of mind, we will spend the majority of class time working in groups and presenting ideas and solutions to problems. We may give mini–lectures to set the context for the class activities, but my main role will be to support and facilitate your engagement with and exploration of the material. This means that we are jointly responsible for how class time is spent as well as the successful development of the course!

Course Objectives

We will be revisiting the mathematics of the elementary school curriculum as future teachers. In this capacity, we will work to develop mathematical practices that will be relevant in the classroom. More specifically, the objectives of this course are that you will be able to:

- Communicate mathematical ideas effectively in both written and oral formats.
- Find and evaluate mathematical content in elementary school work.
- Persist in solving challenging problems and devise strategies to help in this process.
- Justify mathematical solutions while considering both rigor and developmental context.
- Use representations, models, and diagrams to help you solve problems and communicate solutions.
- Recognize mistakes as an important part of doing and learning mathematics.
- Explain your reasoning for using certain procedures in solving a problem.
- Understand the ways in which math content knowledge supports the activity of teaching.
- Evaluate your own mathematics as well as the work of your peers critically and supportively.
- Learn from and mathematically evaluate material found in common teacher resources.

Assessment Plan

Your course grade will be determined from the following categories and weights:

Participation	17%
Homework	33%
Exams (3)	40%
Final Project	10%

You are guaranteed an A (possibly ±) for a score of 90% or higher, a B(±) for a score of 80% or higher, and so on. These thresholds may be lowered (but not raised) at the end of the term, so as to follow the historical grade distribution for this course.

Participation. Participation takes a variety of forms: listening, contributing from your seat, presenting at the board, asking questions, working in small teams, coming to class prepared, etc. In order to have success in this course, it is very important for you to participate in class *actively*. The participation component of your grade will be determined by the following categories:

- *Attendance.* You are allowed one unexcused absence any time during the semester. Additional absences either must be excused by the instructor (with appropriate documentation and in advance, if possible), or will lower your overall grade by 2% per absence.
- *Group Work and Class Discussions.* We will spend a lot of time working on math problems in small groups. Being a productive and contributing group member can take a number of forms: facilitating discussion, suggesting ideas, asking questions, listening closely, considering others' ideas, clarifying concepts, etc. Your participation is integral to both your own and your group members' success in this course, and is assessed by instructor observation every couple weeks on a scale of ($\checkmark-$, $\checkmark$, $\checkmark+$) where $\checkmark-$ indicates you are not participating enough, $\checkmark$ indicates sufficient participation, and $\checkmark+$ indicates exemplary participation.
- *Problem Presentations.* A major component of this class involves you and your classmates presenting your mathematical work to each other. The goals of this activity include: improving your oral mathematical communication, thinking critically about others' mathematical arguments, and providing the opportunity for the class to consider multiple solutions to the same problem, including possibly incorrect solutions. For this reason it is important to note that you are **not graded on mathematical correctness of the work you choose to present.** As we'll see, solutions that are not entirely correct can often be incredibly valuable for us to consider and discuss. **Students are expected to present 3 times during the semester**. Your instructor will usually select presenters off a list of submitted presentation outlines (see below) but there will also be opportunities to volunteer.
- *Problem Presentation Outlines.* On any given day, you may be asked to present a problem you've worked on. One way to structure your thinking and preparation for such presentations is the weekly Presentation Outline. These presentation outlines are due weekly. Note that if you fail to submit presentation outlines, you may not receive opportunities for your 3 required presentations. Also note: if you consistently submit problems that others do not, you may end up presenting more than 3 times and this will be positively reflected in your participation grade.
- *Productive Failures.* Making mistakes is an integral part to doing mathematics. In fact, when accompanied by some reflection, mistakes often lead to a deeper understanding of the mathematics at hand. Twice during the semester you will write up and share a report on some way you productively failed—this could be something that happened during class, out of class, or during an exam. Each report should be turned in in hard copy and include a description of what mistake you made and why it was productive. These reports may be quite short—generally half a hand-written page. The same day you submit the written report you will give a brief oral summary to the class[1]. You can submit these reports at any time during the semester, but please don't put them off until the very end of the semester.

Breakdown of the 17% of your course grade allotted to participation will be: approximately 5% to group work, 5% to presentations, 5% to presentation outlines, and 2% to productive failures.

[1] If a particular day is pressed for time, the instructor may save your summary for the next class.

Homework. Homework will be assigned weekly. There will be four main components to homework: Warmups, Exercises, Workouts, and Reading Responses. *Warmups* are short problems intended to help you review and use some basic skills in connection with the material. **These will not be graded** and solutions will be provided. *Exercises* are based on applications of ideas discussed in class, while *Workouts* usually involve investigation, problem solving, and more involved writing. Exercises will generally be due each Monday[2]. Workouts will be checked for completion at the beginning of class on Monday[3], and we will talk about your solutions in class. Based on the presentations of your peers and the discussion in class, you will be able to revise your work and submit a final draft at the beginning of class on Wednesday[4]. Unless otherwise stated, you are welcome to work with classmates on the homework, but **you must write up your solutions individually** (this means you can work with classmates on solving problems, but you should write your solutions by yourself; this is an issue of academic integrity). Finally, *Reading Responses* will be assigned periodically. These will be graded on a credit (✓)/no credit (redo) scale. The readings sometimes complement the mathematical material we are studying, but more often contextualize the importance of content knowledge in your teaching.

To give you time to get used to the expectations for Workout problems, you'll have ample chances to revise your solutions during the first third of the semester. In particular, for each homework before the first exam, you will be allowed to turn in a *Revision* of the graded workouts, which will be regraded out of the original number of points. Revisions will require a short statement of how and why you revised your solution, and will be due one week after the homework is first turned back to you. The purpose of revisions is to give you opportunities to learn the characteristics of a good mathematical explanation; for that reason, you are not allowed to submit a revision for a problem you did not already seriously attempt.

Exams. There will be three exams during the semester. The written portion of each exam will be scheduled in the evening over a three–hour time block in order to provide ample time to finish (the exams are written with a standard 80 minute class period in mind). The following dates are tentative, pending discussion of conflicts with other courses. They will be finalized by 9/16/15.

- Exam 1: Monday, October 12, 6–9pm
- Exam 2: Monday, November 16, 6–9pm
- Exam 3: Wednesday, December 16, 4–7pm

Any conflicts with these exams dates must be brought to the instructor's attention immediately; there are no make-up exams. Exam 3 is cumulative.

Oral Assessments. There will be an oral assessment attached to the second exam. This will take place on the Thursday and Friday before the scheduled written exam. You must sign up for a 20 minute session. During the week of the oral exam you will be given a list of potential questions for the exam and will be asked to present a single problem during the examination. In order to acclimate you to the setting of an oral exam, we will have a mock oral exam sometime around the first exam. Further details will be provided as the time approaches.

Final Project. You will be assigned a final project, to be completed in groups, that will ask you to synthesize the material between the second exam and the end of the semester. More information on this project will be provided during the third unit.

Course Resources

Canvas. You will need to use the course Canvas site regularly for viewing the homework, accessing readings, submitting some homework, and receiving important communications from the instructor.

Course Textbooks. The required book is about the state of mathematics education in elementary classrooms in the United States. It is very readable and has a lot of interesting information that puts what we do in class into context. Unfortunately, we were not able to get it into the bookstore in time, so you will have to get it elsewhere. The list price is $16 and can be found on Amazon.com here. We will start assigning

[2]This is the normal schedule, but there will be slight changes around Fall Break.
[3]This is the normal schedule, but there will be slight changes around Fall Break.
[4]This is the normal schedule, but there will be slight changes around Fall Break.

readings during the third week of classes.
The optional textbook for this course is a helpful and well-written reference, but it is in no way required for you to complete or do well in this course. This book does a good job of providing explanations of the ideas we will discuss in class, and we will indicate which sections of Beckmann's book correspond to our in-class materials.

required	Boaler, J. (2009). *What's Math Got to Do with It?: How Parents and Teachers Can Help Children Learn to Love Their Least Favorite Subject.* Penguin Books.
optional	Beckmann, S. (2011). *Mathematics for elementary teachers with activity manual.* Pearson Addison Wesley.

Readings. Other relevant readings will be uploaded to Canvas as the semester progresses.

Office Hours. We encourage you to attend office hours! After an initial availability poll, we will update the top of this document with instructors' office hours. Office hours are a great place to spend extra time on the course material and help you build your understanding and skill. You should feel free to attend the office hours of both instructors, regardless of which section you are in.

Accommodation. If you have a documented disability requiring special accommodations, please inform an instructor as early as possible. Special arrangements for graded work require appropriate documentation.

Schedule

The following schedule is subject to revision as needed:

I. Practices and Structures
- 0. Problem Solving
  ...or, the art of doing mathematics.
- 1. Evens and Odds
  ...or, the importance of good definitions.
- 2. Place Value
  ...or, how we write numbers and the ways it affects our thinking.

II. The Four Operations of Arithmetic
- 3. Addition and Subtraction Strategies
  ...or, a great wealth of patterns in our number system.
- 4. Integers
  ...or, why we need more numbers and how to think about them.
- 5. Addition and Subtraction Algorithms
  ...or, the close relationship between standard procedures and place value.
- 6. Models of Multiplication and Division
  ...or, thinking about what our arithmetic means.
- 7. Primes and Factoring
  ...or, the multiplicative structure of the integers.
- 8. Algorithms for Multiplication and Division
  ...or, linking procedures and conceptual understanding.

III. Fractions and Decimals
- 9. Fractions, Models, and Equivalence
  ...or, why we need even more numbers and how to think about them.
- 10. Decimals and Their Fractions
  ...or, relating fractions with the place value system.
- 11. Addition and Subtraction of Fractions
  ...or, how arithmetic plays with fractions (part 1).
- 12. Multiplication of Fractions
  ...or, how arithmetic plays with fractions (part 2).
- 13. Division of Fractions
  ...or, how arithmetic plays with fractions (part 3).