

M132: Number and operations for K-8 teachers

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Office: Math 201

Office Hours: M & F 9:00-10:00; and by apt. (www.fapeck.com/meeting)

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

We are a community.

We explain, argue, and persuade

We collaborate

We critique

We hold each other accountable

We are mathematicians.

We ask questions

We **wonder** about the world—the “real” world and the world of mathematics

We create and use **models, tools, and strategies** to mathematize the world

We are **sense-makers**

We experience **confusion, anxiety, and joy**

We are teachers.

We approach pedagogical interactions as **teacher-learners**

We find the right **models, tools, and strategies** to help people learn

We seek to foster **wonder, perplexity, and understanding**

We're not afraid of a little **confusion or anxiety**

We treat all learners as **people** and promote their development as people

We are a **community** • We are **mathematicians** • We are **teachers**.

About the course

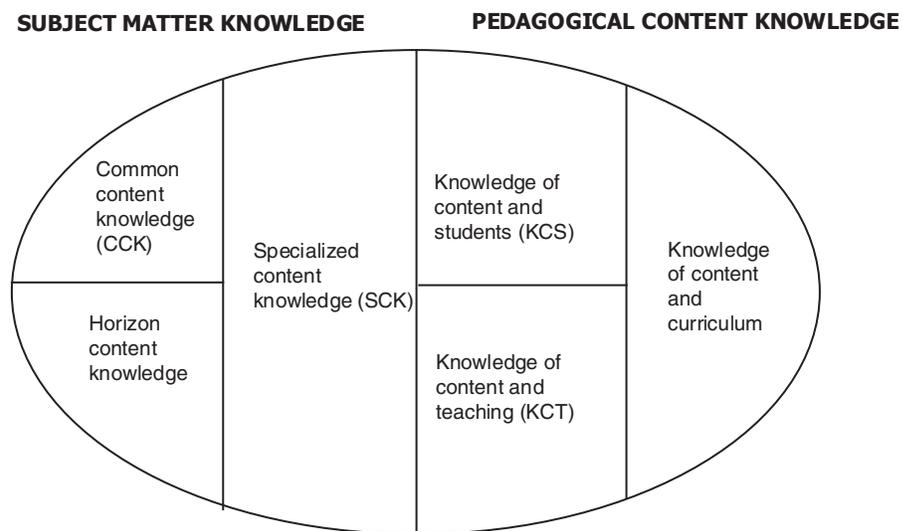
This course is animated by a deceptively simple question:¹

“Who knows mathematics well enough to teach third grade?”

The answer is, very few of us. Teaching is an extraordinarily intellectually demanding profession, and it requires a special kind of knowledge. With respect to math, we call this knowledge *mathematical knowledge for teaching*, or MKT.

As shown in the graphic below², MKT involves both *subject matter knowledge* (knowledge about math content) and *pedagogical content knowledge* (knowledge about teaching math). Both of these are special for teachers. It’s not enough to know math the way a research mathematician might or an engineer might.

Because MKT is special to teaching, this course is especially for teachers.



¹ Ball, D. L., Hill, H. C., & Bass, H. (2005). Knowing mathematics for teaching: Who knows mathematics well enough to teach third grade, and how can we decide? *American Educator*, 29(1), 14-17, 20-22, 43-46.

² Ball, D. L., Thames, M. H., & Phelps, G. (2008). Content knowledge for teaching: What makes it special? *Journal of Teacher Education*, 59(5), 389-407.

Learning outcomes/course objectives

Upon successful completion of this course students will:

Develop as a mathematician and a teacher

1. View mathematics as the human activity of structuring the world
2. Participate with confidence in mathematical activity
3. Become a more-central participant in the community of mathematics teachers

Have subject matter knowledge

4. Understand the meanings and uses of whole numbers, integers, and fractions, as well as representations of those numbers (including place value, decimal [base-10] notation, and fraction notation, all from a *units perspective*)
5. Understand the meanings of addition, subtraction, multiplication, and division; Understand the connections between these operations, concepts, and procedures—including explaining how standard US algorithms work.
6. Solve problems involving numbers and operations
 - Use *models* and *number-sensible strategies* to solve problems
 - Perform U.S. traditional algorithms for operations on whole numbers, fractions, and numbers in decimal notation
 - Explain their reasoning, both verbally and in writing, while solving problems.

Have pedagogical content knowledge

7. Have a working knowledge of how students learn number and operations in formal education
 - Understand the the role of “preformal” models, tools, representations, and strategies in teaching-learning mathematics.
 - Evaluate student work regarding numbers and operations, determine the mathematical reasoning and strategies used, and recognize some common mistakes, including the reasoning that makes these mistakes sensible
 - Formulate feedback and identify instructional activities to further students’ learning

Administrative things

Class time: Section 1: MWF 8:00-8:50

Section 3: MWF 10:00-10:50

Location: LA 235

Prerequisites: Open to Elementary Education or pre-ED majors **only**; Successful completion of M095 (C or higher) or appropriate score on ALEKS (level 4).

Text: *Mathematics for Elementary School Teachers with Activities* (5th Ed.), by Sybilla Beckman

Supplies: You do not have to bring the book to class everyday. Please bring a calculator and/or a laptop, tablet, or smart phone if you can.

Final exam period: Section 1: Monday May 7, 10:10–12:10, LA 235

Section 3: Wednesday May 9, 10:10–12:10, LA 235

About the final exam: We will engage in a summative activity during the University-scheduled time. The final exam schedule is set by the university schedule and the time cannot be changed. Please make your travel arrangement based on the scheduled final exams.

Help!

Teaching-learning is collaborative endeavor, and seeking and providing help is a joint responsibility that is shared by all members of the community. I will seek to recognize when you need help, and I will do my best to provide you with help as much as I can. You should also seek to recognize when your colleagues need help, and try your best to provide it. Finally, you should seek help for yourself as much as you can. I am available during the office hours listed on the front of the syllabus, and I am often available for drop-in help during the day. Still, it's best to make an appointment outside of office hours if you can, so that you can be assured that I'll be there. Use www.fapeck.com/meeting to schedule a meeting with me.

In addition, free drop-in tutoring is available in the Math Learning Center and math@Mansfield:

Math Learning Center

Math Building room 011.

Monday – Thursday, 10:00 am to 3:00 pm

Friday, 10:00 am to 1:00 pm

math@Mansfield

Mansfield Library (main floor, by printing services)

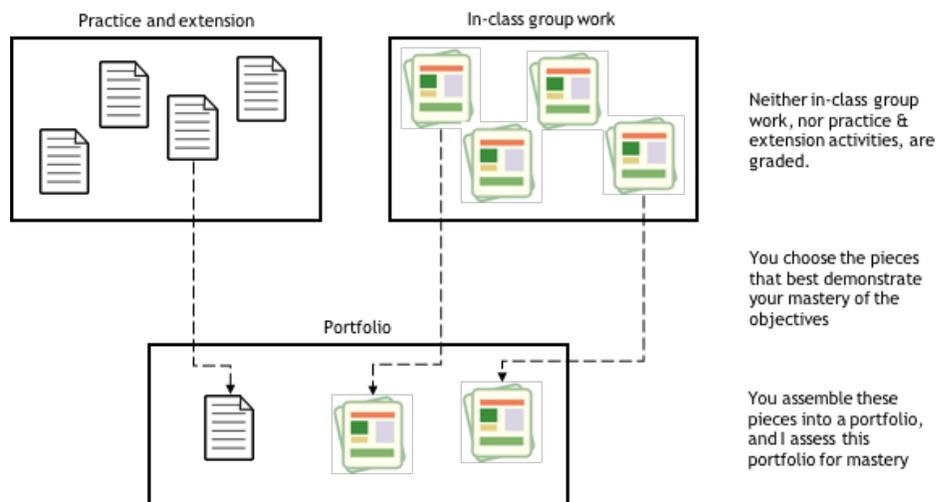
Sunday – Thursday 5:00 pm to 9:00 pm

Assignments

In-class group work: Teaching and learning are collaborative enterprises, and so is mathematics. Most of our work in class will be collaborative in nature.

Out-of-class practice and extension: Practice and extension activities include math problems, analyses of student work and other artifacts of teaching practice, and readings with guiding questions. Homework will be assigned after each class, and should be done before the subsequent class. *Plan to spend about 1 hour per class on practice and extension activities.*

Portfolios: Neither group work, nor practice & extension activities, are graded. At the end of each unit, you will choose the best pieces and assemble these pieces into a portfolio of work that demonstrates your mastery of the unit objectives. Your grade will be based on these portfolios. I will provide detailed instructions for each portfolio when it is assigned.



Long-term projects: There will be two semester-length projects. The first involves *mathematical modeling*: using the mathematical tools of the course to make sense of the world. The second involves reading and summarizing a teacher-focused book about how students learn number and operation. I will give you more information about these projects during the semester.

Weekly self-assessment: Each week you will complete a brief self-assessment of your participation in mathematical and pedagogical activity for the week.

A note on timing: Math has nothing to do with speed! None of the above will be timed. Deadlines are in place to keep everyone on track, but if they are not reasonable for you, we can negotiate them. *You should plan to spend approximately 3-4 hours each week outside of class on work for this course.*

Feedback and grading

Mathematics is both an activity that you *do* and content that you *learn*. First and foremost, mathematics is something that you *do*: it is the human activity of structuring the world mathematically. As we engage in this activity, we create mathematical content: the tools, models, strategies, representations, concepts, and algorithms that we usually are referring to when we say “mathematics.” These are things that you can *learn*. Your grade in this class is based both on what you *do* (your participation in mathematical and pedagogical activity, 50%), and what you *learn* (your mastery of mathematical knowledge for teaching, 50%), as described below.

Participation in mathematical and pedagogical activity (Objectives 1-3; 50%)

We develop as people through our participation in activity. In our class, you will develop as a mathematician and a teacher as you participate in mathematical and pedagogical activity, including participating in the “mathematical practices” identified in the Montana Common Core:

Mathematical practices

- | | |
|------------------------------------------------------------|----------------------------------------------------------|
| 1. Make sense of problems and persevere in solving them | 2. Reason abstractly and quantitatively |
| 3. Construct viable arguments & critique others’ reasoning | 4. Model with mathematics |
| 5. Use appropriate tools strategically | 6. Attend to precision |
| 7. Look for and make use of structure | 8. Look for and express regularity in repeated reasoning |

To be an active participant, you should:

- (a) be present,
- (b) be prepared (i.e., by completing homework and readings), and
- (c) be productively engaged in our course activities and discussions.

Each week, you will complete a short self-assessment of your participation in mathematical and pedagogical activity.

Mastery of mathematical knowledge for teaching (Objectives 4-7; 50%)

Rather than accumulating points for “correctness,” your grade will be based on the extent to which you demonstrate mastery on the course objectives for MKT (objectives 4-7). At the end of each unit, you will assemble a portfolio of work that demonstrates your mastery of the unit objectives. For each objective, I will assess your mastery as follows:

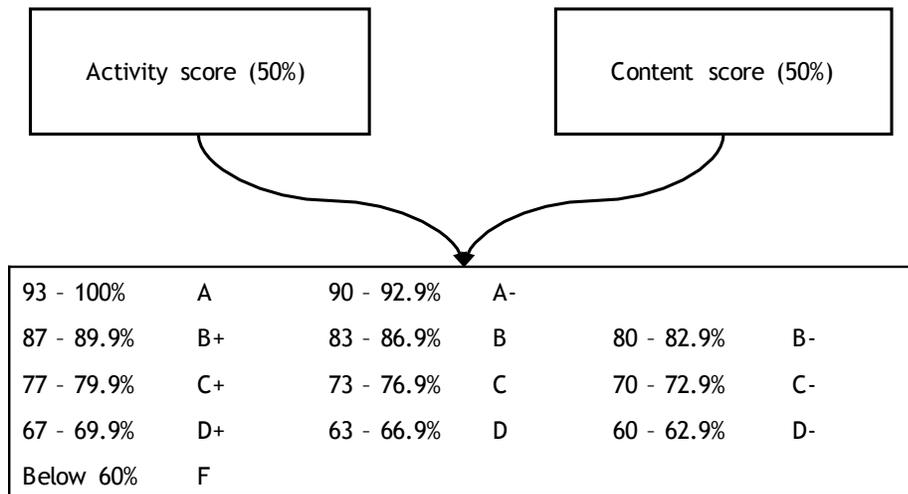
Mastery	The evidence in the portfolio indicates complete mastery of the objective
Approaching	The evidence in the portfolio indicates partial mastery of the objective
Not there yet	There is little to no evidence of mastery of the objective in the portfolio.

I expect that you will demonstrate mastery of every objective. Portfolios that do not demonstrate appropriate mastery (at least “approaching” for each objective) will be returned with feedback, and you will be expected to revise the portfolio and resubmit it, possibly multiple times, until the work in the portfolio demonstrates appropriate mastery.

Final grade

Assuming that you demonstrate at least “approaching mastery” on each course objective, I will determine your course average by weighting your activity score and content score 50% each.

Then, your letter grade is assigned based on your course average:



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.

Attendance/participation: You are preparing for a profession in which timeliness and attendance are strict and non-negotiable. In addition, we will do a lot of important mathematics each day. Finally, you are a resource for your group, and if you are absent, then your entire group suffers. For these reasons, I expect that you attend every class. Things come up, and I understand that. If you know you are going to miss class, please make arrangements with me before hand. If you miss a class that you didn't expect to, please contact me as soon as you can so we can arrange a makeup activity.

Grading: You must earn a grade of C- or better in this course to fulfill the requirement in the College of Education. You may change to CR/NC up to the last day of class and you will receive credit with a grade of D- or better. However, if you choose this option the grade cannot be counted toward the College of Education requirement nor the UM graduate requirement.

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.