
METHODS FOR TEACHING COLLEGE MATHEMATICS

Dr. Douglas A. Lapp

Instructor Info

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Office Hours:

TR 2:00-3:00 pm (PE 222);

& by appointment.

MS Teams, use Code **nm0jbf6**

(For video on joining via Teams click [here](#))

I also maintain an Open Door policy. If my door is open, feel free to drop in. If my door is closed, please take no offense. I am probably hiding because I have some deadline to meet. (Please Feel Free To Call or E-mail! I don't bite.)

Attendance

Class attendance is required.

Attendance will be taken each class period. More than 2 unexcused absences will cause your grade to be lowered a third of a letter grade for each occurrence beyond the first 2 (e.g. 3 missed classes would change a B to a B-, 4 missed classes would change a B to a C+).

About the Course

This course is designed to integrate the subject content knowledge with both pedagogical & curricular content knowledge. In this course we will build on your previous experiences teaching (if any) and examine some introductory research on teaching and learning and apply it to instructional design. We will use vignettes, written cases, and video excerpts to analyze both teacher actions and student activity as they interact in classroom situations. In addition, we will address the practical issues of lesson and unit planning as well as curriculum design.

In this course, we will practice various teaching strategies including inquiry and guided discovery. Since you may be expected to teach any undergraduate course once you graduate from our PhD program, we will examine content from lower-level, mid-level, and upper-level mathematics undergraduate courses and you will write and teach lesson plans for various topics.

Instructional Methods

We will take an active learning approach and so you will be expected to engage in discussions and work with your fellow classmates to discover key concepts. The technology we will use will allow us to have deeper discussions where *your ideas matter*. Be willing to share your thoughts with the class. Keep in mind that the only dumb question is a question unasked.

As we know from research, mathematics is best learned by engaging students in exploration and justification of conjectures. Therefore, this course will model pedagogical methods set forth by organizations such as the National Council of Teachers of Mathematics and the Mathematical Association of America.

Materials

Web Pages:

<http://people.cst.cmich.edu/lapp1da> (Dr. Lapp's page)

<http://people.cst.cmich.edu/lapp1da/math-761.html> (MTH 761)

Grading

Your grade will be based on the following breakdown:

Mini-Teachings	10%
Quick Quizzes/Exit Tickets	5%
Quizzes	5%
Pedagogical Reflections	10%
Reaction Papers	10%
Curriculum Design	10%
Projects/Labs	10%
Flipgrid	10%
Lesson Plans	15%
<u>Research Paper</u>	<u>15%</u>
Total	100%

Your grade will then be figured on the following percent scale.

Scale:

[92, 100]A

[90, 92) A-

[87, 90) B+

[82, 87) B

[80, 82) B-

[77, 80) C+

[70, 77) C

[0, 70) E

Course Withdrawal

Students must DROP a course if they plan to stop attending before the course starts or prior to the second meeting time for face-to-face courses to get a refund. Dropping later than this will incur varying rates of refund (or none at all). For details, see the Drop and Withdrawal Chart. A drop removes the course from your record if done early enough. If you drop after the designated deadline, you may receive a W, but keep in mind that there is date after which you cannot drop. Again, details are given on the Registrar's webpage.

Text & Technology

Text:

Liljedahl, P. (2020). *Building thinking classrooms in mathematics, grades K-12: 14 teaching practices for enhancing learning*. Corwin press.

Technology: For Math 761, you will need a graphing calculator with a Computer Algebra System (CAS) that will also work with our wireless calculator network. A computer algebra system is simply a device that will do symbolic manipulations such as finding symbolic derivatives or integrals, expanding algebraic expressions, working with matrices, or solving equations exactly. For this purpose, you will need a TI-Nspire CX CAS or TI-Nspire CX II CAS that can be used with the wireless network. You may need to spend a little extra time initially familiarizing yourself with the calculator, but once you have become proficient with these machines I am sure you will find their use invaluable. I will be assigning an introductory activity using videos to help you become familiar with basic functionality of the device. Watching and following along with these video clips will be important and you will turn in an electronic file the first week of class.

Expectations for Success

Stay current and be prepared

- Read this entire syllabus and know the policies for each class in which you are enrolled – pay attention to deadlines and due dates! I will keep a Weekly To Do List on the left navigation column on Blackboard to remind you of assignments.
- Check the Course Calendar and Announcements in Blackboard and your email regularly (at least 2-3 times per week).
- Keep current on class material, if for some reason you cannot attend the class.
- Keep current with all course assignments, quizzes, and examinations.

Final Reminders

- Be respectful of your peers and the instructor.
- Participate fully in your cooperative group (both in class and on assignments outside of class)

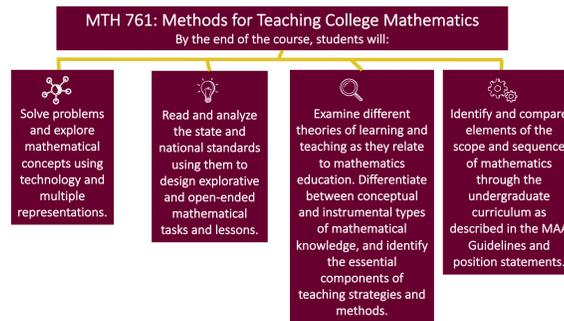
Student Learning Outcomes

The major goal of this course is to connect undergraduate mathematical concepts with the design of instructional materials and practice. We will use curricula and case studies to motivate discussion of the teaching

Instructional Video

In order to encourage discourse about mathematics, we will use MS Teams as a way to work together outside of class. My intention is for this to be your place in cyberspace to work collaboratively. **Microsoft Teams** provides a nice platform for this purpose. Our Teams class allows me to post video clips of my computer screen so that if some folks are struggling with a concept, I can help illustrate ideas in video form. I can also use it to help you learn some functionality of the TI-Nspire CX CAS, especially at the beginning of the course. I will organize the instructional video under the Files tab in MS Teams by using folders coordinated with the *Building Thinking Classrooms* text and other topic categories. In addition to using Teams for specific video posts and peer communication, I will also hold "**Office Hours Live**" as a live stream video feed during my office hours, but **you are welcome to come in person as well**. If you wish to join remotely, I will be available for questions since you can post questions or comments live in the video chat window or simply ask by turning on your audio/video in Teams. There may also be students present at the same time and so this will just extend office hours to cyber space. I have created an open Team called *Office Hours* and you can access it in MS Teams by using Code **nm0jbf6** during office hours.

and learning of mathematics. In addition, we will experience student-centered lessons for undergraduate content and then react to these sessions. We will organize these learning outcomes into four main categories with the specific mathematics content falling into each. Below is a graphic that summarizes the mathematical and pedagogical practices of the student learning outcomes for the course.



Assessment

In order to allow for diversity in student learning styles and achievement measures, you will be assessed using several methods. Since one of our objectives is to be able to continually learn new technologies and apply both mathematics content and learning theory to your classroom long after you leave “formal education”, we want you to be able to learn on your own. For this reason projects will constitute a large portion of your grade. Some of these assignments will require **significant time outside of class**, so be prepared. Throughout the semester you will be asked to work in groups on projects/laboratory activities and present your ideas to the rest of the class.

Quick Quizzes/Exit Tickets

These quizzes are designed to give me a quick assessment to see if everyone is keeping up with course material. These quizzes will be given electronically through the wireless connection of your calculator and will take only a few minutes so that we can optimize class time. In general, the questions on these quizzes will test your understanding of the “big ideas” of the course or basic technological skills. As another method of formative assessment, you will be expected to respond to questions by way of an *exit ticket*. These are a series of short questions related to what was taught *that day*. This will give me a quick view of how students are doing and whether or not I may need to revisit a topic at the next class. Exit tickets can be given via paper or will be given electronically through the wireless calculator network and will take only a few minutes. While the Quick Quizzes will focus on big ideas, the exit tickets will be directed at content we talked about in class that day.

Assessment

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Name, Gender Identity, and Gender Expression

Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name and/or pronoun. Please let me know about any differences as soon as possible so that I may make the appropriate changes to my records. For more information regarding CMU's commitment to making campus a safe space for people of all sexualities and gender identities, visit the [Office of LGBTQ Services](#) (Bovee University Center 108)

Mini-Teaching

You will be expected to prepare lessons and present portions of the lessons to the rest of the class for discussion. Please be ready to interact with peers in the classroom as well as any who may be attending online via MS Teams. Since as a TA, you will be doing this with your regular classes, this should give you additional practice managing technology for synchronous instruction.

Quizzes

The quizzes will be over basic mathematical and pedagogical topics related to the course materials. You will also be expected to use basic functionality of the technology used in various explorations.

Research Paper

The research paper for the course should be focused on a specific, well-defined topic related to the teaching of mathematics at the college level. Topics could include the teaching of a particular course, teaching of a particular mathematical content area (e.g., limits, derivative), a particular pedagogical technique (e.g., cooperative/active learning, using writing in instruction, inquiry), or an educational issue related to curriculum (e.g., What is an optimal balance between skills and concepts for a student completing a calculus course?), instruction (e.g. When should students use calculators?), or assessment (e.g., How do you assess problem solving ability?) in undergraduate mathematics. The project will include a paper and a classroom presentation.

Reaction Papers

Some of the assignments will involve searching the current Mathematics Education journals for articles on the teaching and learning of mathematics concepts. These assignments will involve reading journal articles and reacting to those articles from the perspective of both teacher and student. The library has many fine journals specifically for mathematics education such as *Journal for Research in Mathematics Education*, *School Science and Mathematics*, *International Journal of Mathematical Education in Science and Technology* to name only a few. Many other journals are also acceptable. In addition, I may give you articles as handouts and then expect you to respond to prompts related to the readings.

Pedagogical Reflections

Throughout the course you will be expected to write about your thoughts related to classroom situations as presented by sample student

Recording of Class

In order to protect the intellectual property interests of the instructor, the privacy interests of student members of the class, and to encourage an open and fair exposition of all student views in the classroom without fear that student views expressed will be recorded and possibly posted in another forum, recording (video or audio) of classroom activity (or live video stream) and conversations is not permissible without the expressed, prior written consent of the instructor. Unauthorized recording of classroom activity shall be considered a violation of the CMU Student Code of Rights, Responsibilities, and Disciplinary Procedures as disruptive of a student's right to learn under 3.2.3 Disruption of Learning. While it is expected that students will attend live classes, I will consider streamed class in MS Teams if needed due to University recognized absences if students are required to not attend classes. It is important to note that only members of the class who have a University recognized absence will be able to stream the class and view instructional videos within Teams and sharing them outside this environment will constitute a violation of the CMU Student Code of Rights, Responsibilities, and Disciplinary Procedures as described above. Recording class sessions via other means (e.g. screen-casting software) is not permitted. Please remember that these recordings are not meant to replace class attendance, but rather as a means to study and reflect on course material.

work, written cases, vignettes, or video excerpts. We will use some of the video from various sources as well as the texts for the course to stimulate discussion. We will also draw on your own teaching experiences in our analysis of the teaching and learning of mathematics.

Curriculum Design

Another important aspect of teaching is the ability to create classroom-ready curriculum materials. In this course you will be expected to design student-centered activities that guide students to discover key mathematical ideas or concepts. These activities will include both a student handout as well as a teacher guide for its use in the classroom. Details for these assignments will be given in class.

Projects & Lab Assignments

Throughout the semester you will participate in lab activities designed to help you make connections between the undergraduate mathematics curriculum and issues of teaching and learning. I think that you will not only find these labs helpful in generating ideas for your future teaching, but you will also find that concepts you were taught through memorization during your own school experience will begin to actually make sense. The use of technology in the mathematics classroom can foster an atmosphere of conjecture and proof. Students will be able to explore patterns that they could not before—this is one advantage of technology use and we will model this environment in the course. You will also be expected to explore concepts using the computer and software such as TI-Nspire CX CAS™ software and GeoGebra, as well as hand-held technology such as the TI-Nspire CX CAS™ hand-held with data collection sensors, and the CBR2™.

Lesson Plans

One of the most important parts of classroom instruction involves a well thought out lesson plan. In this course, you will develop lessons that are grounded in research-based practice and are influenced by our analysis of classroom episodes found in both written and video formats. A detailed structure for these lessons will be discussed in class.

Flip

As another method of formative assessment, from time to time you will be expected to respond to questions using Flip. Flip is a video platform where people can submit short (1 to 10 minute) video responses to posed questions via a smartphone, tablet, or computer (I usually try to limit it to 90 seconds). This will give you the opportunity to explain your

Academic Integrity & Use of AI-Generated Materials

To promote integrity and deter dishonest academic work, it is assumed that you will conduct yourself within the University's expectations. Generative Artificial Intelligence (AI) tools and platforms (e.g., ChatGPT, Google AI, Boost.ai, Jasper, etc.) are new technological additions to the higher education landscape and are rapidly evolving. Submitting text and other products generated by AI tools and platforms as your own original work is prohibited and a violation of CMU's Academic Integrity policy. If the use of AI tools and platforms is appropriate within the context of a course, guidance on properly utilizing them, and appropriate methods of citation for direct quotations, ideas, diagrams, code, or paraphrased text generated through AI will be provided by your instructor.

thinking and understanding that goes beyond simple procedural knowledge. You may also be asked to record a micro-teaching rehearsal illustrating teaching moves discussed in class.

Collaborative Groups

You will be placed in random collaborative groups every week or so (at natural breaks in activity). This will allow you to work with a variety of people throughout the semester. To accomplish this, when you are asked to form or change groups, you will draw a random card from a deck when you enter the classroom and then sit at the assigned table corresponding to your group card (e.g. 2, 3, 4, 5, 6, 7, 8, 9, 10, J, Q, K, A). You will work and sit in this location until the groups get rearranged again. As stated earlier, there will also be groups in MS Teams corresponding to these group names as well so that you can collaborate with each other outside of class.

Within each group, roles will also be randomly assigned. Another aspect of group work to help promote an equitable environment is requiring students to take on different roles within the group from time to time so that everyone develops team skills and shares the workload. While there are many good roles that can be used depending on the type of group work, the roles we will use for this course will be: Facilitator/Resource Manager, Recorder, Reporter, and Understanding Coordinator. These roles should suffice to cover most of the needs of the group while exploring mathematics. So that over time, group members will take on a variety of roles, your role for each "shuffling" of the groups will be given by the suit of your card (♣, ♦, ♥, ♠).

♣ **Facilitator/Resource Manager:** Obtains needed materials and keeps the group on track. Monitors time to make sure the group is ready to participate in class discussions when the class is brought together to share results. Makes sure all group members share during discussions.

♦ **Recorder:** Keeps a record of the group's discussion and develops the final write-up for submission.

♥ **Reporter:** Provides explanations of the group's findings to the larger class during discussion. The Reporter will rely on the Recorder's notes and written summaries (often displayed on whiteboards or via calculator screen).

♠ **Understanding Coordinator:** Makes sure all members of the group participate and understand what is being said by members of the group. The Understanding Coordinator may ask group members to re-voice the contributions of others to make sure the meaning is clear.

Accommodations

CMU provides students with disabilities reasonable accommodations to participate in educational programs, activities or services. Students with disabilities requiring accommodations to participate in class activities or meet course requirements should register for services through Student Disability Services, 120 Park Library, 989-774-3018, www.cmich.edu/ess/studentaffairs/SDS/

Comments

You and I are part of a team. If we work together I think we will both come away from this course having learned a great deal. You have the potential to teach me as well. Feel free to share your ideas about mathematics with the class and with me. If you need help, come see me. It is important to get help as soon as possible to avoid falling behind. Call me if you need to see me. I won't bite—I promise. To encourage you to actually read this syllabus, within the first week of classes, when you get to this sentence, email me a picture of Spock from Star Trek and I will add 2 bonus points to your quiz category.

Since each group will generally hand in only one report, as you list the names of the group members at the top, please also list the role they played in the lab or project. Keep in mind that you may at times be placed into a group of size 3 rather than 4. If this happens, one member of your group may be called on to fulfill two roles.

Face Covering and Social Distancing

Face coverings, such as masks, are optional. If you need to wear a mask, please feel free to do so. As every person's situation is different, we will all respect each others' choices for personal protection and be sensitive to the needs of our classmates. Should the situation change and CMU decides to change policy, please refer to the COVID-19 Resources page at <https://www.cmich.edu/about/covid-19-information-and-resources>.

Expectations for Students and Instructor

CMU understands the benefits of pluralism and embracing diversity and is committed to cultivating an “irresistible culture of inclusion.” Therefore, CMU faculty strives to create safe and inclusive learning environments in which students can respect and celebrate diversity through inclusive and mutually respectful language. CMU is committed to transforming as an institution to respond to support enlightened change around ever-evolving attitudes of inclusion.

Student Expectations	Instructor Expectations
Actively participate in whole-class and groups discussions.	Have fun sharing how cool mathematics is.
Be respectful of the ideas and contributions of others.	Encourage students to share their views and show respect as they share.
Share your ideas (even if you think you might be wrong).	Reinforce to students that they are capable of understanding mathematics.
Complete all assignments.	Be prepared for class.
Turn off your cell phones unless needed for class activities.	Respond swiftly and effectively to student concerns.
Come to class on time, as we often begin with a quiz or opening warm-up.	Grade objectively, consistently, and promptly.
Discuss class concerns with me either after class or during designated office hours.	Assure students that making mistakes is OK and part of the learning process.
Come prepared for class by completing readings or pre-activity investigations prior to class.	Accommodate differences in students' learning.
	Provide time in class for students to engage with the instructor and classmates about course ideas.