EDCI 572/372: Teaching Mathematics in the Secondary School

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Students learn mathematics through the experiences that teachers provide. Thus, students' understanding of mathematics, their ability to use it to solve problems, and their confidence in, and disposition toward, mathematics are all shaped by the teaching they encounter in school.

Teaching mathematics well is a complex endeavor, and there are no easy recipes for helping all students learn or for helping all teachers become effective. Nevertheless, much is known about effective mathematics teaching, and this knowledge should guide professional judgment and activity.

(NCTM, 2000, pp. 16-17)

Purpose of the Course
As a future secondary mathematics teacher, you have the opportunity to touch the future. You can play an important role in the development of adolescents and have an influence on the way in which they come to understand the world in which they live. You can help students to develop strong understandings of mathematics and its uses, understandings that are foundational for work beyond high school. What a wonderful career you have chosen! ☺

In this course, you will come to develop knowledge, skills and understandings that will be useful to you in your work as a secondary mathematics teacher. Though there are no "easy recipes" for helping students learn mathematics, research has identified *characteristics* of effective mathematics teaching. Throughout the semester, we will explore these characteristics and ways in which you can incorporate them into your teaching. You will learn how to be reflective about your work and that of other teachers so that you can continue to draw on and build upon the knowledge and understandings you gain in this course throughout your career as a secondary mathematics teacher.

Course Description as provided in the Course Catalog
This course emphasizes developing different styles of teaching and covers curricula, current issues, and research literature in secondary school mathematics. School-based field experience required.

Guiding Questions
To achieve the specified purpose of the course, we will consider the following questions throughout the semester:

1. What does it mean to *do* mathematics?
2. What does it mean to be *proficient* with mathematical content?
3. How do individuals learn mathematics?
4. What does it mean for an adolescent to deeply understand ___*(insert math topic/concept)*__?
5. What tasks would facilitate the development of deep understanding of __*(insert math topic/concept)*__?
6. What characteristics of the classroom environment promote the development of strong understandings of ___*(insert math topic/concept)*__?
7. In what way(s) is student understanding evidenced?

Objectives
Success in this course is measured by the degree to which you are able to:

- demonstrate an understanding of the ways in which students develop strong, usable understandings of secondary mathematics content
- analyze instruction and instructional materials for their potential to promote student learning of secondary mathematics content in diverse settings
- design tasks that foster the development of deep understanding of secondary mathematics concepts
- justify instructional decisions by reference to research findings, national standards, and learning theory
- demonstrate the dispositions appropriate to work as a secondary mathematics teacher
- continue to develop your own knowledge of mathematics and problem solving ability as you explore mathematics from the perspective of a teacher and student

Plan for the Course
We will address the guiding questions and objectives as we progress through the course, which is organized into four sections:

I. The Nature of Mathematics and Current Thinking in Mathematics Teaching and Learning
In this part of the course we will explore the nature of doing and understanding mathematics. You will become familiar with the reform movement in mathematics education and the factors that catalyzed that movement. You will also become familiar with the resulting recommendations for teaching and learning offered by the National Council for Teachers of Mathematics (NCTM).

II. The Learning/Classroom Environment
In this part of the course, you will become familiar with various characteristics of effective mathematics teaching. You will explore ways of using questioning, group activity, and well-designed mathematics tasks to promote the development of strong understandings of secondary mathematics concepts. And, you will examine curricular resources and standards documents in consideration of they made be used to design instruction.

III. Planning Instruction
In this part of the course you will apply the knowledge gained in the previous two sections of the course to instructional design. Throughout this section, you will learn about the teaching and learning of specific content strands and how that content can be organized into a unit of study and/or an individual lesson.

IV. The Responsibility of the Teacher in Today's Schools
In this final section of the course you will consider the role of a *mathematics* teacher in today's world. You will consider your responsibility to the diverse group of students you will be teaching and to the surrounding community.

Textbooks and Materials
Daily access to the following materials is required:

Brahier, D.J. (2009). *Teaching secondary and middle school mathematics* (3rd edition). Boston: Pearson Education Inc.

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: Author.

[Note that excerpts from the *Principles and Standards* document can be found on-line at http://standards.nctm.org/]

Virginia Standards of Learning available at
http://www.pen.k12.va.us/VDOE/Superintendent/Sols/home.shtml

Course Expectations/Assignments
The following assignments will help you (and me) to gauge your development throughout the course:

Assessment	Percentage of Grade
Participation and Preparation	15%
Philosophy Statement (Initial and Final)	10%
Mini-teach and Follow-up Discussion	10%
Instructional Analysis	15%
Interview a Student	15%
Field Work Completion	5%
Filed Work Assignments and Discussion	10%
Unit Plan and Presentation	20%

Participation and Preparation
The participation of each class member is vitally important. If you do not come prepared to discuss the readings, to share you work on a given assignment, and to participate in the activities of the day the entire class will suffer. The input of **everyone** is valuable and necessary! You **must** commit to be coming to every class on time, being prepared for the evening's activities, and being ready to participate.

Philosophy Statement
The instruction a student receives is very much influenced by a teacher's experience and individual philosophy of mathematics teaching and learning. This assignment is meant to help you better understand your philosophy of mathematics teaching and learning at two points: the beginning of the course and the end of the course. A written statement of your philosophy will be valuable to you as you interview for teaching positions.

Problem-Lead
This assignment will give you a chance to test your skills in leading work and discussion on a mathematics problem. Given a mathematics problem, you will prepare a "lesson" based around that problem. After the "lesson" you will reflect upon the effectiveness of the approach you used to engage your peers in work with mathematical content. **Graduate students will do two problem-leads and undergraduate students will only do one.**

Instructional Analysis
After you've spent some time thinking about characteristics of instruction that are effective for promoting the development of strong understandings of mathematics, you will have the opportunity to use what you have learned to critique aspect(s) of mathematics instruction. This assignment will help you to reflect upon instruction as you prepare to plan your own instruction for the unit plan.

Interview a Student
As you learn more about student thinking and development with regard to mathematics learning, you will have the opportunity to apply your knowledge in a practical situation. You will be asked to interview an adolescent student and explore the nature of his/her understanding of a particular mathematics concept (of your choosing, but age appropriate). Ultimately, you will make recommendations for future instruction for this student.

Field Work Completion
Students seeking initial certification are required to complete 15 hours of field work. You will keep a log of these field work hours and submit them at the end of the semester.

Field Work Assignments and Discussion
One of the most valuable pieces of pre-service teacher training is the opportunity to do field work. Throughout the semester, you will be required to complete observation assignments during your field work. These assignments provide you with opportunities to reflect upon the practice of teaching after having watched instances of teaching in real world settings.

Unit Plan and Presentation
Throughout the semester, you will explore many issues related to the teaching and learning of mathematics. In this culminating assignment, you will have the opportunity to use the knowledge, skills, and understandings you've gained in the creation of a complete unit of study. Within this unit plan, you will be asked to design lessons that pay attention to the use of technology, the development of student understanding of mathematics content, various standards documents, assessment of student understanding, and ways to differentiate instruction for diverse groups of learners. After submission of the unit plan, you will present your plan to your peers so that the entire class can begin to create a collection of teaching ideas for various content areas within secondary mathematics.

Pre-Requisites
This course is for students who have already taken or are concurrently taking EDUC 522.

Communication
You must have a GMU email address (and you must check it often as I will only communicate via this medium), you must be able to access Bb, and you must be able to use the library's collection of e-journals.

Evaluation
Final course grades will be assigned based upon weighted percentages as indicated by the Course Expectations.

A	93– 100	B+	87 – 89	C+	77 – 79	D+	67 – 69	F	59 and lower
A-	90 – 92	B	83 – 86	C	73 – 76	D	63 – 66		
		B-	80 – 82	C-	70 – 72	D-	60 – 62		

College Expectations and University honor Code
The Graduate School of Education (GSE) expects that all students abide by the following:

Students are expected to exhibit professional behavior and dispositions. See http://cehd.gmu.edu for a listing of these dispositions.

Students must follow the guidelines of the University Honor Code. See http://www.gmu.edu/catalog/apolicies/#TOC_H12 for the full honor code.

Students must agree to abide by the university policy for Responsible Use of Computing. See http://mail.gmu.edu and click on Responsible Use of Computing at the bottom of the screen.

Students with disabilities who seek accommodations in a course must be registered with the GMU Disability Resource Center (DRC) and inform the instructor, in writing, at the beginning of the semester. See www.gmu.edu/student/drc or call 703-993-2474 to access the DRC.

Tentative Schedule

The dates are subject to change dependent on the progress of the course. Due dates for major assignments will not be moved to an earlier date, only a later date if necessary.

Date	Topic	Special Assignment Due	Chapter(s) from Brahier
Jan. 19	The Nature of Mathematics and the Reform Movement in Mathematics Education	**Register for Field Work by Friday, January 22!!!**	Chapters 1 and 2
Jan. 26	Proficiency, Learning Theory, and Implications for Instruction	Initial Philosophy Statement	Chapters 3 And 7 (pp. 176-191)
Feb. 2	Establishing a Learning Environment Conducive to Student Activity		Chapter 7 (pp. 167-175, pp. 186-202)
Feb. 8	Curricular Resources and Use in Organizing a Course		Chapters 4 and 5
Feb. 16	Planning for Instruction		Chapter 6
Feb. 23	Planning for Instruction (con.)		
Mar. 2	Teaching of Algebra and Data Analysis: Special Considerations		Chapter 8 (pp. 205-216, pp. 2296-238)
Mar. 9	*No Class! Spring Break!*		
Mar. 16	Teaching of Geometry and Discrete Mathematics: Special Considerations	Instructional Analysis At least 7 hours of Field Work completed with accompanying assignments	Chapter 8 (pp. 216-226, pp. 238-254)
Mar. 23	Assessment		Chapters 9 and 10
Mar. 30	Technology Day		
Apr. 6	Educating All Students		Chapter 11
Apr. 13	Catch up Day – and Feedback on ideas for Unit Plan	At least 4 additional hours of Field Work completed with accompanying assignments	
Apr. 20	*No Class! NCTM Annual Meeting* Work on Unit Plan	Clinical Interview	
Apr. 27	Teacher of Mathematics in the School Community	Unit Plan Field Work Log	Chapter 12
May 4	*No Class! GMU reading day!*		
May 11	Unit Plan Presentations (*Final Exam Day*)	Final Philosophy Statement	