

George Mason University
College of Education and Human
Development
Secondary Education Program
EDCI 572: Teaching Mathematics in the
Secondary School



Promoting Learning & Development Across the Lifespan

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

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 (NCTM SPA Standards 7, 8; CEHD Core Value of Research-Based Practice)
- analyze instruction and instructional materials for their potential to promote student learning of secondary mathematics content in diverse settings (NCTM SPA Standards 1, 2, 3, 4, 5; CEHD Core Value of Research-Based Practice and Social Justice)
- design tasks, including those that rely on technology, that foster the development of deep understanding of secondary mathematics concepts (NCTM SPA Standard 6; NCTM SPA Indicators 7.4 and 8.8; CEHD Core Values of Research-Based Practice and Innovation)
- justify instructional decisions by reference to research findings, national standards, and learning theory (NCTM SPA Indicators 7.4; 8.1, 8.4, 8.6, and 8.7; CEHD Core Values of Collaboration and Research-Based Practice)
- demonstrate the dispositions appropriate to work as a secondary mathematics teacher (NCTM SPA Standard 7; CEHD Professional Dispositions)
- continue to develop your own knowledge of mathematics and problem solving ability as you explore mathematics from the perspective of a teacher and student (NCTM SPA Standard 1; NCTM SPA Indicators 10.4, 10.5, 11.4, 13.2, 14.6; CEHD Core Value of Innovation)
- compare and contrast different perspectives on mathematics teaching and learning - graduate students only (NCTM SPA Indicator 8.6; CEHD Core Value of Research-Based Practice)

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 how mathematics content can be organized into a series of lessons.

IV. Technology

In this part of the course you will apply the knowledge gained in the previous three sections of the course to implementing technology into lessons. Throughout this section, you will learn how technology may aid in the conceptual understanding of mathematics content.

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.

Donovan, M. S., & Bransford, J. D. (2005). *How students learn: Mathematics in the classroom*. Washington, D.C.: The National Academies Press. Graduate Students Only: We will look at excerpts from this text, which can be found at: http://www.nap.edu/catalog.php?record_id=11101

National Council of Teachers of Mathematics (2000). *Principles and standards for school mathematics*. Reston, VA: Author. Excerpts 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	Due Date	Percentage of Graduate Grade:
Participation and Preparation		15%
Procedural/Conceptual Assignment	Feb 26	20%
Activity Analysis & Problem Lead	Feb5; March 5, April 2; April 23-30 Present.	20%
Concept Approaches	Feb 12 – April 2	10%
Field Work Assignments	April 23	10%
Lesson Plans	April 30	25%

Every student registered for EDCI 372/572: Teaching Mathematics in the Secondary School, a course with a required performance-based assessment, is required to submit the assessments, Procedural/Conceptual Assignment and Lesson plans, to TaskStream. Evaluation of your performance-based assessment will also be provided using TaskStream. Failure to submit the assessment to TaskStream will result in a course grade reported as Incomplete(IN). Unless this grade is changed upon completion of the required TaskStream submission, the IN will convert to an F nine weeks into the following semester.

Participation and Preparation

The participation of each class member is vitally important. If you do not come prepared to discuss the readings, to share your work on a given assignment, and to participate in the activities of the day the entire class will suffer. You **must** commit to be coming to every class on time, being prepared for the evening's activities, and being ready to participate. You can expect that, in addition to work on the larger projects outlined below, there will be weekly readings and assignments that will fall into this category. If, however, there is an emergency and you cannot make it to class, you **must email me ahead of time** and submit all assignments electronically before the end of class. Missing class will result in a lower participation grade.

Procedural/Conceptual Assignment - required performance-based assessment

Individuals can understand mathematics in different ways. In order to be proficient in mathematics, one needs, among other things, both procedural knowledge and conceptual understanding of mathematics. Teachers need to design lessons that develop both. A first step is outlining what those terms mean with respect to the concept a teacher is about to teach. In this assignment, you will have the opportunity to analyze a mathematical concept and outline what it means to have procedural knowledge and conceptual understanding of that concept.

Collect an Activity - Problem Lead

This assignment will give you the opportunity to build your repertoire of teaching “tools” and give you a chance to test your skills in leading work and discussion on a mathematics problem. You will choose a mathematics topic covered in middle or high school mathematics curricula and search practitioner journals for ideas to teach that topic. You will then summarize and critique those ideas and create an activity using the information from the article. A lesson plan that centers on the activity is to be developed along with a second follow up lesson (See Lesson Plans Assignment).

Expectations for the assignment:

- Find an appropriate article which will be turned in
- Develop a rich task based on the article
- Create a lesson plan based on the activity you have developed.
- Presentation

You will present to your classmates:

- A short 5 min talk about the article
- Lead students through the task (25 minutes).
- Questions to include thought provoking, inquiry responses (above recall level)
- Goal is to have your classmates acknowledge the goals and objectives of the task and the expectations of the students.

Turn in at varying times:

- Article, objectives, and goals
- Motivation and Rich Task
- Article critique and Rich Task final draft
- Presentation reflection
- Lesson plan and all supporting materials (along with a second follow up lesson – to be turned in according to Lesson Plan Assignment.)

Reflection after the presentation:

- On the effectiveness of the approach suggested by the author.
- The rationale behind your approach with your peers and with the task.
- See rubric for additional guidance

Field Work Assignments

One of the most valuable pieces of pre-service teacher training is the opportunity to do field work. You will complete 15 hours of field work and keep a log of these hours for submission at the end of the semester. 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.

Lesson Plan Assignment and Presentation - required performance-based assessment

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 series of lesson plans. Within these lessons, you will design lessons that pay attention to the use of technology, the development of student understanding of mathematics content, various standards documents, and problem-based instruction. Along with submission of the lesson plans, you will present your ideas to your peers so that the entire class can begin to create a collection of teaching ideas for various content areas within secondary mathematics. One of the lessons will be developed throughout the semester as part of collecting and researching topics in practitioner journals. You must meet minimum standard on this, or you will be asked to resubmit.

SEE RUBRIC

Concept Approaches

You will be assigned a topic of which you are to investigate possible strategies to facilitate student learning. Strategies should be student-centered and investigative or explorative in nature. Pre-requisites should be determined for the topic that will be based on a specific grade level or subject.

You are to provide a one-page handout (may be front and back) that contains the pre-requisite skills, objectives to be covered, and a list of possible strategies with examples.

Present this to your classmates – no more than 15 minutes.

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 (<https://courses.gmu.edu/>), and you must be able to use the library's collection of e-journals. The best way to contact me is through email, rather than phone.

Evaluation

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

93-100%
90-92%
88-89%
80-87%
70-79%
Below 70%

Student Expectations (as described by the College of Education and Human Development)

- Students must adhere to the guidelines of the George Mason University Honor Code [See <http://oai.gmu.edu/honor-code/>].
- Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See <http://ods.gmu.edu/>].
- Students must follow the university policy, including that for Responsible Use of Computing [See <http://universitypolicy.gmu.edu>].
- Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check it regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
- Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
- Students are expected to exhibit professional behaviors and dispositions at all times.

Campus Resources

- The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See <http://caps.gmu.edu/>].
- The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See <http://writingcenter.gmu.edu/>].
- For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website [See <http://gse.gmu.edu/>].

College Expectations

The College expects students to exhibit the following Professional Dispositions:

Commitment to the profession

Promoting exemplary practice
 Excellence in teaching and learning
 Advancing the profession
 Engagement in partnerships

Commitment to honoring professional ethical standards

Fairness
 Honesty
 Integrity
 Trustworthiness
 Confidentiality
 Respect for colleagues and students

Commitment to key elements of professional practice

Belief that all individuals have the potential for growth and learning
 Persistence in helping individuals succeed
 High standards
 Safe and supportive learning environments
 Systematic planning
 Intrinsic motivation
 Reciprocal, active learning
 Continuous, integrated assessment
 Critical thinking
 Thoughtful, responsive listening
 Active, supportive interactions
 Technology-supported learning
 Research-based practice
 Respect for diverse talents, abilities, and perspectives
 Authentic and relevant learning

Commitment to being a member of a learning community

Professional dialogue
 Self-improvement
 Collective improvement
 Reflective practice
 Responsibility
 Flexibility
 Collaboration
 Continuous, lifelong learning

Commitment to democratic values and social justice

Understanding systemic issues that prevent full participation
 Awareness of practices that sustain unequal treatment or unequal voice
 Advocate for practices that promote equity and access
 Respects the opinion and dignity of others
 Sensitive to community and cultural norms
 Appreciates and integrates multiple perspectives

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. Additional, smaller assignments, will be made each week.

Class/ Date	Topic	Chapter(s) from Brahier Covered	Major Assignment Due
Class 1 Jan 22	The Nature of Mathematics and the Reform Movement in Mathematics Education	Chapters 1 and 2	
Class 2 Jan 29	Mathematical Proficiency	Chapters 1 and 2 Analyzing Mathematical Instructional Tasks	
Class 3 Feb 5	Learning Theory and Implications for Instruction <i>Concept: Inequalities – Math 6</i>	Chapter 3 (pp. 48-50; 57-66) Chapter 5: Mathematical Understanding:	Activity - Problem Lead BRING TO CLASS: Article, objectives, and goals (“ <i>interesting problem – UG</i> ”)
Class 4 Feb 12	Learning Theory and Implications for Instruction <i>Concept: Integers – Math 7</i>	Chapter 3 (rest of chapter) Chapter 7 (pp. 176-180)	
Class 5 Feb 19	Establishing a Learning Environment Conducive to Student Engagement <i>Concept: Solving Equations – Math 8</i>	Chapter 7 (rest of Chapter) Never Say Anything	Procedural/Conceptual Assignment Due
Class 6 Feb 26	Instructional Design and Learning Objectives <i>Concept: Solving Inequalities – Alg 1</i>	Chapters 4 and 5	Activity - Problem Lead BRING TO CLASS: Motivation and rich task
Class 7 March 5	Considerations for Teaching Algebra <i>Concept: Probability $P(A)$ or $P(B)$; $P(A)$</i>	Chapter 8 (pp. 205-216)	
March 12	<i>No Class</i>		
Class 8 March 19	Considerations for Teaching Geometry <i>Concept: Factoring Polynomials</i>	Chapter 8 (pp. 216-226)	Activity -Problem Lead BRING TO CLASS: lesson plan draft and rich task
Class 9 March 26	Planning for Instruction (Lesson Planning) <i>Concept: Triangle similarity</i>	Chapter 6 (pp. 142-166)	Act - Problem Lead project (Article, critique, rich task final draft) Due
Class 10 April 2	Planning for Instruction (Lesson Planning) <i>Concept: Act/Prob lead Presentations (4)</i>	Chapter 6 (pp. 142-166)	At least 7 hours of Field Work completed with accompanying assignments
Class 11 April 9	Text book analysis <i>Act/Prob lead Presentations (4)</i>		Act – Problem Reflection
Class 12 April 16	Textbook analysis & Technology	Chapter 7 (pp. 180-182) Doerr & Zangor Calculators	Act – Problem Reflection
Class 13 April 23	Technology		All Field Work completed with accompanying assignments and log sheet
Class 14 April 30	Technology		2 Lesson Plans Assignment
Class 15 May 14th	Lesson Plan Presentations <i>(Final Exam Day 7:30 – 10:15 p.m.)</i>		Presentations