

George Mason University
EDCI 672: Advanced Methods of Teaching Mathematics
in the Secondary School

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**Class Meets:** Wednesdays 7:20-10:00 p.m.  
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Mathematics classrooms are more likely to be places in which mathematical proficiency develops when they are communities of learners and not collections of isolated individuals.
(Kilpatrick, Swafford, and Findell, 2001)

All students should have access to an excellent and equitable mathematics program that provides solid support for their learning and is responsive to their prior knowledge, intellectual strengths, and personal interests.

Assessment should not merely be done to students; rather, it should also be done for students.

Teachers should use technology to enhance their students' learning opportunities by selecting or creating mathematics tasks that take advantage of what technology can do efficiently and well – graphing, visualizing, and computing.
(NCTM, 2000)

Purpose of the Course

In *Teaching Mathematics in the Secondary School* course you thought about what it means to *understand* mathematics, were introduced to learning theories, became familiar with standards documents, and learned about characteristics of mathematics instruction that fosters deep understanding of and proficiency in working with mathematics. As a culminating event, you had the opportunity to apply all that you had learned to the design of a unit plan.

In this course, *Advanced Methods of Teaching Mathematics in the Secondary School*, you will have the opportunity to learn more about four aspects of mathematics teaching: managing classroom discourse, differentiation, use of technology, and assessment. As indicated by the quotes listed above, you will explore these aspects of mathematics teaching while keeping a focus on student thinking and learning. Regardless of whether a teacher is engaging with the class, differentiating instruction, incorporating technology or conducting an assessment, the teacher must focus on the development of student thinking about mathematics. You will learn how to do this in this class. This will help you as you embark on internship and your first teaching position! ☺

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.

Pre-requisites:

EDCI 422/522 and EDCI 372/572

Guiding Questions

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

1. How do teachers engage students in meaningful discussions of mathematics content?
2. When students are engaged in whole-class discussion of mathematics content, what role the teacher play in that discussion?
3. How do teachers orchestrate whole-class mathematics explorations?
4. How can instruction be modified to meet the needs of *all* students, without lowering expectations?
5. How can technology be used effectively in promoting strong understandings of mathematics content?
6. How can assessment be used to gain insight into student thinking, not only of procedures, but also of concepts and mathematics processes?

Objectives

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

- demonstrate an ability to critique classroom instruction and the role of the teacher in implementing that instruction
- demonstrate an ability to plan and enact a mathematics lesson that fosters deep understanding of mathematics content for *all* students
- plan a mathematics lesson that includes elements of differentiation, assessment, and technology while adhering to state and national standards
- critique instructional materials that rely on technology to engage students with mathematical content
- develop assessments that give a teacher insight into student thinking about mathematics content
- critique research in an area related to mathematics and discuss implications for the mathematics classroom

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. Managing Classroom Discourse

In this part of the course you will critique and learn more about teacher decisions in managing whole-class mathematical discussions. You will learn more about questioning and will consider appropriate times to ask particular questions. Then, later in the course, you will have the opportunity to practice managing a conversation when you teach a full lesson to the class.

II. Technology

In this part of the course you will learn more about technological tools and their use in the classroom. In particular, you will learn how to incorporate technology into the classroom so that it facilitates, rather than impedes, the development of student understanding.

III. Assessment

In this final section of the course you will consider the role of assessment in a mathematics classroom and will learn more about ways that teachers might gain insight into student thinking about mathematics.

IV. Differentiation

In this final section of the course, you will become familiar with strategies for differentiating mathematics instruction. By focusing on student thinking, you will learn how to meet student needs while holding them to high standards.

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.

Dodge, J. (2005). *Differentiation in Action*. New York, NY: Scholastic.

NCTM. (2000). *Mathematics Assessment: A Practical Handbook*. Reston, VA: NCTM. (choose grades 6-8 or 9-12)

Small, M. & Lin, A. (2010). *More good questions: Great ways to differentiate secondary mathematics instruction*. New York, New York: Teachers College Press.

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% |
| Differentiation Strategy Presentation and Paper | 10% |
| Critique Technology Lesson | 10% |
| Assessment Assignment | 15% |
| Micro-Teaching | 20% |
| Field Work Assignments | 10% |
| Lesson Plan Assignment | 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 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.

Differentiation Strategy Presentation and Paper

For this assignment, you will present (and write about) a strategy for differentiating mathematics instruction. In your written and vocal presentation, you will critique its use in mathematics classrooms and apply it (in a potentially modified form) to a mathematics lesson.

Critique Technology Lesson

For this assignment, you will evaluate the design of teacher resource material(s) aimed to help students learn concepts using the graphing calculator. The evaluation will include an analysis of strategies used to design technology-enhanced mathematical investigations for different ability levels, as well as the development of extension questions aimed to remediate or extend learning.

Assessment Assignment

In this assessment, you will apply what you learned about assessment to your unit plan. Building on what you learned, you will further develop your assessment plan for the unit and, in so doing, develop two assessment instruments and corresponding grading rubrics. One assessment will be a test assessing the goals and objectives in your unit plan. Another assessment will be an alternative form of assessment used to assess the goals and objectives of the unit.

Micro-Teaching Assignment

In this assignment, you will apply all that you learned about planning and orchestrating classroom discourse to the development, implementation, and reflection upon a lesson surrounding a mathematics concept covered in secondary mathematics classrooms. The lesson topic will be assigned by the instructor. The implementation of the lesson will be video-taped so as to facilitate the reflection process. This process is valuable to you as you teach and reflect on your teaching of a lesson.

Field Work Assignments

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 and/or teaching assignments during your field work. These assignments provide you with opportunities to reflect upon the practice of teaching after having watched and/or participated in instances of teaching in real world settings.

Lesson Plan Assignment

For this assignment, you will prepare a well-developed lesson plan that spans a two to three day period. The mathematical topic addressed in this lesson should involve a topic assigned by the instructor and the stated objectives, referenced standards, procedures, and assessment must be consistent and appropriate for this topic. The lesson must include differentiated instruction for students of varying levels and the appropriate integration of technology. Assessment of student learning must accompany the lesson plan. In completing this assignment, you apply all of the knowledge you gained over the course of the semester to instructional design.

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.

Evaluation

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

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|----|---------|----|---------|----|---------|----|---------|---|--------------|
| 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 | | |

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://academicintegrity.gmu.edu/honorcode/>].
- 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 for Responsible Use of Computing [See <http://universitypolicy.gmu.edu/1301gen.html>].
- 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/>].

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 | Text | Major Assignment Due |
|---------|---|--|---|
| Jan. 26 | Managing Classroom Discourse | Additional Readings | |
| Feb. 2 | Managing Classroom Discourse | Additional Readings | |
| Feb. 9 | Technology: Graphing Calculator and CBR | Considerations of Textbook Use of Technology | |
| Feb. 16 | Technology: Applets and GSP | | |
| Feb. 23 | Assessment | NCTM Assessment Book | |
| Mar. 2 | Assessment | NCTM Assessment Book | Technology Critique |
| Mar. 9 | Assessment | NCTM Assessment Book | |
| Mar. 16 | <i>No Class: Spring Break</i> | | |
| Mar. 23 | Micro-Teaching | | At least 7 hours of Field Work completed with accompanying assignments |
| Mar. 30 | Micro-Teaching | | Assessment Assignment |
| Apr. 6 | Micro-Teaching | | |
| Apr. 13 | Differentiation | Dodge | |
| Apr. 20 | Differentiation | Dodge Small and Lin | Differentiation Strategy At least 4 more hours of Field Work completed with accompanying assignments |
| Apr. 27 | Differentiation | Small and Lin | |
| May 4 | Special Considerations in Algebra Instruction | Brahier | Final Fieldwork Paperwork/Assignment |
| May 11 | Lesson Plan Presentations (<i>Final Exam Day: 7:30-10:15 p.m.</i>) | | Lesson Plan Assignment |