# EDCI 672: Advanced Methods of Teaching Mathematics in the Secondary School

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

**Instructor:** Toni M. Smith, Ph.D.
**E-mail:** tsmith10@gmu.edu
**Phone:** 703-993-5081
**Office:** Commerce II, room 113A
**Office Hours:** Wednesdays 2:30-4:00 p.m.
**Class Meets:** Wednesdays 4:30-7:10 p.m.

~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~

*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 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. Differentiation**
In this part 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.

**III. 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.

**IV. 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.

**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 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. 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.

*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 materials 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 quiz assessing the goals and objectives from one of the lessons in your unit plan. Another assessment will be an alternative form of assessment used to assess the goals and objectives of the unit. **[Note: Undergraduate students are not responsible for the alternative form of assessment.]**

*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.

*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 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*
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.

**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.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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.

For other University policies see http://universitypolicy.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 | Major Assignment Due | Text |
|---|---|---|---|
| **1**<br>**Sep. 1** | Managing Classroom Discourse | | |
| **2**<br>**Sep. 8** | Managing Classroom Discourse | | |
| **3**<br>**Sep. 15** | Differentiation | | Small and Lin |
| **4**<br>**Sep. 22** | Differentiation | | Small and Lin/Dodge |
| **5**<br>**Sep. 29** | Differentiation | Differentiation Strategy Presentation and Paper | Dodge |
| **6**<br>**Oct. 6** | Technology | | |
| **7**<br>**Oct. 13** | Technology | | |
| **8**<br>**Oct. 20** | Micro-Teaching | At least 7 hours of Field Work completed with accompanying assignments | |
| **9**<br>**Oct. 27** | Micro-Teaching and Assessment | Technology Critique | |
| **10**<br>**Nov. 3** | Assessment | | NCTM Assessment Book |
| **11**<br>**Nov. 10** | Assessment | | NCTM Assessment Book |
| **12**<br>**Nov. 17** | Assessment<br>(May start Algebra here) | Assessment Assignment | NCTM Assessment Book<br>(Brahier) |
| **Nov. 24** | *No Class* | | |
| **13**<br>**Dec. 1** | Algebra and Number, Special Considerations | At least 4 more hours of Field Work completed with accompanying assignments | Brahier |
| **14**<br>**Dec. 8** | Geometry and Statistics | Lesson Plan Assignment | Brahier |
| **15**<br>**Dec. 15** | Lesson Plan Presentations<br>(*Final Exam Day 4:30-7:15 pm.*) | | |