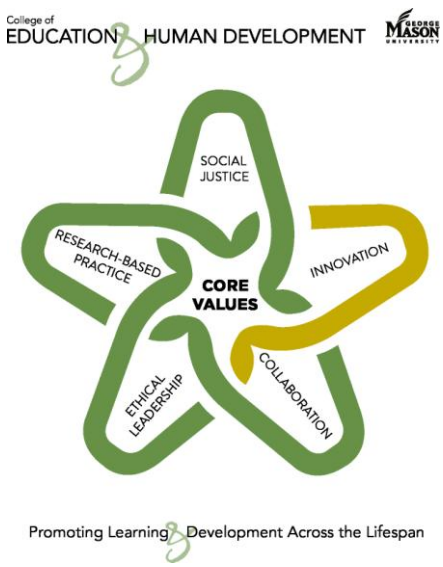
George Mason University
College of Education and Human Development
Secondary Education Program
EDCI 472: Advanced Methods of Teaching Mathematics in the Secondary School



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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 and EDCI 372

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

- demonstrate an ability to critique classroom discourse and the role of the teacher in facilitating that discourse through reference to findings from research on student learning (NCTM SPA Standard 3; NCTM SPA Indicators 7.3, 7.4, 8.6; CEHD Core Values of Collaboration and Research-Based Practice)
- demonstrate an ability to plan and a mathematics lesson that fosters deep understanding of mathematics content for *all* students (NCTM SPA Indicators 7.1, 7.2, 7.3, 7.4, 8.1, 8.4, 8.6, 8.7 and 8.8; CEHD Cores Values of Innovation, Research-Based Practice and Social Justice)
- plan a mathematics lesson that includes elements of differentiation, assessment, and technology, is problem-based, requires students to engaging in sense making, and engages students in mathematical communication while adhering to state and national standards (NCTM SPA Standards 1, 2, 3, 6, 7, and 8; CEHD Core Values of Innovation, Research-Based Practice, and Social Justice)
- critique and modify instructional materials that rely on technology to engage students with mathematical content through reference to findings from research on student learning (NCTM SPA Standard 6; NCTM SPA Indicators 7.2, 7.3, 7.4, 7.6, 8.6, 8.7, 8.9; CEHD Core Value of Innovation)
- develop assessments that give a teacher insight into student thinking about mathematics content (NCTM SPA Indicators 7.5 and 8.3)

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. (2001). *Assessment in middle and high school mathematics: A teacher's guide*. New York: Eye on Education.

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

Additional readings as assigned. Graduate students will have more readings than undergraduate students.

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	15%
Critique Technology Lesson	10%
Assessment Assignment	15%
Micro-Teaching	15%
Field Work Assignment	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. 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 one assessment instruments and corresponding grading rubric. This assessment will be a test assessing the goals and objectives from your unit plan. **[Note: Graduate students are also not responsible for an 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-recorded 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. During this time, you will remain with one teacher and slowly begin to interact with students. By the end of the experience you will have taught a whole, or part of a whole, lesson. You will submit the lesson and reflect upon it effectiveness. This assignment provides you with an excellent opportunity to work with real students as you prepare to become a teacher.

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 taught to secondary mathematics students 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 will 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.

A	93-100%
A-	90-92%
B+	88-89%
B	80-87%
C	70-79%
F	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://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, 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.

Date	Topic	Text	Major Assignment Due
Aug. 31	Managing Classroom Discourse		
Sep. 7	Managing Classroom Discourse		
Sep. 14	Technology – Calculator		
Sep. 21	Technology – Applets and CBL		
Sep. 28	Technology – GSP Assessment – Tests and Quizzes	Assessment Book Chapter 1	
Oct. 5	Assessment – Alternative	Assessment Book Chapters 2 and 3	**Technology Critique**
Oct. 12	Assessment – Determining Final Grades Differentiation – Use of Tasks	Assessment Book Chapters 4 and 5	
Oct. 19	Differentiation – Strategies	Differentiation Book Assigned Chapter	**Differentiation Assignment**
Oct. 26	Micro-Teach (2)		
Nov. 2	Micro-Teach (3)		
Nov. 9	Micro-Teach (3)		**Assessment Assignment Due**
Nov. 16	Micro-Teach (3)		
Nov. 23	*No Class - Thanksgiving Break*		
Nov. 30	Micro-Teach (2)		
Dec. 7	Algebra Considerations Share Field Work Experiences		**Field Work Assignment Due**
Dec. 14	Final Exam Day: Lesson Plan Presentations (*Final Exam time 12/14 from 4:30-7:15)*		**Lesson Plan Assignment**

Rubric for Performance Based Assessment: **Complete Lesson Plan**

Levels: *Criteria:*	**Distinguished (met)** **3**	**Proficient (met)** **2**	**Developing (not met)** **1**	**Unacceptable** **0**	**Score**
Standard 7: **Objectives**	Objectives provide a clear sense of what students will know and be able to do as a result of the lesson. All objectives are clearly and closely related to standards.	Objectives provide some sense of what students will know and be able to do as a result of the lesson. Most of the objectives are related to standards.	Objectives do not provide a clear sense of what students will know and be able to do as a result of the lesson. Some of the objectives are related to standards.	Objectives are missing, unclear, or are unrelated to standards.	
Standard 7: **Standards and Alignment**	Key standards are referenced. Lesson is guided by standards. Standards, objectives, procedures and assessment in lesson plan are completely consistent	Some relevant standards are referenced. Lesson is influenced by standards. Too many or too few standards are included. (Lesson may name many standards instead of focusing on important, key standards; alternately, lesson may not name relevant key standards). Standards, objectives, procedures and assessment in lesson plan are consistent	Standards are alluded to in lesson, and lesson is related to standards. Standards, objectives, procedures and assessment in lesson plan are somewhat consistent	No standards are mentioned in lesson. Lesson is not related to standards. Standards, objectives, procedures and assessment in lesson plan are inconsistent	
Standard 5, 6 & 7: **Resources & Teacher-Created Supporting Materials**	Resources needed for this lesson are included in plan, and notes about assembling materials, contacting outside guests, or locating additional resources are included, as well. Supporting materials and student handouts are clear, complete, and appealing to students. Materials enhance lesson significantly.	Resources needed for this lesson are included in plan. Supporting materials and student handouts are clear and complete. Materials enhance lesson.	Some resources needed for this lesson are not included in plan. Supporting materials and student handouts are messy, incomplete, and/or unappealing to students. Materials do not enhance lesson.	Many resources needed for lesson are not included in plan. No supporting materials are included.	
Standard 4 & 5: **Instructional Activities**	Activities include introduction, strategies/procedures and closure, and provide a logical path to meeting objectives & standards. No activities are extraneous or irrelevant. Plan is highly engaging and motivating.	Activities include introduction, strategies/procedures and closure, and provide a logical path to meeting objectives & standards. A few activities may be extraneous or irrelevant. Plan is engaging and motivating.	Activities include minimal introduction, strategies/ procedures and/or closure, and relate peripherally to objectives and standards. Some activities are extraneous or irrelevant. Plan is minimally engaging and motivating.	Activities do not include introduction, strategies/ procedures and closure, and are unrelated to objectives. Many activities are extraneous and irrelevant. Plan is not engaging and motivating.	
Standard 8: **Assessment**	Assessment is directly related to objectives and standards. Assessment provides opportunities for students with varying learning styles and strengths to excel.	Assessment is related to objectives and standards. Assessment is less accessible for students with certain learning styles and strengths.	Assessment is somewhat related to objectives and standards. Assessment is not appropriate for all students' learning styles and strengths.	Assessment is unrelated to objectives and standards.	
Standard 4 & 6 **Technology Integration**	Technology is appropriately integrated, affordances and constraints of technology support learning outcomes.	Some technology is used; it has limited appropriateness for some learners; preview/preplanning is evident in limited manner.	Technology is not appropriately used; technology does not match goals of the lesson; preview/preplanning is not evident.	Technology is not evident in the lesson.	

Standard 3: **Differentiated Instruction**	Lesson clearly offers appropriate, creative, and well-integrated challenges for students of all levels, including gifted students and students with special needs. Includes multiple learning modes and accessible to students with different learning strengths.	Lesson includes some differentiated instruction for gifted students and students with special needs. Activities are accessible to students using multiple learning modes.	Lesson plan includes minimal differentiated instruction, limited to either gifted students OR students with special needs. Not accessible to different learning modes and strengths.	No differentiation of instruction is mentioned. No attempt is made to individualize activities for learning styles or strengths.	
***Standard* 2: Developmentally Appropriate**	All objectives and activities are appropriate for the intended grade level.	Most objectives and activities are appropriate for the intended grade level.	Some, but not all, objectives and activities are appropriate for the intended grade level.	Objectives and activities are inappropriate for the intended grade level.	
Standards 9 & 10: **Justification for Instructional Decisions**	Instructional decisions are aligned with research-based recommendations. Narrative includes *meaningful* references to the assessment and differentiation texts, as well as NCTM; Doerr and Zangor; and Brahier for justification of instructional decisions. Narrative provides evidence of reflection on instruction designed to meet all students needs', assessment to evaluate students' conceptual understanding, procedural fluency, and problem solving skills, and use of technology to support student thinking.	Instructional decisions are aligned with research-based recommendations. Narrative includes a few references to outside sources. Narrative provides evidence of reflection on instruction designed to meet all students needs', assessment to evaluate students' conceptual understanding, procedural fluency, and problem solving skills, and use of technology to support student thinking.	Instructional decisions are not aligned with research-based recommendations and/or narrative is weak with few references and/or little reflection on instruction designed to meet all students' needs, assessment to evaluate students' conceptual understanding, procedural fluency, and problem solving skills, and use of technology to support student thinking.	Instructional decisions are not aligned with research-based recommendations. Narrative and reflection are weak and/or nonexistent.	
Total					

In order to pass this assignment, teacher candidates must earn a minimum of "1" on each category and mean of "2" overall.