Course Title: MATH 306, Teaching Mathematics in the Secondary School

Frequency of Offering: Yearly, Fall Semester

Prerequisites: MATH 213, MATH 327, MATH 304

Grading: Secondary major and minor Grade Only basis; Graduate credit is available for inservice teachers.

Course Applicable: MTHT secondary major, required, graduate credit is available for inservice teachers.

Catalog Description: This course is designed to inform the prospective secondary mathematics teacher about current trends and issues in the teaching of mathematics. It also focuses on instructional techniques and development of appropriate materials for the classroom. The course includes a 30 hour field experience component at the secondary level. Prerequisites MATH 213, MATH 327, and MATH 304. Offered fall semester.

Number of Credits: 3 Semester Hours

Optional Textbooks:
1) Principles and Standards for School Mathematics (National Council of Teachers of Mathematics, 2000)
2) Every Minute Counts (Johnson, 1982)
3) Motivation Counts: Teaching Techniques that Work (Johnson, 1994)
4) Empowering the Beginning High School Teacher (Chappell, Choppin, & Salls, 2004)
5) Windows on Teaching Mathematics: Cases of Middle School and Secondary Classrooms (Merseth, 2003)

Additional Readings:
In addition to the readings from the required texts, students will be assigned additional readings during the course of the semester.

Student Learning Outcomes: The student will
• Describe national and state math standards and the math reform movement, and explain how they influence today's math curriculum;
• List and use a variety of resources for teachers as professionals- organizations, web sites, publications, etc.
• Make and explain personal decisions regarding the issues of class policies, classroom management, cooperative learning, and classroom diversity;
• Prepare and present lesson and unit plans at different levels incorporating problem solving, reading, writing, and speaking, and the use of manipulatives and technology;
• Prepare, explain, and use both traditional and alternative assessments;
• Demonstrate the use of a variety of teaching and motivational strategies;
• Observe and take part in hands-on teaching experiences as they arise either in class or as field experience in a local school.
• Reflect on what they have learned from the course and how they hope to apply it in their future classroom.

Course Outline:

I. What Does It Mean to “Do,” “Teach,” and “Learn” Mathematics?
   a. Mathematics as a Process
   b. Principles of Mathematics Education
   c. Learning Theories and Psychology in Mathematics Education

II. The Mathematics Curriculum
   a. Curricular Models
   b. Implementing a Course of Study

III. Teaching Mathematics
   a. Planning for Instruction
   b. Teaching Tools and Strategies
   c. Teaching Number Sense and Algebra
   d. Teaching Geometry, Statistics/Probability, and Discrete Mathematics

IV. Assessment in Mathematics
   a. The Role of Assessment
   b. Principles of Assessment Practices

V. Meeting Individual Student and Teacher Needs
   a. Meeting the Needs of All Students
   b. The Teacher of Mathematics in the School Community

Course objectives:
This course is designed to help pre-service mathematics teachers develop competencies outlined in the Minnesota Standards of Effective Practice for Beginning Teachers (see http://www.revisor.leg.state.mn.us/arule/8710/4600.html). In particular, this course will address the following:

I. A teacher of mathematics must demonstrate an understanding of the teaching of mathematics that integrates understanding of mathematics with the understanding of pedagogy, students, learning, classroom management, and professional development. The teacher of mathematics to preadolescent and adolescent students shall:

1. understand and apply educational principles relevant to the physical, social, emotional, moral, and cognitive development of preadolescents and adolescents;
2. understand and apply the research base for and the best practices of middle level and high school education;
3. develop curriculum goals and purposes based on the central concepts of mathematics and know how to apply instructional strategies and materials for achieving student understanding of this discipline;
4. understand the role and alignment of district, school, and department mission and goals in program planning;
5. understand the need for and how to connect students' schooling experiences with everyday life, the workplace, and further educational opportunities;
6. know how to involve representatives of business, industry, and community organizations as active partners in creating educational opportunities;
7. understand the role and purpose of cocurricular and extracurricular activities in the teaching and learning process;
8. understand the impact of reading ability on student achievement in mathematics, recognize the varying reading comprehension and fluency levels represented by students, and possess the strategies to assist students to read mathematical content materials more effectively; and
9. apply the standards of effective practice in teaching students through a variety of early and ongoing clinical experiences with middle level and high school students within a range of educational programming models.

**Additional Requirements:**
Students will be required to complete a 30-hour field experience in which they observe and participate in 9-12 mathematics classrooms with qualified teachers. This experience may include observing, tutoring, mini-teaching, and planning lessons and/or students' tasks.
The Core Belief Statement:
We exist to prepare professionals to continuously improve Birth-to-Grade 12 (B-12) student learning in twenty-first century schools. Through a continuum of clinical experiences and relevant and appropriate instructional methods, WSU graduates are prepared in a community of learners with developmentally appropriate content and pedagogical expertise, and professional dispositions to improve students’ learning by: (1) actively engaging in a culture of reflective practice and continuous improvement (2) demonstrating awareness of and an ability to respond to broader psychosocial and global contexts; and (3) advocating for students and their learning through leadership, collaboration, innovation, flexibility, and critical thinking.

Course Description: The major focus of this course is to provide students with
(1) insight into the current trends and issues in secondary mathematics education.
(2) expertise in instructional techniques and the use of supporting resources
(3) experience developing standards-based lesson plans for an engaging classroom.

Proposed Course Outline and Timeline:

Week #1 - Classroom Routine
Reflecting on students’ own personal high school mathematics experience and how motivation matters. Discussion over how to motivate students.
- Reading and discussion over Every Minute Counts (Johnson, 1982), Chapter 1: Don’t do it the way I did (pp. 1-6).
- Reading and discussion over Chapter 1, “Motivating through the classroom routine” of Motivation Counts (Johnson, 1994) pp. 1-18.

Week #2 and Week #3 Questioning Techniques
Discuss Bloom’s Taxonomy and the impact of it on writing assessment questions and promoting effective classroom discourse.
- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section II: Curriculum and Instruction - Planning, Questioning and Discourse, Tools pp. 13-27.
- Examining “Case 1: Lost in Translation” in Merseth (2003), which discussed the use of literal translations in mathematics classes.
- Reading and discussion over Every Minute Counts (Johnson, 1982), Chapter 2: The art of questioning (pp. 7-16).
- Reading and discussion over Chapter 2, “Motivating through good questioning techniques” of Motivation Counts (Johnson, 1994) pp. 19-40.
Week #4: Problem Solving in Mathematics
Discuss the learning theory of Piaget (radical constructivism).
- Reading and discussion of NCTM Principles and Standards for School Mathematics (2000):
  Problem solving for grades 7-12 pp. 334-341.
- Examining “Case 2: The Marble Line” in Merseth (2003), which discussed the use of an experiment to strengthen students’ understanding of linear functions.

Week #5-Week #6 Classroom Assessments
Discuss the learning theory of Bruner.
- Examining “Case 7: Ships in the Fog” in Merseth (2003), which discussed the use of a different approach to teaching a pre-calculus lesson.
- Reading and discussion over NCTM Principles and Standards for School Mathematics (2000):
  Measurement for grades 7-12 pp. 320-323.
- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section III: Classroom Assessment: pp. 27-34.
- Reading and discussion over Chapter 3, “Motivating through homework and tests” of Motivation Counts (Johnson, 1994) pp. 41-54.
- Reading and discussion over Every Minute Counts (Johnson, 1982), Chapter 3: The new class routine (pp. 17-42).
- Examining “Case 5: Seeing is Believing” in Merseth (2003), which discussed the use of a graphing calculator in an algebra lesson.

Week #7: Evaluation
- Examining “Case 6: What is Pi Anyway?” in Merseth (2003), which discussed the students understanding of Pi.

Week #8: Classroom Organization
Discuss the learning theory of Vygotsky (Social Constructivism).
- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section IV: Classroom Management and Organization pp. 35-42.
- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section VI: School and Community: pp. 51-56.

Week #9-Week #10: Changing the face of Algebra
Discuss the learning theory of Realistic Mathematics Education (Freudenthal).
- Reading and discussion of NCTM Principals and Standards for School Mathematics (2000):
Discussion of using Algebra Tiles in the classroom and technology.

Examining “Case 8: Pushing the Limit” in Merseth (2003), which discussed the idea of the limit.

Reading and discussion over Every Minute Counts (Johnson, 1982), Chapter 4: More ideas for making it work (pp. 43-66).

Examining “Case 9: The More Things Change” in Merseth (2003), which discussed exponential functions.

Week #11-Week #12: The Space of Geometry
Discuss the learning theory of Van Hiele.

- Reading and discussion of NCTM Principles and Standards for School Mathematics (2000): Geometry Standard for Grades 7-12 (pp.308-319) and Reasoning and Proof Standard for Grades 7-12 (pp. 342-347).
- Examining “Case 3: A Picture is Worth a Thousand Words” in Merseth (2003), which discussed proportional reasoning in Geometry.
- Discussion of the benefits of the abstract in mathematics. Reading of Chapter 4, “Motivating by helping students understand the abstract” of Motivation Counts (Johnson, 1994) pp. 55-66.
- Examining “Case 4: Slippery Cylinders” in Merseth (2003), which discussed volume and 3-D solids.

Week #13: The Statistics and Probability Revolution

- Examining “Case 10: Chances Are” in Merseth (2003), which discussed the idea of probability.

Week #14-Week #15: Creating Partnerships for Tomorrow

- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section V: Equity, pp. 43-50.
- Reading and discussion of Empowering the Beginning Teacher of Mathematics HIGH SCHOOL (Chappell, Choppin, & Salls, 2004). Section I: Professional Growth, pp. 51-56.

Method of Instruction: Instruction may model a variety of methods and strategies including lecture, discovery, group activities, writing, reports, student explanation and/or presentations, and/or student guided discussion. The course emphasizes discovery learning/exploration.

General Expectations: All students are expected to attend class on a regular basis, to be active participants in class and to be readers of the texts and
related writings. Students will be expected to demonstrate their knowledge of the subject matter through writing, problem solving, presentations, peer teaching, projects and examinations.

Methods of Assessment: Assessments will vary in style, including teacher evaluation of written exams, written homework problems, written reaction papers, in class group and individual problems, computer investigations and/or projects.

Grading Scale: A (100%-90%), B (89%-80%), C (79%-70%), D (69%-60%), F (59%-0%).

References:


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<th>H. A teacher of mathematics must:</th>
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<td>(3) understand the overall framework of mathematics including the:</td>
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<td>I. A teacher of mathematics must demonstrate an understanding of the teaching of mathematics that integrates understanding of mathematics with the understanding of pedagogy, students, learning, classroom management, and professional development. The teacher of mathematics to preadolescent and adolescent students shall:</td>
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<td>(1) understand and apply educational principles relevant to the physical, social, emotional, moral, and cognitive development of preadolescents and adolescents;</td>
<td>MATH 306 From the MATH 306 Syllabus:</td>
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<td>Learning theories are discussed on Week #2, Week #4, Week #5, Week #8, Week #9, and Week #11. These theories include a discussion of Bruner, Bloom’s Taxonomy, Piaget, Realistic Mathematics Education (Freudenthal), Vygotsky, and Van Hiele.</td>
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<td>Another assessment occurs with the mid-</td>
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<td>(2) understand and apply the research base for and the best practices of middle level and high school education;</td>
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<th>(3) develop curriculum goals and purposes based on the central concepts of mathematics and know how to apply instructional strategies and materials for achieving student understanding of this</th>
<th>MATH 306</th>
<th>From the <strong>MATH 306 Syllabus</strong>:</th>
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<td>One of the primary experiences in this course is creating a unit plan based on NCTM standards, related research and</td>
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peer review. In addition, students need to complete a mini-teaching experience. The purpose of the Mini-Teaching experience is to give students an opportunity to experience first hand how high school mathematics students think about mathematics and problems solving.

This experience will involve creating and revising a unit plan, interviewing a high school student on tasks related to the unit plan, observing high school students in a classroom setting, and reflecting on the experience.

From the mini-teaching experiment handout, students are to create a lesson plan involving two to three problems to be solved by a high school student. Students then reflect on the experiences and report this to the MATH 306 class. In addition, students are critiqued by peers in terms of the effectiveness of their lessons.

Another assessment occurs with the midterm and final examination.

From the MATH 306 Syllabus:

**Readings and Discussions** using *Empowering the Beginning Teacher of Mathematics HIGH SCHOOL*, Edited by Michael F. Chappell, Jeffrey Choppin, and Jenny Salls, NCTM, 2004

- Section I: Professional Growth- Week #14
- Section II: Curriculum and Instruction - Planning, Questioning and Discourse, Tools- Week #2
- Section III: Classroom Assessment- Week #5
- Section IV: Classroom Management and Organization- Week #4
- Section V: Equity- Week #14
- Section VI: School and Community- Week #8

Moreover, this standard is most readily observable in the student teaching.
| (5) understand the need for and how to connect students’ schooling experiences with everyday life, the workplace, and further educational opportunities; | **MATH 306** | **From the MATH 306 Syllabus:**

**Readings and Discussions** using *Empowering the Beginning Teacher of Mathematics HIGH SCHOOL*. Edited by Michael F. Chappell, Jeffrey Choppin, and Jenny Salls, NCTM, 2004

- Section I: Professional Growth- Week #14
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- Section IV: Classroom Management and Organization- Week #4
- Section V: Equity- Week #14
- Section VI: School and Community- Week #8

**Furthermore, this standard is shared with EDUC 308 and EDUC 459.**

- Week #6 |

| (6) know how to involve representatives of business, industry, and community organizations as active partners in creating educational opportunities; | **MATH 306** | **From the MATH 306 Syllabus:**

**Readings and Discussions** using *Empowering the Beginning Teacher of Mathematics HIGH SCHOOL*. Edited by Michael F. Chappell, Jeffrey Choppin, and Jenny Salls, NCTM, 2004

- Section I: Professional Growth- Week #14
- Section II: Curriculum and Instruction - Planning, Questioning and Discourse, Tools- Week #2
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- Section IV: Classroom Management and Organization- Week #4
- Section V: Equity- Week #14 |
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<th>(8) understand the impact of reading ability on student achievement in mathematics, recognize the varying reading comprehension and fluency levels represented by students, and possess the strategies to assist students to read mathematical content materials more effectively; and</th>
<th>MATH 306</th>
<th>Opportunities to address this standard exist on an individual and whole class basis while discussing problem solving, during the mini-teaching sessions, and during the review of the lesson plan for the mini-teaching experience. See the attached syllabus for MATH 306.</th>
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<td>(9) apply the standards of effective practice in teaching students through a variety of early and ongoing clinical experiences with middle level and high school students within a range of educational programming models.</td>
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<td>From the MATH 306 Syllabus: One of the primary experiences in this course is creating a unit plan based on NCTM standards, related research and peer review. In addition, students need to complete a mini-teaching experience. The purpose of the Mini-Teaching experience is to give students an opportunity to experience first hand how high school mathematics students think about mathematics and problems solving. This experience will involve creating and revising a unit plan, interviewing a high school student on tasks related to the unit plan, observing high school students in a classroom setting, and reflecting on the experience. From the mini-teaching experiment handout, students are to create a lesson plan involving two to three problems to be solved by a high school student. Students then reflect on the experiences and report this to the MATH 306 class.</td>
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