

LAST REVIEW: 2008-2009
*(i.e. 2003-2004)***NEXT REVIEW:**
*(i.e. 2008-2009)***STATUS:**
*(A, I, D)***COURSE TITLE:** Methods of Teaching Mathematics in the Middle School**COMMON COURSE NUMBER:** MAE 4320**CREDIT HOURS:** 3**CONTACT HOUR BREAKDOWN**
*(per 16 week term)***CLOCK HOURS:**
(Voc. Course ONLY)

Lecture: 48 Lab:

Clinic: Other: 15

PREREQUISITE(S): EDF3280 and MAC2311**COREQUISITE(S):****PRE/COREQUISITE(S):****COURSE DESCRIPTION** *(750 characters, maximum):*

This course is designed to introduce methods and strategies that have been proven to be effective for teaching middle school mathematics. This course will include topics in appropriate instructional techniques and selection of appropriate resources for diverse classroom activities. Additional topics include real world applications, the use of technology, understanding the diverse learner, multiple means of assessment and learning styles. In this course, the pre-professional educator learns principles of effective curriculum design and assessment and applies these principles by designing and developing interactive mathematics curriculum projects for middle school students. This course addresses specific Sunshine State Standards subject matter competencies and pedagogy pertinent to the discipline. This course requires 20 hours of structured field experience.

UNIT TITLES

1. Reflections and Research Findings on the Middle School Concept
2. Research Based Strategies
3. The Standards (NCTM, FSMCS, FEAPs, NCATE)
4. Number Sense, Concepts, and Operations
5. Measurement
6. Geometry and Spatial Sense
7. Algebraic Thinking
8. Data Analysis and Probability
9. Apply Reflections, Strategies and Standards

EVALUATION:

Please provide a brief description (250 characters maximum) that details how students will be assessed on the course outcomes.

A. Task

1. **Task 1 (FEAP 4.1, 4.2, 4.3):** This is a semester-long project in which the pre-service teacher builds a toolbox of research-based strategies to promote critical/creative thinking and problem solving skills.
2. **Task 2 (FEAP 8.2, 8.4):** The candidate will demonstrate his/her specific content knowledge in the areas of numbers and operations, algebra, geometry, measurement, geometry, and data analysis/ probability.
3. **Task 3 (FEAP 4.8, 5.4, 7.6, 8.1, 12.7):** The candidate will teach a middle school math lesson.
4. **Task 4 (FEAP 1.12, 2.10, 3.15, 4.10, 5.13, 7.7, 8.6, 9.12, 10.17, 11.10):** The candidate will develop short and long term goals based on the current standards and the appropriate subject matter.

B. Major Assignments

1. **Assignment 1:** Each student will be required to submit a paper comparing and contrasting his/her reflections and research findings on the Middle School Concept. Include at least two sources.
2. **Assignment 2:** Each student will be required to submit a paper comparing and contrasting a teacher-centered activity with a student-centered activity.
3. **Assignment 3:** Each student will analyze a lesson plan.
4. **Assignment 4:** Each student will develop a lesson plan for each of the five NCTM Standards.

C. Portfolio

1. Portfolio should include tabs for measurement, geometry and spatial sense, algebraic thinking, and data analysis and probability topics. New lesson plans for each of these content standards should be included.

D. One Peer Group Presentation and Four Peer Evaluation**E. Exams**

1. Midterm and a comprehensive final exam

UNITS

Unit 1. Mathematics, Mathematics Teaching and the Mathematics Student

General Outcome:

- 1.0 The student shall: provide an overview about mathematics, mathematics teaching and the mathematics student.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 1.1 Define Mathematics from three different authors or perspectives.
- 1.2 Explain why we teach mathematics.
- 1.3 Describe the Middle School Concept.
- 1.4 Discuss the Evolution of the 21st Century Student.
- 1.5 Compare and contrast student-centered and teacher-centered lessons.

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Unit 2. Research Based Strategies

General Outcome

- 2.0 Each student will discuss at least five Research Based Strategies for learning.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 2.1 Discuss the Art of Questioning and what to do in the First Five Minutes of Class
- 2.2 State and apply a strategy involving Similarities and Differences
- 2.3 State and apply a strategy involving Nonlinguistic Representation
- 2.4 State and apply a strategy involving Cooperative Learning
- 2.5 State and apply a strategy involving Generating and Testing Hypotheses
- 2.6 State and apply a strategy involving Cues, Questions, and Advanced Organizers

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Unit 3. The Standards (NCTM, FSMCS, FEAPs, NCATE)

General Outcome:

- 3.0 The student shall discuss the current standards in education on the state and national level.

Specific Measureable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 3.1 locate and summarize the development of the National Council of Teachers of Mathematics (NCTM) documents from 1989 beginning with the *Curriculum and Evaluation Standards*, to 1991 the *Professional Standards for Teaching Mathematics* to 1995 the *Assessment Standards of School Mathematics*.
- 3.2 locate and apply the Florida Subject Matter Competencies and Skills – Mathematics (FSMCS) to his/her lesson plans
- 3.3 locate and discuss the twelve Florida Educator Accomplished Practices (FEAPs) and how they relate to the middle school mathematics classroom.
- 3.4 locate and define the National Council for Accreditation of Teacher Education (NCATE) and explain why it was developed in 1954.

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Unit 4. Number Sense, Concepts, and Operations

General Outcome:

- 4.0 The student shall collect strategies and techniques for teaching number sense, concepts and operation in the middle school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 4.1 Increase their knowledge and understanding in the area of number sense as it applies to mathematics content on the middle school level. (MG 5.1-5.11)
- 4.2 Develop a repertoire of student-centered teaching strategies and skills that can be applied when teaching number sense. (E) *See last page for explanation of symbols.
- 4.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 4.4 Collect real world application problems in number sense (MG 5.10 and 5.11)
- 4.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach number sense (MG 2.3)
- 4.6 Broaden their understanding of the diversity of learners, learning styles, behaviors, and ways to make number sense accessible to all (E); and
- 4.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching number sense. (M 15.1 and 15.2)

Common Course Number: MAE 4320**Unit 5. Measurement**

General Outcome:

- 5.0 The student shall collect strategies and techniques for teaching measurement in the middle school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 5.1 Increase their knowledge and understanding in the area of measurement as it applies to mathematics content on the middle school level. (MG 9.1-9.10)
- 5.2 Develop a repertoire of student-centered teaching strategies and skills that can be applied when teaching measurement. (E) *See last page for explanation of symbols.
- 5.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 5.4 Collect real world application problems in measurement. (MG 9.1, 9.3-9.6, 9.9, and 9.10)
- 5.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach measurement (MG 2.3)
- 5.6 Broaden their understanding of the diversity of learners, learning styles, behaviors, and ways to make measurement accessible to all (E); and
- 5.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching measurement. (M 15.1 and 15.2)

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Unit 6. Geometry and Spatial Sense

General Outcome:

- 6.0 The student shall collect strategies and techniques for teaching geometry and spatial sense in the middle school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 6.1 Increase their knowledge and understanding in the area of geometry and spatial sense as it applies to mathematics content on the middle school level. (MG 8.1-8.21)
- 6.2 Develop a repertoire of student-centered teaching strategies and skills that can applied when teaching geometry and spatial sense. (E) *See last page for explanation of symbols.
- 6.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections (Apply Multiple Representation Theory) (MG 2.1)
- 6.4 Collect real world application problems in geometry and spatial sense. (MG 8.8, 8.9, 8.10)
- 6.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach geometry and spatial sense (MG 2.3)
- 6.6 Broaden their understanding of the diversity of learners, learning styles, behaviors, and ways to make geometry accessible to all (E); and
- 6.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching geometry and spatial sense. (M 15.1 and 15.2)

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Unit 7. Algebraic Thinking

General Outcome:

- 7.0 The student shall collect strategies and techniques for teaching algebraic thinking in the middle school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 7.1 Increase their knowledge and understanding in the area of algebraic thinking as it applies to mathematics content on middle school level. (MG 6.1-6.25)
- 7.2 Develop a repertoire of student-centered teaching strategies and skills that can be applied when teaching algebraic thinking. (E) *See last page for explanation of symbols.
- 7.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections
(Apply Multiple Representation Theory) (MG 2.1 and 6.1)
- 7.4 Collect real world application problems in algebraic thinking. (MG 6.6, 6.10, 6.23, 6.24)
- 7.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach algebraic thinking (MG 2.3)
- 7.6 Broaden their understanding of the diversity of learners, learning styles, behaviors, and ways to make algebra accessible to all (E); and
- 7.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching algebraic thinking.
(M 15.1 and 15.2)

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Unit 8. Data Analysis and Probability

General Outcome:

- 8.0 The student shall collect strategies and techniques for teaching data analysis and probability in the middle school. (M 14.1)

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

- 8.1 Increase their knowledge and understanding in the area of data analysis and probability as it applies to mathematics content on middle school level. (MG 7.1-7.9)
- 8.2 Develop a repertoire of student-centered teaching strategies and skills that can be applied when teaching data analysis and probability. (E) *See last page for explanation of symbols.
- 8.3 Collect teaching materials and collaboratively design a lesson plan which incorporates numerical, graphical, algebraic, and written/verbal representations to foster mathematical connections
(Apply Multiple Representation Theory) (MG 2.1)
- 8.4 Collect real world application problems in data analysis and probability.
(MG 7.9)
- 8.5 Broaden their understanding of the variety of ways that technology can be used to learn and teach data analysis and probability (MG 2.3)
- 8.6 Broaden their understanding of the diversity of learners, learning styles, behaviors, and ways to make data analysis and probability accessible to all (E); and
- 8.7 Increase their knowledge of multiple means of assessment and how to incorporate these assessments when teaching data analysis and probability.
(M 15.1 and 15.2)

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Unit 9. Apply Reflections, Strategies and Standards

General Outcome:

9.0 The student shall apply his/her reflections, strategies and standards.

Specific Measurable Learning Outcomes:

Upon successful completion of this unit, the student shall be able to:

9.1 Critique a mathematics lesson plan.

9.2 Teach a mathematics lesson plan.

9.3 Develop short and long term personal and professional goals related to knowledge of the subject matter.

Supplement:

Here are some of the skills listed in the “Competencies and Skills Required for Teacher Certification in Florida, 12th Edition” that are met by some of our units and subunits. Our course outlines exceed these minimum competencies and skills.

Next to the given unit or subunit, if there is a number (e.g., MG 1.1), please refer to the list below to see the competency that it complies with. (Note: “(E)” means that the given unit or subunit exceeds the minimum competencies and skills.)

Middle Grades 5-9 (MG):

- 1.1 Identify appropriate mathematical problems from real-world situations.
- 1.3 Evaluate the reasonableness of results with respect to the original problem
- 1.4 Use mathematics to solve problems in other contexts.
- 2.1 Identify appropriate representations or models for mathematics operations or situations using written, concrete, pictorial, graphical, or algebraic methods.
- 2.2 Interpret results as illustrated by the use of mathematical representations.
- 2.3 Select appropriate manipulatives, mathematical models, or technology for teaching particular mathematics concepts.
- 5.1 Identify elements and subsets of real number systems
- 5.2 Compare the relative size of real numbers expressed in a variety of forms, including fractions, decimals, percents and scientific notation.
- 5.3 Identify estimation strategies
- 5.4 Simplify expressions using the laws of exponents.
- 5.5 Identify equivalent forms of rational exponents and radicals.
- 5.6 Simplify radical expressions.
- 5.7 Determine the prime factorization of composite numbers
- 5.8 Identify the greatest common factor (GCF) and least common multiple (LCM) of sets of numbers.
- 5.9 Evaluate numerical expressions using order of operations.
- 5.10 Solve real-world problems using proportions.
- 5.11 Solve real-world problems that involve real numbers
- 6.1 Predict missing subsequent terms in numerical, algebraic, and pictorial patterns.
- 6.2 Analyze relationships between tables, graphs, or rules.
- 6.3 Analyze relationships to determine the impact when changing parameter of given functions.
- 6.4 Simplify rational and irrational expressions.
- 6.5 Solve equations and inequalities with one variable, including absolute values.
- 6.6 Identify matrices that represent data provided by real-world or mathematical problems.
- 6.7 Identify graphs of first-degree inequalities involving one variable on a number line.
- 6.8 Identify graphs of linear equations or inequalities involving two variables on the coordinate plane.
- 6.9 Identify the slope and intercepts of a graph or an equation.
- 6.10 Identify the interpretation of the slope and intercepts, given a real-world context.
- 6.11 Identify the equation of a line that is perpendicular or parallel to a given line.

- 6.12 Determine an equation of a line.
- 6.13 Determine the greatest common monomial factor of a polynomial.
- 6.14 Factor polynomials.
- 6.15 Solve systems of linear equations involving two variables using graphing, substitution, or elimination.
- 6.16 Determine the solution set of a system of linear inequalities involving two variables.
- 6.17 Solve quadratic equations and inequalities by completing the square, the quadratic formula, and factoring.
- 6.18 Using the discriminant or a graph of a quadratic equation to determine the nature of its real solutions (zero, one two)
- 6.19 Identify the graphs of quadratic functions
- 6.20 Identify graphs of relations involving quadratic inequalities
- 6.21 Solve equations involving radicals, limited to square roots.
- 6.22 Identify the domain and range of specified functions.
- 6.23 Identify quadratic equations or inequalities for solving real-world problems.
- 6.24 Identify equations or inequalities that could be used to solve real-world and mathematical problems involving one or two variables.
- 6.25 Identify properties (e.g., commutative, associative, distributive).
- 7.1 Compute the mean, median, mode and range of a set of data.
- 7.2 Determine whether the mean, median, or mode is the most appropriate measure of central tendency in a given situation.
- 7.3 Interpret information (e.g., correlation, regression, distributions) from various graphic representations.
- 7.4 Identify appropriate graphical representations of a given data set.
- 7.5 Determine probabilities of dependent and independent events.
- 7.6 Predict odds of a given outcome.
- 7.7 Identify an appropriate sample space to determine the probability of a given event.
- 7.8 Make predictions that are based on experimental or theoretical probabilities.
- 7.9 Apply counting principles to solve real-world problems.
- 8.1 Identify angles or pairs of angles as adjacent, complementary, supplementary, vertical, corresponding, alternate interior, alternate exterior, obtuse, acute, or right.
- 8.2 Identify lines and planes as perpendicular, intersecting, skew, or parallel.
- 8.3 Identify triangles using the lengths of their sides or the measures of their angles.
- 8.4 Determine the sum of the measures of the interior angles and the sum of the measures of the exterior angles of convex polygons.
- 8.5 Determine the measures of the specified interior or exterior angles of a triangle or a regular polygon.
- 8.6 Apply the inequality relationships among the angles and sides of a triangle.
- 8.7 Use the SAS, ASA, and SSS postulates to show pairs of triangles congruent, including the case of overlapping triangles.
- 8.8 Solve real-world problems involving similar or congruent figures.
- 8.9 Solve real-world problems applying the Pythagorean Theorem and its converse.
- 8.10 Solve real-world problems by applying the 30° – 60° – 90° or 45° – 45° – 90° triangle relationships.
- 8.11 Solve right triangle problems by applying tangent, sine, or cosine ratios.
- 8.12 Apply the properties of parallelograms, rectangles, rhombuses, squares, or trapezoids.
- 8.13 Apply the distance formula.
- 8.14 Apply the formula for midpoint.
- 8.15 Identify the coordinates of the vertices of a given polygon when it lies in the coordinate plane.
- 8.16 Identify point, line, and plane as undefined terms and symbols for lines, segments, rays, and distances.
- 8.17 Identify transformations, dilations, or symmetry of geometric figures.
- 8.18 Identify characteristics of three-dimensional figures.
- 8.19 Identify the net of a three-dimensional figure.
- 8.20 Identify figures that tessellate.
- 8.21 Identify the two-dimensional view of a three-dimensional object.

- 9.1 Determine appropriate units and instruments for measuring a given quantity in a real-world context.
- 9.2 Estimate measurements, including length, area, volume, weight, time, temperature, and money.
- 9.3 Make conversions within the metric or customary systems in a real-world context.
- 9.4 Apply the formulas for determining the circumferences and areas of circles in a real-world context.
- 9.5 Find the perimeter or area of figures composed of parallelograms, triangles, circles, and trapezoids in a real-world context.
- 9.6 Apply the formulas for surface area and volume to right prisms, regular pyramids, right circular cylinders, cones, and spheres in a real-world context.
- 9.7 Determine how a change in such dimensions as length, width, height, or radius affects other measurements such as perimeter, area, surface area, and volume.
- 9.8 Solve problems involving direct or indirect measurement.

Mathematics 6-12 (M):

- 14.1 Select appropriate resources for a classroom activity
- 14.2 Identify methods and strategies for teaching problem-solving skills and applications.
- 15.1 Identify students' errors, including multiple errors that result in correct or incorrect answers.
- 15.2 Identify appropriate alternative methods of assessment.