MAE 4360  Methods of Teaching Mathematics

Course Description: The student will utilize theory and educational neuroscience research in developing knowledge and pedagogy essential for K-12 mathematics instruction which accommodates the needs of diverse learners. The student will learn the problem-solving approach to design, implement, and assess mathematics instruction and curriculum. (3-hour lecture; Fifteen hours of approved clinical experience are required).

Course Competency

Competency 1: The student will analyze and apply local, state, and national standards by:

1. Analyzing the primary features and goals of state and national standards (e.g., Florida Standards for Mathematical Practices, Florida Mathematics Content Standards, National Council of Teachers of Mathematics (NCTM) Principles and Standards) and identifying commonalities and differences.
2. Analyzing test construction, question types, scoring of statewide and national standardized assessments that measure mathematics knowledge.
3. Defining mathematical literacy (numeracy) and evaluating its importance in society.
4. Identifying and accessing resources and activities for mathematics education that are aligned to the standards.
5. Selecting relevant mathematics and alternate standards and curriculum appropriate for students’ age, instructional needs, and functional performance across settings.
6. Engaging in targeted mathematics professional growth opportunities and reflective practices sponsored

Learning Outcomes

- Communication
- Numbers / Data
- Critical thinking
- Information Literacy
- Cultural / Global Perspective
- Computer / Technology Usage
- Aesthetic / Creative Activities

Updated Spring 2021
by local, state, and/or national professional organizations, both independently and in collaboration with colleagues.

7. Demonstrating mathematics literacy (numeracy) competence and related K-12 subject matter curriculum

**Competency 2:** The student will demonstrate knowledge of how students construct mathematical understanding by:

1. Comparing, and contrasting learning theories related to mathematics (e.g., socio-cultural, constructivism, direct instruction, and educational neuroscience).
2. Identifying instructional strategies that facilitate students’ metacognitive skills in mathematics.
3. Exploring and identifying examples of how mathematics relates to and is applied in the real-world contexts and other disciplines.
4. Identifying fundamental concepts that connect elementary, and middle grades mathematics to high school and postsecondary mathematics (e.g., algebra, geometry, trigonometry, number theory, calculus).
5. Interpreting and developing appropriate models for mathematical concepts including real-world models and equivalent representations (e.g., graphical, symbolic, verbal, numeric).
6. Analyzing mathematical errors involving procedural fluency and/or conceptual understanding.
7. Recognizing the importance of student prior knowledge to learning new mathematics concepts and skills, and problem-solving approaches.
8. Determining the appropriate sequence of lessons for a specific mathematical concept/skill.
9. Recognizing the power of authentic tasks and how their use promotes engagement, relevance, and opportunities for culturally-responsive teaching.
10. Analyzing the ways students think about mathematics, to assess students’ mathematical knowledge.

**Competency 3:** The student will communicate and develop students’ mathematical connections by:

- Communication
- Critical thinking
- Information Literacy

| Updated Spring 2021 |
1. Utilizing statements that correctly communicate mathematical definitions/concepts.
2. Utilizing varied mathematical representations (e.g., verbal statements, manipulatives, pictures, graphs, algebraic expressions).
3. Expressing concepts using multiple representations (e.g., diagrams, symbolic expressions, manipulatives, tables, graphs, technology).
4. Translating word phrases into mathematical expressions and equations, and vice-versa.
5. Creating and utilizing representations to organize, record, and communicate mathematical ideas to model and interpret physical, social, and mathematical phenomena.
6. Exploring and examining relationships between mathematical concepts (e.g., multiplication as repeated addition, powers as repeated multiplication) while integrating them within the curriculum.
7. Employing methods, strategies, and questioning techniques for teaching problem-solving skills and applications.
8. Communicating and organizing mathematical thinking coherently and clearly to peers, faculty, and K-12 students in written and oral form.
9. Utilizing appropriate techniques for fostering and developing problem solving skills and classroom discourse.
10. Examining strategies that reveal, support, and challenge students’ mathematical thinking.
11. Demonstrating the ability to model mathematical problem solving, foster conceptual understanding development, while fostering procedural fluency.

**Competency 4:** The student will use a variety of mathematics teaching approaches by:

- Social Responsibility
- Computer / Technology Usage
- Aesthetic / Creative Activities
1. Identifying and utilizing appropriate and diverse teaching models such as effective explanation, cooperative learning, project-based discovery learning, differentiated instruction, and the problem-solving approach.
2. Identifying and utilizing appropriate techniques for presenting concepts in mathematics such as: modeling with manipulatives, using computer software, calculators, multimedia, and the Internet.
3. Identifying and utilizing national, state, and local instructional resources, such as scholarly journals, NCTM’s Illuminations, Addenda Series, and Navigations Series.
4. Utilizing strategies for increasing accuracy and proficiency in math calculations and applications.
5. Applying research-based instructional practices for developing mathematical literacy (numeracy).
6. Utilizing appropriate materials and resources for teaching diverse groups of students (e.g., varied learning styles and exceptionalities).
7. Applying and adapting a variety of appropriate solution strategies which address the needs of traditionally underserved and underrepresented student groups in mathematics.

**Competency 5:** The student will plan a curriculum that emphasizes the development of students’ mathematics concepts by:

1. Identifying and sequencing mathematics learning activities which are in concert with educational neuroscience.
2. Identifying and selecting appropriate resources and materials based on instructional (long- and short-term) objectives and all student learning needs and performance levels.
3. Interpreting and developing various criteria for the design of the specific scope and sequence of a mathematics curriculum framework with reference to both state and national mathematics standards.
4. Selecting and utilizing a variety of available mathematics curricula and teaching materials for all.

- Communication
- Information Literacy

Updated Spring 2021
5. Identifying mathematical tasks that aim at higher-order thinking (e.g., discovering and formalizing patterns).

<table>
<thead>
<tr>
<th>Competency 6: The student will develop communities of mathematics learners that reflect the attitudes and social values conducive to mathematics learning by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Modeling respect for the diverse ideas, skills, and experiences of all students in their classrooms through collaboration.</td>
</tr>
<tr>
<td>2. Employing teacher behaviors that indicate sensitivity to race, gender, ethnicity, socioeconomic status, ability, and religion.</td>
</tr>
<tr>
<td>3. Employing and valuing the mathematics of different cultures.</td>
</tr>
<tr>
<td>4. Identifying the effect of inequitable practices in the classroom and addressing these practices when they occur.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Course Competency 7: The student will demonstrate the ability to plan and implement research-based instruction (FEAPs) by:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Aligning instruction with state-adopted standards at the appropriate level of rigor.</td>
</tr>
<tr>
<td>2. Sequencing lessons and concepts to ensure coherence and required prior knowledge.</td>
</tr>
<tr>
<td>3. Developing learning experiences that require students to demonstrate a variety of applicable skills and competencies.</td>
</tr>
<tr>
<td>4. Organizing, allocating, and managing the resources of time, space, and attention.</td>
</tr>
<tr>
<td>5. Managing individual and class behaviors through a well-planned management system.</td>
</tr>
<tr>
<td>6. Conveying high expectations to all students.</td>
</tr>
<tr>
<td>7. Respecting students’ cultural, linguistic, and family background.</td>
</tr>
</tbody>
</table>

- Communication
- Critical thinking
- Aesthetic / Creative Activities
8. Modeling clear, acceptable oral and written communication skills.
9. Maintaining a climate of openness, inquiry, fairness, and support.
10. Adapting the learning environment to accommodate the differing needs and diversity of students.
11. Delivering engaging and challenging lessons.
12. Modifying instruction to respond to preconceptions or misconceptions.
13. Relating and integrating the subject matter with other disciplines and life experiences.
14. Employing higher-order questioning techniques.
15. Applying varied instructional strategies and resources, including appropriate technology, to provide comprehensible instruction and to teach for student understanding.
16. Designing and aligning formative and summative assessments that match learning objectives and lead to mastery.
17. Implementing knowledge and skills learning in professional development in the teaching and learning process and adjust planning and continuously improve the effectiveness of the lessons.

**Course Competency 8:** The student will plan and implement instruction, which provides K-12 students the opportunity by:

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

- Communication
- Numbers / Data
- Critical thinking
- Computer / Technology Usage
- Aesthetic / Creative Activities

Updated Spring 2021