MAE4360 Methods of Teaching Mathematics

Course Description: The student will learn and 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 problem-solving approach will be used to design, implement, and assess mathematics instruction and curriculum. Fifteen hours of clinical experience are required. (3 hr. lecture)
Prerequisite: EDG3321
Pre/Corequisite: EDF4430

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<th>Course Competency</th>
<th>Learning Outcomes</th>
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| **Competency 1:** The student will analyze and apply local, state, and national standards by: | 1. Communication  
2. Numbers / Data  
3. Critical thinking  
4. Information Literacy  
5. Cultural / Global Perspective  
8. Computer / Technology Usage  
9. Aesthetic / Creative Activities |
| 1. a. Analyzing the primary features and goals of state and national standards (e.g., Common Core Standards for Mathematical Practices, Common Core Content Standards, National Council of Teachers of Mathematics Principles and Standards) and identifying commonalities and differences.  
b. Analyzing test construction, question types, scoring of state-wide and national standardized assessments that measure mathematics knowledge.  
c. Defining mathematical literacy and evaluating its importance in society.  
d. Identifying and accessing resources and activities for mathematics education that are aligned to the standards.  
e. Selecting relevant general mathematics education and alternate standards and curriculum appropriate for students’ age, instructional needs, and functional performance across settings.  
f. Explaining the value of using a variety of mathematics teaching approaches to meet national and state standards, particularly to groups that traditionally have been underserved and underrepresented in mathematics.  
g. Engaging in targeted mathematics professional growth opportunities and reflective practices sponsored by local, state, and/or national professional organizations, both independently and in collaboration with colleagues. | 1. Communication  
3. Critical thinking  
4. Information Literacy |

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<th>Competency 2: The student will demonstrate knowledge of how students construct mathematical understanding by:</th>
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| 1. a. Discussing how mathematics relates to and is applied in the real world and other disciplines.  
b. Identifying fundamental concepts that connect middle grades mathematics to high school and post-secondary mathematics (e.g., trigonometry, number theory, calculus).  
c. Developing and interpreting appropriate models for mathematical concepts including real-world models and equivalent representations (e.g., graphical, symbolic, verbal, numeric).  
d. Identifying, comparing, and contrasting learning theories related to | 1. Communication  
3. Critical thinking  
4. Information Literacy |
Competency 3: The student will communicate and develop students’ mathematical connections by:

1. Identifying statements that correctly communicate mathematical definitions/concepts.
2. Identifying appropriate mathematical representations (e.g., verbal statements, manipulatives, pictures, graphs, algebraic expressions).
3. Interpreting descriptions, diagrams, and representations of arithmetic operations.
4. Interpreting concepts with multiple representations (e.g., manipulatives, tables, graphs, symbolic expressions, technology).
5. Identifying equivalent representations of the same concept or procedure (e.g., graphical, algebraic, verbal, and numeric).
6. Creating and utilizing representations to organize, record, and communicate mathematical ideas while utilizing these representations to model and interpret physical, social, and mathematical phenomena.
7. Interpreting relationships between mathematical concepts (e.g., multiplication as repeated addition, powers as repeated multiplication) while integrating them within the curriculum (e.g., fractions, ratios, scale factors and proportional reasoning).
8. Identifying methods, strategies, and questioning techniques for teaching problem-solving skills and applications (e.g., constructing tables from given data, guess-and-check, working backwards, reasonableness, and estimation).
9. Communicating and organizing mathematical thinking coherently and clearly to peers, faculty, and K-12 students.
10. Utilizing the language of mathematics to express ideas precisely.
11. Identifying appropriate techniques for utilizing problem solving skills and leading discourse.
12. Examining strategies that reveal, support, and challenge students’ mathematical thinking.
13. Orchestrating discourse among all students about mathematical ideas and processes.
14. Demonstrating the ability to lead classes in mathematical problem solving and in developing in-depth conceptual understanding, and to help students develop and test generalizations.

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

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 that foster critical and creative thinking and respond to cultural, linguistic, and gender differences.
2. Identifying 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 NCTM’s Illuminations, Addenda Series, and Navigations Series.
4. Identifying and applying appropriate methods and
strategies to teach key mathematics concepts (e.g., Operations and Algebraic Thinking, Number and Operations in Base 10). e. Integrating mathematics across the curricula.
f. Utilizing strategies for increasing accuracy and proficiency in math calculations and applications. 
g. Applying research-based instructional practices for developing mathematical literacy.
h. Utilizing appropriate manipulatives for teaching diverse groups of students (e.g., varied learning styles and exceptionalities).
i. Applying and adapting a variety of appropriate strategies to solve mathematics problems.

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

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| a. Identifying and sequencing mathematics learning activities which are in concert with educational neuroscience. 
| b. Identifying and selecting appropriate resources and materials based on instructional (long- and short-term) objectives and all student learning needs and performance levels. 
| c. 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. 
| d. Selecting and utilizing a variety of available mathematics curricula and teaching materials for all. 
| e. Identifying mathematical tasks that aim at higher-order thinking (e.g., discovering and formalizing patterns). |

### Competency 6:
The student will develop communities of mathematics learners that reflect the attitudes and social values conducive to mathematics learning by:

|------------------|---------------------|----------------------------------|
| a. Encouraging respect for the diverse ideas, skills, and experiences of all students in their classrooms. 
| b. Identifying teacher behaviors that indicate sensitivity to race, gender, ethnicity, socioeconomic status, ability, and religion. 
| c. Identifying and valuing the mathematics of different cultures (how concepts are presented, what is valued, where it is used). 
| d. Identifying the effect of inequitable practices in the classroom and addressing these practices when they occur. 
| e. Nurturing collaboration among all students and respecting students’ cultural and family background. |

### Competency 7:
The student will demonstrate the ability to plan and implement research-based instruction by:

|------------------|---------------------|------------------------|-------------------------------|----------------------------------|
| a. Aligning instruction with state-adopted standards at the appropriate level of rigor. 
| b. Sequencing lessons and concepts to ensure coherence and required prior knowledge. 
| c. Developing learning experiences that require students to demonstrate a variety of applicable skills and competencies. 
| 2a. Organizing, allocating, and managing the resources of time, space, and attention. 
| 2b. Managing individual and class behaviors through a well-planned management system. 
| 2c. Conveying high expectations to all students. 
| 2d. Respecting students’ cultural, linguistic, and family background. 
| 2e. Modeling clear, acceptable oral and written communication skills. 
| 2f. Maintaining a climate of openness, inquiry, fairness, and support. 
| 2h. Adapting the learning environment to accommodate the differing needs and diversity of students. 
| 3a. Delivering engaging and challenging lessons. 
| 3d. Modifying instruction to respond to preconceptions or misconceptions. 
| 3e. Relating and integrating the subject matter with other disciplines and life experiences. 
| 3f. Employing higher-order questioning techniques. 
| 3g. Applying varied instructional strategies and resources, including appropriate technology, to provide comprehensible instruction and to teach for student understanding. 
| 4b. Designing and aligning formative and summative assessment. |
assessments that match learning objectives and lead to mastery. 5a. Designing purposeful professional goals to strengthen the effectiveness of instruction based on students' needs. 5b. Examining and using data-informed research to improve instruction and student achievement. 5e. Engaging in targeted professional growth opportunities and reflective practices, both independently and in collaboration with colleagues. 5f. 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.

**Competency 8:** The student will plan and/or implement instruction, which provides K-12 students opportunities for by:

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