Course Description
MAE4360 | Methods of Teaching Mathematics | 3.00 credits

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 problem-solving approach will be used to design, implement, and assess mathematics instruction and curriculum. Fifteen hours of clinical experience are required. Pre-requisites: EDG3321; Pre/Co-requisites: EDF4430.

Course Competencies:

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, and 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 with 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 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 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 conceptual understanding
7. Recognizing the importance of students' 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 their use promotes engagement, relevance, and opportunities for culturally responsive teaching
10. Analyzing how students think about mathematics to assess students' mathematical knowledge

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

1. Utilizing statements that correctly communicate mathematical definitions/concepts
1. Utilizing varied mathematical representations (e.g., verbal statements, manipulatives, pictures, graphs, algebraic expressions)
2. Expressing concepts using multiple representations (e.g., diagrams, symbolic expressions, manipulatives, tables, graphs, technology)
3. Translating word phrases into mathematical expressions and equations, and vice-versa

4. Creating and utilizing representations to organize, record, and communicate mathematical ideas to model and interpret physical, social, and mathematical phenomena
5. Exploring and examining relationships between mathematical concepts (e.g., multiplication as repeated addition, powers as repeated multiplication) while integrating them within the curriculum
6. Employing methods, strategies, and questioning techniques for teaching problem-solving skills and applications
7. Communicating and organizing mathematical thinking coherently and clearly to peers, faculty, and K-12 students in written and oral form
8. Utilizing appropriate techniques for fostering and developing problem solving skills and classroom discourse
9. Examining strategies that reveal, support, and challenge students' mathematical thinking
11. Demonstrating the ability to model mathematical problem solving and foster conceptual understanding development while fostering procedural fluency

Competency 4: The student will use a variety of mathematics teaching approaches by:
1. Identifying and utilizing appropriate and diverse teaching models such as adequate explanation, cooperative learning, project-based discovery learning, differentiated instruction, and problem-solving approaches
2. Identifying and utilizing appropriate techniques for presenting mathematical concepts, such as using computer software, calculators, multimedia, and the Internet, such as modeling with manipulatives
3. Identifying and utilizing national, state, and local instructional resources, such as scholarly journals,
4. NCTM's Illuminations, Addenda Series, and Navigations Series
5. Utilizing strategies for increasing accuracy and proficiency in math calculations and applications
6. Applying research-based instructional practices for developing mathematical literacy (numeracy).
7. Utilizing appropriate materials and resources for teaching diverse groups of students (e.g., varied learning styles and exceptionalities)
8. Applying and adapting appropriate solution strategies that 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 that correspond 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 concerning both state and national mathematics standards
4. Selecting and utilizing a variety of available mathematics curricula and teaching materials for all
5. 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:
1. Modeling respect for the diverse ideas, skills, and experiences of all students in their classrooms through collaboration
2. Employing teacher behaviors that indicate sensitivity to race, gender, ethnicity, socioeconomic status, ability, and religion
3. Employing and valuing the mathematics of different cultures
4. Addressing and identifying the effect of inequitable practices in the classroom and addressing these practices when they occur

Competency 7: The student will demonstrate the ability to plan and implement research-based instruction (FEAPs) by:
1. Aligning instruction with state-adopted standards at the appropriate level of rigor

2. Sequencing lessons and concepts to ensure coherence and required prior knowledge
3. Developing learning experiences that require students to demonstrate various applicable skills and competencies
4. Organizing, allocating, and managing time, space, and attention resources
5. Managing individual and class behaviors through a well-planned management system
6. Conveying high expectations to all students
7. Respecting students' cultural, linguistic, and family backgrounds
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 students' differing needs and diversity
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, adjusting planning, and continuously improving the effectiveness of the lessons

Competency 8: The student will plan and implement instruction, which provides K-12 students the opportunity to persevere in solving them by:
1. Establishing Abstractly and quantitatively
2. Creating viable arguments and critiquing the reasoning of others' models with mathematics
3. Using appropriate tools strategically
4. Demonstrating precision for and using structure and expressing regularity in repeated reasoning

Learning Outcomes:
- Communicate effectively using listening, speaking, reading, and writing skills
- Use quantitative analytical skills to evaluate and process numerical data
- Solve problems using critical and creative thinking and scientific reasoning
- Formulate strategies to locate, evaluate, and apply information
- Demonstrate knowledge of diverse cultures, including global and historical perspectives
- Use computer and emerging technologies effectively
- Demonstrate an appreciation for aesthetics and creative activities