Miami Dade College

Course Description

SCE4362 | Methods of Teaching Science | 3.00 credits

The student will learn to design and implement science instruction utilizing the national framework for K-12 science education and educational neuroscience to provide all students with high-quality science education. The student will also learn about the theoretical knowledge and skills essential for facilitating science instruction in a variety of classroom settings. Fifteen hours of clinical experience are required. Pre/Co-requisites: EDF4430.

Course Competencies

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

1. Summarizing the primary features and goals of state and national standards
2. Defining scientific literacy and evaluating its importance in society and science for all
3. Relating and integrating the subject matter with other disciplines and life experiences
4. Interpreting state- wide and national standardized assessments that measure scientific literacy
5. Identifying and accessing resources and activities for science education aligned to the standards

Competency 2: The student will explain how students construct scientific understanding by:

1. Comparing and contrasting the difference between inert and meaningful knowledge
2. Categorizing the three types of knowledge- content: procedural and metacognitive
3. Recognizing the importance of student's prior knowledge in learning new scientific information
4. Identifying instructional strategies to facilitate all students' metacognitive skills in science and reading
5. Critiquing teaching examples to determine if they represent reception (passive) or transformational (active) approaches to science teaching and learning
6. Scaffolding to help all students accomplish a learning task
7. Discuss how authentic tasks help students participate and stay interested in science, particularly groups traditionally underserved and underrepresented in science

Competency 3: The student will use a variety of science teaching approaches by:

1. Explaining the value of using a variety of science teaching approaches to meet national and state standards, particularly groups that have been traditionally underserved and underrepresented in science
2. Observing, journaling, and critiquing instructional approaches used in science teaching
3. Identifying and interpreting strategies that can be used to help all students learn science
4. Examining strategies that reveal, support, and challenge student thinking
5. Applying research-based instructional practices to develop students' critical thinking
6. Engaging in science education professional development activities sponsored by National, State, and Local professional organizations
7. Identifying and selecting various instructional strategies that foster critical and creative thinking, such as inquiry-based learning, discovery, and problem-solving, that respond to cultural, linguistic, and gender differences
8. Applying research-based instructional practices for developing instructional units that incorporate inquiry

Competency 4: The student will plan a curriculum emphasizing the development of students' science concepts by:

1. Identifying and sequencing science learning activities that correspond with brain research
2. Identifying materials based on instructional (long-term and short-term) objectives and all student learning needs and performance levels
3. Identifying appropriate references, activities, materials, and technology for science based on students' abilities, needs, interests, and backgrounds
4. Interpreting and developing various criteria for designing the specific scope and sequence of a science curriculum framework, with reference to state and national science standards
5. Locating resources and persons from the local and statewide community to assist in the instructional process
6. Interacting with colleagues, supervisors, and students to develop effective lesson plans
7. Identifying teacher behaviors that indicate sensitivity to race, gender, ethnicity, socioeconomic status, abilities, and religion

8. Select and develop instructional materials responding to cultural, linguistic, and gender differences
9. Interpreting and utilizing the learning cycle as a mechanism for building a curriculum that emphasizes the development of students' science concepts to meet national and state standards, particularly groups traditionally underserved and underrepresented in science
10. Planning and applying lessons and assessments that incorporate the learning cycle
11. Reflect on implementing lessons that incorporate inquiry and describing ways to improve their teaching

Competency 5: The student will develop communities of science learners that reflect the intellectual rigor of scientific inquiry and the attitudes and social values conducive to science learning by:

1. Identifying appropriate techniques for utilizing science process skills and leading science discourse
2. Engaging students successfully in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner
3. Orchestrating discourse among all students about scientific ideas and processes
4. Encouraging respect for the diverse ideas, skills, experiences, and cultural and family backgrounds of all students in their classrooms
5. Facilitating ongoing formal and informal discussions based on a shared understanding of the rules of scientific discourse
6. Modeling and emphasizing the skills, attitudes, and values of scientific inquiry

Competency 6: The student will uphold the legal and ethical responsibilities for the welfare of their students, the proper treatment of animals, and the maintenance and disposal of materials by:

1. Analyzing the effectiveness of science teachers' strategies and procedures for managing laboratory and hands-on science lessons
2. Designing the physical environment for laboratory activities to provide optimal learning opportunities for all students
3. Analyzing a variety of classroom demonstrations, field experiences, and laboratory experiments for safety concerns and planning effective strategies for avoiding accidents
4. Discussing the legal issues associated with laboratory and field trip experiences
5. Interviewing a high school science teacher and science department chair about the procedures and problems in obtaining needed chemicals and equipment for laboratory experiments, laboratory safety issues, the regulations involving science stockrooms, including local fire codes as well as OSHA regulations, the safe disposal procedures for various types of substances, and information contained in the Material Safety Data Sheets
6. Preforming a site visit to a science stockroom and detailing the kinds of chemicals needed for each of the sciences, how the chemicals are organized and stored, the equipment needs of each science, and how the equipment is organized and stored
7. Developing a Science Safety Contract for use in their classrooms

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

1. Aligning instruction FEAPs 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. Defining science process skills (e.g., observing, inferring, classifying, measuring, predicting, and communicating) and the characteristics of each skill
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. Employing higher-order questioning technique
14. Applying varied instructional strategies and resources, including appropriate technology, to

comprehensible instruction and to teach for student understandings

15. Designing and aligning formative and summative assessments that match learning objectives and lead to mastery
16. Designing purposeful professional goals to strengthen the effectiveness of instruction based on students' needs
17. Examining and using data-informed research to improve instruction and student achievement
18. Using various data, independently and in collaboration with colleagues, to evaluate learning outcomes, adjust planning, and continuously improve the effectiveness of the lessons
19. Engaging in targeted professional growth opportunities and reflective practices independently and in collaboration with colleagues
20. Implementing knowledge and skills learned in professional development in teaching and learning
21. Applying the Code of Ethics and Principles of Professional Conduct to professional and personal situations

Learning Outcomes:

- 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 ethical thinking and its application to issues in society
- Demonstrate knowledge of diverse cultures, including global and historical perspectives
- Use computer and emerging technologies effectively