SED 525S/SED 525SL
Methods of Teaching Science

COURSE SYLLABUS

Instructor: Norman Herr
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Note: Much more detailed information, resources and links are available on the **Class Website**: normherr.com - navigate to SED 525S

MICHAEL D. EISNER COLLEGE OF EDUCATION CONCEPTUAL FRAMEWORK

The Michael D. Eisner College of Education as a professional school is committed to advancing learning, teaching, and student success. This is accomplished using a developmental approach to promote reflection, critical thinking, and excellence in an inclusive learning community. Its graduates are well-educated, highly skilled, and caring persons who are lifelong learners prepared to practice in an ever-changing, multicultural world. They are committed to promoting achievement of all students as a primary measure of successful educational practice. Graduates assume service and leadership roles in public and private educational, health, and social programs and institutions. The College establishes and maintains productive partnerships throughout campus and with community schools and agencies. The faculty is committed to excellence in teaching, scholarship, service and collaboration with the community and professionals. The values for faculty and students that form the foundation of this Conceptual Framework include the following:

- We value high standards in the acquisition and application of professional knowledge and skills in subject matter, pedagogy, and technology.
- We value the achievement of all students at all levels and advance their success in accordance with national and state standards.
- We value an inclusive learning community.
- We value creative, critical, and reflective thinking and practice.
- We value ethical practice by caring professionals.

COURSE DESCRIPTION

SED 525S and SED 525SL are designed in accordance with the Michael D. Eisner College of Education Conceptual Framework and the principles of Computer Supported Collaborative Science to provide opportunities for teacher candidates to engage in and reflect upon best practices in science teaching and learning. Prospective teachers learn to engage students in the those practices and habits of mind described in the Next Generation Science Standards (NGSS), such as asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information. These courses focus on instructional methods and curriculum in teaching physics, chemistry, biology, earth & space science and health in secondary schools. Students learn how to develop, adapt, evaluate, and use strategies and materials for teaching science, appropriate both to the special needs of the learners and the special characteristics of the various science disciplines. In addition, these courses foster the development of Technological Pedagogical Content Knowledge (TPCK) so that graduates are prepared to use relevant technologies to engage and enhance student learning.

OBJECTIVES

1. **Understanding Science Education Systems (TPE 3, 4, 6)** – Analyze the status of science education in the U.S. within an international context, evaluate instructional effectiveness, and develop logically sequenced curricula that align with state frameworks.

2. **Implementing Next Generation Science Standards (NGSS) (TPE 3, 4, 5)** – Design lessons that integrate NGSS's three dimensions: science and engineering practices, cross-cutting concepts, and disciplinary core ideas while ensuring alignment with California's science framework.

3. **Standards Alignment (TPE 1, 3, 4)** – Develop science lessons that align with **California Common Core Standards (CCCS)** and **English Language Development (ELD) Standards** to support all learners, including English Learners and students with special needs.

4. **Integrating Technology in Science Teaching (TPE 1, 3, 4)** – Utilize **Technological Pedagogical Content Knowledge (TCPK)** and Computer-Supported Collaborative Science (CSCS) techniques to enhance student engagement, inquiry, and accessibility in science instruction.

5. **Classroom Management & Assessment (TPE 2, 5)** – Implement strategies for creating an effective science classroom environment, ensuring **safety, inclusivity, and student engagement**, while using continuous **formative and summative assessments** to guide instruction.

6. **Developing Higher-Order Thinking Skills (TPE 1, 3, 4)** – Teach science in a way that fosters **critical thinking, problem-solving, and inquiry-based learning**, helping students engage with complex scientific concepts.

7. **Effective and Motivational Teaching Strategies (TPE 1, 3, 4)** – Apply a variety of **research-based instructional methods** to increase student engagement, participation, and enthusiasm for science learning.

8. **Science Education Resources & Professional Growth (TPE 6)** – Identify, utilize, and curate instructional resources while engaging in **ongoing professional development**, including participation in science education communities.

9. **Curriculum Development & Course Sequencing (TPE 3, 4)** – Design **structured, developmentally appropriate science curricula** that align with NGSS, Common Core, and the needs of diverse learners.

10. **Self-Reflection & Subject-Specific Teaching Methods (TPE 6, 7)** – Assess and improve **personal teaching effectiveness** while implementing specialized strategies for teaching **life sciences, chemistry, physics, and earth sciences**, ensuring an inclusive and equitable learning environment.

BOOKS (RECOMMENDED)

Herr, N. (2008). *The Sourcebook for Teaching Science – Strategies, Activities, and Instructional Resources.* San Francisco. John Wiley. 584 pages.

Herr, N. & Cunningham, J. (1999). *Hands-On Chemistry Activities with Real-Life Applications.* West Nyack, New York, Jossey-Bass (Prentice-Hall). 638 pages.

Cunningham, J. & Herr, N. (1994). *Hands-On Physics Activities with Real-Life Applications.* West Nyack, New York, Jossey-Bass (Simon & Schuster), 670 pages.

Herr, N. (2013). Everyone in the Pool! Collaborative Data Analysis in the Science Classroom. HP Catalyst Academy. (http://hpca-cscs.com)

SCHEDULE

Week 1: Introduction to Science Teaching & The Language of Science
Understanding scientific terminology and effective communication in science instruction.

Week 2: Developing Science Literacy: Reading & Writing Skills
Strategies for enhancing students' science reading comprehension and scientific writing.

Week 3: Science, Technology, and Society (STS) & Scientific Inquiry
Exploring the interplay between science, technology, and society while fostering inquiry-based learning.

Week 4: Scientific Methods, Reasoning, and Critical Thinking
Applying scientific methods and reasoning to promote critical thinking in science education.

Week 5: Organizing Scientific Concepts: Graphic Organizers & Analogies
Using visual tools and analogies to improve student understanding of scientific concepts.

Week 6: Memory Enhancement Tools & Learning Science through Games
Strategies for improving retention and engagement through memory techniques and educational games.

Week 7: Problem-Solving in Science: Word Problems & Geometric Principles
Teaching students how to approach and solve science-related mathematical and conceptual problems.

Week 8: Visualizing Scientific Problems & Dimensional Analysis
Techniques for helping students conceptualize complex problems using visual aids and unit conversions.

Week 9: Stoichiometry & Quantitative Problem Solving in Science
Teaching strategies for balancing chemical equations, mole concept, and proportional reasoning.

Week 10: Data Management in Science: Scientific Databases & Graphing
Utilizing databases, data visualization tools, and graphing techniques for data-driven science instruction.

Week 11: Mapping & Visualizing Scientific Data
Integrating technology and mapping tools to enhance spatial understanding in science education.

Week 12: Science Inquiry, Research, and Project-Based Learning
Designing and implementing research projects and inquiry-based learning in the science classroom.

Week 13: Science Curriculum & Instructional Planning
Developing effective science curricula, lesson plans, and aligning instruction with NGSS.

Week 14: The Science Laboratory: Safety, Procedures, and Best Practices
Managing lab environments, ensuring safety, and designing engaging hands-on lab experiences.

Week 15: Science Teaching Resources & Course Review
Exploring science reference materials, digital tools, and reviewing key course concepts.

ASSIGNMENTS & ASSESSMENT

- Science Standards (NGSS) (10%)
- Developing Scientific Reasoning (10%)
- Problem Solving (10%)
- Semester & Lesson Planning (10%)
- Science Investigations (10%)
- Take-home Final Exam (50%)
- Grades will be assigned based on the following scale: A (93–100%), A- (90–92%), B+ (87–89%), B (83–86%), B- (80–82%), C+ (77–79%), C (73–76%), C- (70–72%), D+ (67–69%), D (63–66%), D- (60–62%), and F (below 60%).