Syllabus: STL 474/574
Methods in Teaching Elementary Science and Environmental Education
3 Credits

COURSE DESCRIPTION
Methods course for teaching science and environment education in elementary settings. Emphasizes inquiry learning, methods of instruction and assessment, place-based environmental education, integration across the curriculum, safety, and responsiveness to student diversity. Prerequisites: PSCI 170, GEOS 170, BIOL 370. Recommended Co-requisite: STL 476.

EMBEDDED FIELD EXPERIENCE
During this course, candidates will demonstrate competencies drawn from the MN Board of Teaching standards. Competencies associated with this course will be applied and evaluated in a rigorous field experience. The embedded field experience for this semester will include STL 475, STL 476, STL 474, and STL 428. Teacher candidates will spend 16 hours per week, for 7 weeks, in a 4th-6th grade classroom, for a total of 112 hours.

REQUIRED TEXT BOOKS


or


SOURCES OF ADDITIONAL READINGS


COURSE OBJECTIVES
The objectives for this course are derived from and address:

a) Minnesota Board of Teaching standards for elementary teaching in science education and social studies education from Minnesota Rule 8710.3200 *Teachers of Elementary Education,* Subpart 3 *Subject Matter Standards, Elementary Education.*

b) Conceptual Framework of the MSUM Education Unit.

Learning experiences in this course are framed around the candidates’ science abilities and attitudes, and are expected to lead to the following understandings and abilities:

1. An understanding of recent trends in science education policy and goals including state and national standards in science education. (J-8-a; Knowledgeable, Reflective)
2. An understanding of the nature of science, including an understanding of science as a human endeavor, the nature of scientific knowledge, and a historical perspective of science. (J-1; Knowledgeable, Reflective)
3. An ability to plan science and environmental education lessons that are developmentally appropriate and responsive to the needs of diverse groups of students. (J-8-a, J-8-b, J-8-c, J-8-d; Knowledgeable, Humanistic, Creative)
4. An ability to integrate domains of science (including environmental science) with each other and with reading, language arts, mathematics, and social studies. (J-3, D-4; Knowledgeable, Creative)
5. An ability to seek out community resources to safely support the teaching of science and environmental education. (J-8-a, J-8-d; Knowledgeable, Creative)

6. An ability to use quality children’s literature to support meaningful learning in science and environmental education. (J-3, J-8-a; Knowledgeable, Reflective, Humanistic, Creative)

7. An ability to use the 5E inquiry model as well as other instructional strategies to promote safe, developmentally appropriate science learning that addresses common misconceptions. (J-8-a, J-8-b, J-8-c, J-8-d; Reflective, Creative)

8. An ability to establish classroom management rules and procedures that ensure the physical safety of children, safely manage supplies and equipment, and are based on an understanding of legal requirements and ethical considerations. (J-8-d-i/ii/iii/iv/v/vi/vii; Knowledgeable, Humanistic)

9. An ability to construct assessment instruments that are compatible with teaching and that are reflective of assessment of the MN Graduation Standards. (J-8-a; Knowledgeable, Reflective)

10. An ability to use appropriate educational technology to enhance teaching and learning in science and environmental education. (J-3, J-8-a; Knowledgeable, Creative)

11. An awareness of connections between science, technology, and society, as well as the critical thinking skills that students will need to develop solutions to various environmental and technological problems confronting society. (J-1, J-3, J-8-a, D-2-h; Knowledgeable, Creative)

12. An understanding of the role of reflection in professional development. (J-8-a; Reflective)

**ELEMENTARY EDUCATION STANDARDS FOR SCIENCE EDUCATION**

(Item J) A teacher of children in kindergarten through grade 6 must demonstrate a fundamental knowledge of scientific perspectives, scientific connections, science in personal and social perspectives, the domains of science, and the methods and materials for teaching science and scientific inquiry. The teacher must:

(1) understand science as a human endeavor, the nature of scientific knowledge, and the historical perspective of science;

(3) know how to make connections across the domains of science, between science and technology, and between science and other school subjects;

(8) know and apply pedagogy and classroom management in science and scientific inquiry including understanding:
   (a) content standards under chapter 3501 for recommendations regarding curriculum, instruction, assessment, professional development, and program development;
   (b) how to teach scientific inquiry in a developmentally appropriate manner;
   (c) common student misconceptions in science and developmentally appropriate strategies to elicit students’ misconceptions and help them move to accepted scientific understandings; and
   (d) how to implement safe environments for learning science through knowing:
      (i) state and national legal responsibilities and safely guidelines for teaching science;
(ii) how to establish and enforce recognize safety procedures during the science learning experience;
(iii) how to use required safety equipment for classroom, field, and laboratory settings including goggles, fire extinguisher, fire blanket, eye wash, and chemical shower;
(iv) how to manage, maintain, and utilize science supplies and equipment;
(v) state and national guidelines and plan for the care, storage, use, and disposal of chemicals and equipment used to teach science;
(vi) the ethics of and restrictions on making and maintaining collections of scientific specimens and data; and
(vii) the ethics of and restrictions on the use of live organisms, and how to acquire, care, handle, and dispose of organisms.

ELEMENTARY EDUCATION STANDARDS FOR SOCIAL STUDIES EDUCATION
(Item D) A teacher of children in kindergarten through grade 6 must demonstrate knowledge of fundamental social studies concepts and the connections among them. The teacher must know and apply:

(2) concepts of:
   (h) the relationships among science, technology, and society;

(4) the environment as an integrating concept through understanding of how to use the sciences, social sciences, mathematics, arts, and communications in the exploration of environmental issues and topics.
CONCEPTUAL FRAMEWORK OF THE MSUM EDUCATION UNIT

MSUM candidates are professionals who are knowledgeable, reflective, humanistic, and creative.

Knowledgeable: MSUM candidates display competence in their subject matter, built upon a strong grounding in liberal studies. MSUM candidates understand the principles of learning, assessment and technology. They understand and apply legal and ethical considerations in all aspects of their work. MSUM candidates are able to integrate theory and practice, and view learning as an active process. MSUM candidates demonstrate the ability to model connections between philosophical foundations and best practices in the field. As life-long learners, MSUM candidates engage in research and complex thinking. They design opportunities for others to seek knowledge and to understand themselves as members of the world community.

Reflective: MSUM candidates engage in thoughtful analysis of the meaning and significance of their actions, decisions, and results with regard to their work in order to assess progress in meeting this guiding principle. It is through this reflective process that instruction is improved, new ideas are implemented, ineffective methodologies are abandoned, and learning outcomes for students are enhanced. MSUM candidates are skilled at analyzing their teaching from a variety of perspectives and identifying connections between teaching strategies and student learning. In addition, candidates utilize a variety of techniques to question their procedures and consider alternatives for instruction and student growth. MSUM candidates are able to recognize learning, motivational, and developmental variables in their instructional practice and relate those dimensions to their teaching practices. Finally, MSUM candidates bring a questioning spirit to received wisdom and conventional practice when needed.

Humanistic: MSUM candidates value the personal worth of each individual. This is based on a belief in people's potential and their innate ability to develop to their fullest. MSUM candidates' actions are grounded in knowledge of different cultural and ethnic groups within the world community, and in knowledge of the influence of culture and history, ethnicity, language, gender and socio-economics on one's life. This knowledge base informs candidates' decision-making as they create environments that promote freedom, compassion, and success for all learners. MSUM candidates are fair-minded in their interactions with others, as well as sensitive to and accepting of individual differences. Further, MSUM candidates have an understanding of aesthetics and the diversity that is part of the human experience and will incorporate this knowledge into their work. MSUM candidates recognize and accommodate a variety of linguistic and nonlinguistic interpersonal skills in their actions with others. MSUM candidates foster resiliency in the students with whom they work, and model these qualities in their own work.

Creative: MSUM candidates understand the powerful resources of the arts and sciences, and use their knowledge of these areas to bring the best of their imaginative and creative acts into the classroom. MSUM candidates recognize the important role creativity plays in the design of instruction and classroom environment. They will, for themselves and for their students, meet new situations with resourcefulness, excitement and curiosity, with an investigative attitude, and with the ability to pose, seek and design solutions to problems. MSUM candidates are cognizant of the aesthetic elements of the world and draw on that knowledge to make curricular decisions designed to help students not only learn about aesthetics, but to also learn how to think about the world at large.
INSTRUCTIONAL STRATEGIES
Class discussion, small group presentations, teaching lessons in field placement settings, demonstrations, hands on activities, student led presentations, jigsaw activities, field trips.

ASSIGNMENTS
Conceptions of Science Paper (10 pts)
Candidates will individually write a paper (approximately 3 pages in length) describing the nature of science, demonstrating an understanding of science as a human endeavor, the nature of scientific knowledge, and a historical perspective of science. [J-1]
(Graduate Candidates will write a more in-depth paper of approximately 5 pages in length.)

Learning Cycle Activities (10 pts)
Drawing on activities of your choice in Bosak’s Science Is book, your group will prepare and teach a short learning activity, using a three-step learning cycle model. This teaching experience will take place on campus with peers followed by a class discussion to analyze the experience. An outline describing the three steps of the learning cycle for this activity, identifying an underlying key concept or “big idea” in science, explaining the relationship to the MN Academic Standards in Science, and offering advice to others implementing this activity (such as enhancing particular science process skills, possible accommodations, and other recommendations) will be turned in. [J-8-a, J-8-b, J-8-d]
(Graduate students will teach their learning cycle activity to children and prepare a reflection paper identifying elements that were successful and elements to be changed along with a description of potential improvements.)

Inquiry Lesson Using Children’s Literature (15 pts)
Candidates will work in pairs to prepare and teach a 5E inquiry lesson grounded in a work of children’s literature. Candidates are encouraged to select or adapt a lesson from Ansberry & Morgan (2005 or 2007) but may design an original lesson. Documentation of correlation to the MN Academic Standards in Science is required. Lessons will be taught to children in a field placement classroom. An individual reflection papers is a component of this lesson. [J-3, J-8-a, J-8-b]
(Graduate candidates will also develop and describe adaptations for gifted students, students with special needs, or ELL students.)

Learning Center (15 pts)
Candidates will work in small groups to design and implement a learning center that stems from a developmentally appropriate key question in science. The display, instructional materials, and the learning activities should guide students to answer the key question in the allotted time (usually 20-30 minutes). Documentation of correlation to the MN Academic Standards in Science and an annotated bibliography of resources are required components of this assignment. Learning centers will be implemented with children at in a field placement setting. [J-8-a]
(Graduate candidates will also develop and describe adaptations for gifted students, students with special needs, or ELL students.)
Science Instructional Unit (50 pts)
Each candidate will design a series of related lesson plans encompassing at least 200 minutes of instruction (including assessment) focused on science but integrating various school subjects. A minimum of two lessons will utilize the 5E inquiry model; each may span across more than one day as long as the 5 elements are clearly identified. At least one lesson must demonstrate a clear connection to an environmental or science-technology-society issue. Candidates are encouraged to consider learning activities involving data collection experienced as a learner in PSCI 170, GEOS 170, and/or BIOL 370 (e.g. Wisconsin fast plants, mealworms, etc.), and adapt such learning activities for developmental appropriateness. Lesson plans will specify common student misconceptions and developmentally appropriate strategies to identify and address them. Safety considerations must be in place. Documentation of correlation to the MN Academic Standards in Science and an annotated bibliography of resources are required components of this assignment. [J-3, J-8-a, J-8-b, J-8-c, J-8-d, D-2-h, D-4]

(In addition to designing this unit plan, Graduate Candidates will implement it, revise it, and write a 2-3 page reflection paper about the strengths, revisions, and considerations for future implementation of this science instructional unit.)

GRADING
Conceptions of Science Paper 10 points
Learning Cycle Activity 10 points
Inquiry Lesson Using Children’s Literature 15 points
Learning Center 15 points
Science Instructional Unit 50 points
Total 100 points

90-100 % =A
80- 89% =B
70- 79% =C
60- 69% =D
59 % > =F

PROFESSIONAL REQUIREMENTS
Each MSUM student should approach the field experience and field observations as a professional. Notify the Cooperating Teacher prior to an absence. Dress in a professional manner. Wear identification while in the school, your MSUM ID or a driver’s license.

INSURANCE
Each MSUM student teacher must carry liability insurance when working in the schools. Joining Education Minnesota Student Program will provide you with liability insurance.

CONFIDENTIALITY POLICY
Each MSUM student, upon entering teacher education, assumes a number of obligations, one of which is maintaining professional conduct. The MSUM student assumes the trust and obligation to insure the full protection of information acquired about students/children, teachers, families, and other school personnel, both educational and personal, during all field experiences. The Code of Ethics for Minnesota Teachers states, “In accordance with state and federal laws, a
teacher shall disclose confidential information about individuals only when a compelling professional purpose is served or when required by law.” MSUM students will abide by this principle.

SPECIAL ACCOMMODATIONS
Students with disabilities who believe they may need an accommodation in this class are encouraged to contact Greg Toutges, Coordinator of Disability services at 477-5859 (voice) or 1-800-627-3529 (MRS/TTY), CMU 114, as soon as possible to ensure that accommodations are implemented in a timely fashion.

STATEMENT OF ACADEMIC INTEGRITY
Students are expected to practice the highest standards of ethics, honesty, and integrity in all academic work. Any form of academic dishonesty (e.g. plagiarism, cheating, or misrepresentation) may result in disciplinary action. Possible disciplinary actions include failure for part or all of the course, as well as suspension from the university.
<table>
<thead>
<tr>
<th>Topics</th>
<th>Readings</th>
<th>Standards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome and introduction. What is science? Why teach science? The nature of science. Conceptions of science and scientists.</td>
<td>Koch, Ch. 1&amp;2</td>
<td>J-1</td>
</tr>
<tr>
<td>Role and organization of national and state science education standards. Science literacy for all.</td>
<td>MN Academic Standards in Science; AAAS, Introduction, Ch. 1</td>
<td>J-8-a</td>
</tr>
<tr>
<td>Helping children construct knowledge about science. Misconceptions. Concept mapping</td>
<td>Koch, Ch.3</td>
<td>J-8-c</td>
</tr>
</tbody>
</table>
| Science process skills. Science circus. Science notebooks. Extending our senses with computer technology. | Koch, Ch. 4                                                              | J-8-a     
|                                                        |                                                                         | J-8-b     |
| Inquiry for all children. Learning cycle and 5 E model. Including all children. Developmental appropriateness. Gender equity. ELL’s. Gifted students. Students with special needs. | Koch, Ch. 6 & 7; Ansberry & Morgan, Ch. 3 & 4 | J-8-b     |
| Lesson planning. Role of questioning. Lesson adaptations for inclusive science education. | Koch, Ch.11                                                              | J-8-a     
|                                                        |                                                                         | J-8-b     |
| Authentic assessment in science education. | Koch, Ch. 13                                                             | J-8-a     |
| Curricular integration. Environment as an integrating concept. Using picture books in science. | Martin, Sexton, Franklin, Ch. 9; Ansberry & Morgan, Ch. 1 | J-3       
|                                                        |                                                                         | D-4       |
| Green science. Place-based environmental education. Local explorations of global environmental issues. Trip to Regional Science Center. | Koch, Ch. 5; Orr, Sobel, Louv                                             | J-8-a     
|                                                        |                                                                         | D-4       |
| Science-Technology-Society connections. Conceptions of technology. Design technology. | Koch, Ch. 1 & 12; AAAS, Ch. 3                                             | J-8-a     
|                                                        |                                                                         | J-1       
|                                                        |                                                                         | D-2-h     |
| Reflection and self-assessment. Changes to our own conceptions of science. Growing as a professional. | Koch, Ch.14                                                              | J-8-a     |