

Eastern Illinois University
Department of Early Childhood, Elementary, and Middle Level Education
ELE 5660 Science Curriculum in the Elementary and Middle School
Fall 2009 Section 001

Prerequisites: Six semester hours of science; ELE3290 or permission of the department chair.

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Class Meetings: Thursdays 4:30pm-7:00pm

Credit Hours: 3 semester hrs.

Unit Theme

The Educator as a Creator of Effective, Educational Environments: Integrating Students, Subjects, Strategies, Societies, and Technologies.

Mission Statement

The Department of Early Childhood, Elementary, and Middle Level Educations seeks to advance scholarly preparation by providing quality teaching and promoting excellence in research/creative activity in order for graduate students to exemplify best teaching practices for children from birth through age fourteen.

The Department is dedicated to the preparation of knowledgeable citizens of the 21st century and seeks to empower individuals to meet the challenges faced by professional educators in a rapidly changing society. Candidates for the Master of Science in Education Degree will be prepared to teach in diverse environments recognizing multiple pathways of learning.

The Department is committed to enhancing the graduate academic experience in order to create educators who can function effectively in a culturally diverse, technologically advanced, and global environment in order to engage learning at all levels.

Catalog Course Description

(3-0-3) Scope and sequence of the elementary science curriculum; new experimental curricula; selection of materials and equipment.

Course Purpose/Rationale

This course allows teachers to analyze their present science curriculum in light of current methods and philosophies and technologies.

Course Texts

Peters, J. M. & Stout, D. L. (2006). *Science in elementary education: Methods, concepts, and inquiries* (8th ed.). Upper Saddle River, NJ: Pearson, Merrill Prentice Hall. .

Information-Processing Models

Information-processing models emphasize ways of enhancing the human being's innate drive to make sense of the world by acquiring and organizing data, sensing problems and generating solutions to them, and developing concepts and language for conveying them. (pp. 25-28)

The *scientific inquiry model* uses The Biological Sciences Curriculum (BSCS) model as one example of a curriculum that uses inquiry teaching in developing science curriculum. "The essence of the model is to involve students in a genuine problem of inquiry by confronting them with an area of investigation, helping them identify a conceptual or methodological problem within that area of investigation, and inviting them to design ways of overcoming the problem." (p. 169) In addition, the Scientific Inquiry Model uses the work of Richard Suchman to support the Inquiry Training Model. Suchman believed that students can be conscious of their process of inquiry and can be taught the scientific procedures directly. "The model promotes strategies of inquiry and the values and attitudes that are essential to an inquiring mind, including: process skills; active, autonomous learning; verbal expressiveness; tolerance of ambiguity; persistence; logical thinking; and an attitude that all knowledge is tentative." (p. 185)

Personal Models

The *personal models of learning* begin from the perspective of the selfhood of the individual. They attempt to shape education so that we come to understand ourselves better, take responsibility for our education, and learn to reach beyond our current development to become stronger, more sensitive, and more creative in our search for high-quality lives. (pp. 30-32)

Joyce, B., Weil, M., & Calhoun, E. (2009). *Models of teaching* (8th ed.). Boston: Pearson.

Outcomes for all Graduate Students at Eastern Illinois University

Graduate students will:

1. possess a depth of content knowledge including effective technology skills and ethical behaviors;
2. engage in critical thinking and problem solving;
3. exhibit effective oral and written communication skills;
4. engage in advanced scholarship through research and/or creative activity;
5. demonstrate an ability to work with diverse clientele, recognizing individual differences; and
6. collaborate and create positive relations within the school, community, and profession in which they work.

Outcomes specific to this course

Graduate students will:

1. analyze current curricular and instructional issues in education.
2. synthesize knowledge gained from published research in education on curricular, instructional, and legal issues.
3. engage in reflective inquiry about program and practice.
4. design programs, curriculum, and strategies based on the current body of professional research and practices.
5. identify and explain philosophical, sociological, and psychological perceptive/models that under gird curricular and instructional approaches.
6. assess, plan, implement, and evaluate curriculum and instructional programs.
7. apply knowledge gained from publications and research in education to current curricular, instructional, and legal issues.
8. design programs, curriculum, and strategies based on current body of professional research and best practice.

International Society for Technology in Education (ISTE)

Standards for Students (2007)

http://www.iste.org/Content/NavigationMenu/NETS/ForStudents/2007Standards/NETS_for_Students_2007.htm

Standards for Teachers (2008)

http://www.iste.org/Content/NavigationMenu/NETS/ForTeachers/2008Standards/NETS_for_Teachers_2008.htm

Standards for Elementary Science Teachers

National Science Education Standards (NSES)

http://www.nap.edu/openbook.php?record_id=4962

Standards for Certification in Special Teaching Field—Elementary

<http://www.isbe.net/profprep/macstandardrules.htm>

ISBE Standards for Certification in Elementary - Standard 4 - Curriculum: Science

The competent elementary teacher understands the interrelationships among science, technology, and society: understands the fundamental concepts of life, physical, environmental, earth, and space sciences; and uses strategies to engage all students in acquiring new knowledge through the use of scientific thinking and reasoning.

| Course (Core) Requirements | Demonstrated Competencies | Graduate Standards |
|----------------------------|---|---|
| Participation | <p>NSES Professional Development Standard 4 & 5 Professional development for teachers of science requires learning essential science content through the perspectives and methods of inquiry. Science learning experiences for teachers must</p> <ol style="list-style-type: none"> 4. Build on the teacher's current science understanding, ability, and attitudes. 5. Incorporate ongoing reflection on the process and outcomes of understanding science through inquiry <p>NSES Professional Development Standard D 1 Professional development programs for teachers of science must be coherent and integrated. Quality preservice and in-service programs are characterized by clear, shared goals based on a vision of science learning, teaching, and teacher</p> | <p>1.d. an understanding and respect for professional ethics in the discipline 3.a. effective oral communication skills 3.c. effective, fair, and honest communication considering not only the message but also the audience</p> |

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| | development congruent with the National Science Education Standards | |
| Research Paper | <p>ISBE 4A - The competent elementary teacher understands the interrelationships among science, technology, and society in historical and contemporary contexts.</p> <p>ISBE 4E - The competent elementary teacher demonstrates and communicates the concepts, theories, and practices of science.</p> <p>ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning.</p> <p>NSES - Professional Development Standard C 5 & 6 Professional development for teachers of science requires building understanding and ability for lifelong learning. Professional development activities must</p> <ol style="list-style-type: none"> 5. Provide opportunities to know and have access to existing research and experiential knowledge. 6. Provide opportunities to learn and use the skills of research to generate new knowledge about science and the teaching and learning of science. | <p>1.a. a depth of content knowledge in the discipline</p> <p>1.b. effective use of technology as appropriate</p> <p>3.b. effective written communication skills</p> <p>4.a. an understanding of the role of research in the discipline</p> <p>4.b. the ability to conduct research and apply it to practice</p> |
| Science Curriculum Evaluation | <p>ISBE 4C - The competent elementary teacher understands principles and procedures, including safety practices, related to the design and implementation of scientific investigations and the application of inquiry skills and processes to develop explanations of natural phenomena.</p> <p>NSES Teaching Standard A 1 - Teachers of science plan an inquiry-based science program for their students. In doing this, teachers develop a framework of yearlong and short-term goals for students.</p> <p>NSES Professional Development Standard D 6 Professional development programs for teachers of science must be coherent and integrated. Quality preservice and in-service programs are characterized by continuous program assessment that captures the perspectives of all those involved, uses a variety of strategies, focuses on the process and effects of the program, and feeds directly into program improvement and evaluation.</p> | <p>1.c. the ability to apply content knowledge to practice</p> <p>2.a. critical thinking & problem solving</p> <p>3.b. effective written communication skills</p> <p>4.a. an understanding of the role of research in the discipline</p> <p>5.c. a respect for individual differences through the use of rich and varied approaches</p> |
| Science Curriculum Unit | <p>ISBE 4B - The competent elementary teacher understands the fundamental concepts, principles, and interconnections of life, physical, environmental, earth, and space sciences and their use to interpret, analyze, and explain phenomena.</p> <p>ISBE 4D - The competent elementary teacher understands the use of scientific investigation and inquiry skills across the sciences to conduct experiments and solve problems.</p> <p>ISBE 4F – The competent elementary teacher demonstrates and uses strategies to engage students in acquiring new knowledge through the use of scientific thinking and reasoning.</p> <p>ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning.</p> <p>NSES Teaching Standard A 1 & 2 - Teachers of science plan an inquiry-based science program for their students. In doing this, teachers</p> <ol style="list-style-type: none"> 2. Select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students 3. Select teaching and assessment strategies that support the development of student understanding and nurture a community of science learners. | <p>1.a. a depth of content knowledge in the discipline</p> <p>1.b. effective use of technology as appropriate</p> <p>1.c. the ability to apply content knowledge to practice</p> <p>3.b. effective written communication skills</p> <p>3.c. effective, fair, and honest communication considering not only the message but also the audience</p> <p>4.a. an understanding of the role of research in the discipline</p> <p>4.b. the ability to conduct research and apply it to practice</p> <p>5.a. an understanding of individual differences in</p> |

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| | NSES Teaching Standard F1 - Teachers of science actively participate in the ongoing planning and development of the school (classroom) science program. In doing this, teachers plan and develop the school (classroom) science program. | clientele |
| Presentation | ISBE 4F - The competent elementary teacher demonstrates and uses strategies to engage students in acquiring new knowledge through the use of scientific thinking and reasoning. | 1.b. effective use of technology as appropriate 1.d. an understanding and respect for professional ethics in the discipline 3.a. effective oral communication skills 3.c. effective, fair, and honest communication considering not only the message but also the audience 5.c.a respect for individual differences through the use of rich and varied approaches |
| Alternative Assignment | ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning. | 1.a. a depth of content knowledge in the discipline 1.b. effective use of technology as appropriate 4.a. an understanding of the role of research in the discipline 4.b. the ability to conduct research and apply it to practice |

| Course (Core) Requirements | Brief Descriptions | Point Values (Approximate Weight) | Due Dates* |
|-------------------------------|--|-----------------------------------|------------|
| Participation | Performance includes presence, participation and preparation for group and whole class discussions, and participation in lab activities working cooperatively with peers. Focus is on practices and behaviors that allow the learner to grow professionally. | 10% | |
| Research Paper | Performance includes analysis and synthesis of required readings and additional self-selected readings to establish a foundation for understanding the <i>inquiry</i> based learning process. The student will write a 6-12 page research paper including a reference list using a minimum of five additional resources, | 20% | |
| Science Curriculum Evaluation | Performance requires student to examine a model inquiry based science curriculum. The student will compare/contrast their district's science curriculum with the model science curriculum. The student will create an improvement plan for their district's existing science curriculum. | 20% | |
| Science Curriculum Unit | Performance requires the student to create a year-long curriculum and instructional plan for current grade level. The student will develop an essential question related to one of their curricular topics to develop an inquiry based science unit. The student will create a two week science unit built around an essential question. The unit will include a | 30% | |

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| | background knowledge paper with reference list, concept hierarchy or concept map, two week unit overview (including concepts and standards—NSES/ILS, materials and resources—including trade books and web sites, and a brief description of hands-on and interactive activities), two complete lesson plans following the learning cycle model. | | |
| Presentation | Performance requires the student to teach a model inquiry-based science lesson from his/her science unit that actively engages peers. The student will receive constructive feedback from peers and instructor. | 10% | |
| Alternative Assignments | Performance in the alternative assignments promotes life-long learning. The alternative assignments require effective communication related to the experiences. Performance increases awareness of outside agencies, materials, and resources. | 10% | |

****The instructor will provide detailed instructions and expectations for each assignment. Topics, assignments, and due dates will be posted on the course calendar.***

Grading Scale: A 93%-100%; B 85%-92%; C 77%-84%; D 69%- 76%; & F Below 69%.

Weekly Content Outline

- ❖ Identifying barriers to Science Instruction (weeks 1-3)
- ❖ What are the “big ideas” related to teaching and learning science?
 - constructivism, inquiry, discovery, concepts and misconceptions
 - Inquiry processes and skills*
 - questioning*
 - assessment*
 - safety*
- ❖ Why a science curriculum? (WEEKS 4-6)
 - brief history of curriculum
 - curriculum design
 - scope and sequence
 - Illinois Learning Standards*
 - National Science Education Standards
 - science as inquiry*
 - life, physical, and earth and space science*
 - science and technology
 - science in personal and social perspectives
 - history and nature of science
 - science curriculum models
- ❖ What materials and resources are available for teaching science and subject integration? (Weeks 7-10)
 - trade books, media and teacher materials*
 - web sites
 - community resources
- ❖ How science curriculum develops? (11-16)
 - Unifying concepts of science (big ideas)
 - systems, order, and organization
 - evidence, models, and explanation
 - constancy, change, and measurement
 - evolution and equilibrium
 - form and function
 - Develop a hierarchy of learning
 - Concept mapping
 - Unit planning
 - Lesson planning following the learning cycle model (The 5 E model)*
 - engage
 - explore
 - explanation
 - expansion
 - evaluation

*Each class period will provide opportunity for participation in hands-on inquiry based activities demonstrating the “the interrelationships among science, technology, and society; the fundamental concepts of life, physical, environmental, earth, and space sciences; and strategies used to engage all students in acquiring new knowledge through the use of scientific thinking and reasoning.” ISBE Standards for Certification in Elementary - Standard 4 - Curriculum: Science

PERFORMANCE TASKS: Results-Driven Components

Complete TEN professional growth opportunities from the following:

(** Required- remaining five are your choice). Rubrics, writing and research requirements will be given in class.

1. Verbal sharing of a recent science finding/innovation**
2. Verbal/written sharing/explanation of a promising science activity**
3. Sharing & description of a high potential resource (electronic, print, human)**
4. Development of a rubric for a specific project based activity**
5. Mini-presentation on a science topic **
6. Summary and critique of a journal article on research in science teaching.
7. Modification/improvement of an existing high potential science activity.
8. Produce a sample of a Parent newsletter addressing a science related topic.
9. Development of a performance based assessment option for a science unit.
10. Example of an interdisciplinary activity that addresses two distinct concepts.
11. Modification of an activity that could be done with parents.
12. Development of a rubric and/or procedures for a science fair and/or invention convention.
13. Sharing of an activity and/or resource about women in science and/or multicultural awareness.
14. Sharing of a high potential media source and how it could be utilized.
15. Writing and submission of an idea and/or activity to the Illinois Science Teachers Association Journal, The Spectrum.
16. Summary and analysis of a Position Paper on Science (www.nsta.org.)
17. Demonstration of an effective use of technology in Science teaching.
18. Sharing and explanation of a promising trade book and how it can be infused in an inquiry manner in a science lesson.
19. Explanation and analysis of an environment based activity and/or project.
20. Suggestions for inquiry based projects including investigative questions.

Reference List

***Denotes Unit Conceptual Framework References**

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