

**Eastern Illinois University**  
**Department of Early Childhood, Elementary, and Middle Level Education**  
**ELE 5660.001 Science Curriculum in the Elementary and Middle School**



Credit Hours: 3 semester hours  
Prerequisites: Six semester hours of science: ELE3290 or permission of the department chair  
Instructor: Denise E. Reid  
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Location: Buzzard 2430  
Class Meetings: Tuesday/7:01-9:31 p.m.

**Unit Theme**

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

**Mission Statement**

The Graduate Program in Elementary Education advances 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 graduate curriculum encompasses comprehensive content knowledge and promotes the use of critical thinking and problem solving to cultivate teacher-researchers who are empowered to serve as leaders in the profession. Faculty members challenge students to bridge the gap between theory and practice as they develop the skills required for ethical and effective collaboration and communication within the local school community and a culturally diverse, technologically advanced global environment.

**Catalog Course Description**

(3-0-3) Scope and sequence of the elementary and middle level 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**

- Abell, S. K. & Volkmann, M. J. (2006). *Seamless assessment in science: A guide for elementary and middle school teachers*. Portsmouth, NH: Heinemann.
- Klentschy, M. & Thompson, L. (2008). *Scaffolding science inquiry through lesson design*. Portsmouth, NH: Heinemann.
- Norton-Meier, L., Hand, B., Hockenberry, L. & Wise, K. (2008). *Questions, claims, and evidence: The important place of argument in children's science writing*. Portsmouth, NH: Heinemann.
- Worth, K., Winokur, J., Crissman, S., Heller-Winokur, M. & Davis, M. (2009). *The essentials of science and literacy: A guide for teachers*. Portsmouth, NH: Heinemann.

**Supplemental Materials**

1. Students will be required to utilize Desire 2 Learn (D2L).
2. Students will be required to purchase a course packet.

**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* (8<sup>th</sup> 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.

**Performance Outcomes**

- The competent elementary teacher demonstrates and communicates the concepts, theories, and practices of science.
- 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.
- 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.
- The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning.
- Teachers of science select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students.
- Teachers of science select teaching and assessment strategies that support the development of student understanding and nurture a community of science learners.

**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](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](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](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 &amp; 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"> <li>4. Build on the teacher's current science understanding, ability, and attitudes.</li> <li>5. Incorporate ongoing reflection on the process and outcomes of understanding science through inquiry</li> </ol> <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 development congruent with the National Science Education Standards</p>	<p>1.d. an understanding and respect for professional ethics in the discipline 2.a. critical thinking and problem solving 3.a. effective oral communication skills 3.c. effective, fair, and honest communication considering not only the message but also the audience 5.f. an ability to engage in reflective practice</p>
Research Paper	<p>ISBE 4A - The competent elementary teacher understands the interrelationships among science, technology, and society in historical and contemporary contexts. ISBE 4E - The competent elementary teacher demonstrates and communicates the concepts, theories, and practices of science. ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning. NSES - Professional Development Standard C 5 &amp; 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"> <li>5. Provide opportunities to know and have access to existing research and experiential knowledge.</li> <li>6. Provide opportunities to learn and use the skills of research to generate new knowledge about science and the teaching and learning of science.</li> </ol>	<p>1.a. a depth of content knowledge in the discipline 1.b. effective use of technology as appropriate 2.a. critical thinking and problem solving 3.b. effective written communication skills 4.a. an understanding of the role of research in the discipline 4.b. the ability to conduct research and apply it to practice 5.e. an ability to provide evidence of inquiry based instruction 5.f. an ability to engage in reflective 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. 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. 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 2.a. critical thinking &amp; problem solving 3.b. effective written communication skills 4.a. an understanding of the role of research in the discipline 5.c. a respect for individual differences through the use of rich and varied approaches</p>

		<p>5.d. an ability to provide evidence of differentiation of curricula                      5.e. an ability to provide evidence of inquiry based instruction                      5.f. an ability to engage in reflective practice</p>
<p>Science Curriculum Unit</p>	<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.                      ISBE 4D - The competent elementary teacher understands the use of scientific investigation and inquiry skills across the sciences to conduct experiments and solve problems.                      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.                      ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning.                      NES Teaching Standard A 1 &amp; 2 - Teachers of science plan an inquiry-based science program for their students. In doing this, teachers</p> <ol style="list-style-type: none"> <li>2. Select science content and adapt and design curricula to meet the interests, knowledge, understanding, abilities, and experiences of students</li> <li>3. Select teaching and assessment strategies that support the development of student understanding and nurture a community of science learners.</li> </ol> <p>NES 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.</p>	<p>1.a. a depth of content knowledge in the discipline                      1.b. effective use of technology as appropriate                      1.c. the ability to apply content knowledge to practice                      2.a. critical thinking and problem solving                      3.b. effective written communication skills                      3.c. effective, fair, and honest communication considering not only the message but also the audience                      4.a. an understanding of the role of research in the discipline                      4.b. the ability to conduct research and apply it to practice                      5.a. an understanding of individual differences in clientele                      5.d. an ability to provide evidence of differentiation of curricula                      5.e. an ability to provide evidence of inquiry based instruction                      5.f. an ability to engage in reflective practice</p>
<p>Presentation</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>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</p>

		<p>5.d. an ability to provide evidence of differentiation of curricula</p> <p>5.e. an ability to provide evidence of inquiry based instruction</p> <p>5.f. an ability to engage in reflective practice</p>
Alternative Assignment	ISBE 4G - The competent elementary teacher selects and uses a wide range of instructional resources and technologies to support scientific learning.	<p>1.a. a depth of content knowledge in the discipline</p> <p>1.b. effective use of technology as appropriate</p> <p>2.a. critical thinking and problem solving</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.f. an ability to engage in reflective practice</p>

Although graduate courses may have common assignments (e.g., critiques of journal articles, literature reviews, or research papers), the overall goal of the program in elementary education is to provide a “spiral curriculum”. The class assignments submitted by a graduate student must provide evidence of growth and advancement by building upon prior coursework, but not duplicating previous projects, experiences, or materials.

<b>Course (Core) Requirements</b>	<b>Brief Descriptions</b>
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.
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.
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.
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 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.
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.

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

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

### Course Assignments

Research Paper	100 points
Conservation Tasks Assignment	50 points
Science Curriculum Evaluation	50 points
Science Curriculum Unit	100 points
Presentation	30 points
Responsive Double-Entry Journal	100 points (25 points each)
Participation	30 points

The Department of EC/ELE/MLE is committed to the learning process and academic integrity as defined within the Student Conduct Code Standard I. "Eastern students observe the highest principles of academic integrity and support a campus environment conducive to scholarship." Students are expected to develop original and authentic work for assignments submitted in this course. "Conduct in subversion of academic standards, such as cheating on examinations, plagiarism, collusion, misrepresentation or falsification of data" or "submitting work previously presented in another course unless specifically permitted by the instructor" are considered violations of this standard.

### Weekly Content Outline

- ❖ What are the "big ideas" related to teaching and learning science? (Three Weeks)
  - constructivism, inquiry, discovery, conceptions and misconceptions
  - processes skills\*
  - questioning\*
  - assessment\*
  - safety\*
- ❖ Why a science curriculum? (Three Weeks)
  - 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? (Three Weeks)
  - trade books, media and teacher materials\*
  - web sites
  - community resources
- ❖ How science curriculum develops? (Six Weeks)
  - 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

### Reference List

#### \*Denotes Unit Conceptual Framework References

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