Eastern Illinois University
Department of Early Childhood, Elementary, and Middle Level Education
ELE 5660.001/Fall 2017 Science Curriculum in the Elementary and Middle School

https://www.cnet.com/pictures/amazing-photos-of-solar-eclipses/5/

Credit Hours:	3 semester hours
Prerequisites:	Six semester hours of science: ELE3290 or permission of the department chair
Instructor:	Denise E. Reid
Office:	Buzzard 2211
E-mail:	dereid@eiu.edu
Office Hours:	Thursday 7:00 – 8:00 p.m. through the D2L Online Room (I will be available at this time for face time questions, etc. You do not have to be online at this time, I am available if you need me.)
Phone:	Office (217) 581-5728 (Messages Only) Cell (217) 549-3633
Location:	Online
Class Meetings:	Online Course: Modules will be completed through D2L

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 An * indicates the primary books used in this course. There will be some readings from the other two 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. Graduate students will be required to utilize D2L. The instructor will send messages through Panthermail or D2L, not personal or school e-mail accounts.
2. Materials for Science Investigations (Items can be purchased for minimal cost, e.g. a bag of m & ms, or can be found around the house.)

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) BSCS – Biological Sciences Curriculum Study https://bscs.org/about

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.

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 addressing the Next Generation Science Standards (NGSS) and the Common Core State Standards (CCSS) for their students. In doing this, teachers develop a Unit of Study that addresses the Performance Expectations for a particular topic or Disciplinary Cord Ideas.
- 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.

Standards for Elementary Science Teachers

Illinois Common Core Standards http://www.isbe.net/common_core/pls/level1/pdf/ela-standards.pdf

Illinois Professional Teaching Standards http://www.isbe.state.il.us/peac/pdf/IL_prof_teaching_stds.pdf

2.2 Science—Candidates know, understand, and use fundamental concepts of physical, life, and earth/space sciences. Candidates can design and implement age-appropriate inquiry lessons to teach science, to build student understanding for personal and social applications, and to convey the nature of science.

Illinois Social Emotional Learning Standards (SEL) http://www.isbe.net/ils/social_emotional/standards.htm

Association for Childhood Education International Elementary Education Standards and Supporting Explanation 2007
http://acei.org/programs-events/acei-standards-for-elementary-level-teacher-preparation

Course (Core) Requirements	Demonstrated Competencies	Graduate Standards
Threaded Discussions	• Focus is on practices and behaviors that allow the learner to grow professionally. • Demonstrate commitment to improving knowledge in best practice pedagogy for concept attainment, inquiry, and skill development.	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
Double Entry Journal Notes and Reflections	• Utilize inquiry and critical thinking in understanding how individuals develop and learn. • Synthesize the information and effectively communicating the concepts, theories, and practices of science.	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
Science Curriculum Unit	• Use the performance expectations for the NGSS to develop curriculum using backward design. • Understand the use of scientific investigation and inquiry skills across the sciences to conduct experiments and solve problems. • Demonstrate and use strategies to engage students in acquiring new knowledge through the use of scientific thinking and reasoning. • Selects and uses a wide range of instructional resources and technologies to support student scientific learning.	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

Science Curriculum Evaluation (Peer Unit)	• Understand 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. • Develop and exercise a working knowledge of the NGSS. • The teacher uses critical thinking and science instructional pedagogy to assess curriculum.	1.c. the ability to apply content knowledge to practice 2.a.critical thinking & 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 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
Presentation	• Model an inquiry based science lesson that addresses the NGSS using the research based instructional learning cycle model. • Use effective communication. • Demonstrate content and pedagogical competency.	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 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
Module/Weekly Assignments • Readings (Chapters and Articles) • Videos • Science Labs • Written Assignments • Discussion Board	• Performance promotes life-long learning. • Performance increases awareness of outside agencies, research-based instructional practices, pedagogical knowledge, materials, and resources. • Uses effective communication related to the learning experiences.	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 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.f. an ability to engage in reflective practice

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.

Course (Core) Requirements	Brief Descriptions	Due Dates*
Threaded Discussion	Performance includes participation and preparation for group discussions. Focus is on using evidence to support reflective thinking.	

Double Entry Journal Notes and Reflections	The participant will keep a double entry journal for the primary texts for this course: • *Seamless assessment in science: A guide for elementary and middle school teachers.* • *The essentials of science and literacy: A guide for teachers.*	
Science Curriculum EQuIP Rubric	Examine the EQuIP Rubric for assessing science units and curriculum to see how well they are aligned with the Next Generation Science Standards (NGSS).	
Science Curriculum Unit	Create an instructional unit that addresses the NGSS. Begin with a minimum of two performance expectations and develop an essential question related to the selected curricular topic to develop an inquiry based science unit. The unit will include a background knowledge paper with reference list, a unit overview (including concepts and standards—NGSS, materials and resources—including trade books and web sites, and a brief description of hands-on and interactive activities), and one complete lesson plan following the learning cycle model (LCM-5E).	
Presentation	Create a presentation of Science Curriculum Unit. Provide constructive feedback for peer presentation.	
Supporting Assignments	Performance in the modular assignments promotes life-long learning. The modular assignments require effective communication related to the experiences. Performance increases awareness of outside agencies, instructional practices, pedagogical knowledge, 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 in D2L.

Instructor Response Time: I routinely check my e-mail and the D2L course site for postings and e-mail between 12:00 p.m. and 4:30 p.m., Monday – Friday. Use my EIU email address to contact me dereid@eiu.edu. You can anticipate a response from me within 12 to 48 hours. If you need a quicker response, please send me a text message**.**

Learner Interaction Policy and Participation Guidelines: This is a course where you will learn by doing. As a student, you are required to complete the assignments (readings, videos, labs, written assignments, threaded discussions, etc.) by the set due dates found in the module assignments and course calendar.

***Threaded Discussion Rubric:**

9-10 points: Written responses demonstrate exceptional conceptual understanding of key concepts. The responses are supported with evidence from readings and include appropriate citations. Responses are linked to experiences. The responses offer new interpretations of discussion material, and encourage further discussion from group members. The posting is the appropriate length, and clearly and concisely states ideas using appropriate academic vocabulary.

7-8 points: Written responses show evidence of conceptual understanding of major concepts. The response includes some evidence from readings and citations. The response offers an occasional divergent viewpoint or challenge. The response is the appropriate length and uses academic vocabulary.

5-6 points: Written responses demonstrate shallow grasp of the key concepts, and often restates information found in the readings. The response rarely demonstrates a stand on issues. The written responses offer inadequate levels of support. The written responses do not meet the minimum length requirement. Written responses contain simple sentences and vocabulary.

1-4 points: A minimal posting of material. Shows no significant understanding of material. Language is mostly incoherent.

*Rubric adapted from https://onlinelearning.rutgers.edu/faq/grading-threaded-discussions-model

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

Course Assignments	****See attached Course Calendar for Due Dates**
Conservation Tasks Assignment	50 points
Science Curriculum Unit (Module 10)	100 points

Presentation (Module 10)	30 points
Responsive Double-Entry Journal	100 points (20 points each)
Survey & Quizzes	30 points (10 points each)
Module Assignments: • Module 1: Course Information • Module 2: Teaching for Conceptual Understanding in Science • Module 3: Constructivism, Inquiry, and Misconceptions • Module 4: The NGSS and Curriculum Development • Module 5: Instructional Models & Instructional Strategies • Module 6: Literacy in the Science Curriculum • Module 7: Assessment & Feedback • Module 8: Safety • Module 9: Science Resources • Module 10: Science Unit of Study	Points will vary per assignment Most modules include readings, videos, a lab, and discussion.

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
  - Questioning*****
  - Assessment*****
  - Safety*****
- What are the necessary components needed to create effective science curriculum? (Three Weeks)
  - Next Generation Science Standards
    - Performance Expectations
    - Scientific and Engineering Practices: 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.
    - Disciplinary Core Ideas: life, physical, and earth and space science, technology, engineering and applications of science*****
    - Crosscutting Concepts: patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change.
- What materials, instructional models, instructional strategies, and resources are available for teaching science and subject integration? (Three Weeks)
  - Trade books, media and teacher materials*****
  - Science notebooks
  - Web sites
  - Community resources
  - Instructional Models: The 5E Learning Cycle Instructional Model; The Conceptual Change Model; Argument Driven Inquiry (ADI), etc.
  - Instructional Strategies
- How science curriculum develops? (Six Weeks)
  - Starting with the performance expectations in NGSS and using backward design
  - Unifying concepts of science (big ideas)
  - 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

Reference List

***Denotes Unit Conceptual Framework References**

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