

ES 308 Science for the Elementary School Teacher (3 semester hours)
Fall 2013

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Meetings: Floyd Science Building—221

Course Description:

This study will include content from selected topics in elementary science teaching units: biology, chemistry, physics, geology, astronomy, and meteorology. Candidates will demonstrate practical techniques in the development of lesson plans, use of materials and science equipment. Emphasis will be placed on implementing science curricula through inquiry strategies, strengthening the role of science in the elementary program, and fostering scientific behavior. Assessment of developmental appropriateness of activities and content will be embedded in all experiences while processes will be emphasized as concepts are developed.

Course Prerequisites Desirable: BI 101, 102, or BI 111, 112, PH 101, ES 121 & ES 121L

Text: Goldston, M. & Downey, L. (2013). *Your Science Classroom: Becoming an Elementary/Middle School Science Teacher*. Thousand Oaks, CA: SAGE.

On-line References:

Next Generation Science Standards. (Updated Edition released April 2013.)

National Science Education Standards (highly recommended for future use) National Research Council, 1996.

Up to six field experiences, including community service, and up to three field trips may occur outside the regular class time.

Learning Outcomes related to the University/Departmental Goals:

Upon completion of courses in the Natural Sciences, students will be able to:

1. Recognize the logic of scientific methodology for advancing theories within a discipline.
2. Demonstrate comprehension of the essential ideas and unifying concepts associated with a discipline.
3. Discuss how to address a scientific question, collect and analyze appropriate data, and interpret the results.
4. Understand the dynamic nature of science and its relation to everyday life.

Course Comment: An emphasis is placed on inquiry-based learning, questioning strategies for teachers and students, understanding how to implement science education reform strategies as supported by the *Alabama Course of Study: Science*; National Science Teachers Association (NSES) *National Science Education Standards, Benchmarks* developed by the American Association for the Advancement of Science (AAAS) and Project 2061—the national goal for science, technology, and mathematics literacy.

Learning Objectives
Knowledge Standards

References are made to standards including the national science education standards (NSES) which were released in April 2013.

Upon the completion of this course students will be able to demonstrate knowledge of:

1. the importance of developing learning objectives based on the Alabama Courses of study and the needs, interests and abilities of students
CF1 & CF 5 290-3.3.03 (2)(c)2.(i);
2. the components of comprehensive, research-based, effective science programs
3. academic knowledge and methods to plan and provide a developmentally appropriate curriculum, (inquiry-based curriculum, pedagogy and assessment) for elementary students in accordance with *Alabama Courses of Study* for health education including sciences
290-3-3-.06 (2)(b)2.(i)(I); NSES 6/ 6A, B, C; NSES 8 B/8 A, C;
4. developmentally appropriate inquiry strategies for teaching math and science, including those advocated by the Alabama Mathematics, Science, and Technology Initiative
290-3-3-.06(2)(b)2.(i)(II)
5. various techniques, strategies, curriculum, and literacy models and programs for promoting maximum development of children including decision-making skills
6. approaches to knowledge construction and application to all disciplines
7. concepts of science in personal and social perspectives
CF 1 290-3-3-.06(2)(b)2.(i)(IV); NSES 4 A/B, C
8. Academic content and methods to plan and provide a developmentally appropriate curriculum for elementary students in accordance with the *Alabama Course of Study: Science*, national standards, and the needs, interests, and abilities of students
CF 1 & CF 5 290-3-3-.06 (2)(b)2.(i)(I); NSES 1.A; NSES 6/A, B, C;

9. the inquiry processes scientists use in the development of new knowledge, including those advocated by the Alabama Math, Science and Technology Initiative and to understand and apply mathematics in problem solving and science experiences such as the Five E Model;
290-3-3-.06 (2)(b)2.(i)(II); NSES 1/1 D; NSES 3. A/B;
10. the current national science education reformation goal--achieve a science literate nation (Project 2061) through the Benchmarks of American Association for the Advancement of Science and the National Science Education Standards
NSES 6/6 A, B, C;
11. unifying concepts of physical, life, and Earth and space science in accordance with the *Alabama Course of Study: Science* and the National Education Standards
290-3-3-.06 (2)(b)2.(i)(III); NSES 1. A/B; UNA President's Global Initiative
12. the major roles of the history and nature of science in order to develop science literacy
290-3-3-.06 (2)(b)2.(i)(V); NSES 6
13. procedures for organizing and administering a science laboratory, including health and safety procedures through the use of appropriate scientific instruments and laboratory equipment
290-3-3-.06 (2)(b)2.(i)(VI)
14. how elementary students differ in their development
CF 1 290-3-3-.03(4) (2)(c)2.(i)
15. how elementary students differ in their approaches to learning
CF 1 290-3-3-.03(4) (2)(c)2(ii)(II)

Ability Standards

Upon the completion of this course students will be able to demonstrate the ability to

16. facilitate children's development and skills in...inquiry...and reasoning
17. teach science using the components of a comprehensive, research-based, effective science programs discuss and use elementary science projects including those advocated by the Alabama Math, Science, and Technology Initiative
CF 1 & CF 6 290-3-3-.06 (2)(b)2.(ii)(I);
18. apply the fundamental concepts in teaching the subject matter of science and the inquiry processes scientists use in the discovery of new knowledge to build a base for scientific technological and environmental literacy, including those advanced by AMSTI
290-3-3-.06 (2)(b)2.(ii)(II);

19. organize and conduct laboratory demonstrations, experiments, and field experiences emphasizing safety at all times
290-3-3-.06 (2)(b)2.(ii)(III)
20. teach constructivist theory in the context of prior and alternative conceptions emphasizing the history and nature of science
CF 1 290-3-3-.06 (2)(b)2.(i)V; NSES 2 A/B; 5/5E
21. show, by means of participation, an awareness of problems and solutions posed by science, technology, and society
NSES 7/7A
22. demonstrate an awareness of environmental and energy problems and solutions to those problems by being able to prepare appropriate inquiry-based elementary science activities;
NSES 3 A/B
23. prepare and discuss science activities that incorporate the psychological and philosophical works of Brunner, Piaget, Lowry, and others;
24. demonstrate knowledge of various techniques, strategies, curriculum and literacy models, and programs for promoting maximum development of children including appropriate intervention methods for students with special needs and decision-making skills
26. apply learning through peer teaching and clinical experiences;
27. demonstrate the ability to engage students through inquiry and divergent questioning
NSES 3 A/B
28. understand contributions to science through character studies (scientists) in historical context and human endeavors NSES 4A/4 B, C
29. demonstrate, through class participation and assessments, a knowledge of laws pertaining to liability, safety hazards, and precautions in the science classroom protecting students' physical, psychological, and emotional health NSES 9/9 A, B
30. demonstrate through actions and interactions professional behavior identified in the UNA College of Education and Human Sciences conceptual framework. NSES 10/10 A, B, C, D
31. demonstrate a positive attitude about teaching science (scientific attitudes).

Content

- A. Connecting Learning Theory to Pedagogy and Decision-making in the Science Classroom
1. Piaget; Dewey; Bruner; Ausebel; and other philosophers
 2. Advantages and Disadvantages Associated with Various Instructional Strategies
 3. The Learning Cycle
 4. The Five-E Learning Model
 5. Creating a Developmentally Appropriate Curriculum (founded on Alabama Course of Study, Needs, Interests, and Abilities of Students) CF 1 290-3-3-.06 (2)(b)2.(i)(I)
 6. Reformation in Science Education NSES 6
 7. Scientific Literacy—Benchmarks/Project 2061 NSES 1. B; NSES 6
- B. Content of the National Standards for Science Education
NSES 1 A; NSES 6/6 A, B, C
1. Properties of Objects NSES 6
 2. Position and Motion of Objects NSES 6
 3. Light, Heat, Energy and Magnetism NSES 6
 4. Organisms and Environments NSES 6
 5. Life Cycles of Organisms NSES 6
 6. Characteristics of Earth Systems NSES; 6 President’s Global Initiative
 7. Objects in the Sky: Earth in the Solar System NSES 6
 8. Changes in Earth and Sky NSES 6
 9. Personal Health NSES 6
 10. Characteristics and Changes in Populations and Ecosystems NSES 6
 11. Changes in Environments: Diversity and Adaptation NSES 6
 12. Natural Hazards NSES 6
 13. Science and Technology NSES 6 NSES 6
 14. Matter and Temperature NSES 6
- C. Understanding and Applying the Nature of Science
1. Knowledge Construction
 2. Science as a Dynamic Body of Information
290-3-3-.06 (2)(b)2.(i)(II); NSES 2A/2 B
 3. Science as an Inquiry and Reasoning Process
CF 1 290-3-3-.06 (2)(b)2.(i)(II); NSES 3 A/B
 4. Science as a Human Endeavor and Connections to Students’ Lives
290-3-3-.06 (2)(b)2.(i)(V); NSES 4 A/ B, C
 5. Evidence, Argument, and Explanation NSES 6
 6. Historical Context/Scientists NSES 4 A/B, C
- D. Understanding and Implementing the National Science Standards and the Alabama State Standards

1. Importance of Developing Learning Objectives Based on the Alabama Courses of Study; National Standards in Science Education; and the Needs, Interests, and Abilities of Students in Early Childhood and Elementary
CF 1 & CF 5 290-3-3-.06 (2)(b)2.(i)(I)
NSES 1. A; NSES 6/6 A, B
 2. Major Concepts and Principles of the Teaching Disciplines—Unifying Concepts of physical, life, and Earth and space science
CF 1 290-3-3.06 (2)(b)2.(i)(III); NSES 1 A
 3. Inquiry-based Learning from Student Experience
CF 1, CF 4, & CF 6 290-3-3-.06 (2)(b)2.(i)(II); NSES 3 A/B
 4. Children’s Development and Skills in Communication, Inquiry, and Reasoning including Prior and Alternative Conceptions
CF 1 290-3-3-.03(4) (2)(c)2.(i)(I); CF 1 290-3-3-.03(4) (2)(c)2(ii)(II);
NSES 3 A B; 5/5E
 5. Higher-level questioning
 6. Problem-Solving
 7. Expository to Guided Discovery to Discovery (Inquiry Continuum)
NSES 3 A/B
 8. Project 2061
 9. Physical, Psychological, and Emotional Safety
290-3-3-.06 (2)(b)2.(i)(VI)
NSES 9/9 A, B
- E. Selecting Curricula Activities
1. Components of comprehensive, research-based, effective science programs; Discuss and use elementary science projects such as ESS, SAPA, SCIS, OBIS, BSCS, GEMS, AIMS, FOSS (used or advocated by AMSTI), JASON, and others;
 2. Developmentally Appropriate Inquiry Activities/Strategies for Teaching Math and Science, including Those Advocated by the Alabama Math, Science and Technology Initiative
CF 1 & CF 290-3-3-.06 (2)(b)2.(i)(II)
NSES 1/1D; NSES 3A/B
 3. Developmental Issues P-Grade 6
 4. Technology and Community Human and Institutional Resources to Advance the Learning of Science in the Classroom and Field
NSES 7/7A, B
- F. Assessment that Reflects Higher Level Responses
- G. Teach Science

1. Integrate Research-based Pedagogy into Lesson Planning, Assessment, Peer Teaching and Field Experience Teaching
CF 1 & CF 6 ; NSES 1A; NSES 1 B; NSES 8 B/ A, C
 2. Accommodate All Learners: Develop Knowledge of Various Techniques, Strategies, Curriculum and Literacy Models, and Programs for Promoting Maximum Development of Children
CF 5
 3. Relating Science to Personal and Social Perspectives
CF 1 290-3-3-.06(2)(b)2.(i)(IV)
 4. Context of Prior and Alternative Conceptions NSES 4 A/B, C; NSES 5/5E
 5. Laboratories
 - A. Procedures for Organizing and Administering a Science Laboratory, including Health and Safety Procedures through the Use of Appropriate Scientific Instruments and Laboratory Equipment CF 1
290-3-3.06 (2)(b)2. (i)(VI)
 - B. Organize and Conduct Laboratory Demonstrations, Experiments, and Field Experiences—Emphasizing Safety at All Times CF 1
290-3-3.06 (2)(b)2.(ii)(III)
- H. Professional Development
1. UNA College of Education and Human Sciences Conceptual Framework
 2. Mandated Programs and Scripted Lessons
 3. Impact on Student Achievement
 4. Major Concepts and Principles of the Teaching Disciplines NSES 1 A

Course Requirements

Attend all classes--meeting at the established time.

In addition to the listed requirements, you are expected to observe in an elementary school for a three-hour period and three one-hour periods. Your observations will be recorded and a reflection turned in to the faculty member. A form documenting your observation period is required—signature of teacher of principal. This form will be provided.

Assessment of Knowledge and Skill

Each candidate will:

1. Implement peer-teaching (inquiry) strategies one or more periods during a

semester that reflect current theory in science pedagogy particularly inquiry based learning;

NSES 3 A/ B

2. Actively participate in thirty or more activities during class. These provide opportunities for all candidates and students to develop knowledge, skills, and strategies in critical thinking and in understanding major concepts and principles unifying science concepts in physical, life, Earth and space science.
CF 1 290-3-3-.06 (2)(b)2.(i)(III)
3. Prepare up to 5 inquiry-based lesson plans and evaluate other plans that reflect learning objectives based on the Alabama Courses of Study, National Standards, AMSTI recognized principles, and the needs, interests, and abilities of early childhood and elementary students. Assessments will reflect alignment of learning objectives and instruction and will reflect divergent strategies.
CF1 & 5 290-3-3-.03(2)(c)2.(i) ;
NSES 1. A; NSES 3 A/ B; NSES 6/6 A, B, C; NSES 8 B/A, C
4. Demonstrate knowledge of various techniques, strategies, curriculum and literacy models, and programs for promoting maximum development of children including appropriate intervention methods for students with special needs and decision-making skills through lesson planning and field experiences—all based on inquiry and reasoning.
CF 1 290-3-3-.03(4) (2)(c)2.(i)(I); CF 1 290-3-3-.03(4) (2)(c)2(ii)(II)
5. Conduct outside professional reading of research methods or current issues in science teaching and develop and share summaries of periodical articles;
6. Facilitate children’s development and skills in communication, inquiry, and reasoning and science process skills and content through the development and implementation of lesson plans which integrate content areas during field experiences through science process skills.
290-3-3-.06(2)(b)2.(i)(II) ; NSES 3 A/B NSES 5/5 B, C
32. Select and evaluate the use of science textbooks, technology resources, and other materials lesson plans and teaching strategies for P-3 and 4-6 to determine advantages and imitations of instructional strategies including planning and administering a science laboratory, including health and safety procedures through the appropriate scientific instruments and laboratory equipment
CF 1 290-3-3-.06 (2)(b)2.(i)(VI)
33. Survey and evaluate components of comprehensive, research-based, effective science programs discuss and use elementary science projects such as ESS, SAPA, SCIS, OBIS, BSCS, GEMS,AIMS, FOSS(used/endorsed by AMSTI),JASON, and others.

34. Use technology to review appropriate resources for teachers, candidates, and elementary student resources for teaching, assessing and communicating science content information including community human and institutional resources to advance the learning of science in the classroom and field
NSES 7 & 7 A/ B
35. Evaluate resources, including Internet sites, that support science learning such as children's literature and integrated content/disciplines including AMSTI curricula
36. Teach elementary children emphasizing the history nature of science.
CF 1 290-3-3-.06 (2)(b)2.(i)(IV) ; NSES 2A/2 B
12. Engage in Teaching Field Experiences to demonstrate an academic knowledge and methods to plan and provide a developmentally appropriate curriculum (inquiry-based), pedagogy, and assessment for early childhood and/or elementary students in accordance with Alabama Courses of Study, the National Standards, AMSTI integrating physical, life, Earth and space sciences.
CF 1 209-3-3-.06 (2)(b)2.(i)(I); NSES 1 A; NSES 1 B; NSES 8 B/ A, C
13. Demonstrate an understanding of approaches to knowledge construction by relating science to the personal and social perspectives, needs and interests of students and to human values and endeavors including in the context of prior and alternative conceptions through classroom and independent assignments.
CF 1 290-3-3-.06(2)(b)2.(i)(IV); NSES 4 A/ B,C; NSES 5/5E
14. Prepare reflective comments on curriculum, pedagogy, and assessment and changed lesson plans based on reflection.
NSES 8 B/8 A, C
15. Incorporate journal writing as to promote integration of language and communication skills and particularly involve scientific skills as a springboard to descriptive and expository writing.
16. Participate in all field experiences and field trips; including organizing and conducting laboratory demonstrations, experiments, and field experiences, emphasizing health safety at all times and demonstrate through planning and teaching you will incorporate procedures for organizing and administering a science laboratory, including health and safety procedures through the use of appropriate scientific instruments and laboratory equipment
CF 1 290-3-3-.06 (2)(b)2.(i) (VI); CF 1 290-3-3-.06 (2)(b)2.(ii)(III)
17. Develop a Learning Center to uses as a strategy for instruction
18. Integrate science disciplines and content areas embedded in all planning reviewing of materials; and implementation of lessons

19. Prepare an electronic science portfolio (items will be given—short paper, lesson plans, etc.)
20. Visit the AMSTI Center; participate in and assess an AMSTI Learning Activity;
21. Select a scientist and report his/her major contributions including the historical context NSES 4 A/B, C
22. Identify Current Issues in Science and in Teaching Science such as students' alternative conceptions or global environmental issues;
CF 1 (290-3-3-.06 5) President's Global Initiative
23. Participate in collaborative discussions on physical, psychological, and emotional health and safety
CF 1 290-3-3-.06 (2)(b)2.(i)(V); NSES 9/9
24. Overall, through projects and teaching, apply the fundamental concepts in teaching the subject matter of science and the inquiry process scientists use in the discovery of new knowledge to build a base for scientific, technological and environmental literacy, including those advocated by the Alabama mathematics, Science, & Technology Initiative
CF 1 290-3-3-.06 (2)(b)2.(ii)(I); CF 1 290-3-3-.06 (2)(b)2.(ii)(II);
25. Teach science (peer teaching and in field experiences) using the components of a comprehensive research-based, effective science program (and the research) including those advocated by the Alabama Mathematics, Science, Technology, Initiative
CF 1 290-3-3-.06 (2)(b)2.(ii)(I)
26. Participate in a diversity project that reflects decisions on appropriate planning, pedagogy, and assessment.
CF 1 290-3-3-.03(4) (2)(c)2.(i)(I); CF 1 290-3-3-.03(4) (2)(c)2(ii)(II)
26. Professional behavior is expected in all interactions and in performance of the UNA College of Education's conceptual framework.
NSES 10/10 A, B, C, D

Notes

No cell phone or other technology tools may be used use either for talking or text messaging during class time.

Work on science methods class rather than outside courses during this class time.

Oral directions carry as much weight as written ones. Please listen carefully.

Make electronic back up copies of all work handed to instructor for future portfolios.

Attendance:

Attendance is expected and required. More than four absences may cause a reason for lowering grade by one letter grade. **Three tardies equal one absence. Think professionally!**

Grading Procedures

All requirements of the course must be satisfactorily completed to receive credit for the course. To apply credit for this course to a Teacher Education program, the candidate must earn a C or better.

No grade will be given until a total of 6 observations hours are documented as instructed. All activities are required.

Exams (3)		300 points
Reading Quizzes (announced)	up to	100 points
Text/Article Reviews		25 points
Lesson Plans (3-5)		100 points
Peer Teaching/Planning/ Implementation/ Reflections		100 points
Planning Field Experiences/Reflections		100 points
Class Participation		100 points
Field Trip(s)/Related Activities		100 points
Other		

The final grade for the course will be determined according to the following scale:
A=93%-100%, B= 83%-92%, C= 73%-82%, D=63%-72%, F=62% and below.