



University of North Carolina at Greensboro
School of Education
Department of Curriculum & Instruction
Course Syllabus – Summer 2006

1. **Course Prefix & Number:** CUI 519
2. **Course Title:** Science in the Elementary and Middle School
3. **Credits:** 3 semester hours
4. **Course Prerequisites/Corequisites:** One course each in the biological sciences, the physical sciences and the earth/space sciences (at least one of which must have included laboratory credit) or equivalents and PDS CPT team membership.
5. **For Whom Planned:** This course is a graduate-level course that is required for students in the Elementary Education Masters Program-CPT
6. **Instructor Information:** Dr. Helen M. Cook
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Office Hours: Before or after class or by appointment

7. Course Purpose/Catalog Description: This course is designed to provide you with “curriculum and teaching techniques in science... with emphasis on problem solving and critical thinking abilities.” You will develop the basic skills, knowledge and competencies required to teach and assess science concepts and inquiry skills in the elementary school setting. By the end of this course, you should be clear about your own personal answers to the following questions:

- What is science and why should I teach it?
- How do students learn science?
- How can I teach so that all students can successfully learn science?

Based on your answers to these and other questions, you should be able to explain your philosophy of science education and defend your pedagogical approach to the teaching of science. Hopefully you will also learn a good deal of science content along the way. Please note, however, that in one semester it is impossible to give you a thorough grounding in each of the various scientific disciplines. My hope is that you leave this class feeling confident that you possess the skills needed to learn the relevant science content along with your students, as well as to facilitate their

learning of this material. A successful elementary science teacher is willing to engage in inquiry and exploration and admits when she or he doesn't know all the answers. If you don't currently view science as a subject that is both fun and engaging, I hope that you will come to see it that way by the end of this semester.

This course is aimed at helping the preservice elementary teacher develop:

- (a) a theoretical framework for teaching science at the elementary level,
- (b) a repertoire of methods for teaching science,
- (c) favorable attitudes toward science and science teaching,
- (d) deeper understandings of some science content.

8. Teachers Academy Conceptual Framework Mission Statement: The mission of professional education at UNCG is to prepare and support the professional development of caring, collaborative, and competent educators who work in diverse settings. This mission is carried out in an environment that nurtures the active engagement of all participants, values individual as well as cultural diversity and recognizes the importance of reflection and integration of theory and practice. UNCG's professional education programs are guided by shared commitments to: (a) equity and excellence in teaching, research, and service; (b) professional integrity and ethical deliberation in dealing with students and colleagues (university-based, school-based, and community-based); (c) the construction of a professional knowledge base through collaboration and collegiality; and (d) the dissemination of professional knowledge, skills, and dispositions through the preparation and continuing professional development of teachers, principals and other school personnel.

9. Course Goals and/or Objectives/Student Learning Outcomes:

This course is primarily designed to introduce the pre-service elementary teacher to the principles and practices of reform-based science instruction as described in the *National Science Education Standards*. The central concept of inquiry is key to reform-based instruction. The disciplines of science are broad as are the methods for how science "gets done"; therefore, there is no single method for teaching science. The goal of this course then is to explore the various science concepts you will be teaching as well as the different pedagogical methods best suited to each concept. Always keep in mind that student learning is the goal of good teaching. You should come out of this course with a beginning understanding of good science instruction. It is my hope that you will build on this beginning understanding throughout your career as a teacher.

This course will provide multiple opportunities to:

1. Develop the knowledge, skills, and attitudes to understand that learning and teaching science requires that you become a life-long learner and foster this same value with your students (INTASC 9, NCATE 1A, NCPTS).

2. Construct knowledge of science and the nature of science, with a special emphasis on inquiry (INTASC 1, NCATE 1A, NCPTS).
3. Critically design, select, and/or adapt materials and resources for teaching the science curriculum to students with a variety of ages, interests, developmental levels, cultural and linguistic backgrounds, and exceptionalities (INTASC 2, 3, 4, NCATE 1B).
4. Experience, plan, and teach activities that are consistent with the North Carolina Standard Course of Study (NC SCOS) and support inquiry-based, reform-based instruction (INTASC 1, NCATE 1B).
5. Learn about and apply current research findings about teaching and learning science to the planning and teaching of science. Become aware of professional organizations and literature (INTASC 1, 6, 7, 10, NCATE 1C).
6. Learn about various ways to use technology to support the facilitation of inquiry and collaboration (INTASC 6, NCATE 1B).
7. Select and integrate into your instructional plans a variety of methods of assessment (INTASC 8, 9, NCATE 1D).
8. Learn how to evaluate students' work using performance-based measures (INTASC 2, 8, NCATE 1D).
9. Develop interdisciplinary lessons and units for teaching science that integrate a variety of skills and content (INTASC 1, 5, 7, 9, NCATE 1B).

¹Thanks to Heidi Carlone for the language expressed in many of these objectives and to Kathy Matthews and Terry Tomasek for ideas to make this course more meaningful.

Interstate New Teacher Assessment and Support Consortium (INTASC) Model Standards for Beginning Teachers Licensing and Development

- Principle #1 – Content Pedagogy
- Principle #2 – Student Development
- Principle #3 – Diverse Learners
- Principle #4 – Critical Thinking
- Principle #5 – Management and Motivation
- Principle #6 – Communication and Technology
- Principle #7 – Planning
- Principle #8 – Assessment
- Principle #9 – Reflective Practice and Professional Development
- Principle #10 – School and Community Involvement

National Council for Accreditation of Teacher Education (NCATE)

Standard 1: Candidates' preparing to work in schools as teachers or other professional school personnel know and demonstrate the content, pedagogical, and professional knowledge, skills, and dispositions necessary to help all students learn.

- A. *Content Knowledge* for Teacher Candidates: Teacher candidates have in-depth knowledge of the subject matter that they plan to teach as described in

professional, state, and institutional standards. They demonstrate their knowledge through inquiry critical analysis, and synthesis of the subject.

- B. *Pedagogical Content Knowledge* for Teacher Candidates: Teacher candidates reflect a thorough understanding of pedagogical content knowledge delineated in professional, state, and institutional standards. They have in-depth understanding of the subject matter that they plan to teach, allowing them to provide multiple explanations and instructional strategies so that all students learn. They present the content to students in challenging, clear, and compelling ways and integrate technology appropriately.
- C. *Professional and Pedagogical Knowledge and Skills* for Teacher Candidates: Teacher candidates reflect a thorough understanding of professional and pedagogical knowledge and skills delineated in professional, state, and institutional standards. They develop meaningful learning experiences to facilitate learning for all students. They reflect on their practice and make necessary adjustments to enhance student learning. They know how students learn and how to make ideas accessible to them. They consider school, family and community contexts in connecting concepts to students' prior experience and applying the ideas to real-world problems.
- D. *Student Learning* for Teacher Candidates: Teacher candidates accurately assess and analyze student learning, make appropriate adjustments to instruction, monitor student learning, and have a positive effect on learning for all students.

North Carolina Professional Teaching Standards (NCPTS)

Elementary teachers know, understand, and use fundamental concepts in the subject matter of science including life, physical and earth sciences. They also know and understand concepts in science and technology science in personal and social perspectives, the history and nature of science, the unifying concepts of science, and the inquiry processes that scientists use when discovering knowledge that can be used to build a base of scientific and technological literacy.

Indicator 1: Teachers have knowledge of basic life science concepts.

Indicator 2: Teachers have knowledge of basic physical science concepts.

Indicator 3: Teachers have knowledge of basic earth science concepts.

Indicator 4: Teachers have knowledge of controversial issues and how they impact learning, including evolution and genetics.

10. Teaching Strategies: Teaching strategies for this course include lecture, class discussion, group work, student presentations, field-based activities, lab work and teaching simulations.

11. Evaluation Methods and Guidelines for Assignments: The following grading scale will be used to determine letter grades.

		A	94-100%	A-	90-93
B+	87-89	B	83-86	B-	80-82
C+	77-79	C	73-76	C-	70-72
D+	67-69	D	63-66	D-	60-62
F	59% or less				

Each assignment, which is described in this section, is worth the following percentage of your total grade:

Curriculum Survey/Lesson Plan	20%
Conceptual Understanding Research Paper	20%
Reading Quizzes	10%
Inquiry Project	20%
Field Trip Project	20%
Participation	10%

Curriculum Survey/Lesson Plan (G)

Due July 6

Select a different goal from the NCSCOS for your grade level. *Starting* in the TRC, begin a survey of elementary science curriculum materials. You must include one STC item, one AIMS item, five age-appropriate Internet Sites, one WebQuest site, one educational software package, at least one lesson idea from your textbook, two items of your choice and ten science tradebooks. I will hand out a form for you to work from that lists each item. For each item include the name of the material and where you found the resource—for tradebooks, provide bibliographical information. Provide a brief description (Enough so that another person would have a good idea about this item). Answer one of the following questions: I like this item because... OR I do not like this item because... You should also submit a lesson plan showing how you might use **one** of these items to teach your students. Please use the lesson plan format (5E) provided in your textbook. You may work on this assignment as a grade level team or on your own (no more than three people in a group). “Divide and Conquer” may be a good plan IF you will get back with each other to share and discuss what you have found. [If you work as a grade level team on the survey, the lesson plan must be written individually. In other words, your grade level team can turn in one curriculum survey, but each individual must turn in a different lesson plan to go with the survey.] The survey needs to be in a folder or notebook and needs to be double-spaced. 12-point font in New Times Roman. Place the handout given in class at the front of the folder/notebook as well as a table of contents.

Professionalism/Participation

Throughout the Summer Session

Professional teachers are rarely absent, always arrive on time, contact the school in a timely manner when they are going to be absent, turn in work that is on time and meticulously done and are active, well prepared participants in staff development and other opportunities for intellectual growth. As soon-to-be professional teachers, I expect the same behaviors in this class. If you must miss class, I expect you to get notes, assignments, and handouts from a classmate by the next class period.

Missing more than one class for ANY reason will result in a deduction of 5 points on your final grade in the class. We are a community of learners where the ideas, voice and actions of everyone affect and transform the way we all think, feel and act. You are important to every class meeting. Together, we will “explore and construct ideas and explanations of the natural world within a supportive community of learners” (Carin, Bass & Contant, 2005).

Reading Quizzes

Throughout the Summer Session

We will have quizzes on the material in the textbook on the days noted in the calendar for the summer session. You will be allowed to use your book and have 20-30 minutes to complete the quiz. The quiz format may include multiple choice questions, true/false questions, and/or short answer questions. The purpose of the quizzes is to insure that you are doing the required reading, allow you to connect the ideas in the readings to class activities and discussions, and give me a chance to understand the knowledge you’re constructing as we proceed through the course.

Conceptual Understanding Research Paper (I)

Due July 25

Guide to be given out in class. Download the research article(s) related to your grade level. Write a 2-3 page paper describing the conceptual understandings of children related to your topic. Use the questions on the handout to guide your paper. The paper should be double-spaced, 12-point font-New Times Roman.

Science Inquiry Project (G)

Due July 11

Many elementary and some middle schools in Guilford County conduct science fairs. While science fairs are somewhat controversial, the research that is available shows that science fairs are positive experiences for teachers, students and parents. You may find yourself responsible for organizing and conducting the science fair at your school. Therefore this assignment is designed to prepare you for that responsibility. You as a member of a group at the grade level you have chosen (no more than three) will conduct an investigation and prepare a trifold display much like children in your class will be expected to do.

We will, as a class, have a science fair and have a chance to judge each group’s project. A list of suggested investigations follow:

- 1) Size of a shadow caused by an object and the distance of that object from a light source.

- 2) Size of an object based on the shadow that that object projects.
- 3) Mass of a toy car and the time it takes to roll down an inclined plane.
- 4) Mass of a pendulum bob and the amount of time it takes to complete one cycle.
- 5) Angle of incline of a surface and the time it takes a drop of water to run down the surface.
- 6) Relationship between physical activity and heart rate.
- 7) Effect of temperature, over time, on the volume of air in a balloon.
- 8) Antagonistic behavior of *Betta splendens* when confronted with various stimuli.
- 9) Effect of temperature on evaporation rate.
- 10) Effect of changing temperatures (and changing states of matter) on a given volume of water.
- 11) Effect of rate of vibration of an object on its pitch.
- 12) Effect of varying hours of light exposure on growth rate in plants.
- 13) Effect of soil type on water retention capacity.
- 14) Effect of volume ($l \times w \times h$) and weight on ability of objects to sink or float.
- 15) The effect of various irregularly shaped objects on water displacement.
- 16) Effect of heat on the rate of decomposition.
- 17) Effect of type of material on its ability to conduct heat.
- 18) Effect of distance on a magnet.
- 19) Effect of substances on a magnet.
- 20) Effect of increasing voltage on brightness.
- 21) Effect of temperature on condensation.
- 22) Others.

Field Trip Project (G)

Due July 24

School systems and schools vary in their requirements and allowance of field trips, but research has shown that field trips, done properly, are an excellent method for teaching and student learning. Preparation is the key to a successful field trip. You are going to work in groups of no more than three at your grade level and plan a field trip to a site that would be appropriate for one of the goals of the NCSCOS. You will be given class time to visit the site. You will prepare a notebook containing information about the site that could serve as a guide for teachers wanting to visit the site and a plan of what you would do at the site the day of the field trip in the form of a plan (one lesson plan for the entire group). Please include pictures of the site as well as all pertinent information you were able to gather about the site. Include directions to the site from UNCG. The paper should be double-spaced, 12-point font-New Times Roman.

The following questions may help guide the compilation of the notebook:

1. What are of the Guilford County's requirements regarding field trips?
2. What forms are necessary for a Guilford County field trip? Include these if possible.
3. How much will the field trip cost per student (admission and transportation)? How did you arrive at this figure?
4. What method of transportation will you use?
5. Are there lesson plans that the site provides? Include samples if possible.
6. Are there docents at the site? What are their responsibilities? Will they be available for your field trip?
7. What is the travel time?
8. What is the schedule for the day?
9. Is there a web site for the field trip site?
- 10.

12. Required Textbook:

Carin, A.A., Bass, J.E., & Contant, T.L. (2005). *Teaching Science as Inquiry* (10th Ed.). Upper Saddle River, NJ: Merrill Prentice Hall.

13. **Topical outline:** See attached course schedule

14. Other Information:

All assignments should be WORD-processed, spell-checked, checked for grammatical errors, double-spaced and be submitted on time. All materials prepared for this course must include attention to both the National Science

Education Standards (NSES) as well as NC’s Standard Course of Study (SCOS). All class members will abide by the UNCG Academic Honor Policy. Please be sure to read this policy at <http://saf.dept.uncg.edu/studiscp/Honor.html>.

15. Recommended Text(s) and/or Readings:

Bourne, B. (2000). *Taking Inquiry Outdoors: Reading, Writing, and Science Beyond the Classroom Walls*. Portland, MA: Stenhouse Publishers.

BSCS (1999). *Teacher’s How-To Handbook: Strategies and Methods Across the Curriculum*. Dubuque, Iowa: Kendall/Hunt Publishing Company.

Doris, E. (1991). *Doing What Scientists Do: Children Learn to Investigate Their World*. Portsmouth, NH: Heinemann.

Kelsey, K and Steel, A. (2001). *The Truth About Science: A Curriculum for Developing Young Scientists*. Arlington, VA; NSTA Press.

Rutherford, F. and Ahlgren, A. (1990). *Science for All Americans*. NY, NY: Oxford University Press.

16. Assignment Alignment with Course Goals: See course goals and objectives and individual assignment descriptions for further alignment to state and national standards.

Assignments	Course Objectives								
	1	2	3	4	5	6	7	8	9
Quizzes	X	X							
Conceptual Understanding Research Paper	X	X				X			
Curriculum/LP	X		X	X	X	X	X		X
Science Inquiry Project	X	X	X	X	X		X	X	X
Participation	X	X	X	X	X	X	X	X	
Field Trip Project	X	X	X	X	X		X	X	X

Tentative Course Schedule: Additional readings assigned as needed.

Session Date	Topic	Readings and Assignments are due the following week unless otherwise stated
Session 1 June 22	Children, Science and Inquiry	What is Science? Who does Science? Review of Syllabus Discussion of Chapter 1 HW: Read Chapter 1
Session 2 June 26		Field Trip to Vulcan Materials 9:00-10:30
Session 3 June 27	Processes of Science and Scientific Inquiry	Discussion of Inquiry Projects Quiz on Chapter 1 Discussion of Chapter 2 Work Session for Inquiry Projects HW: Read Chapter 2
Session 4 June 29		Meet at TRC Work Session for Curriculum Survey Projects
July 3 /4		No Class
Session 5 July 6	Learning Science with Understanding	Quiz on Chapter 2 Discussion of Chapter 3 Presentation of Curriculum Survey Projects Work Session for Field Trip Project HW: Read Chapter 3
Session 6 July 10	Teaching Science Through Inquiry	Quiz on Chapter 3 Discussion of Chapter 4 Work Session for Articles HW: Read Chapter 4
Session 7 July 11	Questioning Strategies for Inquiry Teaching	Quiz on Chapter 4 Discussion of Chapter 5 Science Fair HW: Read Chapter 5
Session 8 July 13		Time to Visit Field Trip Destination
Session 9 July 17	Assessing Science Learning, Preparing for Inquiry Instruction, Connecting Science with Other Subjects	Quiz on Chapter 5 Discussion of Chapter 6, 7 and 8 Activities Catch up Time HW: Read Chapters 6
Session 10 July 18		Quiz on Chapter 6 HW: Read Chapter 7

		Activities
Session 11 July 19		Project WILD Quiz on Chapter 7 HW: Read Chapter 8
Session 12 July 20		Project WILD Quiz on Chapter 8 HW: Read Chapter 9
Session 13 July 24	Educational Technology and the Science Curriculum Science for All Learners	Quiz on Chapter 9 Discussion of Chapter 10 Presentation of Field Trip Projects HW: Read Chapter 10
Session 14 July 25		Quiz on Chapter 10 Research Article(s) Paper Due Discussion of Articles Activities
Session 15 July 27		Class will not meet.