

<p>Program Course Information:</p>	<p><b>PROGRAM:</b> COLE/NC TEACH  <b>EDUC 550 SECTION</b> 961  <b>COURSE TITLE:</b> Science Teaching</p> <p><b>INSTRUCTOR NAME and CONTACT INFORMATION:</b>  Nick Cabot, Ph.D.  Email address: <a href="mailto:nicabot@email.unc.edu">nicabot@email.unc.edu</a>  Phone Number: 843-9844 (office)  Office: Peabody 201A  Office hours: by appointment and anytime via email  Blackboard Course Site: Login to <a href="http://blackboard.unc.edu/">http://blackboard.unc.edu/</a> and select <b>EDUC 550</b>  Acrobat Connect Course Site: Login to <a href="http://breeze.unc.edu/">http://breeze.unc.edu/</a> and select <b>EDUC 550</b></p> <p><b>DATE SYLLABUS REVISED:</b> June 2009  <b>COURSE DESCRIPTION:</b> This course is intended to be a general introduction to science teaching at the middle grades and secondary levels that will help prepare you for your first days of school. We will begin an investigation and conversation that will continue throughout the methods course sequence regarding the goals and objectives of teaching science, the North Carolina 21<sup>st</sup> Century Professional Teaching Standards, the North Carolina Standard Course of Study, how students learn science, curriculum design, instructional approaches and techniques, assessment, and classroom management. An important component of this class is a demonstration of the depth and rigor of candidates' science content knowledge through the preparation of a high quality research paper on a topic consistent with the NCSCOS at the applicable grade level.</p>
<p>UNC-CH School of Education Conceptual Framework:</p>	<p><b>Preparing Leaders in Education</b></p> <p>The School of Education is committed to the preparation of candidates who can assume leadership roles in the field of education. Such preparation is accomplished through the coherent integration of the abilities and predispositions of candidates, the knowledge and abilities of faculty, and the contextual elements of academic and field settings. Candidates accept their professional responsibilities and focus their expertise and energy on supporting Birth-12 student development and learning. They must work to maintain a meaningful involvement in activities within schools and in partnership with parents and the community.</p> <p>The growth and development of candidates is promoted through curriculum, instruction, research, field experiences, clinical practice, assessments, evaluations, and interactions with faculty and peers. All of these elements work together to build a solid foundation for exemplary practice in education, creating educational practitioners who are prepared to better serve children, families and schools, as well as business and agencies of government within North Carolina, across the nation and throughout the world.</p> <p><b>For Equity and Excellence</b></p> <p>Preparation of educational leaders for today's society is based in values of equity and excellence that assure our candidates' and their students' future success. Attending to the challenge of promoting both equity and excellence is imperative. To address only one of these goals would, on the one hand, sacrifice those put at risk by social and cultural hierarchies in society or would, on the other hand, fail to press for the highest possible levels of accomplishment. Equity and excellence must be pursued concurrently to assure that all students are well served and that all are encouraged to perform at their highest level.</p> <p>Within the School of Education, equity is seen as the state, quality, or ideal of social justice and fairness. It begins with the recognition that there is individual and cultural achievement among all social groups and that this achievement benefits all students and educators. Equity acknowledges that ignorance of the richness of diversity limits human potential. A perspective of equity also acknowledges the unequal treatment of those who have been historically discriminated against based on their ability, parents' income, race, gender, ethnicity, culture, neighborhood, sexuality, or home language, and supports the closure of gaps in academic achievement. Decisions grounded in equity must establish that a wide range of learners have access to high quality education in order to release the excellence of culture and character which can be utilized by all citizens of a democratic society.</p> <p>Within the School of Education, excellence is seen as striving for optimal development, high levels of achievement and performance for all and in all that is done. In preparatory programs across grade levels, curriculum and instruction furthers excellence when it moves a learner as effectively as possible toward</p>

expertise as a thinker, problem solver and creator of knowledge. Excellence entails a commitment to fully developing candidates, not only academically but also in moral and political senses.

### **In a Democratic Society**

The preparation of exemplary practitioners in education to meet the challenges of equity and excellence is best accomplished through preparation for a democratic society. Democracy around the globe is an ideal, one with the potential to meet the needs, recognize the interests and establish the rights of all citizens.

Education is a necessary foundation for this ideal, and both must be subscribed to and participated in by all.

### **School of Education Conceptual Framework Principles**

The School of Education is committed to diverse, equitable, democratic learning communities. As a result, candidates are expected to acquire and apply the knowledge, skills and dispositions that prepare them to support the development and education of all students.

The School of Education uses the following unit principles, applicable at all program levels, to identify the knowledge and skills that are central to preparation of candidates. It is the School of Education 19s goal that candidates will become leaders supporting and promoting the development, teaching and learning of all students in multiple contexts.

1. Candidates possess the necessary content knowledge to support and enhance student development and learning.
2. Candidates possess the necessary professional knowledge to support and enhance student development and learning, including meeting student needs across physical, social, psychological, and intellectual contexts. Candidates incorporate a variety of strategies, such as technology, to enhance student learning.
3. Candidates possess the necessary knowledge and skills to conduct and interpret appropriate assessments.
4. Candidates view and conduct themselves as professionals, providing leadership in their chosen field, including effective communication and collaboration with students and stakeholders.

### **SOE Conceptual Framework Dispositions**

Certain dispositions are essential to prepare leaders who support equity and excellence in education within a democratic society. Dispositions are beliefs that foster commitments, leading to actions within educational environments with students, colleagues, families, and communities. Candidates strengthen these dispositions as they think deeply, reflect critically and act responsibly in their professional practice. These dispositions are interconnected with knowledge and skills; specific dispositions connect to and exemplify unit principles, facilitating their enactment in particular programs.

1. Candidates will exhibit behavior that demonstrates a belief that all individuals can develop, learn, and make positive contributions to society.
2. Candidates will exhibit behavior that demonstrates a belief that continuous inquiry and reflection can improve professional practice.

Course Objectives:

*By the end of the course candidates will be able to:*

1. Understand the expectations for science teaching presented in the science education reform documents (specifically the National Science Education Standards and North Carolina Standard Course of Study) and develop and implement science lessons that meet the expectations set forth in these documents.
2. Understand how to create a safe, nurturing classroom environment where all students have the opportunity to grow and learn.
3. Describe and use a diverse repertoire of instructional strategies in teaching science.
4. Implement assessments to evaluate one's own teaching and student learning.

<p>Course Standards (Addressed):</p>	<p><b><i>UNC School of Education Standards</i></b></p> <ul style="list-style-type: none"> <li>• Principle 1: Candidates possess the necessary content knowledge to support and enhance student development and learning</li> <li>• Principle 4: Candidates view and conduct themselves as professionals, providing leadership in their chosen field.</li> <li>• Disposition 2: Candidates will exhibit behavior that demonstrates a belief that continuous inquiry and reflection can improve professional practice.</li> </ul> <p><b><i>Interstate New Teacher Assessment and Support Consortium (INTASC) Principles</i></b></p> <ul style="list-style-type: none"> <li>• INTASC-1: The teacher of science understands the central ideas, tools of inquiry, applications, structure of science and of the science disciplines he or she teaches and can create learning activities that make these aspects of content meaningful to students.</li> <li>• INTASC-4: The teacher of science understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem-solving, and performance skills.</li> <li>• INTASC-6: The teacher of science uses knowledge of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the classroom.</li> <li>• INTASC-7: The teacher plans instruction based upon knowledge of subject matter, students, the community, and curriculum goals.</li> </ul> <p><b><i>North Carolina Core Standards for Teachers</i></b></p> <ul style="list-style-type: none"> <li>• NCCore-1: Teachers know the content they teach.</li> <li>• NCCore-4: Teachers are leaders.</li> </ul> <p><b><i>North Carolina Core Standards for Diversity</i></b></p> <ul style="list-style-type: none"> <li>• NCDIV-1: Teachers understand the central concepts, tools of inquiry, and structures of the discipline(s) they teach and can create classroom environments and learning experiences that make these aspects of subject matter accessible, meaningful and culturally relevant for diverse learners.</li> <li>• NCDIV-4: Teachers acknowledge and understand that diversity exists in society and utilize this diversity to strengthen the classroom environment to meet the needs of individual learners.</li> </ul> <p><b><i>North Carolina Core Standards for Technology</i></b></p> <ul style="list-style-type: none"> <li>• NC-CTECH-1: Teachers plan and design effective learning environments and experiences supported by technology.</li> <li>• NC-CTECH-3: Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning.</li> <li>• NC-CTECH-5: Teachers use technology to enhance their productivity and professional practices.</li> </ul> <p><b><i>North Carolina Specialty Standards for Science</i></b></p> <ul style="list-style-type: none"> <li>• NCSCI-2: Science teachers understand the nature of science and the development of scientific thought.</li> <li>• NCSCI-6: Science teachers plan and implement appropriate scientific investigations to develop problem solving and critical thinking skills in science</li> <li>• NCSCI-8: Science teachers create and use appropriate assessment strategies and instruments to improve science instruction for all students.</li> <li>• NCSCI-9: Science teachers integrate appropriate technology to enhance instruction in science and scientific investigation.</li> <li>• NCSCI -10: Science teachers develop strategies to address science topics that are controversial to diverse groups.</li> <li>• NCSCI-11: Science teachers encourage underrepresented groups to engage in science.</li> <li>• NCSCI-14: Science teachers understand safety and liability issues in science and advocate for appropriate safety materials and enforcement practices in the classroom.</li> </ul>
<p>Course Standards (Assessed):</p>	<ul style="list-style-type: none"> <li>• NC-CH2004-P1: Candidates possess the necessary content knowledge to support and enhance student development and learning</li> <li>• NC-CH2004-P4: Candidates view and conduct themselves as professionals, providing leadership in their chosen field.</li> <li>• NC-CH2004-D2: Candidates will exhibit behavior that demonstrates a belief that continuous inquiry and reflection can improve professional practice.</li> <li>• NCCore-1: Teachers know the content they teach.</li> <li>• NCCore-4: Teachers are leaders.</li> <li>• NC-CTECH-1: Teachers plan and design effective learning environments and experiences supported by technology.</li> </ul>

	<ul style="list-style-type: none"> <li>• NC-CTECH-5: Teachers use technology to enhance their productivity and professional practices.</li> <li>• NCSCI-2: Science teachers understand the nature of science and the development of scientific thought.</li> </ul>
<p>Activities &amp; Assignments:</p>	<p><b>NOTE:</b> Please plan to attend at least one Saturday lab session at CCEE to be arranged.</p> <p><b>6/22 Introductions and Expectations</b></p> <ol style="list-style-type: none"> <li>1. <b>Read</b> and be prepared to comment on Chapter 1 in Teaching textbook.</li> <li>2. What are your expectations about this program?</li> <li>3. Why do you want to be a teacher? Do you have the “right stuff” to be a good one?</li> <li>4. How will your background enhance your ability to teach science? (Not just content background!)</li> <li>5. What are your expectations as a new teacher?</li> <li>6. What are your initial questions and concerns about teaching?</li> <li>7. <b>Fill out</b> the My Concerns worksheet (Activity 1-5 in Teaching textbook). Submit your answers on your private thread.</li> <li>8. The School of Education’s Conceptual Framework: Leadership for Excellence and Equity in a Democratic Society.</li> <li>9. Requirements and expectations for this class.</li> <li>10. Using Blackboard.</li> <li>11. Introduction to Research paper with concepts maps assignment (due 7/15).</li> </ol> <p><b>6/24 (Thinking about) Becoming a Science Teacher</b></p> <ol style="list-style-type: none"> <li>1. What do YOU think the scientifically and technology literate person should know and be able to do? How should science “inform the choices (citizens) must make in their personal and social lives?” Have a response ready to share with the class.</li> <li>2. <b>Read</b> the Nature of Science in the Benchmarks for Science Literacy (at the appropriate grade level – available via Blackboard external links) and comment: how closely does the philosophy espoused in the Benchmarks coincide with your own? <b>Post</b> your comments in the Class forum (Blackboard discussion board) and <b>respond</b> to one of your classmates posts.</li> <li>3. <b>Complete</b> the STEBI and Test of Scientific Reasoning (Blackboard course documents). Submit your answers on your private thread.</li> </ol> <p><b>6/29 (Thinking about) Instructional Theory</b></p> <ol style="list-style-type: none"> <li>1. <b>Read</b> and be prepared to comment on Chapter 2 in Teaching textbook.</li> <li>2. <b>Complete</b> the My Aims and Preferences (Activity 2-3) in Teaching textbook. Submit your answers on your private thread.</li> <li>3. <b>Read</b> Chapter 9: Scientific Inquiry and How People Learn in <i>How Students Learn: Science in the Classroom</i> (Blackboard external links). Then <b>read</b> either Chapter 11, if you are a middle grades teacher, or Chapter 12, if you are a secondary teacher.</li> <li>3. Consider the instructional methods mentioned in Chapter 2 of the Teaching textbook. Which of these methods do you think you would be most/least comfortable using? Which seem to be most/least consistent with the tenets of <i>How Students Learn</i>? <b>Write</b> a one page response and submit it on your private thread. Be prepared to share your choices in class.</li> <li>4. We will discuss the results of the STEBI and Test of Scientific Reasoning (in general terms).</li> </ol> <p><b>7/1 What’s Expected of a Teacher in North Carolina</b></p> <ol style="list-style-type: none"> <li>1. <b>Read</b> the NC Professional Teaching Standards and What Teachers Should Know and Be Able to Do (Blackboard course documents). Pick one of the five standards from the NC Professional Teaching Standards and <b>write</b> a one page reflection on what you think the teacher behaviors described in the standard actually look like in practice. Submit your answers on your private thread and be prepared to share your thoughts with the class.</li> <li>2. Take a <b>look</b> at the TPAI-R and Certification of Teaching Capacity (Blackboard course documents).</li> <li>3. <b>Read</b> Chapters 19 and 20 in the Teaching textbook. <b>Write</b> a one page reflection on how the information in the text, Standard II in the NC Professional Teaching Standards, and Disposition 1 of the SOE Conceptual Framework have changed your perceptions of your role as a teacher.</li> </ol> <p><b>7/6 Taking a Look at the North Carolina Standard Course of Study (Science)</b></p> <ol style="list-style-type: none"> <li>1. <b>Read</b> and be prepared to discuss Chapters 4, 5, and 6 in Teaching textbook.</li> <li>2. <b>Read</b> the first page of the NCSCOS website appropriate to your grade level (Blackboard external links). Then pick one grade level in middle school or one sub-discipline in high school and <b>read</b> the front material and then <b>read</b> the Competency Goals. Next, take a <b>look</b> at the Support Document. After that, click on the “K-12 Curriculum Units” link on the left side of the screen, select the appropriate grade level, and find the corresponding list of curriculum units, and, just at the high school level, the “Blueprint” for the sub-</li> </ol>

discipline.

3. **Write** a one to two page response to the following questions and be prepared to discuss your response in class. First, (after you've waded through all the verbiage) it should be fairly clear that there is a distinction between the science process standards (what students should be able to *do*) and the science content standards (what students should *know*). Moreover, you have at least some inkling about how students *learn* science. Now that you've briefly examined the course of study for one grade level or sub-discipline, how well do you think the NCSCOS addresses these three instructional issues (do, know, and learn)? Be sure to provide some documentary evidence for your position. Second, what do think this all means for your classroom practice? Submit your response on your personal thread.

#### 7/8 (Thinking about) Curriculum Design

1. **Read** and be prepared to discuss Chapters 15 and 16 in Teaching textbook.
2. **Complete** Activities 16-1 (just part 1), 16-2, and 16-3. Submit on your private thread.
3. **Go** to the NC K-12 Curriculum Units – Science website (Blackboard external links) and **select** a unit that you might like to teach. **List** the components of the unit by type (e.g., grade level, unit title, etc.). **Write** a short reflection on the unit and submit it with your list of components on your private thread.

#### 7/13 Student Misconceptions in Science and Conceptual Change

1. **Read** Conceptual Change Among Students in Science (Blackboard course documents).
2. **Read** Chapter 11 – Conceptual Change in Teaching textbook.
3. **Read** Chapter 3 in *Ready, Set, Science* (Blackboard external links).
4. **Read** *The parallelism between scientists' and students' resistance to new scientific ideas* (Blackboard course documents).
5. **Watch** *A Private Universe* (Blackboard external links).
6. **Write** a one page reflection on how this information changes your perceptions of your role as teacher and how it might influence your classroom practice. Submit it on your private thread and be prepared to share your thoughts with the class.

#### 7/15 Lecture/Demonstration vs. Direct instruction vs. Inquiry vs. Project-Based Learning

1. Content assignment due! Have your concept maps ready to share with the class (on Acrobat Connect). Be sure you submit your assignment on your personal thread.
2. **Watch** a few minutes of any of Dr. Walter Lewin's (MIT) physics lectures (Blackboard external links).
3. **Read** Direct Instruction: Is it the Most Effective Science Teaching Strategy? (Blackboard external links) and Using direct instruction to teach content vocabulary (Blackboard course documents)
4. **Read** EQUIPing Teachers (Blackboard course documents).
5. **Read** Project-Based Science Instruction: A Primer and Problem-Based Learning Tools (Blackboard course documents). You might want to watch the movie *October Sky*.
6. **Write** a one or two page reflection comparing and contrasting these different pedagogies. Which is more suited to your personal style? What do see as the pros and cons of these pedagogies? Submit it on your personal thread and be prepared to share your thoughts with the class.

#### 7/20 Thinking About Assessment

1. **Read** Chapters 17 and 12 in the Teaching textbook.
2. What are, where can you find, and how do you design effective assessment instruments to meet the multiple purposes of assessment (i.e., diagnostic, formative, and summative)?
3. How do you use diagnostic assessment data?
4. How do you use formative assessment data?
5. How do you use summative assessment data to reform instruction?
6. What gets graded (e.g., homework, in-class worksheets, activities, tests, quizzes, projects, papers, lab reports, warm-ups (pre-instruction), exit slips (post-instruction), participation, citizenship)?
7. What is the purpose of grades? Is all graded material weighted equally?
8. **Select** one North Carolina End-of-Course or End-of-Grade test (Blackboard external links) appropriate to your grade level. **Write** a one page reflection on how well you think the test assesses what a student *should* know and be able to do (based on the NCSCOS).

#### 7/22 Classroom Management and (surviving) the First Days of School

1. **Read** and be prepared to discuss Chapter 22 in the Teaching textbook.
2. **Complete** Activity 22-1 and submit your responses in your personal thread.
3. What is your management style? **Complete** the Beliefs on Discipline Inventory and the What is your classroom management profile? in Classroom Management (Blackboard course documents). **Write** a short piece reflecting on how this information might inform your classroom management decision-making process. Submit your responses on your personal thread.

	<p>4. Find some classroom rules – no more than 6 (should include: Be on time, Be prepared, Be courteous).  5. Check out the Top 10 Tips for Classroom Management and Discipline (Blackboard external links).  6. Read the Survival Guide for New Teachers (Blackboard external links).</p> <p><b>Research Paper with Concept Maps Assignment (due July 15, 2009)</b></p> <p>This three-part assignment includes a research paper focused on a relatively narrow topic within your content-area and consistent with the North Carolina Specialty Standards and Standard Course of Study (e.g., differential equations in mathematics or cosmic rays in science), a concept map diagramming the relationships of important concepts within the context of the topic, and a second concept map that places the topic within the larger context of a sub-discipline of the content-area (e.g., biology in science or algebra in mathematics). The research paper may have been previously submitted in another class.</p> <p><b>Directions:</b></p> <p>Select a topic within your content-area and grade-level consistent with the North Carolina Specialty Standards and Standard Course of Study and prepare an 8 to 10-page (not including title pages or references), double-spaced research paper that explores the topic in some depth, including its historical development, applications, and significance to the larger field of study. Your goal is to demonstrate a sophisticated understanding of the subject matter itself, not its pedagogical relevance or how to teach it. In conjunction with the paper, using Cmap or any other concept map software, prepare a concept map* that illustrates the relationships among the important concepts encompassed by the topic and a second concept map that places the topic within the larger context of the relevant content-area sub-discipline.</p> <p>* A concept map is a diagram showing the relationships among concepts. They are graphical tools for organizing and representing knowledge. They include concepts, usually enclosed in circles or boxes of some type, and relationships between concepts indicated by a connecting line linking two concepts (from <a href="http://en.wikipedia.org/wiki/Concept_map">http://en.wikipedia.org/wiki/Concept_map</a>). Examples of concept maps in science can be found at many websites including <a href="#">HyperPhysics</a>.</p>
<p>Requirements:</p>	<p>Policies:</p> <ul style="list-style-type: none"> <li>• You are responsible for knowing and adhering to due dates. Please do not request extensions or make-ups except under extraordinary circumstances.</li> <li>• You are expected to abide by the UNC Honor Code. Plagiarism and cheating are not accepted and all suspected cases will be pursued.</li> <li>• All work turned in is expected to be of professional quality. This means that it will be free of typos, grammatical errors, and slang, and that written and oral presentation will be coherent and follow a logical progression.</li> </ul> <p>Grading:</p> <p>A grade of HIGH PASS (H) is reserved for students who excel at all assignments, who attend each class session, and who evince quality participation.  A grade of PASS (P) will be assigned to students who complete all assignments, attend class, and competently prepare and participate.  A grade of LOW PASS (L) will be assigned to students whose work is consistently less than proficient.</p> <p>Research paper w/ concepts maps – 100 pts.  Textbook activities (5 pts. ea.) and reflection papers (10 pts./page) – 170 pts.  Participation – 30 pts.</p> <p>H : 270- 300 pts., P: 240-269 pts., L: 210 – 239 pts., F: &lt; 209 pts.</p> <p><b>NOTE:</b> Regardless of total points earned, the Research paper assignment must be scored at least “proficient” in each assessed category to pass the class.</p>
<p>References &amp; Resources:</p>	<p>See the course Blackboard site.</p> <p>Trowbridge, L., Bybee, R. W. &amp; Powell, J. C. (2004 or 2007). <i>Teaching Secondary School Science – Strategies for Developing Scientific Literacy</i> 8<sup>th</sup> or 9<sup>th</sup> Edition. New Jersey: Pearson.</p>