

**ESCI 4450/6450 - Science Curriculum and Learning
Fall Semester 2008**

Instructor: Thomas R. Koballa, Ph.D.

Class Hours and Location: 8:00-10:55, 215 Aderhold Hall

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Catalog Course Description

Science curriculum models for students in grades 7 through 12 in relation to goals for science education and classroom practice. Development, selection, and evaluation of curriculum materials based on research in learning.

Prerequisite: EPSY 2020 and EFND 2030

Course Overview

In this course, you will learn about essential aspects of science curriculum and how curriculum can be used to enable student learning. The course is organized around three themes: (1) science is a way of thinking and investigating as well as a body of knowledge, (2) effective instructional planning enables and facilitates student learning, and (3) standards and assessment are inextricably linked, guiding how teachers teach and what students learn.

The following driving questions will be explored in this course:

Science

What is science? What are the unifying concepts of science? How are science and technology related? How does science differ from other ways of knowing?

Inquiry

What is inquiry? What does inquiry look like in the context of school science?

Issues in Science

How is science related to socially important issues? What processes can be used to analyze and make decisions about science-related societal issues?

Science in the Community

How is science related to the community? How can community resources be used to promote the learning of science?

Assessment

What tools and strategies can be used to assess student learning? How can assessment results be used to guide and modify instruction, the classroom environment, and student learning?

Curriculum

What are the curricular recommendations of the National Science Education Standards (NSES) and the Georgia Performance Standards (GPS)? How can curriculum units be planned to address the goals of the NSES and the GPS as well as the needs and abilities of students?

Attendance Policy

Good attendance and punctuality are critical elements of teacher professionalism. It is recognized that people get sick, attend professional meetings, and have family emergencies, but attendance and participation are prerequisites to learning.

More than two unexcused absences (i.e., without written documentation) will result in a student being dropped from the course. Arriving more than 30 minutes late or leaving class with 30 minutes or more remaining will be counted as an absence. If you have extenuating circumstances that cause you to be absent more than twice during the semester (e.g., serious illness), please consult your instructor about how to make up missed work.

Academic Honesty

The University of Georgia seeks to promote and ensure academic honesty and personal integrity among students and other members of the University community. In keeping with the University Honor Code and Academic Honesty Policy, each student is expected to do his/her academic work and to acknowledge fully any assistance and academic resources. All academic work must meet the standards contained in "A Culture of Honesty." All students are responsible to inform themselves about those standards before performing any academic work.

Textbooks and Other Instructional Materials Required

Chiappetta, E. L., & Koballa, T. R. (2006). *Science instruction in middle and secondary schools*. Upper Saddle River, NJ: Merrill Prentice-Hall.

National Research Council. (1996). *National Science Education Standards*. Washington, DC: National Academies Press. Available online:

http://www.nap.edu/openbook.php?record_id=4962

National Science Teachers Association. (2003). *Standards for Science Teacher Preparation*. Available online:

<http://www.nsta.org/pdfs/NSTASTandards2003.pdf>

Georgia Department of Education. *Introduction to Science Performance Standards, Grades 6-8 and 9-12*. Available online: <http://www.georgiastandards.org/science.aspx>

Optional

Abell, S. K., & Volkmann, M. J. (2006). *Seamless assessment in science: A guide for elementary and middle school teachers*. Portsmouth, NH: Heinemann.

Driver, R., Squires, A., Rushworth, P, & Wood-Robinson, V. (1994). *Making sense of secondary science: Research into children's ideas*. London: RoutledgeFalmer.

Michaels, S., Shouse, A. W., & Schweingruber, H. A. (2008). *Ready, set, science!* Washington, DC: The National Academies Press. Available online:
http://books.nap.edu/openbook.php?record_id=11882&page=R1

Rutherford, F. J., & Ahlgren, A. (1990). *Science for all Americans*. New York: Oxford University Press.

Course Requirements and Grading Summary

1. Core science concept map	15% (=30 points)
2. Performance assessment	15% (=30 points)
3. Nature of science	15% (=30 points)
4. Inquiry	15% (=30 points)
5. Curriculum unit and reflections	40% (=80 points)
Total Possible Points	200 points

Grades are assigned by summing each students' points and dividing by 2 to obtain a percentage with 93-100 percent = A; 90-92 percent = A-; 87-89 percent = B+; 83-86 percent = B; 80-82 percent = B-; 77-79 percent = C+; 73-76 percent = C; 70-72 percent = C-; etc.

Course Assignments

If you have questions about an assignment, please consult your instructor. All written work must be typed and submitted as email attachments.

- 1. Core science concept map** - Teachers are central to helping students develop age-appropriate, expert-like understandings of science. Teachers must recognize their own understanding of the hierarchical structure of the science discipline they teach. In this assignment, you

will construct a map of the conceptual terrain for a science course that you plan to teach (e.g., high school biology). In doing so, you will develop a visual representation of your understanding of the hierarchical structure and interconnections that exist among the core science concepts that comprise a science course. A handout will provide more details about this assignment. **Due on Monday, September _____.**

2. **Performance assessment** - Science units tend to have multiple learning outcomes that address content knowledge, skills, and occasionally learner dispositions. For this reason, the preferred summative assessment of student learning associated with science units is often a performance task rather than a paper-and-pencil test. In this assignment, you will develop a performance assessment that makes explicit what counts as evidence of learning for the unit and how students will demonstrate their learning. Part of the performance assessment you develop will be a rubric. The rubric tells students what is expected of them and can be used to scaffold students' learning as well as to assess their mastery of the unit's intended learning outcomes. A handout will provide more details about this assignment. **Due on Monday, _____.**
3. **Nature of science** - All Americans must come to understand science as a way of thinking and a way of investigating in addition to a collection of knowledge. Moreover, they must understand how scientists go about their work and the significance of laws, theories, argumentation, and models in the context of science. In this assignment, you will build a science learning experience to help students develop accurate understandings about the nature of science. A handout will provide more details about this assignment. **Due on Monday, _____.**
4. **Inquiry** - All students must be provided with many opportunities to explore the natural world in order to learn how it works. Student interest in and understanding of science increases when they are placed in situations where they are actively involved in the study of natural phenomena. However, in order for school science to resemble authentic science, to some degree, it must reflect how science is practiced. In this assignment, you will build a science learning experience that illuminates the thinking and investigative activities that scientists use to construct knowledge. A handout will provide more details about this assignment. **Due on Monday, _____.**

5. Curriculum unit and reflections - Well-designed curriculum units lead to meaningful science learning. A curriculum unit is a segment of a course of study that reflects coherence, is aligned with standards, and develops in students a deep understanding of concepts, principles, and topics. For this assignment, you will develop a science curriculum unit suitable for a high school or middle school course. Your unit must address the following Standards for Science Teacher Preparation (2003) and be accompanied by statements that indicate how each standard is met in your unit:

- Science Concepts and Principles (Standard 1a)
- Unifying Concepts of Science (Standard 1b)
- Technology in Science (Standard 1c)
- Nature of Science (Standard 2c)
- Inquiry (Standard 3b)
- Issues in Science (Standard 4b)
- Curriculum (Standard 6)
- Science in the Community (Standard 7b)
- Assessment (Standard 8)

A handout will provide more details about this assignment. **Due on Monday, _____.**

Chemical Right To Know Training

By August 25, please provide verification that you have completed the "Chemical-Specific RKT Training for Laboratory Personnel." This training is provided online at <http://www.esd.uga.edu/rtkcs>

**ESCI 4450/6450 - Science Curriculum and Learning Fall
Tentative Daily Calendar
Fall Semester 2008**

August

Aug 18	Course Syllabi and Assignments - NSTA Standards for Science Teacher Preparation
Aug 25	Planning to Teach Science - Purpose of science teaching in U.S. schools - National Science Education Standards - Georgia Performance Standards Read: Science Instruction, Chap 2; In press, Chap 3 (provided by Koballa) Check Out: National Science Education Standards; Georgia Performance Standards

September

Sep 1	Labor Day Holiday
Sep 8	Planning to Teach Science Cont. - Introduce curriculum unit assignment - Discuss core concept map assignment - Student learning (prior knowledge, learning is a social process, what counts as learning in science) Read: Science Instruction, Chap 9; Seamless Assessment, Chap 1 (provided by Koballa); NSTA Standard for Science Teacher Preparation 6
Sep 15	Nature of Science and Technology - Relationship between sci and tech - Unifying concepts of science - Historical perspectives Read: Science Instruction, Chap 7; Chap 12 (pp. 184-187); All Americans, Chap 1, 3, 10, & 11 (provided by Koballa)

Sep 22	<p>Nature of Science and Technology</p> <ul style="list-style-type: none"> - Locate learning experiences that emphasize nature of sci and tech - Discuss nature of science assignment - Discuss NSTA standards: Science Concepts and Principles (Standard 1a), Unifying Concepts of Science (Standard 1b), Technology in Science (Standard 1c), and Nature of Science (Standard 2c) <p>Read: NSTA Standards for Science Teacher Preparation 1 and 2; Ready, Set Science, Chaps 5 and 6</p>
Sep 29	<p>Revisiting and Clarifying</p> <ul style="list-style-type: none"> - Curriculum unit assignment (reflective statements) - Nature of science assignment <p><i>Presentation of concept maps</i></p>

October

Oct 6	<p>Science Assessment</p> <ul style="list-style-type: none"> - Science learning assessment system - Science tests <p>Read: Science Instruction In Press Chap 4 (provided by Koballa)</p>
Oct 13	<p>Science Assessment Cont.</p> <ul style="list-style-type: none"> - Alternative assessments - Locate alternative assessments, rubrics and checklists - Discuss performance assessment assignment <p>Read: NSTA Standards for Science Teacher Preparation 8</p>
Oct 20	<p>Inquiry</p> <ul style="list-style-type: none"> - Conceptions of inquiry <p>Read: Science Instruction, Chap 10; Inquiry in the Classroom - Introduction (provided by Koballa)</p>
Oct 27	<p>Inquiry</p> <ul style="list-style-type: none"> - Locate learning experiences that emphasize scientific inquiry

	<ul style="list-style-type: none"> - Discuss inquiry assignment Read: NSTA Standard for Science Teacher Preparation 3; Ready, Set Science, Chaps 5 and 6
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November

Nov 3	Revisiting and Clarifying <ul style="list-style-type: none"> - Curriculum unit assignment - Nature of science assignment - Inquiry assignment <i>Presentation of performance assessment</i>
Nov 10	Issues in Science <ul style="list-style-type: none"> - Areas of pedagogical importance for SSI - Analytical decision-making and structured controversy models - Discuss NSTA Standard: Issues (Standard 4) Read: Science Instruction, Chap 12 (pp. 187-195); NSTA Standards for Science Teacher Preparation 4
Nov 17	Science in the Community <ul style="list-style-type: none"> - Culturally relevant science teaching - Discuss NSTA Standard: Science in the Community (Standard 7) - Identify community resources for teaching science <i>Presentation of nature of science learning experience</i> Read: NSTA Standards for Science Teacher Preparation 7
	Thanksgiving Holiday

December

Dec 1	Revisiting and Clarifying <ul style="list-style-type: none"> - Inquiry assignment - Curriculum unit assignment - Differentiating instruction Read: Science Instruction In press, Chap 8 (provided by Koballa)
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Dec 8	Revisiting and Clarifying - Curriculum unit assignment
Dec 15 Final Exam Period	Celebration of Learning <i>Presentation of inquiry learning experiences and unique selection from curriculum unit</i>