ESCI 4450/6450 - Science Curriculum and Learning
Fall Semester 2009

Instructor: Thomas R. Koballa, Ph.D.
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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 or equivalent

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 science 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 become ill, attend professional meetings, and have family emergencies, but class 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. (2010). *Science instruction in middle and secondary schools*. Upper Saddle River, NJ: Merrill Prentice-Hall.

Banilower, E. Cohen, K., Parley, J., & Weiss, I. (2008). *Effective science instruction: What does research tell us?* Portsmouth, NH: RMC Research Corporation, Center on Instruction. Available online: http://hub.mspnet.org/index.cfm/16096

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

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	10% (=20 points)
2. Performance assessment	15% (=30 points)
3. Nature of science	10% (=20 points)
4. Curriculum unit and reflections	40% (=80 points)
5. Preparing for the unexpected	10% (=20 points)
6. Daily Quizzes and paragraphs	15% (=30 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 unit that you plan to teach situated within a middle school science course or a high school introductory biology, chemistry, physics or physical science course. 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 unit. A handout will provide more details about this assignment. **Due on ____.**

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 _____.**

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 facts. 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 _____.**

4. **Preparing for the unexpected** – All teachers will be asked, at some time in their career, to quickly craft

plans for a topic about which they have little knowledge. When this happens, teachers need to know how to use their content and pedagogical understandings to prepare instruction that will motivate students and enable them to learn. In this assignment, you will be asked to build the skeleton of a science unit suitable for a high school or middle school course. A handout will provide more details about this assignment. **Due on _____.**

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 understands of concepts, principles, and topics. For this assignment, you will develop a science curriculum unit suitable for a middle school course or a high school introductory biology, chemistry, physics or physical science 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 _____.**

6. Daily Quizzes and paragraphs

Come to class prepared to demonstrate your developing understanding of science teaching and learning on the days identified below.

a. Monday, August 24th – short quiz over readings (3 points)
b. Wednesday, August 26th – short quiz on readings (3 points)
c. Monday, August 31st – short quiz on readings (3 points)
d. Wednesday, September 9th – short quiz on readings (3 points)
e. Monday, September 14th – bring 2-4 test items & paragraph to class (5 points)

f. Monday, September 21st – short quiz on readings (3 points)
g. Monday, September 28th – bring paragraph description of inquiry learning experience (5 points)
h. One week before Monday, October 5th, send question to Dr. Graber and copy to your instructor (5 points)

Chemical Right To Know Training

By Monday, August 24th, please provide verification that you have completed the "Chemical-Specific RKT Training for Laboratory Personnel." This training is provided online at http://www.busfin.uga.edu/rtk/index.htm