George Mason University
EDCI 553.X01: SCIENCE METHODS FOR THE ELEMENTARY CLASSROOM (3)
Summer 2010

Instructor: **Dr. Mollianne Logerwell**
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Class: TR, June 17-July 29, 4:30–7:30 PM
Saturday, June 19, 9 AM – 3:30 PM
Classroom: A412 Robinson Hall

I. Course Description

Develops skills and abilities in science teaching methods, applications of technology, safety practices, and the creation of integrated science curricula. Examines science teaching based on contemporary theory, practice, and standards. Field experience in public schools is required. Prerequisite: Admission to elementary education licensure program.

II. Learning Outcomes

This course will enable students to:

A. Further develop your content knowledge base in science and health through a hands-on, inquiry-based approach that includes investigative problem-solving
B. Develop a series of interdisciplinary lesson plans utilizing a variety of science and health education materials and technology resources
C. Predict safety issues when preparing for a hands-on classroom experience
D. Collect a variety of materials for future use in your classroom via the course, PDS, and community resources
E. Examine science and health curricula and methods with respect to "Science for All" and standards documents at local, state, and national levels
F. Develop an annotated bibliography of resources aligned with Virginia's Science and Health Standards of Learning
G. Develop an assessment tool for use in the science and health classroom

III. Relationship to Program Goals and Professional Organizations

INTASC:

#1. The teacher understands the central concepts, tools of inquiry, and structures of the discipline he or she teaches and can create learning experiences that make these aspects of subject matter meaningful for students.

#2. The teacher understands how children learn and develop, and can provide learning opportunities that support a child's intellectual, social, and personal development.

#3. The teacher understands how students differ in their approaches to learning and creates instructional opportunities that are adapted to diverse learners.

#4. The teacher understands and uses a variety of instructional strategies to encourage students' development of critical thinking, problem solving, and performance skills.

#5. The teacher uses and understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement in learning, and self-motivation.

#6. The teacher uses an understanding of individual and group motivation and behavior to create a learning environment that encourages positive social interaction, active engagement, in learning, and self-motivation.

#7. The teacher plans instruction based upon knowledge of subject matter, students, the community and curriculum goals.

#8. The teacher understands and uses formal and informal assessment strategies to evaluate and ensure the continuous intellectual, social and physical development of the learner.

#9. The teacher is a reflective practitioner who continually evaluates the effects of his or her choices and actions on others and who actively seeks out opportunities to grow professionally.

#10. The teacher fosters relationships with school colleagues, parents, and agencies in the larger community to support student's learning and well-being.

ACEI:
2.2 Science— Candidates know and understand fundamental concepts of physical, life, and earth/space sciences as delineated in the National Science Education Standards. Candidates can design and implement age-appropriate inquiry lessons to teach science, to
build student understanding of personal and social applications, and to convey the nature of science. (INTASC #1 Subject Matter Knowledge)

3.1 Integrating and applying knowledge for instruction— Candidates plan and implement instruction based on knowledge of students, learning theory, connection across the curriculum, curricular goals, and community. (INTASC #7 Planning)

3.4 Active engagement in learning— Candidates use their knowledge and understanding of individual and group motivation and behavior among students at the K-6 level to foster active engagement in learning, self- motivation, and positive social interaction and to create supportive learning environments. (INTASC #5 Management)

3.5 Communication to foster learning— Candidates use their knowledge and understanding of effective verbal, nonverbal, and media communication techniques to foster activity inquiry, collaboration, and supportive interaction in the elementary classroom. (INTASC #6 Communication)

5.2 Professional growth, reflection, and evaluation—Candidates are aware of and reflect on their practice in light of research on teaching, professional ethics, and resources available for professional learning; they continually evaluate the effects of their professional decisions and actions on students, families, and other professionals in the learning community and actively seek out opportunities to grow professionally. (INTASC #9 Reflection)

VA Health Education Standards of Learning:
Goal 1: Knowledge and Skills: Act with skill and reason to demonstrate an understanding of the concepts and behaviors that reduce health risks and enhance the health of self and others.

Goal 2: Information Access and Use: Demonstrate the ability to access, evaluate, and use health information, products and services that influence health and well-being in a positive manner.

Goal 3: Community Health and Wellness: Demonstrate the use of appropriate health practices and behaviors to promote a safe and healthy community when alone, with family, at school, and in other group settings.

Technology (ISTE NETS):
I. Teachers demonstrate a sound understanding of technology operations and concepts.

II. Teachers plan and design effective learning environments and experiences supported by technology.

III. Teachers implement curriculum plans that include methods and strategies for applying technology to maximize student learning.

V. Teachers use technology to enhance their productivity and professional practice.

Student Outcomes Referenced to Selected National Standards

Learning Outcomes	INTASC Principles	ACEI	VA Health	ISTE NETS
A	1	2.2	1, 2, 3	I, V
B	1, 2, 3, 4, 5, 6, 7, 8, 9	2.2, 3.1, 3.4, 3.5, 5.2	1, 2, 3	I, II, III, V
C	2, 3, 6, 9	2.2, 3.5, 5.2	1, 2, 3	I, V
D	4, 7, 10	2.2, 3.1	1, 2, 3	I, V
E	2, 3, 4, 7, 9, 10	2.2, 3.1, 5.2	1, 2, 3	I, V
F	1, 2, 3, 4, 5, 7, 9, 10	2.2, 3.1, 3.4, 5.2	1, 2, 3	I, V
G	1, 7, 8, 9	2.2, 3.1	1, 2, 3	I, V

Key:
ISTE NETS = International Society for Technology in Education National Education Technology Standards 2000
INTASC = Interstate New Teacher Assessment and Support Consortium
ACEI = Association for Childhood Education International
VA Health = Virginia Health Education Standards

IV. Nature of Course Delivery
Science is everywhere around us. Turning on our lights at night, baking a cake, throwing a basketball while expecting someone to catch it, and taking care of our bodies are just a few examples of how we use concepts in science on a daily basis. Research on student learning and motivation shows that effective teaching is *grounded in students' prior experiences* and provides ample opportunities for students to *explore* more of their natural world in a *social* context. Through these opportunities, students gain new conceptual knowledge and skills while increasing their overall interest in the science

discipline. In this course you will be exposed to a variety of content, curricula, and methods designed to shape your future teaching practices so that your future students will be motivated learners in your classroom.

Further research on the effects of increased conceptual knowledge and skills shows that education is a tool of empowerment. The aim of this course is to provide you with numerous experiences in science teaching to empower you as you strive to become an effective elementary classroom teacher. As you utilize experiences gained in this course while continuing in your life-long learning and development of your teaching practices, you will become more and more capable of providing experiences in your classroom that, in turn, will empower your own students to make informed decisions, seek new opportunities, and continue in their progress as life-long learners.

V. Required Texts & Readings

Course readings and related materials (handouts and e-reserves as necessary).

Board of Education, Commonwealth of Virginia. (2003). *Standards of learning for Virginia Public Schools.* Available online: http://www.doe.virginia.gov/testing/sol/standards_docs/science/complete/stds_sciencek-12.doc PRINT K-6 SCIENCE SOLS.

Board of Education, Commonwealth of Virginia. (2003). *Science standards of learning curriculum framework.* Available online: http://www.doe.virginia.gov/testing/sol/frameworks/science_framewks/framework_science-complete.doc DO NOT PRINT.

National Research Council (1996). *National science education standards.* Washington, DC: National Academy Press. Available Online: http://www.nap.edu/readingroom/books/nses/html/ DO NOT PRINT.

One* of these two texts:

Bass, J., Contant, T., & Carin, A. (2009). *Teaching science as inquiry, 11th edition*. Upper Saddle River, NJ: Pearson. OTHER EDITIONS ARE FINE.

Bass, J., Carin, A., & Contant, T. (2009). *Methods for teaching science as inquiry, 10th edition*. Upper Saddle River, NJ: Pearson. OTHER EDITIONS ARE FINE.

***Please Note:** The first option is more expensive, but contains lots of activity examples of science activities in the appendix. The second text is cheaper, but lacks the appendix of examples – I can't say the additional cost is worth it since there are so many science activities online and in other resources, so I've asked the bookstore to supply the second text.

VI. Course Requirements

Student Products Referenced to Learning Outcomes and Selected National Standards

Products	Learning Outcomes	INTASC Principles	ACEI	VA Health	ISTE NETS

Inquiry-Based Unit Project	A, B, C, D, E, G	1, 5, 6, 7, 9	2.2, 3.1, 3.4, 3.5, 5.2	1, 2, 3	I, II, III, V
Investigation Project	A, C, D, E	1, 2	2.2, 3.4	1, 2, 3	I, V
Science Journal	A, C, D, E	1, 2, 3, 10	2.2, 5.2	1, 2, 3	I, II, V
Annotated Bibliography Project	D, F	1, 2, 3	2.2, 3.1	1, 2, 3	I, V

1. Inquiry-Based Unit Project 50%

A special feature of the EDCI 553 class in the summer is the CREST science camp teaching experience. The curriculum for camp should be based on a problem-based learning model and should emphasize integration of other content areas with science, such as social studies. In addition to functioning as a participant observer of camp experience according to the distributed camp schedule, your team will teach for your selected days of science camp. For your selected days of instruction, your group will submit in advance the following items: lesson plans (use your program's lesson plan format), teaching materials, either a NEW webpage or PowerPoint presentation to be used during your teaching, and a culminating assessment of student learning for your unit (include a rubric). Even though you will work as a team to create these items, you are each required to submit a copy of all items in a packet with your individual name on it. You will be required to submit emailed reflections about your participation in the experience. You will be required to attend both pre-teaching and post-teaching sessions on the days your team teaches and observes. While teaching, at least one of your lessons will be videotaped. You will review the tapes from your teaching and reflect on them. The class will view team-selected sections of the tapes after your teaching is completed, and your team will lead a brief discussion on the teaching observed. During your EDCI 553 class, you will do what is called "micro-teaching." "Micro-teaching" is where you teach 10-12 minutes of a lesson plan (a hands-on science portion of the lesson) from your camp experience to your preservice teacher peers enrolled in the course. You will be asked to reflect on your teaching progress in terms of the evaluation form you received during science camp. Even though you have worked as a team to plan and teach, your reflections are submitted individually. Detailed descriptions of the micro-teaching task and a copy of the reflection guidelines and evaluation form can be found on Blackboard in the "Assignments" section.

As your Performance-Based Assessment for EDCI 553, the following chart can be used to track your mastery of competencies as documented by your work on this assignment:

Standard	**Rubric Item (must earn at least a 2 for all items to enter "MET" in your chart)**
INTASC 1. Content (ACEI 2.2)	I, J, L, M
INSTASC 2. Development	Not Applicable
INTASC 3. Diversity	Not Applicable
INTASC 4. Instruction	Not Applicable
INTASC 5. Management (ACEI 3.4)	H, K, S, T
INTASC 6. Communication (ACEI 3.5)	N, O, P, R
INTASC 7. Planning (ACEI 3.1)	A, B, C, D, E, F
INTASC 8. Assessment	Not Applicable

INTASC 9. Reflection (ACEI 5.2)	G, Q, U
INTASC 10. Community	Not Applicable

2. Investigation Project 10%

Participate in our in-class investigation experience and submit an experiment report based on the experience. Additionally, analyze your particular grade level's SOLs in terms of the expectations for experiment reports by answering the following questions:

- What are the investigative skills that students are to learn during your selected grade level?
- How are each of these particular skills used during the design, performance, and/or reporting of an experiment?
- According to local curriculum information you are able to find online for that grade level, describe the opportunities students have to learn and practice these skills during the school year.
- For this particular investigation, what are the safety hazards involved and what would you do to prevent them?

Detailed project descriptions and rubric expectations (including length of essays) can be found on Blackboard in the "Assignments" section.

3. Science Journal 10%

Complete a journal documenting your participation during EDCI 553 class in four inquiry-based activities and one use of a science-related community resource site in the camp's curriculum (<u>total of 5 entries</u>). For all activities and community resources, identify one standard from the K-6 science Virginia SOLs and its corresponding standard from the *National Science Education Standards* aligned with the activity/resource. For each activity/resource, illustrate your **knowledge and understanding** of the content of this science standard through a mode of your choice (examples include items you might create yourself or collect during camp: bulleted list, poetry, concept map, sheet you design for students with answer key, written skit, story, diagram, model, child's work). For all activities/resources, identify and explain how the activity/resource relates to an aspect of the nature of science as identified in EDCI 553 class and how you can make this aspect of the nature of science explicit to elementary children via this activity/resource. Include documentation of your participation/use of each activity/resource (copy of handouts and any notes you took). **Upon conclusion of this assignment, your four entries should include the following areas of science: physics, chemistry, biology, and Earth/space science.** Detailed project descriptions and rubric expectations (including length of journal entries) can be found on Blackboard in the "Assignments" section.

4. Annotated Bibliography Project 20%

Select one SOL for a particular grade level. For the SOL you selected, find one example of a developmentally-appropriate book to use during the teaching of that particular topic/theme. Feel free to use this book during camp if the topic fits the curriculum. For the book you select, you will need to provide the following information:

a. Topic and SOL:
b. APA citation:
c. Summary of the book:
d. Summary of the science concepts addressed via the book including your assessment of its accuracy using a reputable science content resource text (cite your resource):

e. Your ideas about HOW the book can be used in the classroom to teach the science concepts:
f. One example of an anticipated naïve theory or misconception of students regarding these science concepts that the book might propagate:
g. Your strategy for how to prevent this:
h. Your description of how the content of the book relates to a unifying principle in science:
i. Your description of how the content of the book relates to the nature of science:
j. Your name:

Detailed project descriptions and rubric expectations (including length of essays) can be found on Blackboard in the "Assignments" section.

5. Technology Assignment 10%

Explore the probeware and digital microscope provided in class. Select one piece of technology that you wish to learn more about. Feel free to incorporate any of these technologies into your camp teaching. In this project you will:

- Select a released SOL science test item (Grade 3, 5, or 8) that you feel the technology could prepare students to accurately answer.
- Identify a science SOL aligned with the test item.
- In one MSWord document, create a 5-E learning cycle that targets the standard, utilizes your selected technology, and incorporates the released item in the "evaluation" phase.
- Share your 5-E cycle in class via the computer projector, demonstrate how the technology works with volunteers from your audience, and go over the released item with your audience.

Detailed project descriptions and rubric expectations can be found on Blackboard in the "Assignments" section.

Special Note for All Projects:

Descriptions of expectations for each project can be found in course documents on Blackboard in "Assignments." Project work will be evaluated according to rubric expectations. All products must be submitted in word-processed format on paper or electronically by email. Projects may be resubmitted based on instructor feedback and resubmitted once for re-scoring. Correct grammar and mechanics are expected of graduate students; work submitted with numerous errors may be returned to the student for editing before grading. APA style is required. **Assignments are due by the beginning of class unless prior arrangements are made with the instructor.** The faculty coordinates due dates, so extensions should only be requested when absolutely necessary. Work that is submitted late without consulting the instructor will have points subtracted.

VII. Course Schedule

SUMMER 2010 CALENDAR
CLASS SCHEDULE

Session	Topic/Learning Experiences	Readings & Assignments
Thursday, June 17	•Pre-assessment •Investigation: Mealworms •Discussion: How are the mealworm activities aligned with the Virginia science SOLs? (Introduce	•**Bring Science SOLs to every class** •Chapter 1 (Children, Science, and Inquiry: Some Preliminary

	science SOLs and curriculum framework website) •Discussion: Investigation at the elementary level, National Science Standards, Community resources – How does science relate to the real world? (Introduce Science Journal) •Discussion: Safety	Questions)
Saturday, June 19	•Discussion: Nature of Science •Investigation: Cornstarch putty •Discussion: Parts of controlled experiment (Introduce Investigation Project) •Investigation continued: Group cornstarch putty or mealworms experiments •Share: Findings from group experiments •Discussion: Learning cycles in science •Discussion: Learning cycles in science and the role of children's literature (Introduce Annotated Bibliography Assignment)	•Chapter 2 (Processes and Strategies for Inquiry) •Chapter 4 (Teaching Science for Understanding: The 5-E Model of Instruction) •Chapter 5 (Planning and Managing Inquiry Instruction) •***Investigation Project due at end of class***
Tuesday, June 22	•Share: Findings from Annotated Bibliography Project •Discussion: Why hands-on? Why inquiry-based? •Discussion: Unifying principles in science •Discussion: Guiding questions •Discussion: Strategies for integrated curriculum planning (problem-based, project-based, and Jacobs model)	•***Annotated Bibliography Project due at beginning of class (bring your children's book to class to share)*** •Chapter 7 (Effective Questioning) •Chapter 9 (Connecting Science With Other Subjects)
Thursday, June 24	•Introduction to CREST Science Camp (Introduce Inquiry-Based Unit Project) •Work on units	•Read article "Weather Tamers" during class
Tuesday, June 29	•Work on units	•Chapter 3 (Learning Science with Understanding)
Thursday, July 1	•Peer feedback: One of the lesson plans (with teaching materials) from the unit you will teach in camp •Camp planning	•**Bring one lesson plan from your unit to class today for peer feedback**
Tuesday, July 6	•Peer feedback: Culminating assessment •Camp planning	•**Bring your culminating assessment from your unit you will teach in camp to class today for peer feedback**
Thursday, July 8	•Peer review of units in order they will be taught during camp •Discussion: Strategies for final curriculum development efforts and implementation of units •Camp planning	•***Lesson plans, teaching materials, PPT or website, culminating assessment with rubric from Inquiry-Based Unit Project due at beginning of class.*** **Submit reflections following the schedule described on the assignment sheet.**
Tuesday,	•Camp experiences	•Chapter 8 (Technology Tools

July 13	•Investigation: Technology and science (microscope; probeware)	and Resources for Inquiry Science)
Thursday, July 15	•Camp experiences •Share: Technology Project •Video: Differentiation •Discussion: Differentiation in science	***•Technology Project due at beginning of class*** •Chapter 10 (Science for All Learners)
Tuesday, July 20	•Camp experiences •Discussion: Assessment in Science	•Chapter 6 (Assessing Science Learning)
Thursday, July 22	•Camp experiences	
Tuesday, July 27	•Camp experiences	
Thursday, July 29	•Discussion: The practicalities of science in the elementary classroom •Course Evaluations and data collection	***•Inquiry-Based Unit AND Science Journal due by August 1 to Robinson A412***

VIII. POLICIES

SAFETY

The university has a policy that requests students to turn off pagers and cell phones before class begins; however, you may leave your cell phone on vibrate to receive emergency calls in class. If you receive a call, please answer it immediately, say "please hold," and walk outside the room before beginning your conversation.

Register for campus alerts at https://alert.gmu.edu. An emergency poster exists in each classroom explaining what to do in the event of crises. Further information about emergency procedures exists on http://www.gmu.edu/service/cert.

HONOR CODE

To promote a stronger sense of mutual responsibility, respect, trust, and fairness among all members of George Mason University and with the desire for greater academic and personal achievement, George Mason University has set forth a code of honor that includes policies on cheating and attempted cheating, plagiarism, lying and stealing. Students must follow the guidelines of the University Honor Code. See http://www.gmu.edu/catalog/apolicies/#TOC_H12 for the full honor code.

INDIVIDUALS WITH DISABILITIES POLICY

The university is committed to complying with the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 by providing reasonable accommodations for applicants for admission, students, applicants for employment, employees, and visitors who are disabled. Students with disabilities who seek accommodations in a course must be registered with the GMU Disability Resource Center (DRC) and inform the instructor, in writing, at the beginning of the semester. See www.gmu.edu/student/drc or call 703-993-2474 to access the DRC.

ATTENDANCE POLICY

Students are expected to attend the class periods of the courses for which they register. Although absence alone is not a reason for lowering a grade, students are not relieved of the obligation to fulfill

course assignments, including those that can only be fulfilled in class. Students who fail to participate (because of absences) in a course in which participation is a factor in evaluation, or students who miss an exam without an excuse, may be penalized according to the weighted value of the missed work as stated in the course syllabus (GMU University Catalog, pg. 32).

PROFESSIONAL BEHAVIOR & DISPOSITIONS
Students are expected to exhibit professional behavior and dispositions. See www.gse.gmu.edu for a listing of these dispositions.

Students must agree to abide by the university policy for Responsible Use of Computing. See http://mail.gmu.edu and click on Responsible Use of Computing at the bottom of the screen.