GEORGE MASON UNIVERSITY
COLLEGE OF EDUCATION AND HUMAN DEVELOPMENT
GRADUATE SCHOOL OF EDUCATION
Elementary Education Program

EDCI 553.C01: SCIENCE METHODS FOR THE ELEMENTARY CLASSROOM

3 Credits, Summer 2016
Mondays and Wednesdays, 12:00 – 4:35, Thompson Hall 2020

Instructor: Sarah Glassman
Phone: (518) 396-7043
Email: sglassma@masonlive.gmu.edu
Office Hours: Mondays and Wednesdays by appointment

This course is only open to students in the Elementary Education program.

COURSE DESCRIPTION

A. Prerequisites/Corequisites - Admission to the Elementary Education program.

B. **University Catalog Course Descriptions**
Develops skills and abilities in science teaching methods, applications of technology, safety practices, and creation of integrated science curricula. Examines science teaching based on contemporary theory, practice, and standards. Prerequisite(s): Admission to elementary education licensure program.
Notes: Requires field experience in public schools.

C. Expanded Course Description
The goal of this course is to provide you with the practical experience, theoretical background, content knowledge, and resources to successfully teach elementary science. Science is everywhere around us. Understanding our bodies, taking care of our environment, using household electronics, and playing sports are just a few examples of science in our everyday lives. Research on student learning and motivation shows that effective teaching *is grounded in students' prior experiences* and provides ample opportunities for students to *explore* science phenomena in a *social* context. This course provides inquiry-based and hands-on investigations of natural phenomena to ignite students' curiosity and increase students' understanding of science. Bring your own curiosity to class each day. The course will also provide opportunities to increase your own science content knowledge.

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, you will become more and more capable of providing experiences in your classroom that increase your students' interest in and understanding of science. This class experience is merely a first step in your journey of becoming the kind of educator you wish to be.

LEARNER OUTCOMES

This course will enable students to:

A. Build pedagogical content knowledge base in science and health through inquiry-based investigation
B. Conceptualize core principles regarding the Nature of Science, ie. how wonder, creativity experimentation, and evidence frame scientific thinking
C. Develop lesson plans demonstrating inquiry-based principles in science education including the incorporation of technology
D. Demonstrate age-appropriate safety standards when designing hands-on classroom experiences
E. Examine science curricula and methods with respect to "Science for All" and standards documents at local, state, and national levels
F. Develop viable assessment tools for science contexts

KEY PROFESSIONAL STANDARDS ADDRESSED FOR PBA ASSESSMENTS

INTASC: *Interstate Teacher Assessment and Support Consortium*, Model Core Teaching Standards

#4. Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.
#5. Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.
#6. Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.
#7. Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.
#8. Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

ACEI: *Association for Childhood Education International* - Standards for elementary level teacher preparation:

1.0 Development, Learning, and Motivation--Candidates know, understand, and use the major concepts, principles, theories, and research related to development of children and young adolescents to construct learning opportunities that support individual students' development, acquisition of knowledge, and motivation.
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)
2.6 Health education— Candidates know, understand, and use the major concepts in the subject matter of health education to create opportunities for student development and practice of skills that contribute to good health. (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)

#4.0 Assessment for Instruction -- Candidates know, understand and use formal and informal assessment strategies to plan, evaluate and strengthen instruction that will promote continuous intellectual, social, emotional, and physical development of each elementary student.

Technology (ISTE NETS): *International Society for Technology in Education / National Educational Technology Standards*

Standard I. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

COURSE DELIVERY
Face to face, 100%

REQUIRED TEXTS & READINGS

Board of Education, Commonwealth of Virginia. (2010). *Standards of learning for Virginia Public Schools: Science* Available online:
http://www.doe.virginia.gov/testing/sol/standards_docs/science/complete/stds_sciencek-12.doc

Board of Education, Commonwealth of Virginia. (2008). *Standards of learning for Virginia Public Schools: Health.* Available online:
http://www.doe.virginia.gov/testing/sol/standards_docs/health/complete/stds_healthk-10.doc

NGSS Lead States (2013). *Next generation science standards.* Available online:
http://nextgenscience.org/

Outstanding Science Trade Books for Children http://www.nsta.org/publications/ostb/

Articles and other materials will be provided throughout the course.

Optional Texts:
Ansberry, K. & Morgan, E (2010). *Picture-Perfect Science Lessons*. Arlington, VA: National Science Teachers Association.

Ansberry, K. & Morgan, E (2007). *More Picture-Perfect Science Lessons.* Arlington, VA: National Science Teachers Association

Contant, T. L., Bass, J. E., & Carin, A. A. (2014). *Teaching Science Through Inquiry and Investigation*. Upper Saddle River, NJ: Pearson.

National Research Council (2012). *A Framework for K-12 Science Education*. Washington DC: National Academies Press.

National Science Teachers Association Elementary Journal, *Science and Children* Available online:
http://www.nsta.org/elementaryschool/

You can consider any elementary science teaching text as a resource for lesson ideas and support for theoretical underpinning regarding your pedagogical approaches.

COURSE ASSIGNMENTS/ASSESSMENTS

1. **Wonder and Philosophy Project** **15%**

   Wonder List: Spend some time after our first class section thinking about science. Ask yourself questions, feel the movements and forces while you drive, look at the sky, watch your pet, engage with another human, etc. After you have engaged with some of these and spent some time with your thoughts, **craft a list of 5 things you wonder about in relation to science**. There are no real rules here. Your wonders are yours and unique to how you envision the world around you.

   Philosophy Statement: (roughly 500 - 750 words)
   This reflective thinking exercise is designed to consider your past, present and future science experiences as both a student and future teacher. This exercise is a written introspection for how you believe science should be taught in schools as well as your own thoughts and experiences with classroom science. Look deeply into the following issues:
   1) Provide some insights into your prior science experiences both inside and outside of school. How do you envision your relationship with science?
   2) How do you feel science should be taught in schools? Why? Any theorists/research to support your thoughts?
   3) What are your goals for your future classroom? How will you enact these kinds of approaches?
   4) Do you see any obstacles from enacting the approach you desire?
   These questions have been provided as a guideline, but feel free to approach this assignment in the manner of your choosing as long as you look into these major issues in the process.
   Due Thursday June 30 at 11:59 PM on Blackboard.

2. **Three Lesson Inquiry Unit (PBA)** **40%**

   The goal of this project is construct a three lesson inquiry-based unit designed around the 5 E model of lesson planning. The unit will entail building a detailed and well-supported narrative description for the approach that will be employed. The three-lesson sequence will build science content understanding in engaging and dynamic ways for students and provide some key theoretical and research-based support for the content, approach and activities constructed. The unit will be comprised of the following components and scored via the rubric provided later in the syllabus as part of the PBA.

   Unit Planning document - Outline of the 5 E approach
   Unit narrative description - roughly 750 word description of the unit goals, activities (including technology) and theoretical foundations for the project
   Three individual lesson plans - sequenced using the 5 E's with objectives clearly aligned to Virginia Science SOL's (or NGSS DCIs)
   Assessment description - roughly 250 words with supporting literature describing the assessment activities used across the lesson
   References Cited section

   During EDCI 553, you will teach 5 minutes of a lesson plan from your unit (a hands-on portion of the lesson). The lesson that you select to teach must use hands-on science materials.

   Due Thursday July 21 at 11:59 PM on Blackboard.

3. Children's Literature Assignment 15%

Select one VA science SOL (or NGSS DCI) for a particular grade level. For the SOL (DCI) you selected, find one example of a developmentally-appropriate book to use during the teaching of that particular topic/theme. For the book you select, you will need to provide the following information:

a. Topic and SOL (or DCI):
b. Title and author:
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/health content resource text (cite your resource):
e. Your ideas about HOW the book can be used in the classroom to teach the science/health concepts:
f. One example of an anticipated naïve theory or misconception of students regarding these science/health 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 cross-cutting concept in science (see NGSS):
i. Your description of how the content of the book relates to the nature of science (see VMSC/NGSS):
j. Your name:

Due Thursday July 14 at 11:59 PM on Blackboard.

4. Lab Reflections 15%

During each class we will explore at least one hands-on and/or inquiry-based activity. Following three of these activities (you choose which three), reflect on the experience by answering the following prompts (250-500 words):

- What did you like and/or not like about this activity as it relates to using the activity in your future classroom?
- How would you modify the activity to use in your classroom? (How might you modify it for a different age group?)

and two of these five prompts:

- What about this activity makes it an inquiry-based activity?
- How could the activity be modified to better engage students in the process of doing science?
- How does this activity exemplify Nature of Science (NOS) to students?
- How could the activity be modified to exemplify another aspect of NOS?
- How could you make students explicitly aware of how this activity exemplifies NOS?

Refection #1 Due, 11:59 PM Tuesday, July 12
Reflection #2 Due, 11:59 PM, Tuesday, July 19
Reflection #3 Due, 11:59 PM, Tuesday, July 28

5. Participation **15%**

Success in the course is predicated on being an active participant in the learning process. To this end, there will be a number of class-based assignments, discussions and activities over the duration of the course that will also be included in your overall participation. My expectation is that active and engaged students stand the most to gain from the approaches we will use in class. Consequently, you are expected to *be present, actively* involve yourself in class activities, and treat classmates with respect. Also remember that this class is a two way street. If there is a topic or idea that you would like to further investigate or need additional support…bring it up in class.

COURSE GRADING SCALE:

Grade	GRADING	Grade Points	Interpretation
A	94-100	4.00	Represents mastery of the subject through effort beyond basic requirements.
A-	90-93	3.67	
B+	85-89	3.33	Reflects an understanding of and the ability to apply theories and principles at a basic level
B	80-84	3.00	
C*	70-79	2.00	Denotes an unacceptable level of understanding and application of the basic elements of the course
F*	<69	0.00	

Note: "C" is not satisfactory for a licensure course
"F" does not meet requirements of the Graduate School of Education

Other expectations

Attendance: It is your responsibility to attend all class sessions. You are held accountable for all information from each class session whether you are present or not. Absences must be reported to the instructor in writing (via email) before our class session begins.

Tardiness: It is your responsibility to be on time for each class session.

Assignments: All assignments are to be turned in to your instructor on time. Late work will not be accepted for full credit. If the student makes prior arrangements with the instructor, assignments turned in late will receive a 10% deduction from the grade per late day or any fraction thereof (including weekends and holidays).

TK20 PERFORMANCE-BASED ASSESSMENT SUBMISSION REQUIREMENT

Every student registered for any Elementary Education course with a required performance-based assessment is required to submit this assessment, Three Lesson Inquiry Unit to Tk20 through Blackboard (regardless of whether the student is taking the course as an elective, a onetime course or as part of an undergraduate minor). Evaluation of the performance-based assessment by the course instructor will also be completed in Tk20 through Blackboard. Failure to submit the assessment to Tk20 (through Blackboard) will result in the course instructor reporting the course grade as Incomplete (IN). Unless the IN grade is changed upon completion of the required Tk20 submission, the IN will convert to an F nine weeks into the following semester.

SUMMER 2016 CLASS SCHEDULE

Session	Topic/Learning Experiences	Readings & Assignments
SUMMER	**Mondays and Wednesdays, 12:00 PM – 4:35 PM**	
Monday, June 27	• What is Science? What is Inquiry? • How might we best teach science to young children?	-Read Introduction, *A Short History of Nearly*

	• Physical Science – Mystery of the cans • Science Process Skills • Introduce Three Lesson Inquiry Unit	*Everything* --Read Chapter 1 *Inquiry and the National Science Education Standards*
Wednesday, June 29	• Inquiry Discussion • Mealworm Investigation • 5E Learning Cycle • Writing learning objectives and unit construction • Life Science: Seed germinations • Science Standards	--Bring unit/topic ideas for Inquiry Unit --Read Chapters 2 (Reading Aloud) and 4 (5E), *Picture Perfect Science Lessons* **Wonder Assignment Due, 11:59 PM Thursday, June 30th on Blackboard**
Monday, July 4	• NO CLASS	
Wednesday, July 6	• Share objectives and standards for unit project • Children's literature • Physical Science: Roller Coasters • Physical Science: Pendulums • Observe seeds and mealworms	--Bring objectives and standards for your Inquiry Unit --Read VMSC White paper, *Scientific Inquiry and the Nature of Science*
Monday, July 11	• Share 3E outline • Nature of Science – Plate Tectonics Example • Safety considerations • Earth Science: The Changing Moon • Earth Science: Seasons • Earth Science: Earthquakes	--bring 5E outline for Inquiry Unit **Reflection #1 Due, 11:59 PM Tuesday, July 12 on Blackboard**
Wednesday, July 13	• Share safety and NOS • Engineering • Engineering: Phones • Engineering: Parachutes • Observe seeds and mealworms	--bring safety and NOS plan for Inquiry Unit **Children's Literature Assignment Due 11:59 PM, Thursday, July 14 on Blackboard**
Monday, July 18	• Share draft lesson and assessment • Physical science: States of Matter/ Oobleck • Physical science: Chemical Reactions	-- Bring a draft lesson from Inquiry unit --bring assessment example for Inquiry Unit **Reflection #2 Due, 11:59 PM, Tuesday, July 19 on Blackboard**

Wednesday, July 20	• Engineering / Environmental Science: water filters • Life Science/ Earth Science: Fossils	**Three Lesson Inquiry Unit Due, 11:59, Thursday, July 21 on TK20 (on Blackboard)**
Monday, July 27	• Share 5 minute hands-on activities from Inquiry Unit • Physical Science: Magnets • Physical Science: Electricity	**Reflection #3 Due, 11:59 PM, Tuesday, July 28 on Blackboard**
Wednesday, July 30	• Share 5 minute hands-on activities from Inquiry Unit • Physical Science: Light and reflection • Life Science: Bugs	

ASSESSMENT RUBRICS:

Rubric for EDCI 553's PBA (You must earn at least 2 for all items or you will be required to resubmit)

PBA: Three Lesson Inquiry Unit (40% of total grade)

Assessment Summary: The project is meant to facilitate your understanding for the design and teaching of an inquiry-based science unit. This will require research into both inquiry-based lesson planning and science content. The goal is bring powerful learning theory to life in classrooms and design science experiences that both excite and engage elementary children.

Description and standard addressed	**Exceeds Expectations – 3**	**Meets Expectations – 2**	**Does Not Meet Expectations – 1**	**Does Not Meet Expectations – 0**
A. Lesson Framework (pedagogical process & procedure, narrative description) INTASC: # 8 ACEI: #1.0 (10 pts)	Utilizes inquiry-based lesson model (5E's), clearly describes pedagogical process that embodies inquiry. Clearly described, highly usable and innovative ideas with original elements; uses a myriad of excellent and well-respected sources properly referenced within narrative descriptions.	Utilizes inquiry-based lesson model (5E's), clearly describes pedagogical process that embodies inquiry. Effectively describes, usable and effective ideas; uses dependable sources that properly referenced within narrative descriptions.	Difficult to use; does not have complete components; and/or is not self-explanatory. Does not utilize reputable sources within narrative descriptions and/or more needed clarity within narrative.	No consistent format nor serious professional commitment to student needs.
B. Aligned Standards, Objectives, Activities & Resources INTASC: # 7; ACEI: #3.1 (5 pts)	All are student-oriented objectives and stated in observable student learning outcomes; spans all levels of student thinking; all are appropriate for the lesson. Standards, objectives and lesson activities all seamlessly align and support one another.	All are student-oriented objectives and stated in observable student learning outcomes; covers some levels of student thinking; most are clearly connected directly to lesson activities; there exists alignment between standards, objectives and activities.	A mix of student- and teacher-oriented objectives or not stated in terms of observable student learning outcomes; has only minimal levels of student thinking; has way too little or many objectives; and/or some are inappropriate for lesson. Standards, objectives and activities not clearly aligned.	Missing
C. Assessment INTASC: #6 ACEI #4 (5 pts)	Innovative, well-supported assessment strategies clearly linked to objectives; demonstrates all stated objectives, copies of assessments included. Will include diagnostic, formative and summative approaches throughout the unit.	Assessment clearly linked to objectives; demonstrates nearly all stated objectives, copies of written assessments are attached. Will include diagnostic, formative and summative approaches throughout the unit.	Assessment is not clearly linked to objectives; demonstrates some stated objectives, and/or copies of written assessments are not attached. Does not include all three types of assessment.	Missing

D. Science Content (Earth science, space science, life science, physical science) INTASC: #4 ACEI #2.2 (10 pts)	Content utilized in lesson plan is accurate, complete (as defined by listed standards); incorporates innovative, exciting and scientifically accurate approaches; multiple connections are made to students everyday lives and accessible.	Content utilized in lesson plan is accurate, complete (as defined by listed standards); incorporates These approaches make attempts to connect to students everyday lives.	Content utilized in lesson plan is inaccurate in some places, key content is not addressed (as defined by listed standards); incorporates mostly scientifically accurate approaches; little effort to connect to students everyday lives.	Missing
E. Nature of Science and Safety INTASC Content #5 ACEI #2.2 (5 pts)	Lesson supports essential enactment of science processes consistent with accepted notions of NOS. These include wonder, evidence, investigation, testing, concluding based on findings, etc. These approaches are well-supported with research literature. There also exists keen attention to issues that could arise and clearly provides appropriate safety measures.	Lesson supports enactment of science processes consistent with accepted notions of NOS. These include wonder, evidence, investigation, testing, concluding based on findings, etc. There also exists keen attention to issues that could arise and clearly provides appropriate safety measures.	Lesson tries to support enactment of science processes consistent with accepted notions of NOS, but misses on key approaches or those approaches are absent. (including wonder, evidence, investigation, testing, concluding based on findings, etc.) There is not enough attention paid to issues that could arise and do not clearly provide appropriate safety measures.	Missing
F. Technology Plan INTASC #5 ISTE: #I (5 pts)	Provides excellent description for technology use that connects subject matter with multiple forms technology that advance student learning through creative, and innovative ways.	Strong description for technology use that connects subject matter with technology approaches that advance student learning through creative, and innovative ways.	Description for technology lacks specifics and does not clearly offer ways to advance student learning in creative, innovative and meaningful ways.	Missing

GEORGE MASON POLICY STATEMENTS

1. GMU Policies and Resources for students
    a. Students must adhere to the guidelines of the George Mason University Honor Code [See http://academicintegrity.gmu.edu/honorcode/].
    b. Students must follow the university policy for Responsible Use of Computing [See http://universitypolicy.gmu.edu/1301gen.html].
    c. Students are responsible for the content of university communications sent to their George Mason University email account and are required to activate their account and check It regularly. All communication from the university, college, school, and program will be sent to students solely through their Mason email account.
    d. The George Mason University Counseling and Psychological Services (CAPS) staff consists of professional counseling and clinical psychologists, social workers, and counselors who offer a wide range of services (e.g., individual and group counseling, workshops and outreach programs) to enhance students' personal experience and academic performance [See http://caps.gmu.edu/].
    e. Students with disabilities who seek accommodations in a course must be registered with the George Mason University Office of Disability Services (ODS) and inform their instructor, in writing, at the beginning of the semester [See http://ods.gmu.edu/].
    f. Students must follow the university policy stating that all sound emitting devices shall be turned off during class unless otherwise authorized by the instructor.
    g. The George Mason University Writing Center staff provides a variety of resources and services (e.g., tutoring, workshops, writing guides, handbooks) intended to support students as they work to construct and share knowledge through writing [See http://writingcenter.gmu.edu/].
    h. The Office of Student Support staff helps students negotiate life situations by connecting them with appropriate campus and off-campus resources. Students in need of these services may contact the office by phone (703-993-5376). Concerned students, faculty and staff may also make a referral to express concern for the safety or well-being of a Mason student or the community (http://studentsupport.gmu.edu/) and the staff will follow up with the student.

PROFESSIONAL DISPOSITIONS

Students are expected to exhibit professional behaviors and dispositions at all times.

CORE VALUES COMMITMENT

The College of Education & Human Development is committed to collaboration, ethical leadership, innovation, research-based practice, and social justice. Students are expected to adhere to these principles: **http://cehd.gmu.edu/values/**.

For additional information on the College of Education and Human Development, Graduate School of Education, please visit our website http://gse.gmu.edu/.