George Mason University
College of Education and Human Development
Early Childhood Education

ECED 516.001 Science for Diverse Young Learners
3 Credits, Spring 2019
Wednesdays/ 4:30 – 7:10 pm
Thompson L003, Fairfax Campus

Faculty

Name:	Carley Fisher-Maltese, PhD
Office Hours:	By Appointment
Office Location:	Thompson Hall 1251, Fairfax Campus
Office Phone:	703-993-4848
Email Address:	cfisherm@gmu.edu

Prerequisites/Corequisites
ECED 403 or 503

University Catalog Course Description
Examines ways to foster development of science in preschool to third-grade children. Covers construction of science lessons and hands-on experiences that promote learning in children with diverse abilities and cultural and linguistic backgrounds. Offered by Graduate School of Education. May not be repeated for credit.

Course Overview
Not applicable

Course Delivery Method
This course will be delivered using a lecture and discussion format.

Learner Outcomes or Objectives
This course is designed to enable students to do the following:

1. Discuss the historical, philosophical, and sociological foundations underlying the role of, development, and organization of science in public education.
2. Describe the knowledge, skills, and practices of the four core science disciplines of Earth sciences, biology, chemistry, and physics as defined in Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds and the Virginia Science Standards of Learning and how these standards provide a sound foundation for teaching science in the early/primary grades.
3. Describe the nature of science and scientific inquiry, including the following:
    a. Function of research design and experimentation;
    b. Role and nature of the theory in explaining and predicting events and phenomena;
    c. Practices required to provide empirical answers to research questions, including data collection and analysis, modeling, argumentation with evidence, and contracting explanations;

    d. Reliability of scientific knowledge and its constant scrutiny and refinement;
    e. Self-checking mechanisms used by science to increase objectivity, including peer review; and
    f. Assumptions, influencing conditions, and limits of empirical knowledge.
4. Describe the knowledge, skills, and practices for conducting an active elementary science program, including the ability to do the following:
    a. Design instruction reflecting the goals of the Virginia Science Standards of Learning;
    b. Implement classroom, field, and laboratory safety rules and procedures, and ensure that students take appropriate safety precautions;
    c. Conduct research projects and experiments, including applications of the design process and technology;
    d. Conduct systematic field investigations using the school grounds, the community, and regional resources;
    e. Organize key science content, skills, and practices into meaningful units of instruction that actively engage students in learning;
    f. Design instruction to meet the needs of diverse learners using a variety of techniques;
    g. Evaluate instructional materials, technologies, and teaching practices;
    h. Conduct formative and summative assessments of student learning;
    i. Incorporate instructional technology to enhance student performance in science; and
    j. Ensure student competence in science.
5. Understand the content, skills, and practices of the four core science areas, including Earth sciences, biology, chemistry, and physics supporting the teaching of preK-3 science as defined by the Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds and Virginia Science Standards of Learning and equivalent to academic course work in each of these four core science areas.
6. Explain the core scientific disciplines of Earth science, biology, chemistry, and physics to ensure the following:
    a. The placement of the four core scientific disciplines in an appropriate interdisciplinary context;
    b. The ability to teach the processes and crosscutting concepts common to the Earth, biological, and physical sciences;
    c. The application of key science principles to solve practical problems; and
    d. A "systems" understanding of the natural world.
7. Describe the contributions and significance of science, including the following:
    a. Its social, cultural, and economic significance;
    b. The relationship of science to mathematics, the design process, and technology; and
    c. The historical development of scientific concepts and scientific reasoning.
8. Develop strategies to enable young children to become scientifically literate, think critically and creatively, and to see the relationships between science and other content areas
9. Select, evaluate, and adapt instructional materials and strategies, including instructional technology, to engage diverse young learners in science
10. Explore ways to promote student achievement in science.
11. Construct science experiences in a safe environment that promotes equity and responds to cultural, linguistic, and ability diversity.
12. Describe the role of family and community knowledge, experience, and resources in planning and implementing science content in the curriculum.

13. Reflect on one's own use of inquiry strategies in facilitating children's learning of science concepts.
14. Design, evaluate, and modify science-rich environments and classroom management and behavior guidance strategies that maintain a positive learning environment; respond to each child's individual strengths and needs, and promote diverse young children's interest and engagement in mathematics.
15. Plan, implement, and reflect on evidence-based, culturally responsive assessment and instruction that uses knowledge of how standards provide the core for teaching Science to support young children's achievement of the Virginia Standards of Learning in English and Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds.

Professional Standards – Interstate Teacher Assessment and Support Consortium (InTASC), Council of Exceptional Children (CEC), and National Association for the Education of Young Children (NAEYC)

Upon completion of this course, students will have met the following professional standards:
N/A -- Students will work toward meeting InTASC, CEC, and NAEYC standards.

Required Texts

American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author.

Peters, J. M., & Stout, D. L. (2011). *Science in elementary education: Methods, concepts, and Inquiries* (11th ed.). Boston: Pearson. ISBN: 9780135031506

Shillady, A. (Ed.) (2013). *Spotlight on young children: Exploring science*. Washington, DC: National Association for the Education of Young Children. ISBN: 9781928896944

Required Online Documents

Achieve Inc. (2013). *Next generation science standards*. Washington, DC: Author. https://www.nextgenscience.org/search-standards

Virginia Department of Education. (2010). Science standards of learning. http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml

Virginia Department of Education. (2010). Science curriculum framework. http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml

Virginia Department of Education. (2013). Virginia foundation blocks for early learning: Comprehensive standards for four-year-olds. http://www.doe.virginia.gov/instruction/early_childhood/

Course Performance Evaluation

Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Tk20, hard copy).

Assignments	Due Dates	Points
Attendance and Participation	Ongoing	**15**
Personal Journal Part 1 Part 2	 Jan 30 May 1	**20**

Science Activity Share	Variable	**20**
Enriching Science Inquiry with Literature	Feb 20	**5**
5E/PBL Lesson Plan	Mar 6	**15**
Science Lesson Implementation and Reflection Part 1 Part 2	 Mar 27 Apr 24	**25**
TOTAL		**100**

- **Assignments and/or Examinations**

NOTE: With exclusion of the personal journal, each of the major assignments for this course should focus on a <u>different</u> science area: physical science, life science, earth/space science, or engineering (i.e., no two assignments should focus on the same area.)

Personal Journal (Part 1=10 points; Part 2=10 points)
Part 1: To initiate class experiences, students will write a critical reflection on their personal experiences as a learner of math (2 pages). They will use the following prompts to help guide their reflection process.

- Begin with your earliest memories (give examples) and reflect until the present as a graduate student in a teacher preparation program.
- Reflect on your experiences in school, out of school, in the context of your family, etc.
- How do you see yourself as a math learner?
- Why do you think you feel that way?
- How do you think these experiences will shape you as a teacher of math? In other words, what positive impacts or challenges on your teaching practice do you foresee from your prior experiences or self-conception?

Part 2: In conclusion of the course, students will revisit their initial thoughts in their first journal entry and reflect on how their thoughts and/or self-conception have changed, if at all (2 pages). They will use the following prompts to help guide their reflection process.

- What have you learned in the course?
- Do you view yourself as a math learner differently than you did before?
- Is there a concept you learned in the course that really stuck out for you? (Include references to course readings, as necessary.)
- Is there a particular reading, handout, or material from class that you found particularly helpful or eye-opening? (Include references to course readings, as necessary.)
- Articulate the kind of early childhood mathematics teacher you plan to be. Will something you learned in the course be included in your guiding principles?

Science Activity Share (20 points)
Students will choose a science content area listed on the class schedule on the syllabus during the first class session in which to present an activity. Three students will sign up per content area: one person will focus on PreK, one on K-grade 1, and one on grades 2-3. Individual students will prepare a lesson plan using the template provided and lead an informative and interactive center on their science content area to a small group of classmates. During the center, each student will include the following:

- An overview of the topic, including the key ideas or content and the importance of the topic to students' science learning.
- An overview of relevant state and national content standards at the appropriate grade level(s), noting consistencies (or inconsistencies, if the case may be).
- A description of classroom and behavior management strategies that would increase the effectiveness of the implementation of the activity and contribute to creating and maintaining a safe environment.
- Modeling of how to engage in the activity. The student will then oversee classmates engaging in the activity by assisting and answering questions. Students will bring or borrow from the instructor all appropriate materials for the activity.
- Preparation for how to adapt the center activity for a range of learners should be evident.
- A list of at least three resources related to teaching the topic that could include children's literature, websites, manipulatives or materials, or other teacher resources (at least one must be a relevant developmentally appropriate picture book and one must be an article from a practitioner journal on the topic).
- All share materials (lesson plan, resources) will be posted on Blackboard under Discussion Board before the presentation.

Enriching Science Inquiry With Literature: A Focus on Reading and Writing (5 points)
Students will identify a focused science concept area and compile a chart of at least 10 literature resources, including fiction, non-fiction, digital, and non-digital forms, that promote children's engagement in the science concept. The chart will provide a brief summary of the text, identify possible literacy experience(s) for the resource (e.g., read aloud, guided reading, exploration center, research text, independent reading, as a resource to promote writing, etc.), and identify possible 5E entry points for the resource (i.e., engage, explore, explain, elaborate, evaluate).

5E/PBL Lesson Planning (15 points)
Students will use both an **inquiry-based** (5E model) and a **problem-based** approach to develop a detailed 5E lesson plan for one of the following science areas: physical science, life science, earth/space science, or engineering. *The lesson plan should include rationales and connections to course readings*. Students will integrate questioning, curiosity, and active engagement, with real materials in the lesson whenever possible. Students will include plans for classroom and behavior management and building community. They will also include how they will create and maintain a safe environment. They will use the lesson plan format provided by the instructor. In addition, students will develop the student sheets and any other supporting materials needed for their lesson. Students will create an assessment of student learning for their lesson and a rubric for the assessment.

Science Lesson Implementation and Reflection (25 points)
In two-person partnerships, students will choose a developmentally appropriate science lesson from either the VA Department of Education or *Picture-Perfect Science Lessons* series (NSTA Press). They will implement the lesson during one of two "Afternoons of STEM Learning" at the Mason Child Development Center (CDC) to multiple groups of preschool children, making necessary modifications and taking reflective notes. Students will bring any necessary materials for the lesson. Students will visit the CDC two consecutive times. One partner will teach the

lesson while the other partner takes anecdotal notes during the lesson iterations; the next week the partners will switch roles. Students will submit a written reflection in two parts.

- Part 1—Planning the Lesson (15 points). The first part of the reflection will be due before the experience and will include how the lesson was selected and how the student prepared to implement the lesson. Students will include plans for classroom and behavior management, building community, and creating and maintaining a safe environment. Preparation of all of the necessary materials for the lesson so the student was prepared to implement the lesson upon arrival at the CDC on the assigned day will be assessed in this part. (1-2 pages)

- Part 2—Reflecting on the Lesson (10 points). The second part will be due after the experience and will include how the lesson went (what went well, what could have been done differently/better for next time), key learnings, and "aha" moments. Students will reflect on both teacher learning (themselves) and student learning during the lesson. Students will also reflect on their classroom and behavior management, how they built community, and how they created and maintained a safe environment. Students will provide specific linkages to course readings. Partners will submit reflections independently. (2 pages)

- **Other Requirements**

Attendance and Participation (15 points)
Because active participation and engagement are imperative for optimal learning, preparation for and participation in in-class and online activities will be evaluated based on the following criteria:

- Students attend class, arrive on time, and stay for the entire class period.
- Students use laptops and personal devices for instructional purposes only.
- Students complete readings and prepare for class activities prior to class as evidenced by their ability to discuss and write about the concepts presented and examined in the texts as well as participate fully in related activities.
- Students are actively involved in in-class and online learning experiences as evidenced by (a) participating in all activities, (b) engaging in small- and large-group discussions, (c) completing written work related to the activities, and (d) supporting the participation and learning of classmates.
- Students show evidence of critical reflective thinking through in-class and online discussions, activities, and written reflections.
- Students display professional dispositions at all times while interacting with the instructor and other students.
- Students complete participation activities across the semester that complement the scheduled course topic. Instructors will periodically collect artifacts from the activities. Students in attendance and who actively engage in the learning experience will receive credit for their efforts. Graded participation activities are not announced and are implemented at the discretion of the instructor.

Note: Participation points will be deducted due to an excessive number of absences. It is students' responsibility to attend all class sessions. They are held accountable for all information

from each class session, whether they are present or not. A make-up assignment will be required in the case of an absence. Reasons for any absence must be reported to the instructor in writing.

Written Assignments
Assignments are due on the assigned day. Extensions for assignments must be requested in writing *before* the assignment is due. Extensions only will be granted for extenuating circumstances. Grade point deductions will be taken for every additional day an assignment is late. All formal written assignments will be evaluated for content and presentation. The American Psychological Association, Sixth Edition (APA) style will be followed for all written work. All written work unless otherwise noted must be completed on a word processor and should be proofread carefully. (Use spell check!) If students are not confident of their own ability to catch errors, they should have another person proofread their work. When in doubt, they should check the APA manual. Portions of the APA manual appear at the Style Manuals link on the Mason library website at http://infoguides.gmu.edu/content.php?pid=39979. Students may consult the Writing Center for additional writing support.

Students will do the following:

1. Present ideas in a clear, concise, and organized manner. (Avoid wordiness and redundancy.)
2. Develop points coherently, definitively, and thoroughly.
3. Refer to appropriate authorities, studies, and examples to document where appropriate. (Avoid meaningless generalizations, unwarranted assumptions, and unsupported opinions.)
4. Use correct capitalization, punctuation, spelling, and grammar.
5. Type the paper with double spacing, indented paragraphs, 1-inch margins all around, and 12-point Times New Roman font.

- **Grading**

A = 95-100 A- = 90-94 B+ = 87-89 B = 80-86 C = 70-79 F = <70
Incomplete (IN): This grade may be given to students who are passing a course but who may be unable to complete scheduled coursework for a cause beyond reasonable control.

All CEHD undergraduate and graduate students are held to the university grading policies as described in the Academic Policies section of the current catalog, which can be accessed at http://catalog.gmu.edu. Those students enrolled in a CEHD Licensure Graduate Certificate program, however, must earn a B- or better in all licensure coursework. A degree-seeking graduate student will be dismissed after accumulating grades of F in two courses or 9 credits of unsatisfactory grades (C or F) in graduate courses. A 3.0 grade point average is required for completion of the graduate degree.

Professional Dispositions
Students are expected to exhibit professional behaviors and dispositions at all times. See https://cehd.gmu.edu/students/policies-procedures/.

Class Schedule

Date	Topics	Readings & Assignments
Jan 23	Inquiring Minds in the Classroom Inquiry, Nature of Science	Peters & Stout (2011) Chapter 1 Spotlight: Science, p. 2-10
Jan 30	Discovering Science Through Inquiry Constructivist Approach to Teaching Relevant Learning Theories/Theorists 5E Model	Peters & Stout (2011) Chapter 2 Spotlight: Science, p. 41-47 On Blackboard: *Piaget Information* *Vygotsky Information* *Multiple Intelligences* *Bloom's Taxonomy* **Due – Personal Journal (Part 1)**
Feb 6	Planning for Inquiry, Backwards Design, Problem-Based Learning (PBL) Approach Introduction to Science Standards (National Standards, VA SOLs) Integrating Science With Other Content Areas (e.g., Literacy, Math)	Peters & Stout (2011) Chapter 3 Spotlight: Science, p. 72-73 48-54, 68-71 On Blackboard: *Weather Tamers* *Modeling Problem-Based Instruction*
Feb 13	Inquiry and Assessment *Role of Documentation in Reggio Emilia* *Science Journals in the Preschool Classroom* Promoting Scientific Skills: Observing, Classifying, Measuring, Communicating, Inferring, Predicting, and Experimenting Introduction to *Picture-Perfect Science Lessons* Series (NSTA Press)	Peters & Stout (2011) Chapter 4, 5 Spotlight: Science, p. 48-54 On Blackboard: *Performance-Based Assessments in Science*
Feb 20	Inquiry Experiences for *All* Children Celebrating Diversity **Science Activity Share EXAMPLE (Instructor Led)**	Peters & Stout (2011) Chapter 6 Spotlight: Science 61-67 On Blackboard: *Science Success for Students with Special Needs* **Due – Enriching Science Inquiry with Literature (bring 1 of the books to class!)**

Date	Topics	Readings & Assignments
Feb 27	Physical Science Inquiry Unit • Light, Energy, Matter, Sound **Science Activity Share – Physical Science I**	Peters & Stout (2011) Inquiry Unit 1, pp. 180-252 Spotlight: Science, p. 29-35
Mar 6	Physical Science Inquiry Unit • Magnetism, Electricity, Simple Machines **Science Activity Share – Physical Science II**	Peters & Stout (2011) Inquiry Unit 1, pp. 253-325 **Due – 5E/PBL Lesson Plan**
No Class Mar 13	SPRING BREAK	
Mar 20	Life science Inquiry Unit • Plants, Animals (Vertebrates & Invertebrates), Molds & Fungi FIELD TRIP TO THE MASON GREENHOUSE (tentative) **Science Activity Share – Life Science I**	Peters & Stout (2011) Inquiry Unit 2, pp. 328-383 Spotlight: Science, p. 11-16, 23-28 On Blackboard: *Blending In-Using an Adaptation Activity to Integrate Math and Science*
Mar 27	Life Science Inquiry Unit • Weather, Seasons, Habitat, Environmental Education **Science Activity Share – Life Science II**	Peters & Stout (2011) Inquiry Unit 2, pp. 384-427 Spotlight: Science, p. 36-40 On Blackboard: *Teaching with Play-An Introduction to Environmental Stewardship for Preschoolers* **Due – Science Lesson Reflection (Part 1)**
Apr 3	Earth and Space Science Inquiry Unit • Earth: Changing Surface, Soil, Rocks & Minerals, Water, Earth's Rotation (Day & Night) **Science Activity Share – Earth and Space Science I**	Peters & Stout (2011) Inquiry Unit 3, pp. 430-471 Spotlight: Science, p. 61-67
Apr 10	Earth and Space Science Inquiry Unit • Moon, Sun, Solar System and Beyond **Science Activity Share – Earth and Space Science II**	Peters & Stout (2011) Inquiry Unit 3, pp. 472-514 Spotlight: Science, p. 17-22 On Blackboard: *Representation of the Moon in Children's Literature*

Date	Topics	Readings & Assignments
	CDC Visit #1 – Science Lesson Implementation 4:30-5:30 pm	
Apr 17	The "E" in STEM – Engineering Using Community Resources & Field Trips to Enhance Science Instruction Science Activity Share – Human Body (5 Senses, Nutrition, Physical Activity) *CDC Visit #2 – Science Lesson Implementation 4:30-5:30 pm*	Spotlight: Science, p. 55-60 On Blackboard: They Can't Spell Engineering but They Can Do It Young Learners at a Natural History Museum
Apr 24	FIELD TRIP TO THE MASON APIARY (tentative)	TBD **Due – Science Lesson Reflection (Part 2)**
May 1	Technology in Early Childhood Science Science Inquiry Invitations for Family Explorations (Home-School Connections) Self-Reflections on Filling the Role of Science Teacher for Diverse Young Learners	Technology in Early Childhood Science Science Inquiry Invitations for Family Explorations (Home-School Connections) Self-Reflections on Filling the Role of Science Teacher for Diverse Young Learners **Due – Personal Journal (Part 2)**

Note: Faculty reserves the right to alter the schedule as necessary, with notification to students.

Core Values Commitment
The College of Education and 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/.

GMU Policies and Resources for Students

Policies

- Students must adhere to the guidelines of the Mason Honor Code (see https://catalog.gmu.edu/policies/honor-code-system/).

- Students must follow the university policy for Responsible Use of Computing (see http://universitypolicy.gmu.edu/policies/responsible-use-of-computing/).

- Students are responsible for the content of university communications sent to their Mason 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.

- Students with disabilities who seek accommodations in a course must be registered with George Mason University Disability Services. Approved accommodations will begin at the time the written letter from Disability Services is received by the instructor (see http://ods.gmu.edu/).

- Students must follow the university policy stating that all sound emitting devices shall be silenced during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to Tk20 should be directed to tk20help@gmu.edu or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to http://coursessupport.gmu.edu/.

- For information on student support resources on campus, see https://ctfe.gmu.edu/teaching/student-support-resources-on-campus.

For additional information on the College of Education and Human Development, please visit our website: https://cehd.gmu.edu/students/.