

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

ECED 514.DL1.600.601 Mathematics and Science for Diverse Young Learners  
3 Credits, Spring 2018  
Wednesdays/ 5:30 – 8:10 pm  
NET: 1/22 – 3/9  
Face-to-Face Sessions: 1/24, 1/31, 2/7, 2/14, 2/21, 2/28, 3/7  
Founders Hall 478, Arlington Campus

**Faculty**

Name: Carley Fisher-Maltese, PhD  
Office Hours: By Appointment  
Office Location: Thompson Hall 1307, Fairfax Campus  
Office Phone: 703-993-2381  
Email Address: [cfisher@gmu.edu](mailto:cfisher@gmu.edu)

**Prerequisites/Corequisites**

Admission to the Early Childhood Education program or approval of course instructor.

**University Catalog Course Description**

Examines ways to foster development of mathematics and science in preschool to third-grade children. Covers construction of math and science lessons and hands-on experiences that address the needs of culturally, linguistically, and ability diverse children. Field experience required. 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. Develop an understanding of the changing focus in both curricula and pedagogy at the early childhood level and implications for math and science instruction.
2. Develop strategies to help young children become mathematically and scientifically literate, think critically and creatively, and to see the relationships between mathematics, science, social studies, and language/literacy.
3. Develop the skills necessary to utilize a variety of methods in teaching mathematics and science to young children.
4. Develop insight in selecting, modifying, and presenting instructional activities in mathematics and science.
5. Develop science activities for young children using the scientific process with an emphasis on describing, analyzing, and quantitatively presenting findings.

6. Construct math and science experiences in an environment that promotes equity and responds to cultural, linguistic, and ability diversity.
7. Use state and local curriculum standards for mathematics and science, the standards identified by the National Council of Teachers of Mathematics, and national-level science standards to plan instruction.
8. Describe the role of family and community knowledge, experience, and resources in planning and implementing mathematics and science content in the curriculum.
9. Use a variety of sources for ideas and materials useful in teaching mathematics and science when planning instruction.
10. Integrate mathematics and science objectives into planning and implementing an integrated project.
11. Use authentic assessment strategies to describe young children's understanding of mathematics and science concepts.
12. Reflect on one's own use of inquiry strategies in facilitating children's learning of mathematics and science concepts.

**Professional Standards** (Council of Exceptional Children and National Association for the Education of Young Children)

Upon completion of this course, students will have met the following professional standards:  
Not Applicable

### Required Texts

- American Psychological Association. (2010). *Publication manual of the American Psychological Association* (6th ed.). Washington, DC: Author. ISBN: 9781433805615
- Copley, J. V. (2010). *The young child and mathematics* (2<sup>nd</sup> ed.). Washington, DC: National Association for the Education of Young Children. ISBN: 9781928896685
- Shillady, A. (ed.) (2013). *Spotlight on young children: Exploring science*. Washington, DC: National Association for the Education of Young Children. ISBN: 9781928896944

### Additional Resources

- Achieve Inc. (2013). *Next generation science standards*. Washington, DC: Author.  
<http://www.nextgenscience.org>
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: Author. <http://www.nctm.org/standards/content.aspx?id=16909>
- National Council of Teachers of Mathematics. (2006). *Curriculum focal points for prekindergarten through grade 8 mathematics*. Reston, VA: Author.  
<http://www.nctm.org/standards/content.aspx?id=270>
- Virginia Department of Education. (2009). Mathematics standards of learning.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/mathematics/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/index.shtml)
- Virginia Department of Education. (2016). Mathematics curriculum framework.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/mathematics/2016/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/mathematics/2016/index.shtml)
- Virginia Department of Education. (2010). Science standards of learning.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/science/index.shtml](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](http://www.doe.virginia.gov/testing/sol/standards_docs/science/index.shtml)

Virginia Department of Education. (2013). Virginia’s Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds.  
[http://www.doe.virginia.gov/instruction/early\\_childhood/](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	<i>Ongoing</i>	<b>15</b>
Mathematics/Science Activity Share	<i>Ongoing</i>	<b>20</b>
Field Experience Documentation <ul style="list-style-type: none"> <li>• Field Placement Approval Form (1 point)</li> <li>• Field Placement Documentation Form (9 points)</li> </ul>	<i>January 31</i> <i>March 7</i>	<b>10</b>
5E Lesson Plan	<i>February 14</i>	<b>15</b>
Home-School Connections	<i>February 25</i>	<b>10</b>
Teaching Observation Analysis	<i>March 7</i>	<b>20</b>
Reflection for Year-Long Planning	<i>March 9</i>	<b>10</b>
<b>TOTAL</b>		<b>100</b>

- **Assignments and/or Examinations**

#### Field Experience Documentation (10 points)

This course requires a minimum of 10 hours field experience. To initiate this assignment, students will visit <https://cehd.gmu.edu/endorse/ferf> and complete the online “Field Experience Request Form.” On the form they will be asked to indicate how their placement will be arranged.

Students will upload the *Field Experience Placement Approval Form* to Blackboard. In this form, they will provide a statement confirming that they have completed the online “Field Experience Request Form” and they will provide information to the instructor about where and how they will complete the field experience (1 point). Upon completion of their field experience hours, students will complete the *Field Experience Documentation Form* and will upload the form to Blackboard (9 points).

#### Mathematics/Science Activity Share (20 points)

Students will choose a mathematics or 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 mathematics content area to a small group of classmates. The chosen center activity should demonstrate developmentally appropriate practice (i.e., active/hands-on learning, use of *real* materials, limited use of worksheet/paper-pencil tasks). 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' mathematics/science learning (e.g., the sequence of learning pertaining to the topic).
- An overview of relevant state and national content standards at the appropriate grade level(s), noting consistencies (or inconsistencies, if the case may be).
- 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.

### **5E Lesson Plan (15 points)**

Students will use both an **inquiry-based** (5E model) and **problem-based** (PBL) approach to develop a detailed lesson plan for a particular science lesson. They will use the lesson plan format located on Blackboard. They will clearly delineate each of the five phases of the 5E model (engage, explore, explain, extend, evaluate). They also will specify at what point of entry (i.e., which phase) they will integrate PBL. They will develop the student sheets and any other supporting materials needed for their lesson. Additionally, they will create an assessment of student learning for their lesson and a rubric for the assessment.

### **Home-School Connections to Mathematics and Science (10 points)**

Teachers of young children are particularly responsible for initiating and encouraging communication between their students' families and the school.

The student will develop **one** of the following:

- A one page handout with ideas for families to extend mathematics and science development that builds on classroom activities on a particular topic or concept. The student must provide opportunities for the child to bring back products done with family members at home.
- A detailed plan for a "skill backpack". The backpack can remediate or extend a mathematics or science skill that students often have a difficult time developing or provide an extension of a classroom activity for students with advanced proficiency. The student must provide opportunities for the child to bring back products done with family members at home.
- A detailed plan for a family mathematics and/or science night. The plan should include how the student will involve parents and what activities will be done.
- Include citations of at least two course readings to support work.

### **Teaching Observation Analysis (20 points)**

Students will observe one mathematics lesson *or* science lesson (can be interdisciplinary). Based on the observation, students will prepare a paper addressing the required criteria (a rubric will be provided). The focus is on describing, analyzing, and reflecting upon the instructional content

and strategies the teacher uses to teach mathematics or science. The paper should provide specific linkages to course readings (include citations as noted in the rubric) and topics discussed in class.

### **Reflection for Year-Long Planning (10 points)**

The student will write a 2-3-page paper using APA format that describes the mathematics and science material covered in the class that he or she found most interesting, most immediately applicable, most surprising, and most difficult. The student will discuss how his or her mathematics and science lessons for the upcoming year will reflect the readings, class discussions/lessons, and assignments or aspects of his or her mathematics or science teaching that will remain the same, and why. The student will include citations of at least two course readings to support work.

- **Other Requirements**

### **Attendance, Participation & Professional Dispositions (15 points)**

Because active participation and engagement are imperative for optimal learning, preparation for and participation in in-class activities will be evaluated based on the following criteria:

- Students attend class, arrive on time, and stay for the entire class period. Participation points will be deducted due to an excessive number of absences. (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. 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.)
- Students complete readings and prepare for class activities prior to class as is 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.
- *Discussion Board Posts* – For online classes, students will post a two-paragraph response to weekly materials (e.g., video(s), readings) on Discussion Board in their Mathematics/Science Learning Group’s Forum. Students will engage in an online discussion with other Learning Group members (students should respond to a minimum of two other students’ posts).
- Students are actively involved in in-class and online learning experiences as is 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.
- Professional dispositions are to be displayed at all times while interacting with the instructor and other students. **Cell phones are not to be used during class. Laptops are to be used for instructional purposes only.**

### **Written Assignments**

*Assignments for face-to-face classes are due by 5:30 p.m. on the night of class; assignments for online classes are due by 11:59 p.m. Sundays of the assigned week.* 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

Class	Topics	Assignments & Readings Due
<i>January 24</i>	Introduction & understandings Self reflection on math and science experiences Constructivist environments to support mathematics/science learning Relevant learning theories/theorists <i>Piaget Information</i> <i>Vygotsky Information</i> <i>Bloom Information</i> <i>Multiple Intelligences</i> Introduction to mathematics and science content standards Sequential nature of mathematics	Copley, Chapter 1 & 2 Spotlight: Science, pp. 2-10, 72-73 <u>On Blackboard:</u> <i>Got Standards Don't Give up on Engaged Learning</i>
<i>Online</i>	Focus on math instruction to develop the “five processes of mathematical understanding” Math and science process skills (handout) The Scientific Method in early childhood  Watch: <i>Thinking Math-ishly: Amy Lin</i> (TEDx Talks)	Copley, Chapters 3 Spotlight: Science, p. 36-40 <b>DUE: January 28</b> Discussion Board post
<i>January 31</i>	Authentic math and science assessment—addressing the needs of diverse learners Developing number sense <b>Mathematics/Science Activity Share</b> <b>EXAMPLE – Number Sense &amp; Place Value (Instructor Led)</b>	<u>On Blackboard:</u> <i>Implementing Portfolio Assessment</i> <i>Performance-Based Assessments in Science</i> <i>Calendar time for Young Children – Good Intentions Gone Awry</i> <i>Developing “Five-ness”</i>  <b>Field Experience Placement Approval Form Due</b>
<i>Online</i>	STEM/STEAM Problem-based/Project-based learning (PBL)  Read: PBL Presentation by FCPS’s Jeff Lonnett	Spotlight: Science, p. 17-22 <u>On Blackboard:</u> <i>Weather Tamers</i> <i>Modeling Problem-Based Instruction</i> <b>DUE: February 4</b> Discussion Board post
<i>February 7</i>	Operations and computation	Copley, Chapters 4

	<p>Inquiry-based approach to teaching science – 5E Model          Inquiry through play          Life science          Garden-based learning and outdoor learning</p>	<p>Spotlight: Science, p. 11-16, 23-28, 41-47  <u>On Blackboard:</u>  <i>Engaging in Inquiry-based Instruction and Using the 5E Model</i>  <i>Science Journals in the Preschool Classroom</i>  <b>DUE:</b>  <a href="#">Operations and Computation Activity Share</a>  <a href="#">Life Science Activity Share</a></p>
<i>Online</i>	<p>Patterns, functions, and algebraic thinking</p> <p>Watch: <i>Algebra the Fun and Easy Way: Hands-On Equations</i></p>	<p>Copley, Chapter 5  <u>On Blackboard:</u>  <i>What Comes Next? The Mathematics of Pattern in Kindergarten</i>  <i>Emerging Understandings of Patterning in 4-Year-Olds</i>  <b>DUE: February 11</b>          Discussion Board post</p>
<i>February 14</i>	<p>Geometry and spatial sense          Introduction to <i>Picture-Perfect Science Lessons</i> Series (NSTA Press)          Physical science</p>	<p>Copley, Chapter 6          Spotlight: Science, p. 29-35, 48-54, 68-71  <b>DUE:</b>  <a href="#">Geometry Activity Share</a>  <a href="#">Physical Science Activity Share</a>  <b>5E Lesson Plan</b></p>
<i>Online</i>	<p>Common misconceptions in astronomy          The phases of the moon – activity modeling phases with an orange          The seasons</p> <p>Take: <i>Private Universe</i> quiz (first)          Watch: <i>Private Universe</i> Video</p>	<p><u>On Blackboard:</u>  <i>Representation of the Moon in Children’s Literature</i>  <b>DUE: February 18</b>          Discussion Board post</p>
<i>February 21</i>	<p>Fractions          Earth and space science</p>	<p>Spotlight: Science, p. 61-67  <u>On Blackboard:</u>  <i>Making Fractions Meaningful</i>  <b>DUE:</b>  <a href="#">Fractions Activity Share</a>  <a href="#">Earth and Space Science Activity Share</a></p>
<i>Online</i>	<p>Measurement          Using community resources &amp; field trips to enhance math and science instruction          Home-School Connections</p>	<p>Copley, Chapter 7          Spotlight: Science, p. 55-60  <u>On Blackboard:</u>  <i>Young Learners at a Natural History Museum</i></p>



		<b>DUE: February 25</b> NO Discussion Board Post <b>Home-School Connections</b>
<i>February 28</i>	The “E” in STEM – Engineering Making math and science accessible for students with special needs	<u>On Blackboard:</u> <i>They Can’t Spell Engineering but They Can Do It</i> <i>Science Success for Students with Special Needs</i> <b>DUE:</b> <a href="#">Engineering Activity Share</a> <a href="#">Money Activity Share</a>
<i>Online</i>	Data analysis and probability Integrating math and science  Watch: <i>Supporting Mathematical Development in Young Children -- Data</i>	Copley, Chapter 8 <u>On Blackboard:</u> <i>Zoos, Aquariums, and Expanding Students’ Data Literacy</i> <i>Blending In—Using an Adaptation Activity to Integrate Math and Science</i> <b>DUE: March 4</b> Discussion Board post
<i>March 7</i>	Contributions of different cultures to the history and development of mathematics and science Technology in early childhood math and science Evaluating good math/science games & apps	<u>On Blackboard:</u> <i>Multicultural Mathematics Instruction</i> <i>Meaningful Technology Integration in Early Childhood</i> <i>Putting the “T” in STEM for the Youngest Learners</i> <b>DUE:</b> <b>Field Experience Documentation Form</b> <b>Teaching Observation Analysis</b>
<i>Online</i>		<b>DUE: March 9</b> <b>Reflection for Year-Long Planning</b>

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](mailto: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/>.**