

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

ECED 514 (001) - Mathematics and Science for Diverse Young Learners  
3 Credits, Fall 2016  
Tuesdays, 4:30 – 7:10 pm  
Krug Hall Room 102, Fairfax Campus

**Faculty**

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**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.

**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 for Exceptional Children, 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. **[PLEASE PURCHASE IF YOU DO NOT HAVE ALREADY]**
- Achieve Inc. (2013). *Next generation science standards*. Washington, DC: Author.  
<http://www.nextgenscience.org>
- Copley, J. V. (2009). *The young child and mathematics* (2<sup>nd</sup> ed.). Washington, DC: National Association for the Education of Young Children. **[PLEASE PURCHASE]**
- 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>
- Shillady, A. (ed.) (2013). *Spotlight on young children: Exploring science*. Washington, DC: National Association for the Education of Young Children. **[PLEASE PURCHASE]**
- Virginia Department of Education. (2009). Mathematics standards of learning.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/index.shtml)
- Virginia Department of Education. (2009). Mathematics curriculum framework.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/index.shtml)
- Virginia Department of Education. (2010). Science standards of learning  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/index.shtml)
- Virginia Department of Education. (2010). Science curriculum framework.  
[http://www.doe.virginia.gov/testing/sol/standards\\_docs/index.shtml](http://www.doe.virginia.gov/testing/sol/standards_docs/index.shtml)

### **Additional Resources**

\*Cross, C., Woods, T., & Schweingruber, H. (2009). *Mathematics learning in early childhood: Paths toward excellence and equity*. Washington, D. C.: National Research Council.

\*Available as free downloads under early childhood education at the National Academies Press website: <http://www.nap.edu/topicpage>

### **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 and Examinations**

#### **Reading Guides (20 points)**

- Students will complete a reading guide by answering the open-ended questions about the assigned readings and submitting them electronically to BlackBoard BEFORE class on the due date.
- The objective of the Reading Guides is to ensure that students have completed and thought critically about the readings before class. While questions or clarification about issues raised in the readings will be discussed during class, readings may or may not be discussed specifically. The purpose is to allocate the majority of class time to inquiry-based explorations; readings will provide important background knowledge for these explorations.

#### **Group Topic Presentations (15 points)**

- Students will choose presentation groups based on a topic of interest listed on the class schedule on the syllabus. All members will participate in gathering information, preparing materials, and presenting. Some class time will be provided to work in groups.
- Students will select an appropriate article or chapter to provide to the class at least a week before the presentation that provides foundational information related to the topic (email a pdf of the reading selection to your instructor at least one week prior to your presentation).
- Groups will prepare and present an informative and interactive 25–30 minute presentation on their math or science topic with all group members participating equally.
- The presentation will include:
  - An overview of the topic to include the key ideas or content and the importance of the topic to students' mathematical or scientific learning supported by class readings and additional resources.
  - A research-based developmental sequence or learning trajectory for pre-kindergarten-3<sup>rd</sup> grade students specific to the topic.
  - A list of state and national content standards related to the topic.
  - Lesson ideas or learning activities for teaching the topic including the modeling of (and audience participation in) at least 1 learning activity with all appropriate materials during the presentation.
  - Strategies for instruction in the topic for a range of learners.
  - A list of at least 10 resources related to teaching the topic that could include children's literature, websites, manipulatives or materials, or other teacher resources.

- A handout that includes all of the above and references used to develop the presentation (distribute one paper copy to each of your audience members; email a pdf of handout to instructor by 11:59 PM of presentation night for posting on Blackboard).

### **Informal Assessment Video Analysis (10 points)**

Students will choose one video clip on Blackboard to analyze.

In a bulleted list or in paragraphs, students will answer in detail the following questions:

- List and provide evidence for four skills/ knowledge the child has mastered.
- List and provide evidence for three skills/ knowledge the child is developing.
- List and provide evidence for two skills/ knowledge that are emergent for the child or which might reasonably be expected to develop next.
- Develop and list five learning objectives for what the student could next be expected to become familiar with, learn, or master.
- Provide short descriptions for three whole or small group learning experiences or lessons based on the learning objectives to further the child's learning in the topic or content area.
- Describe and provide evidence for how the teachers' lessons could be adapted to better meet the individual needs of the learner based on his or her current skills, knowledge, and interests.

Students will note which video clip was used. They will include citations of at least two course readings to support the analysis.

Due by due date via Blackboard.

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

Students will observe **one** math lesson *or* science lesson (can be interdisciplinary), at their internship site or field experience site. Based on the observation, students will prepare a paper using the attached template (**Attachment 1**). The focus is on describing, analyzing, and reflecting upon the instructional content and strategies the teacher uses to teach math or science. The paper should provide specific linkages to course readings (include citations as noted in the rubric).

Due by due date via Blackboard.

### **Lesson Planning Project (15 points)**

Students will use both an **inquiry-based** (5E model) and **problem-based** approach to develop a detailed lesson plan for a particular science lesson. They will use the lesson plan format located in the syllabus. They also will develop the student sheets and any other supporting materials needed for their lesson. They may not use student sheets "as is" because they will need to tailor these to fit the particular lesson. Additionally, they will create an assessment of student learning for their lesson and a rubric for the assessment.

### **Self Reflection (5 points)**

- Students will reflect on what they have learned in the course and past and present experience to articulate the kind of early childhood math and science teacher they plan to be.

- **Other Requirements**

**Attendance and Participation (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.
- 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.
- 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) using laptops and other electronic devices only to support discussion and learning and not for non-academic uses during class time, (d) completing written work related to the activities, and (e) supporting the participation and learning of classmates.
- Students show evidence of critical reflective thinking through in-class and online discussions, activities, and written reflections.

**Note:** To determine whether the campus is closed due to inclement weather, call 703-993-1000 or go to [www.gmu.edu](http://www.gmu.edu).

**Written Assignments**

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 web 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.

- **Course Performance Evaluation Weighting**

<b>Assignments</b>	<b>Due Dates</b>	<b>Points</b>
Participation (Individual/group/preparation)	<i>Ongoing</i>	15
Reading Guides (10 Total)	<i>Ongoing</i>	20
Group Topic Presentations	<i>Various</i>	15
Informal Assessment Video Analysis	<i>October 18</i> <i>Submit via Blackboard</i> <i>by 11:59 PM</i>	10
Lesson Plan Project	<i>November 1</i> <i>Submit via Blackboard</i> <i>by 11:59 PM</i>	15
Teaching Observation Analysis	<i>November 29</i> <i>Submit via Blackboard</i> <i>by 11:59 PM</i>	20
Self Reflection	<i>December 6</i> <i>Submit via Blackboard</i> <i>by 11:59 PM</i>	5
<b>TOTAL</b>		<b>100</b>

- **Grading Policies**

A = 95-100   A- = 90-94   B+ = 87-89   B = 83-86   B- = 80-82   C = 70-79   F = < 70

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.

## **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 <http://oai.gmu.edu/the-mason-honor-code/>).
- 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/api/tk20>. Questions or concerns regarding use of Blackboard should be directed to <http://coursessupport.gmu.edu/>.
- 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/>).
- 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/>).

- The George Mason University 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 by going to <http://studentsupport.gmu.edu/>, and the OSS staff will follow up with the student.

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

### Class Schedule

<b>Date</b>	<b>Topics Addressed</b>	<b>Readings Prior to Class</b>	<b>Assignment Due</b>
Week 1 – <i>August 30</i>	Getting set up for your Field Experience Cognitive aspects of math and science Meaningful math and science learning	Welcome to ECED 514!	
Week 2 – <i>September 6</i>	Constructivist environments to support math/science learning Relevant learning theories/theorists Mathematics and science content knowledge for teaching and learning	Copley, Chapter 1 Spotlight: Science, p. 2-10 <u>On Blackboard:</u> <i>Piaget Information</i> <i>Vygotsky Information</i> <i>Multiple Intelligences</i>	Reading Guide
Week 3 – <i>September 13</i>	Introduction to mathematics and science content standards, including the Virginia Standards of Learning Sequential nature of mathematics	Spotlight: Science, p. 72-73 National and State Math and Science Learning Standards <u>On Blackboard:</u> <i>Got Standards Don't Give up on Engaged Learning</i>	Reading Guide
Week 4 – <i>September 20</i>	Focus on math instruction to develop the “five processes of mathematical understanding” Developing number sense	Copley, Chapters 3 <u>On Blackboard:</u> <i>Calendar time for Young Children – Good Intentions</i> <i>Gone Awry</i> <i>Developing “Five-ness”</i> <i>Montessori Place Value Article</i>	Reading Guide
Week 5 –	Authentic math and science	Copley, Chapter 2 & 4	Reading Guide



September 27	assessment—addressing the needs of diverse learners	On Blackboard: <i>Implementing Portfolio Assessment Performance-Based Assessments in Science</i>	<b>Operations and Computation Presentation</b>
Week 6 – October 4	Inquiry-based approach to teaching science 5E Model Questioning techniques	Spotlight: Science, p. 41-47, 61-67 On Blackboard: <i>Engaging in Inquiry-based Instruction and Using the 5E Model Science and Engineering Practices in the NGSS</i>	Reading Guide
Week 7 – October 11	NO CLASS	NO CLASS	NO CLASS
Week 8 – October 18	Geometry and spatial sense Problem-based learning	Copley, Chapter 6 On Blackboard: <i>Weather Tamers Modeling Problem-Based Instruction</i>	<b>Geometry Presentation</b> Reading Guide <b>Informal Assessment Video Analysis (due via Blackboard)</b>
Week 9 – October 25	Focus on math and science instruction for diverse young children Contributions of different cultures to the history and development of mathematics and science	Spotlight: Science, p. 29-35 On Blackboard: <i>Science Success for Students with Special Needs Multicultural Mathematics Instruction</i>	<b>Physical Science Presentation</b> Reading Guide
Week 10 – November 1	Life science Life cycles of insects  Garden-based learning Classroom management in the outdoor classroom	Copley, Chapter 7 Spotlight: Science, p. 11-16, 23-28 On Blackboard: <i>TBD</i>	<b>Life Science Presentation</b> NO Reading Guide <b>Lesson Planning Project (due via BlackBoard)</b>
Week 11 – November 8	Fractions The role of science in explaining and predicting events and phenomena  Developing the skills of data analysis, measurement, observation, prediction, and experimentation	Copley, Chapter 7 & 8 Spotlight: Science, p. 36-40 On Blackboard: <i>Making Fractions Meaningful Encounters with Sunlight and a Mirror Ball</i>	<b>Fractions Presentation</b> Reading Guide

Week 12 – <i>November 15</i>	Technology in early childhood math and science Resources and references for young children and math and science  The phases of the moon	Copley, Chapter 5 Spotlight: Science, p. 74-76 <u>On Blackboard:</u> <i>Meaningful Technology Integration in Early Childhood</i> <i>Representation of the Moon in Children’s Literature</i>	Reading Guide  <b>Earth and Space Science Presentation</b>
Week 13 – <i>November 22</i>	Creating safe environments for children’s research and experimentation Using community resources & field trips to enhance math and science instruction	Spotlight: Science, p. 55-60 <u>On Blackboard:</u> <i>Young Learners at a Natural History Museum Zoos, Aquariums, and Expanding Students’ Data Literacy</i>	<b>Money Presentation</b> Reading Guide
Week 14 – <i>November 29</i>	Math and science across the disciplines Integrated Curriculum	Spotlight: Science, p. 17-22, 48-54 & 68-71 <u>On Blackboard:</u> <i>The Art of Science and Notebooks</i>	NO Reading Guide <b>Teaching Observation Analysis (due via Blackboard)</b>
Week 15 – <i>December 6</i>	Self-reflections on filling the role of math and science teacher for diverse young learners Celebration and math/science lessons using food!  Course wrap-up	Copley, Chapter 9 Spotlight: Science, p. 77-80  <u>On Blackboard:</u> <i>The Positive Classroom – Joy in School</i>	NO Reading Guide <b>Self Reflection about yourself as a future Math and Science Teacher</b>

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

**Assessment Rubric(s)**

Not Applicable