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 2017
Tuesday 5:30 – 8:10 pm
NET January 23 – March 12, F2F Meetings 1/24, 1/31, 2/7, 2/14, 2/21, 2/28, 3/7
Arlington Founders Hall 310, Arlington 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.

Note: Field Experience Required

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. **[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* (2nd 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

Virginia Department of Education. (2009). Mathematics curriculum framework. 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

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

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**
Participation (Individual/group/preparation)	*Ongoing*	15
Group Topic Presentations	*Various (class reading selection due 1 week prior to presentation)*	15
Informal Assessment Video Analysis	*February 7*	10
Lesson Planning Project	*February 14*	15
Teaching Observation Analysis	*February 28*	20
Home-School Connections	*By March 7*	10
Good Games Through the Grades	*By March 7*	10
Reflection for Year Long Planning	*March 10*	5
TOTAL		100

- **Assignments and/or Examinations**

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 by due date).
- Groups will prepare and present an informative and interactive 25–30 minute presentation on their mathematics or science topic with all group members participating equally. Designing 2-3 centers (depending on the number of group members) for classmates to participate in is recommended.
- 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-3rd 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.
Include citations of at least two course readings to support the analysis.
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.

- Use the George Mason University GSE-approved lesson plan format.
- Develop the student sheets and any other supporting materials needed for their lesson. Do not use student sheets "as is" because they will need to tailor these to fit the particular lesson.
- Additionally, create an assessment of student learning for the lesson and a rubric for the assessment.

Due by due date via Blackboard

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.
Due by due date via Blackboard

Good Games Through the Grades (10 points)
There are many online and computer games that promise to meet mathematics and science objectives. The teacher is responsible for previewing games and ensuring that each activity is an enriching use of the child's time. The student will play five games from the list in the folder labeled "Games for Review" on Blackboard and develop an evaluation rubric to rate each game. The rubric should include 5 to 10 items to determine the quality of the games for mathematics and science development. List the games reviewed and approximate grade level targeted. (The games listed are not necessarily *good* games.)
Include citations of at least two course readings to support work.
Due by due date via Blackboard

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. 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).
Due by due date via Blackboard

Reflection for Year-Long Planning (5 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 to include aspects of his or her mathematics or science teaching that will remain the same, aspects that will change, and why.
Include citations of at least two course readings to support work.
Due by due date via Blackboard

- **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 (1) participating in all activities, (2) engaging in small- and large-group discussions, (3) completing written work related to the activities, and (4) supporting the participation and learning of classmates.
- Students show evidence of critical reflective thinking through in-class and online discussions, activities, and written reflections.

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.

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 = 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.

Class Schedule

Date	Topics Addressed	Readings Prior to Class	Assignment Due
CLASS 1: January 24	Cognitive aspects of mathematics and science Meaningful mathematics and science learning Constructivist environments to support mathematics/science learning Mathematics and science content knowledge for teaching and learning Introduction to mathematics and science content standards, including the Virginia Standards of Learning Sequential nature of mathematics	Welcome to ECED 514! Copley, Chapter 1 Spotlight: Science, p. 2-10 On Blackboard: *National and State Mathematics and Science Learning Standards* (also available online) *Got Standards Don't Give up on Engaged Learning*	
CLASS 2: January 31	Focus on mathematics instruction to develop the five processes of mathematical understanding—reasoning mathematically, solving problems, communicating mathematics effectively, making mathematics connections, and using mathematical representations of different levels of complexity Authentic mathematics and science assessment—addressing the needs of diverse learners	Copley, Chapter 3 Spotlight: Science, p. 17-22 On Blackboard: *Calendar Time for Young Children: Good Intentions Gone Awry* *Developing "Five-ness" in Kindergarten* *Montessori Place Value* *Implementing Portfolio Assessment*	
CLASS 3: February 7	Inquiry-based approach to teaching science 5E Model Questioning techniques Problem-based learning Don't forget the "E" in STEM! – Engineering	Operations and Computation Reading Copley, Chapters 2 & 4 Spotlight: Science, p. 41-47, 61-67 On Blackboard:	Operations and Computation Presentation **Informal Assessment Video Analysis (due via Blackboard by 11:59PM)**

		Engaging in Inquiry-based Instruction and Using the 5-E Model *Investigating Rocks and Sand* *Weather Tamers* *Modeling Problem-Based Instruction*	
CLASS 4: February 14	Focus on mathematics and science instruction for diverse young children Multiple mechanisms for representing mathematical concepts and procedures Contributions of different cultures to the history and development of mathematics and science	Physical Science reading Copley, Chapter 7 Spotlight: Science, p. 61-67 On Blackboard: *Multicultural Mathematics Instruction*	Physical Science Presentation **Lesson Planning Project (due via Blackboard by 11:59PM)**
CLASS 5: February 21	The role of science in explaining and predicting events and phenomena Developing the skills of data analysis, measurement, observation, prediction, and experimentation Technology in early childhood mathematics and science	Fractions reading Copley, Chapter 5 Life science reading Spotlight: Science, p. 11-16, 23-28, 36-40, 74-76 On Blackboard: *Making Fractions Meaningful* *Meaningful Technology Integration in Early Childhood*	Fractions Presentation Life Science Presentation
CLASS 6:	Creating safe environments	Earth and space science	Earth and Space

February 28	for children's research and experimentation Mathematics and science across the disciplines The Phases of the Moon	reading Copley, Chapter 8 Spotlight: Science, p. 48-54, 55-60, 68-71 On Blackboard: *STEM Comes to Preschool* *Representation of the Moon in Children's Literature*	Science Presentation **Teaching Observation Analysis due via Blackboard by 11:59PM**
CLASS 7: March 7	Self-reflections on filling the role of mathematics and science teacher for diverse young learners Informal Learning and field trips Using community resources to enhance mathematics and science instruction	Money reading Copley, Chapter 9 Spotlight: Science, p. 77-80 On Blackboard: *Young Learners at a Natural History Museum* *Zoos, Aquariums, and Expanding Students' Data Literacy*	Money Presentation
ONLINE			Home-School Connections (due by March 7 via Blackboard by 11:59pm)
ONLINE			Good Games Through the Grades (due by March 7 via Blackboard by 11:59PM)
ONLINE			Reflection for Year Long

			Planning (due by March 10 via Blackboard by 11:59PM)

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 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 or https://cehd.gmu.edu/aero/tk20. Questions or concerns regarding use of Blackboard should be directed to http://coursessupport.gmu.edu/.

- The Writing Center 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 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 Student Support & Advocacy Center staff helps students develop and maintain healthy lifestyles through confidential one-on-one support as well as through interactive programs and resources. Some of the topics they address are healthy relationships, stress management, nutrition, sexual assault, drug and alcohol use, and sexual health (see http://ssac.gmu.edu/). Students in need of these services may contact the office by phone at 703-993-3686. 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://ssac.gmu.edu/make-a-referral/.

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