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 2017
Mondays/ 7:20 – 10:00 pm
Thompson Hall L013, 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. Notes: 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* (2nd 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

Virginia Department of Education. (2016). Mathematics curriculum framework. 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

Virginia Department of Education. (2010). Science curriculum framework. http://www.doe.virginia.gov/testing/sol/standards_docs/science/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
Attendance and Participation	Ongoing	15
Group Topic Presentations	Ongoing	15
Field Experience Documentation • Field Placement Approval Form (1 point) • Field Placement Documentation Form (9 points)	September 11 December 11	10
Informal Assessment Video Analysis	October 16	15
5E Lesson Planning Project	October 30	20
Teaching Observation Analysis	November 27	20
Self-Reflection	December 11	5
TOTAL		**100**

- **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).

Group Topic Presentations (15 points)
- Students will choose presentation groups based on a topic of interest listed on the class schedule of the syllabus. All members will participate in gathering information, preparing materials, and presenting. Some class time will be provided to work in groups.
- At least one week prior to the class presentation, students will provide the instructor with an appropriate article or chapter that provides foundational information related to the topic. They will email a PDF of the reading selection to the instructor at least one week prior to the presentation.
- Groups will prepare and present an informative and interactive 25- to 30-minute presentation on their math or science topic with all group members participating equally.
- The presentation will include the following:
  - 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 to third-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 one learning activity with all appropriate materials during the presentation.
- Instructional strategies supporting 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 (15 points)
Students will choose one video clip on Blackboard to analyze. In a bulleted list or in paragraphs, students will answer the following questions in detail:

- 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 using APA format to support the analysis.

Lesson Planning Project (20 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.

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).

Self-Reflection (5 points)
Students will reflect on what they 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 (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 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.

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

Class	Topics	Assignments & Readings Due
Aug 28	Getting set up for your Field Experience Cognitive aspects of math and science Meaningful math and science learning	Welcome to ECED 514!
Sept 4	***No Class – Labor Day Holiday***	
Sept 11	Constructivist environments to support math/science learning Relevant learning theories/theorists Mathematics and science content knowledge for teaching and learning	Copley, Chapter 1 On Blackboard: *Piaget Information* *Vygotsky Information* *Multiple Intelligences* *Bloom's Taxonomy* **Field Experience Placement Approval Form Due**
Sept 18	Introduction to mathematics and science content standards, including the Virginia Standards of Learning Sequential nature of mathematics	Spotlight: Science, pp. 2-10, 72-73 On Blackboard: *Got Standards Don't Give up on Engaged Learning*
Sept 25	Focus on math instruction to develop the "five processes of mathematical understanding" Math and science process skills Developing number sense	Copley, Chapters 3 On Blackboard: *Calendar time for Young Children – Good Intentions Gone Awry* *Developing "Five-ness"* *Montessori Place Value Article* Place Value Presentation
Oct 2	Authentic math and science assessment—addressing the needs of diverse learners	Copley, Chapter 2 & 4 On Blackboard: *Implementing Portfolio Assessment* *Performance-Based Assessments in Science* Operations and Computation

		Presentation
Oct 10 Monday Classes Meet on Tuesday	Inquiry-based approach to teaching science 5E Model Questioning techniques	Spotlight: Science, p. 41-47, 61-67 On Blackboard: *Engaging in Inquiry-based Instruction and Using the 5E Model*
Oct 16	Geometry and spatial sense Problem-based learning	Copley, Chapter 6 On Blackboard: *Weather Tamers* *Modeling Problem-Based Instruction* Geometry Presentation **Informal Assessment Video Analysis Due**
Oct 23	Physical science 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: *Science Success for Students with Special Needs* *Multicultural Mathematics Instruction* *Encounters with Sunlight and a Mirror Ball* Physical Science Presentation
Oct 30	Life science Garden-based learning and outdoor learning Classroom management in the outdoor classroom	Copley, Chapter 7 Spotlight: Science, p. 11-16, 23-28 On Blackboard: *Science Journals in the Preschool Classroom* Life Science Presentation **5E Lesson Planning Project Due**
Nov 6	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 8 Spotlight: Science, p. 36-40 On Blackboard: *Making Fractions Meaningful* Fractions Presentation
Nov 13	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 On Blackboard: *Young Learners at a Natural History Museum* *Zoos, Aquariums, and Expanding Students' Data Literacy* Money Presentation
Nov 20	Technology in early childhood math and science Resources and references for young	Copley, Chapter 5 On Blackboard: *Meaningful Technology Integration in*

	children and math and science The phases of the moon	*Early Childhood* *Putting the "T" in STEM for the Youngest Learners* *Representation of the Moon in Children's Literature* *An Observer's Guide to Viewing the Eclipse* Earth and Space Science Presentation
Nov 27	Math and science across the disciplines Integrated Curriculum Environmental Education	Spotlight: Science, p. 17-22, 48-54 & 68-71 On Blackboard: *The Art of Science and Notebooks Blending In-Using an Adaptation Activity to Integrate Math and Science* *Teaching with Play-An Introduction to Environmental Stewardship for Preschoolers* **Teaching Observation Analysis Due**
Dec 4	The "E" in STEM – Engineering 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 On Blackboard: *They Can't Spell Engineering but They Can Do It* *The Positive Classroom – Joy in School*
Dec 11	***No Class – Reading Day***	**Field Experience Documentation Form Due** **Self Reflections Due**
Dec 18	***No Class – Finals Week***	

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/.

- 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/.