George Mason University
College of Education and Human Development
Elementary Education Program

ELED 453.002
Science Methods for the Elementary Classroom (3 credits)
Spring 2022 (Jan. 24 – May 4)
Wednesday 1:30-4:10, Thompson Hall 2020 – Fairfax Campus

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Office Hours: Zoom hours by appointment

Prerequisites/Corequisites
Admission to the Elementary Education Program

University Catalog Course Description
Develops skills and abilities in science teaching methods, applications of technology, safety practices, and creation of integrated science curricula. Examines science teaching based on contemporary theory, practice, and standards. Prerequisite(s): Admission to elementary education licensure program

Expanded Course Description
The primary goals of this course are to provide you with practical experience, theoretical background, and pedagogical skills that will help you to be successful in your future career as a teacher. Two main themes run through the course: 1) inquiry-based pedagogy, and 2) science and health content. With respect to content, the course is intended to help develop your background knowledge with the goal of successful teaching in an elementary science context. This course will also consider the intersections of science, self, and society through an exploration of healthrelated content including human body systems, nutrition, emotional health, and identity.

A troubling concern we will address is that children often come to school with a keen interest in the world around them, but by the end of elementary school there is a noted waning of interest in science. This is at least partially attributed to the ways in which "school science" does not always emphasize the experiences of beauty, joy, liveliness, and meaningful learning that can come from engaging with science and connecting scientific understanding to the everyday experiences of children. Consequently, we will explicitly consider experiences involving wonder, actively building/ creating new knowledge and the joy of discovery as opposed to the rote memorization of 'science facts.' For this reason, we will utilize inquiry and constructivist approaches to learning as a means of approaching science content that is too often presented as an exercise in the acquisition of vocabulary.

Another intention of this course is to illuminate and sometimes problematize circulating assumptions related to science. For example, opportunities will be provided for us to experience encounters together that make us wonder about the world, our relationship with it, and our role within it, as a part of the natural world – not just as observers and/or exploiters of it. Also, science will be presented in a realistic light where scientists are recognized as humans, living in a specific time, and in a specific place, struggling to better understand the world (just like the rest of us) as opposed to omnipotent, infallible heroes that society and textbooks sometimes portray.

Course Delivery Method
Face to face 95%, Online 5%

Under no circumstances, may candidates/students participate in online class sessions (either by phone or Internet) while operating motor vehicles. Further, as expected in a face-to-face class meeting, such online participation requires undivided attention to course content and communication.

Technical Requirements
To participate in this course, students will need to satisfy the following technical requirements:

- High-speed Internet access with standard up-to-date browsers.
    - For a list of Blackboard's supported browsers, see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#supported-browsers
    - For a list of supported operation systems on different devices, see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#tested-devices-and-operating-systems
- Students must maintain consistent and reliable access to their GMU email and Blackboard, as these are the official methods of communication for this course.
- Students will need a headset microphone and web camera for use with the Blackboard Collaborate web conferencing tool.
- Students may be asked to create logins and passwords on supplemental websites and/or to download trial software to their computer or tablet as part of course requirements.
- The following software plug-ins for PCs and Macs, respectively, are available for free download:
    - Adobe Acrobat Reader: https://get.adobe.com/reader/
    - Windows Media Player: https://windows.microsoft.com/en-us/windows/downloads/windows-media-player/
    - Apple Quick Time Player: www.apple.com/quicktime/download/
    - Screeencast-O-Matic: http://screencast-o-matic.com/
    - Zoome: https://zoom.us/

Expectations

- Course Week: Our course week will begin on the day that our face-to-face meetings take place as indicated on the Schedule of Classes.
- Participation: Students are expected to actively engage in all course activities throughout the semester, which includes viewing all course materials, completing course activities and assignments, and participating in course discussions and group interactions.

- Log-in Frequency: Students must actively check the course Blackboard site and their GMU email for communications from the instructor, class discussions, and/or access to course materials at least 2 times per week. In addition, students must log-in for all scheduled online synchronous meetings.
- Technical Competence: Students are expected to demonstrate competence in the use of all course technology. Students who are struggling with technical components of the course are expected to seek assistance from the instructor and/or College or University technical services.
- Workload: Please be aware that this course is **not** self-paced. Students are expected to meet *specific deadlines* and *due dates* listed in the **Class Schedule** section of this syllabus. It is the student's responsibility to keep track of the weekly course schedule of topics, readings, activities and assignments due.
- Instructor Support:Students may schedule a one-on-one meeting to discuss course requirements, content or other course-related issues. Students can meet the instructor via in-person meetings on on web conference. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.
- Classroom Etiquette: The course environment (including when online) is a collaborative space meant to foster independent thought and critical analysis of complex ideas. Be open to the thoughts of others, particularly when they may be different from your own. Seek first to understand another's perspectice from their point of view. Do not be afraid to ask one another difficult questions, but be positive in your approach and thoughtful with your words. Remember that you are not competing with classmates but sharing information and learning from others. All faculty are similarly expected to be similarly respectful in all communications.
- Accommodations:Online learners who require effective accommodations to ensure accessibility must be registered with George Mason University Disability Services.

Learner Outcomes or Objectives

This course will enable students to:

A. Build a pedagogical content knowledge base in science and understand the systems of nature in Earth science, biology, chemistry and through inquiry-based investigation
B. Conceptualize core principles regarding the Nature of Science, i.e., how wonder, creativity experimentation, and evidence frame scientific thinking, as well as how theory is used in predicting and explaining phenomena.
C. Engage in and use scientific practices such as data collection, analysis, modeling, use of evidence, construction of explanations, reliability, self-checking, and identification of limitations to conduct research experiments.
D. Understand the historical development of scientific concepts and the social, cultural, and economic significance of science.
E. Understand and use knowledge, skills, and practices of the four core science disciplines of Earth science, biology, chemistry, and physics to develop lesson plans demonstrating inquiry-based principles in science and health education including the incorporation of technology
F. Demonstrate age-appropriate safety standards when designing hands-on classroom experiences

G. Examine science and health curricula and methods with respect to "Science for All" and standards documents at local, state, and national levels
H. Develop viable assessment tools for science and health contexts
I. Understand the relationship of science to math, the design process, and technology.
J. Understand, possess, and integrate the knowledge, skills, dispositions, and processes needed to support learners' achievement in an interdisciplinary manner in Virginia's Foundation Blocks for Early Learning: Comprehensive Standards for Four-Year-Olds and the Virginia Standards of Learning in English, mathematics, history and social science, science, and computer technology

Professional Standards

INTASC: *Interstate Teacher Assessment and Support Consortium Model Core Teaching Standards*

#4. Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

#5. Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

#6. Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

#7. Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

#8. Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Technology (ISTE NETS): *International Society for Technology in Education / National Educational Technology Standards*:

Standard I. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.

Required Texts

Workman Publishing. (2016). *Everything You Need to Ace Science in One Big Fat Notebook*. Workman Publishing Co. Inc. ISBN-10 : 0761160957 ISBN-13 : 978-0761160953

Other required readings will be provided via Blackboard

Course Assignments

Assignment	**Due Date**	**Total Points**
Participation	Ongoing	15

Wonder Journal	Ongoing - Selection of entries due **April 27**	10
Science Lesson Analysis	**February 23**	15
Thinking/Reading Strategies Creative Write-Up and Presentation	Various dates	15
5E Mini-Unit Project (PBA*)	**April 13**	30
Wonder Investigation	**May 4**	15

* Designated performance-based assessment (PBA)

1. Participation [Course goals: A-F] 15%

Success in the course is predicated on being an active participant in the learning process. To this end, there will be a number of class-based assignments, discussions, and activities over the duration of the course that will also be included in your overall participation. My expectation is that active and engaged students stand the most to gain from the approaches we will use in class. Consequently, you are expected to be present, actively involve yourself in class activities, and treat classmates with respect. Many times we will intentionally unplug ourselves and engage with our thoughts and ideas while avoiding the temptation for quick answers via the Internet. I have found this approach leads to increased science confidence and builds classroom community. The hope is to create a joyful context where laughing, lively discussion, raising questions and engaging with your group members are the norm.

I strongly encourage you to consider how your individual role can positively impact our time together. I fully expect that each participant will attend every class and communicate ahead of time if that is going to be impacted. There is also a professional expectation that students will not work on other classroom projects, browse the web or send/check text messages during our class time. Lastly, there will be check-ins at the beginning of each class that will prompt thinking from assigned readings; these will be part of the participation grade for the course.

2. Wonder Journal [Course outcomes: A & B] 10%

Think about the science that you see in the everyday. Ask yourself questions, feel the movements and forces while you drive, look at the sky, watch your pet, engage with another human, think about your place in this world, go for a long walk, and just think...no phone, no worries, just get lost in your thoughts. Remember, this is homework so you have an excuse. Over the course of the semester use a composition book/journal to make note of various things that you observe in the natural world around you and list, sketch, question, observe and record those things that capture your attention and imagination. These wonderings about the natural world are just that: what do you see, feel, and think about those things that fascinate and/or confuse you, questions or thoughts that move into and out of your mind. There may be elements from the assigned readings that trigger your thinking or it might be watching the clouds move while walking your dog. The inspiration doesn't matter, but we will engage deeply with those thoughts we usually discard because we live our lives in a hurry. We will intentionally slow down and use old technology (paper and pencil) to engage with our wonders.

There are no real rules here. Well, I lied, there are two rules: 1) you will need to complete 12 dated entries total (more is fine); 2) we will turn in our journals at some point near the end of the semester.

Your wonders are yours and unique to how you envision the world around you. "Dance like nobody is watching" while you build your entries.

3. Science Lesson Analysis [Course outcomes: B, G, J] 15%

Being able to evaluate science lessons is an important skill for educators. There are many resources online that may or may not be well-designed for classroom use in a way that is authentic and inquiry-based. This assignment's goal is to give you practice finding and analyzing a science lesson regarding it's appropriateness and alignment with Virginia's SOLs. You will write a 2-3 page analysis using some guiding questions (found on Bb) to consider the usefulness of your chosen lesson.

4. Thinking/Reading Strategies Creative Write-Up and Presentation

[Course outcomes: A & E] 15%

Thinking and reading pedagogical strategies within the science classroom can be useful tools to encourage student thinking and add to students' depths of understanding. This assignment seeks to add to your science pedagogy "toolbox". You will choose one thinking/reading strategy from the list on Bb and sign of for a date to present to the class. There are two primary components to this assignment. Part I involves a 1-page creative scenario in which you use the strategy within an imaginary science classroom. Be creative! Imagine yourself as a teacher using this strategy with a real group of learners. Part II involves a 5-minute presentation to the rest of the class. This can be a video, poster, sample teaching, diagram, or interactive discussion. Practice your presentation to make sure you are as close to 5 minutes as possible! Remember this is a "snapshot" of your teaching/reading strategy.

5. 5E (Inquiry-Based) Mini-Unit Project (PBA)

[Course goals: A-F] 30%

The goal of this project is construct and teach an inquiry-based unit within your field site. We will design this work around the 5 E model of lesson planning. The unit will entail building a detailed and well-supported narrative description for the approach that will be employed. The five-E sequence (generally taught over three to five class sessions) will build science content understanding in engaging and dynamic ways for students within your field site and provide some key theoretical and research-based support for the content, approach and activities constructed. Be sure that your unit plan can illustrate the following three aspects of teaching: introducing new content, hands-on assignments, and assessment of student learning. These activities should focus on the essential science concepts and connections, assess higher order thinking skills that target all learners. The unit will be comprised of the following components and scored via the rubric provided later in the syllabus.

All unit plans will include:

A. Overview

Theme/Topic: Give insight into the overall content concepts and provide an overarching description of the unit and goals. Consider it the "movie trailer" of the unit where you set the stage and excite the reader for what lies ahead.

Teacher Background Knowledge: This section highlights the facts that teachers should be familiar with. You should include some resources and/or sources. It may also be helpful to list some common misconceptions (or naïve conceptions) children and adults may hold concerning the topic.

*Description of Students:*Provide brief overview, describing the audience for which the unit is designed.

B. Detailed Lesson Plans

The unit will follow the 5E model and as such your lessons should span the 5E process. These will generally be one or two E's per lesson and would require 5 detailed lessons for the unit (See Bb site for lesson template). However, in some cases you may get more or less time and the enactment of the unit is up to the amount of time you have allotted in your class context.

C. Assessment

The unit should include a final assessment that would evaluate whether your students achieved the objectives at the end of the unit. This final assessment should include the questions/tasks the students are required to do and indicate what objectives are being assessed and how they are being assessed. For instance, posters, investigations, debates, etc. should align with original unit objectives.

D. **Support Materials** (all materials for the daily lesson plans)

For the daily lesson plans, you will develop all support materials that the teacher and students will use. For teaching and learning activities include each sheet of paper distributed to the students to carry out the daily lesson plans - laboratory experiments, activities, worksheets, instructions, assessments, rubrics, etc. Attach these to the appropriate lesson plan. Other teaching aids (ie. instructions for teacher demo or photos of experiment set up, etc.) used during the unit should also be included. Your 'evaluation' portion of the unit should contain major assessment instruments and grading criteria for the unit.

E. References Cited section

6. Wonder Investigation [Course goals: A, B, E, F] 15%

This project is designed to evoke and engage future teachers in the possibilities that science content holds for elementary contexts as well as for yourselves. Science often generates negative feelings associated with memorization and mind-numbing procedural approaches (think about lab reports or 'if – then' statements), which is not the norm in typical/real science contexts. The goal of this project is to pursue an idea that you find interesting. You will choose a topic from your wonder journal (or a new and different wonder) and pursue some answers, ideas and most importantly further questions related to that wonder.

The goal is not necessarily to prove one single answer, but to understand something to a greater degree and then consider all the new questions that come along with that wondering and investigating.

The project will entail a public presentation (preferably a poster, museum display, or other visual of some sort) that will highlight:

a) the wonder itself
b) the information identified to make more sense of that wonder (diagrams, sketches, etc.)
c) create a wonder map
d) list key scientific concepts behind that wonder (definitions, models, etc.),
e) list further questions and hypotheses related to that wonder,
f) how might you design an experiment or process to answer those further wonders,
g) and lastly be provided a few ways you might consider using wonder in a classroom context.

Grading Scale

Grade	GRADING	Grade Points	Interpretation
A	94-100	4.00	Represents mastery of the subject through effort beyond basic requirements.
A-	90-93	3.67	
B+	85-89	3.33	Reflects an understanding of and the ability to apply theories and principles at a basic level
B	80-84	3.00	
C*	70-79	2.00	Denotes an unacceptable level of understanding and application of the basic elements of the course
F*	<69	0.00	

Note: "C" is not satisfactory for a licensure course, "F" does not meet requirements of the Graduate School of Education

Work Timliness Expectations

It is expected that all class assignments will be submitted on time. Therefore, **All assignments are to be completed by the date listed in the syllabus. Written work will not be accepted after the due date unless prior arrangements have been made with the instructor**. All assignments must be submitted by the beginning of class (Eastern standard time) on the due date stated within the syllabus (see below) and should only be submitted via Blackboard.

If you are unable to complete an assignment due to an emergency or difficult circumstance, communication must be made with the instructor via email or in person. In situations that are deemed an emergency or a difficult circumstance, I will work with you to set a new submission date that will not be considered late.

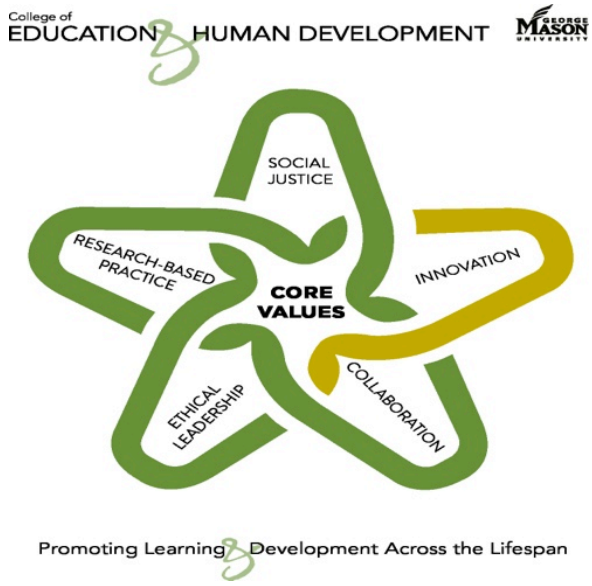
Other Expectations

All written papers are **expected to be double-spaced, with 1" margins, and in 12-point font** (Times New Roman). **APA format is expected**. If you do not have a 7th Edition APA manual, the OWL at Purdue is an excellent resource: http://owl.english.purdue.edu/owl/resource/560/01/

*Please Note: The GMU Writing Center offers online support via email. They will provide feedback on your writing within one hour. Graduate and professional writing can be difficult; I encourage you to take advantage of this service. http://writingcenter.gmu.edu/?page_id=177

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

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 https://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 https://ds.gmu.edu/).

- Students must silence all sound emitting devices during class unless otherwise authorized by the instructor.

Campus Resources

- Support for submission of assignments to VIA should be directed to viahelp@gmu.edu or https://cehd.gmu.edu/aero/assessments. Questions or concerns regarding use of Blackboard should be directed to https://its.gmu.edu/knowledge-base/blackboard-instructional-technology-support-for-students/.

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

Notice of mandatory reporting of sexual assault, sexual harassment,interpersonal violence, and stalking: As a faculty member, I am designated as a "Non-Confidential Employee," and must report all disclosures of sexual assault, sexual harassment, interpersonal violence, and stalking to Mason's Title IX Coordinator per University Policy 1202. If you wish to speak with someone confidentially, please contact one of Mason's confidential resources, such as Student Support and Advocacy Center (SSAC) at 703-380-1434 orCounseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance or support measures from Mason's Title IX Coordinator by calling 703-993-8730, or emailing titleix@gmu.edu.

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

CLASS SCHEDULE ELED 453: Spring 2022

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

Everything You Need to Ace Science = EYNAS

Session	Topic/Learning Experiences	Readings & Assignments
Week 1 Jan 26	**Overview: Science, Children, the Natural World, and You** • What is science? What does it mean to be a scientist? • Goals of science education • Course overview • 3-dimensional learning	Bring your EYNAS book to class and an electronic device
Week 2 Feb 2	**The Power of Inquiry** • Inquiry-based instruction • Nature of science (NOS) • Teacher vs student role *Energy – electricity and circuits*	EYNAS chapters 1, 2, 3 (skim pp. 23-28) Choose 1: *Inspired Inquiry* or *Capitalizing on Curiosity*
Week 3 Feb 9	**The Five Es** • Engage, explore, explain, elaborate, evaluate *Energy – forms: light, sound, solar*	EYNAS chapters 13, 16, 17
Week 4 Feb 16	**Noticing the Natural World** • Recording data (qual vs quant) • Journals • Outdoor education *Plants – structure and reproduction*	EYNAS chapters14, 15 *Reinvigorating Science Journals*
Week 5 Feb 23	**Lesson Planning and Sequencing** • NGSS and VA SOLs • Learning objectives and unit construction *Physics – motion, forces, work*	EYNAS chapter 32 *How to Make a Plant Field Guide* **Science Lesson Analysis Due**

Week 6 Mar 2	**Equity, Diversity, and Social Justice** • Whose science? • Diverse learners *Life – classification and cells*	EYNAS chapters 9, 10, 11, 12 *Is it Worth it? Can I do it?* *Addressing Student Diversity and Equity* (optional)

Session	Topic/Learning Experiences	Readings & Assignments
Week 7 March 9	**Integrated Approaches to Science** • Integrating other subjects • Literacy and children's literature • STEM/STEAM *Animals – vertebrate and invertebrate, adaptations*	EYNAS chapters 28, 29, 30, 31 *Seven Myths of STEM*
March 16	**SPRING BREAK**	
Week 8 March 23	**Unit Planning Workshop** *Health and Nutrition – body systems*	EYNAS chapters 33, 34, 35 *Wonder-Full Thinking*
Week 9 March 30	**Unit Planning Workshop** *Matter – sink or float*	EYNAS chapters 36, 37, 38, 39, 40, 41
Week 10 April 6	**Project-Based Learning and Classroom Management** • PBL – inquiry-based, relevant, integral • Classroom management strategies • Safety in the science classroom *Matter – chemical reactions and solutions*	EYNAS chapter 4 (skim, but read p. 40) *Teaching Temperature with Problem-Based Learning* *Managing Your Classroom for Success*
Week 11 April 13	**Science Grounded in *Place*** OUT-OF-CLASSROOM – meet at Confucius statue at 1:30 pm • Place-based education • Field study *Ecology and Place*	EYNAS chapters 6, 7, 8 *Cultivating Place* **5E Mini-Unit Project Due**
Week 12 April 20	**Assessing for Learning** • How and why we assess student scientists • Backwards design *Earth Science – weather systems & geology*	EYNAS chapters 46, 47, 48, 49 *Assessing Students as Scientists*
Week 13 April 27	**Technology** • Using technology effectively • Individual Wonder Project check-ins *Earth Science – earth, moon, sun, stars*	EYNAS chapters 22, 23, 24, 25, 26, 27 **Wonder Journal Due**

Week 14 May 4	**Presentations of Wonder Project**	EYNAS chapters 18, 19, 20, 21 **Wonder Investigation Due**