George Mason University
College of Education and Human Development
Elementary Education Program (ELED)

ELED 453 Section 002
Science Methods for the Elementary Classroom (3 credits)
Spring 2024 (January 17 – May 1)
Wednesdays, 1pm - 3:40pm
Face-to-Face
Thompson 2020, Fairfax Campus

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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.

Course Overview: The primary goal of this course is to support teacher candidates in developing their confidence and capacity to plan and teach effective and engaging elementary science learning experiences through the approach of doing real science together as a community. We will begin from the premise that children come to classrooms full of curiosity and experiential knowledge from their previous explorations of the world in their own local contexts. Our aim is to build on this curiosity and knowledge to hone and develop their scientific skills, content knowledge, and practices in the service of developing a lifelong interest in learning more about how the world works and how to maintain an active and healthy participation in it. In addition to content and methods specific to science, health and technology topics will also be explored.

Course Delivery Method: This course will take place in a face-to-face weekly meeting format with asynchronous tasks to complete between classes via online methods: Blackboard Learning Management system (LMS) housed in the MyMason portal and Google Drive. You will log in to the Blackboard (Bb) course site using your Mason email name (everything before @gmu.edu) and email password. The Bb course site will be available on or before Wednesday, January 10th. Face-to-face class sessions will include small/large group discussions and tasks, mini lectures, and student-led activities. A detailed class schedule is included below.

Field Hours: This course requires 15 hours of field observation. Additional details are in the "Assignments" section below under "Field Notes: Theory to Practice".

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

1. High-speed Internet access with standard up-to-date browsers. To get a list of Blackboard's supported browsers see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support - supported-browsers
2. To get a list of supported operating systems on different devices see: https://help.blackboard.com/Learn/Student/Getting_Started/Browser_Support#tested-devices-and-operating-systems
3. Students must maintain consistent and reliable access to their GMU email and Blackboard accounts, as these are the official methods of communication for this course.
4. Students will need a headset microphone for use with Zoom or other required web conferencing tools.
5. 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.
6. 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://support.microsoft.com/en-us/help/14209/get-windows-media-player
    - Apple Quick Time Player: www.apple.com/quicktime/download/

Expectations
1. Course Week: Our course week will begin on the day of our face-to-face meetings (Mondays) as indicated in the Class Schedule.
2. 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 5 times per week.
3. Participation: Students are expected to actively engage in all course activities throughout the semester, which includes reading and viewing all course materials, completing course activities and assignments, participating in course discussions and group interactions, and completing after-class reflections.
4. 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.
5. Technical Issues: Students should anticipate some technical difficulties during the semester and should, therefore, budget their time accordingly. Late work will not be accepted based on individual technical issues.
6. 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.

7. Instructor Support: Students may schedule a one-on-one meeting to discuss course requirements, content, or other course-related issues. These meetings can take place in person on the Mason Fairfax campus or virtually via videoconference. Students should email the instructor to schedule a one-on-one session, including their preferred meeting method and suggested dates/times.
8. Netiquette: The course environment is a collaborative space. Experience shows that even an innocent remark typed in the online environment can be misconstrued. Students must always re-read their responses carefully before posting them, so as others do not consider them as personal offenses. *Be positive in your approach with others and diplomatic in selecting your words*. Remember that you are not competing with classmates; rather, you are sharing information and learning from others. All faculty are similarly expected to be respectful in all communications.
9. Accommodations: Students who require effective accommodations to ensure accessibility must be registered with George Mason University Disability Services.

LEARNER OUTCOMES:
This course is designed to enable teacher candidates to:

A. Build a pedagogical content knowledge base for science teaching grounded in an overarching understanding of the systems of nature in biology, chemistry, physics, and Earth science.
B. Conceptualize and apply core principles of the nature of science (NOS).
C. Engage in authentic scientific practices as a means of learning about and teaching science.
D. Understand the historical development of scientific concepts and the social, cultural, and economic significance of science.
E. Understand and apply the knowledge, skills, and practices of the four core science disciplines of biology, chemistry, physics, and Earth science 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:
Upon completion of this course, students will have met the following professional standards:

INTASC (The Interstate Teacher Assessment & Support Consortium):

#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:

- There are no required texts for this class, per se, though I highly recommend the texts listed below for your current and future use as you develop your science teaching practice.
- All required readings will be posted on Blackboard.

RECOMMENDED TEXTS:

1. Brown, P. (2020). *Instructional sequence matters grades 3-5: Explore before explain.* NSTA Press.

   ISBN 9781681406589 (paperback)
   ISBN 9781681406596 (pdf)
   LCCN 2019027258 (ebook)

2. Colburn, A. (2017). *Learning science by doing science: 10 classical investigations reimagined to teach kids how science really works, grades 3-8*. NSTA Press.

   ISBN 9781506344614

And, for a fun and accessible overview of science content knowledge (great for studying for the Praxis!):

3. Geisen, M. (2016) *Everything you need to ace science in one big fat notebook*. Workman Publishing.

   ISBN-10 : 0761160957

   ISBN-13 : 978-0761160953

COURSE PERFORMANCE EVALUATION:
Students are expected to submit all assignments on time in the manner outlined by the instructor (e.g., Blackboard, Google Drive).

COURSE EVALUATION and ASSIGNMENTS AT A GLANCE

Assignment	**Due Date**	**Total Points**
Content and Tech Group Project	Due: 2/28	**10**
Wonder Journal	Ongoing; 10+ total entries turned in for review on 3/27	**10**
Wonder Investigation Presentation	Due 4/24	**15**
Field Notes (theory to practice)	Ongoing; final review: 4/29	**10**
Lesson Series/Mini Unit Project (PBA*)	Draft Due: 4/10 Final Due: 5/1	**30**
Class Participation: • Between-Class Activities (BCA) • During-Class Activities (DCA) • After-Class Activities (ACA)	Ongoing: • BCA: by 9:00 am on the day of class. • DCA: during f2f and online classes • ACA: by 11:59 pm on the Friday after class.	**25**

	Total	**100**

*Designated performance-based assessment (PBA)

Assignments:

1. **Content and Tech Group Project (10%)**
   DUE: Wednesday, February 28

   Although the acquisition of specific science content knowledge is not the main purpose of this course, it is a very important aspect of science teaching and learning, and *it is not possible to teach science well without a solid understanding of the content*.

   An additional goal of this course is to become familiar with the ways technology tools might be integrated into the teaching and learning of science.

   The purpose of this assignment is to combine these two important areas to create an educational experience for your peers. Working in small groups assigned to the same grade level in your field placements, you will dive deeply into the **science content knowledge** necessary to teach well at this grade level. Together you will also explore the ins and outs of an **educational technology tool** that can do three things related to the "**Explain**" phase of 5E instruction:

   a. support students' active participation in sharing their explanations of the phenomena they have (already) investigated
   b. allow the instructor to share terminology, new representations, and supporting content not easily discoverable or accessible from the students' hands-on investigations.
   c. Provide students with opportunities for practicing the new terms and concepts

   Your group will design and share a presentation for your colleagues that introduces them to the technology tool and incorporates a demonstration of the tool using detailed, specific, and accurate science content knowledge from your grade level. Also included in this presentation is an outline of ideas for the other E's that would support this particular technologically-mediated version of Explain. This activity will help you as you develop and flesh out your final lesson plans.

2. **Wonder Journal (10%)**
   DUE: Ongoing throughout the course; 10+ entries turned in on Wednesday, March 27

   This project is about tracking your engagement with your everyday world and making connections between these encounters and science. Your task is to pay attention to and notice the world in action and write/draw entries/do some counting about what you notice and wonder about in a journal. For example, you might: feel the movements and forces while you walk, drive, or ride a bike. You might look up at the sky, feel the sun on your face, watch your pet, communicate with another human, pay attention to the plants and wildlife in your

neighborhood. You might listen to birdsong, count crows, or visit with a body of water. You might take note of the smell of rain, of soil, of flowers. You might notice the play of light and shadows. You might pay attention to the wind and/or collect and look closely at rocks. You might consider the physics of a Frisbee game, visit with a mountain, or hang out with a tree. You might track the moon. To work on these entries, you might go for a long walk and just wonder (without your phone!). You might just get lost in your thoughts and/or bodily sensations. What do you notice? What do you wonder? What do you feel?

Over the course of the semester, you will use a notebook provided in class to create journal entries about these experiences. The basic idea is to document the various things that catch your attention: what you feel/observe/notice in and about the world. The assignment is to write about, sketch, question, observe, count, and record those things that capture your attention and spark your imagination.

There are not many rules…just two:

1. Complete at least 10 entries in total (more is fine) that include words, sketches, and (if possible) numbers.
2. You will turn in this journal for review* on April 3rd.

Important note: Your wonder experiences are yours and unique to how you engage with and think about the world, therefore **there is no wrong way to do these journal entries - as long as it is clear you put more than just passing thought and effort into them. Your grade for this project will be a reflection of effort and completion rather than any judgment about right or wrong answers.*

3. Wonder Investigation Presentation (15%)
DUE: Wednesday, April 24 (last day of class).

As a culmination of your journey with wonder this semester, you will choose a topic from your wonder journal (or possibly a new and different wonder topic if something new comes up), learn more about it, and share what you've learned (and how you learned it) with the rest of us.

This project will take the form of a science-fair type project that will highlight:

a) the wonder(ing) itself and its relationship to you/your interests/your environment/community
b) the information you identified to make more sense of the topic (diagrams, sketches, experiments, data, observations, notes, photographs, etc.)
c) a diagram/wonder road map – how did your exploration with wonder unfold?
d) identify key scientific concepts related to this topic (definitions, models, connections to other scientific areas, etc.)
e) list further questions you have and any ideas/hypotheses related to this exploration,
f) explain how you might design an experiment or further exploration process from here
g) explain how this project connects with the Nature of Science (NOS) and/or the NGSS science practices and/or Science SOLs

h) how this project impacted you, and, if applicable, your relationship to science, your thoughts/feelings about teaching science
i) any ideas you have for incorporating wonder (not necessarily *this wonder*) into your future teaching.

4. Field Notes (theory to practice) (10%)
DUE: These are to be completed each week (when assigned). A final review of content and quality will take place on April 29

You will be given prompts (approximately weekly, but sometimes we might skip a week) on a Google Doc for observations and/or minor pedagogical experimentations designed to connect theory (course activities and readings) to practice (the real students and classrooms you are working with). The goal is for you to use your 15 field hours to have encounters that serve as discussion points for us to analyze and consider together.

5. Lesson Series/Mini Unit Project (30%)
Draft Due: April 10
Final Due: May 1

This project is your major Performance Based Assessment (PBA) for this course. The goal of this project is to demonstrate your ability to plan a series of science lessons (a short unit plan) appropriate for the context of your field site. The series of lessons will follow an Explore Before Explain (EBE) theoretical framework for science teaching (Brown, 2020). You will also write two introductory sections summarizing your overall science topic and instructional approach before the inclusion of your lesson plans. A template for the lesson plans will be provided.

Your final submission will include all of the following components and will be assessed via the rubric provided at the end of this syllabus:

Section 1: Overview

Theme/Topic:
Describe the **overall topic** and provide a **summary of your series of lessons** including your learning goals for your students.
(1-2 paragraphs)

Teacher Background knowledge:
Describe the **detailed and specific** content knowledge and scientific concepts that a teacher (in this case, you) needs to know well in order to teach this series of lessons. This section should include important terms, concepts, diagrams, graphs, etc. that explain the content. **Resources for further exploration** of this content knowledge should be included. This section should also include possible misconceptions (or naïve conceptions) to be aware of that children and/or adults may have developed about the topic.
(2-3 paragraphs)

Description of Students:
Provide an overview of **what you know about the group of students** for which the series of lessons are designed. Predict how this particular group of students might respond to this series of lessons and why.
(1-2 paragraphs)

Section 2: Theoretical Framework for Science Instruction

Describe your approach to teaching your series of lessons, based on modern developmental theory and learning theory using your course readings to support your instructional choices.
(1-2 paragraphs)

Section 3: Detailed Lesson Plans

The unit will follow the Explore Before Explain (EBE) approach, and therefore should include a series of 3-5 lessons. *A scaffolded EBE lesson plan template will be provided in class.* The lessons should include:

1. Science SOLs (practices and content) and specific objectives for each lesson.
2. Detailed procedures, including all activities, scripted-out key teacher statements and questions, and potential student responses/interactions.
3. Formative assessments/checks for understanding and a summative assessment plan aligned with the learning goals (as outlined in class).
4. Lists of all hands-on materials needed, and links and/or copies of all support materials to be used.
5. The ways in which safety is addressed.

Attendance and Participation (25%)

Your success in this course is predicated on being an active and engaged participant in *all course activities*, in the service of your future students. Your full participation includes active engagement in aspects of the course that take place between, during, and immediately following our face to face (f2f) or online meetings, and include:

1) Between-Class Activities (BCA): Asynchronous activities to be completed between classes. These activities can be found in the "Class Materials" Blackboard folder posted each week, and include readings, watching videos, wonder journaling, meeting with group members to work on projects, completing field notes, etc. All BCAs are to be completed by 12:00 pm noon on the day of our f2f or online meeting day (Wednesdays) unless otherwise indicated.
2) During-Class Activities (DCA): being fully present* (in both senses of the word), attending class from beginning to end, fully engaging with your classmates in the

discussions and activities, and actively contributing to any processes and products created.

3) After-Class Activities (ACA): At the end of each class, two items are to be completed (by 11:59 pm 48 hours after class):
    a. An exit ticket (serves as formative assessment for the instructor and an opportunity for you to concretize your learning)
    b. A documentation and reflection on your participation and learning for the entire week (a structured format for this will be provided)

Your final participation grade will be developed based on an accumulation of weekly participation points grounded in the above three areas, generally 3 points for each area (BCA, DCA, and ACA). A midterm participation grade will be provided.

As outlined in #2 above, it is expected that you will attend every class from beginning to end. If circumstances arise where this expectation is impacted, it is up to you to notify the instructor in advance, and to take full responsibility for what was missed. BCAs and ACAs will still be expected, and participation points can still be earned in these two areas even if an absence occurs. DCA points cannot be earned or made up in the case of an absence. See the CEHD attendance policy below.

**There is a professional expectation that students will not work on other classroom projects, browse the web, or send/check text messages during our class time. This is a vital aspect of being present to and for one another.*

ELED Attendance Policy:

•In accordance with the GMU Attendance Policies (University Catalog, 2023-2024), "Students are expected to attend the class periods of the courses for which they are registered. In-class participation is important not only to the individual student, but also to the class as a whole. Because class participation may be a factor in grading, instructors may use absence, tardiness, early departure, or failure to engage in online classes as de facto evidence of nonparticipation."
•If you must be absent from class, inform the instructor prior to the beginning of the class session. Missed classes (or portions of classes) will result in loss of participation points. Unless there are extenuating circumstances that have been shared with the instructor, more than two missed classes will result in a failing grade and you must retake the course.
•Absence from class to observe a religious holiday, to serve jury duty, or to participate in required military service are exemptions to the above policy. If you anticipate being absent for any of these reasons, please make arrangements at least 48 hours in advance.
•In addition, **you are expected to be on time to class** each week unless 48 hours advance notice has been provided to the instructor.

Work Timeliness & Assignment Expectations

All assignments are to be submitted **by 12:00 Noon on the date listed in the syllabus, unless otherwise noted in class. Work will not be accepted after the due date unless prior arrangements have been made with the instructor.** All assignments must be submitted on the due date stated within the syllabus (see below) and should be submitted in the format

indicated by the instructor in class. ***Please note that assignments submitted in PDF format will not be accepted.***

Note: I reserve the right to add, alter, or omit any assignment as necessary during the course of the semester. You will always receive advance notice of any modifications.

GRADING POLICIES

The grading for this course is as follows:

Grade	Grading Scale	Interpretation
A+	97-100	Represents mastery of the subject through effort beyond basic requirements
A	93-96	
A-	90-92	
B+	87-89	Reflects an understanding of and the ability to apply theories and principles at a basic level
B	83-86	
B-	80-82	
C+	77-79	
C	73-76	
C-	70-72	Denotes an unacceptable level of understanding and application of the basic elements of the course. Grade does not meet the minimum requirement for licensure courses.
D	60-69	
F	<59	

PROFESSIONAL DISPOSITIONS
Students are expected to exhibit professional behaviors and dispositions at all times (see Elementary Education Program Handbook). See https://cehd.gmu.edu/students/policies-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/).
- New! Use of AI: There will be times in the education field that use of AI tools will be needed for you to do well at the job and there will be times where you will need to be able to do the work without support from these tools. This course aims to provide you with experience in the real-world scenarios that you may encounter once you leave the university. Therefore, when explicitly stated by the instructor, Generative AI tools are allowed on the named assignment.

Students will be directed if and when citation or statement-of-usage direction is required. Use of these tools on any assignment not specified will be considered a violation of the academic integrity policy. All academic integrity violations will be reported to the office of Academic Integrity. Some student work may be analyzed using an originality detection tool focused on AI tools. Generative AI detection tool use will be revealed when the assignment directions are provided to students.

- 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 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 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 or Counseling and Psychological Services (CAPS) at 703-993-2380. You may also seek assistance 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*

**Faculty reserves the right to alter the schedule as necessary with notification to students.*

Session	Key Topics	Readings and Assignments (DUE by Noon *BEFORE* CLASS unless otherwise indicated)

Class 1
 	
Wednesday, January 17
	Overview: Science, Society, and Us
	● Science, society, and you.
	● Who are we as a class?
	● What is science anyway?
	● Introduce course approach:
	  ○ Learning by Doing
	  ○ Explore Before Explain
	● Overview of course assignments
	● Introduce wonder journals
		Reading:
		● N/A
		
		Activities:
		● Complete *Science and You* Survey
		● Upload "place" photos to our shared Google Slides

Class 2
 	
Wednesday, January 24
	Elementary Science Education Basics
	● Science standards: NGSS and Virginia Science SOLs
	● The Nature of Science (NOS)
	● The brilliance of children: overview of child development and learning theory and implications for science instruction.
	● Milk Fireworks Activity
		Reading:
		● Colburn, *Learning Science By Doing Science* (*LSDS*),
		  ○ Preface (pgs. vii-xiii)
		● Brown, *Instructional Sequence Matters* (*ISM*)
		  ○ Introduction: (pgs. xvii-xiv only)
		  ○ Ch. 1: Rethinking Development and Learning (pgs. 2-9)
		
		Activities:
		● Complete first wonder journal entry

Class 3 **Wednesday, January 31**	**Hands-On/Minds-On Activities** ● Establishing a theoretical framework for science teaching ● The power of hands-on/minds-on experiences for developing interest and deep understanding in science ● Inquiry and equity ● Circuit Activity #1	**Reading:** ● Colburn, *LSDS*, Ch. 1: Take us Out Mr. Data (pgs. 1-13) ● Brown, *ISM*, Ch. 2: Connecting Hands-On with Minds-On Experience (pgs. 12-17) **Activities:** ● Watch *Equity through Inquiry* Video: Zaretta Hammond ● Field Notes ● Wonder journaling

Class 4 **Wednesday, February 7**	**The 5E Model for Teaching Science** ● Science and ways of knowing ● The 5E Model ● Circuit Activity #2	**Reading:** ● Colburn, *LSDS*, Ch. 2: Think Different (pgs. 15-29) ● Brown, *ISM*, Ch. 3: Modern Sequences of Instruction (pgs. 20-25) **Activities:** ● Field Notes ● Wonder journaling
Class 5 **Wednesday, February 14**	**Interweaving Content & Process** ● Three-dimensional learning ● Exploring grade level content and process standards ● Applying the 5E Model ● Activity: Ice melting on different surfaces	**Reading:** ● Skim: Brown, *ISM*, Ch. 4: Content and Process Working Together (pgs. 28-37) ● Brown, ISM, Ch. 9: Making the Connection: Addressing Student's Misconceptions of Circuits **Activities:** ● Field Notes ● Wonder journaling
Class 6 **Wednesday, February 21**	**Planning POE and 5E Lessons** ● Planning EBE lesson series ○ Designing from scratch ○ Modifying existing lessons ● Theories and Laws in Science ● Sink and Float, Part 1	**Reading:** ● Brown, *ISM*, Ch. 5: Where to Start (pgs. 40-52) ● Colburn, *LSDS*, Ch. 3: I've Got a Theory About That (pgs. 31-46) **Activities:** ● Work on Content and Tech Project ● Wonder journaling
Class 7 **Wednesday, February 28**	**Content and Tech Project Presentations** ● The Multiple Methods of Science ● Sink and Float, Part 2	**Content and Tech Group Projects Due** **Reading:** ● Coburn, *LSDS*, Ch. 4: Elementary, My Dear Watson (pgs. 47-68) **Activities:** ● Field Notes ● Wonder journaling

Wednesday, March 6	NO CLASS – SPRING BREAK!	
Class 8 **Wednesday, March 13**	• Return to Practices and NOS • SEP Practice across the 5Es: Modeling	**Readings:** • No readings this week: enjoy your spring break! **Activities:** • No activities this week: enjoy your spring break! • It's Ok to write in your wonder journal if you'd like, though :)
Class 9 **Wednesday, March 20**	**Science is a Human Activity** • Indirect evidence and inference • Objectivity and subjectivity • Science and culture	**Readings:** • Coburn, *LSDS*, Ch. 5: I Must Be a Bit Indirect in the Chapter (pgs. 69-89) **Activities:** • Field Notes • Wonder journaling
Class 10 **Wednesday, March 27**	**Scientific Investigations: Research Design(s)** • Designing for variable control and investigation fairness • Nonexperimental investigations • Designing wonder investigation projects	**Wonder Journals Due** **Readings:** • Coburn, *LSDS*, Ch. 6: Scientists Do Experiments… (pgs. 91-107) **Activities:** • 5Eifying an existing lesson
Class 11 **Wednesday, April 3**	**Data and Conclusions** • Variability and subjectivity • Obtaining, evaluating, and communicating information • Lesson Planning Workshop	**Readings:** • Coburn, *LSDS*, Ch. 7: We're Counting on You (pgs. 109-129) • Brown *ISM*, Ch. 10: Gliding Into Understanding (pgs. 96-104) **Activities:** • Field Notes

Class 12 **Wednesday, April 10**	**Projects Workshop** ● Community workshopping: lesson plan series -peer feedback	**Draft Lesson Series Due** **Readings:** ● Coburn, LSDS, Ch. 9: Learning to Fish (pgs. 147-159) **Activities:** ● Work on final wonder project ● Field Notes
Class 13 **Wednesday, April 17**	**Synthesizing our Learning** ● Lessons learned ● Extending the EBE model to health topics	**Readings:** ● Brown, *ISM*, Ch. 14: Leadership and Lessons Learned (pgs. 142-148) ● Coburn, *LSDS*: Appendix B Teacher to Teacher **Activities:** ● Field Notes
Class 14 **Wednesday, April 24**	**Wonder Matters** ● Sharing Wonder Investigation Projects	Due: Wonder Investigation Projects

Final review of Field Notes: Monday, April 29th

Due Wednesday, May 1: PBA: **Lesson Series/Short Unit Project**

PBA: Lesson Series/Short Unit Project
Assessment Rubric
50 points available
(30% of total grade)

The goal of this project is for you to demonstrate your ability to plan a series of science lessons (a short unit plan) appropriate for the context of your field site. The series of lessons will follow an Explore Before Explain (EBE) theoretical framework for science teaching (Brown, 2020). This project will be submitted in the format of a written paper, with two introductory sections summarizing the overall science topic and the theoretical grounding for your instructional approach before inclusion of the lesson plans. The lesson plan format must follow the CEHD format. A scaffolded lesson plan template will be provided. For the full assignment description, see "Assignments" sections on our Syllabus, Blackboard, and our shared course folder in Google Drive.

Description and standard addressed	**Exceeds Expectations 4 points**	**Meets Expectations 3 points**	**Does Not Meet Expectations 2 points**	**Does Not Meet Expectations 1 point**
Overview (Summary, content knowedge, and context description) INTASC: #4, 5, 7; (10 pts)	Provides a powerful and engaging overview of the topic, series of lessons, and overall unit goals. Includes very detailed and specific content knowledge needed to teach the topic well, including multiple resources. Excellent description of the specific students the unit is designed for and how it is expected they will respond to the unit.	Gives a good basic overview of the topic, series of lessons, and overall unit goals. Lists the basic content knowledge teachers would need to know to carry out the lesson goals, including resources. Provides a solid description of the students that the unit is designed for. Overall sufficiently composed, but may rise to the level of detailed excellence in one or more areas.	Does not provide a complete overview of the topic, series of lessons, and overall unit goals. Some information is provided, but much is missing. Some content knowledge is included, but it lacks detail and/or resources. Provides little or no information about a specific group of students for whom the lessons are designed.	Missing or very minimal attempt.
Theoretical Framework for Science Instruction INTASC: #8, 6 (5 pts)	Utilizes inquiry-based lesson model (5Es), clearly describes pedagogical process that embodies inquiry. Uses at least 3 references from our class readings to support the approach. Describes excellent plans for diagnostic, formative and summative assessments throughout the unit.	Utilizes inquiry-based lesson model (5Es), and describes pedagogical process that embodies inquiry, but not necessarily in a clear manner. Uses 1 or 2 references from our class readings to support the approach. Describes adequate diagnostic, formative and summative assessments throughout the unit.	Does not provide complete descriptions and/or theoretical background; and/or is not self-explanatory. Does not utilize resources. Does not include all three types of assessment.	Missing or very minimal attempt.

Detailed Lesson Plans INTASC: #4, 5, 6, 7, 8 (35 pts)	Standards (process *and* content), objectives, detailed procedures for each lesson activity (including teacher statements and questions and anticipated student responses), formative and summative assessments, and all supporting materials are included and seamlessly aligned and interwoven with one another. All aspects of the lessons are firmly grounded in an EBE instructional approach, and thus clearly begin with the interests, experiences, and hands-on explorations of students, in support of their development of increasingly sophisticated understanding of science concepts and practices. Everything included is clearly described, highly usable, and includes creative connections and innovative thinking. Copies of and/or links to all assessments and support materials are included. Support materials are multiple, varied, creative, and extensive, representing a great deal of research, time, and effort toward providing rich and meaningful opportunities for student learning and engagement. Safety is clearly and adequately addressed.	All required elements are included with visible efforts to integrate and align them with one another. A clear attempt to ground all aspects of the lessons in an EBE approach is evident. Children's interests, experiences, and ideas are incorporated. Explanations are provided after students have had adequate time to wonder about and explore with materials and develop their own ideas. Copies of and/or links to all assessments and support materials are included. Safety is clearly and adequately addressed.	Some of the required lesson elements are present, and some are missing. And/or some of the elements are either not well developed and/or not well aligned with one another. The lessons are not yet grounded in an EBE approach. There is little or no evidence that the interests, experiences, or ideas of the students have been considered. Explanations are provided before students have had an opportunity to have shared experiences exploring phenomena. Lesson elements are either missing, not clearly described, and/or appear difficult to use. Few copies and/or links to assessments and support materials are provided. Safety is not adequately addressed.	Missing or minimal attempts to address the basic requirements.