Teaching Elementary Science

Education 421 Fall 2014

Course Information

Instructor: Sylvie Kademian
John-Carlos Marino

Section: Section 002
Section 001

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Class time: Monday 8:30-11:30
Tuesday 8:30-11:30

Classroom: 2241 SEB
2241 SEB

Office hours: Monday 11:30am-1pm or by appointment
Friday 12:00pm-2pm or by appointment

Professor Betsy Davis (betsyd@umich.edu) is the lead faculty for the course. Students from either section are welcome to speak with her.

If you have special needs for which accommodations may be needed, please inform your instructor as soon as possible. See further details on page 5 of this syllabus.

If you will be missing class due to one or more religious holidays, please let your instructor know during the first week of class.

Course Objectives and Organization

In Elementary Science Methods, we will build on current research and best practice to prepare you to foster science learning in elementary school students. Our main goals are for you to:

- incorporate the three dimensions of the Next Generation Science Standards into effective elementary science teaching to support students as they engage, experience, and explain with evidence through science investigations. Specifically, you will work on science teaching practices such as:
  - appraising and modifying science lesson plans and activities to address a specific learning goal
  - setting up and managing small-group investigative work
  - establishing norms and routines for classroom discourse and work that are central to science (such as asking children for evidence to support their claims)
  - choosing and using representations, examples, and models of science content
  - explaining core content and supporting students in constructing scientific explanations
  - enacting science lessons or portions thereof to support a specific learning goal
- identify and enact instructional practices that make science accessible to all students. Some practices that may facilitate equitable instruction include:
  - selecting and enacting the activities with care, including through connecting science to students' lives
  - using scientific language in accessible and accurate ways, and helping children to do so
• using multiple representations of the ideas and making connections between representations
• considering a broad conception of scientific expertise
• being explicit about what might have been invisible to some learners (e.g., providing rationales for instructional decisions, unpacking terminology, having clear rules, being clear about what's invisible or otherwise inaccessible about the scientific phenomenon)
• learn how to prepare, teach, and analytically reflect on elementary school science investigation lessons

The expectations are high this semester. You've already experienced two semesters of coursework in the School of Education and two semesters in the field. This semester, we'll help you make connections between what you've learned already, and what you're learning now.

Throughout the semester, we will work on the goals listed above. We'll read relevant chapters and articles that can help us unpack the ideas related to these, and we'll also use other records of practice (video, student work, etc.) to help bring some of the ideas to life. Each week, we'll be working on some key teaching practices, and you'll be practicing those practices in our ED421 class, in the field, or both. By the end of the course, you should feel better prepared to put the pieces together to teach science effectively as a beginning teacher.

We've structured the class to allow for a focus on elements of science teaching. Many science lessons can be broken down into three basic elements: *engage, experience, and explain with evidence*. Sometimes, these elements will span across a unit, rather than a lesson. We'll work through different teaching strategies associated with each element, focusing on using investigations to help students learn science content and scientific practices.

What are possible ways to engage, experience, and explain with evidence in science lessons? Watch for these elements when you observe science teaching. For example, you might see a teacher use journal writing to *engage* students by eliciting their ideas at the beginning of a lesson, and/or the teacher might review previous lessons. For the *experience* element, a teacher might provide students multiple opportunities to interact with scientific phenomena and concepts. For example, the teacher could have students conduct a first-hand investigation, supporting them in collecting and recording data systematically. S/he might also have students read a text, watch a video, conduct research using the Web, or use data that had already been connected, and we'll explore in class how these kinds of experiences can complement first-hand experiences with the phenomenon. In the *explain with evidence* element of a lesson, the teacher might have students look for patterns in data, make claims based on evidence, construct a consensus model, or all of the above. Some of these approaches might, in turn, serve as formal or informal assessments.

**Course Reading Materials**

**Required Readings and Other Course Expenditures**


*What’s Your Evidence?: Engaging K-5 Students in Constructing Explanations in Science* provides a framework for you to help your students develop their ability to construct scientific explanations. The book focuses on how you can have students use explanations to enhance conceptual understandings and communicate effectively in the science classroom. The book also includes a DVD with videos of practitioners carrying out many of the strategies discussed by the authors. In addition to reading assignments, you also will be expected to view videos from the DVD in preparation for class. You can purchase *What’s Your Evidence?: Engaging K-5 Students in Constructing Explanations in Science* at Ulrich’s. (If you buy a used copy, be sure that it includes the DVD.)
Michigan Department of Education. *Michigan Grade Level Content Expectations.*

The Michigan Department of Education has a set of standards for teaching science in Michigan. These science standards can be found in the *Michigan Grade Level Content Expectations (GLCEs)*, available at [www.michigan.gov/documents/mde/Item_C_194161_7.pdf](http://www.michigan.gov/documents/mde/Item_C_194161_7.pdf).

**Next Generation Science Standards**

The Next Generation Science Standards is a new set of standards for teaching science (released in 2013) that integrate the disciplinary core ideas in science, science practice, and cross-cutting concepts. The Next Generation Science Standards are available at [http://www.nextgenscience.org](http://www.nextgenscience.org). While the state of Michigan has not yet adopted the Next Generation Science Standards, Michigan was a lead state in their development.

The other required readings are provided on CTools under "Resources" and within the "Weekly Resources" folder, by week.

**In addition to the required readings, you should expect to need to spend no more than $25 to cover expenses associated with your science teaching in your elementary classroom.**

*Additional Resources*

You may find some of the following books to be useful, as well. At least portions of these books are available online. Each is linked from the CTools site.


The *Framework*, as this document is called, is the foundation for the Next Generation Science Standards. The Framework is available at [http://www7.nationalacademies.org/bose/Standards_Framework_homepage.html](http://www7.nationalacademies.org/bose/Standards_Framework_homepage.html).


Common Core State Standards Initiative (2010). *Common Core State Standards for English Language Arts.*

The Common Core will guide your math and language arts instruction, but you should also use these documents in making connections to science. For example, the ELA Common Core emphasizes content-area literacy and science is a key discipline for being able to make such connections.


The *Atlas* provides a concept map view of the Benchmarks described above, demonstrating how the different concepts are interconnected. Some of the Atlas' maps are available on-line at [http://www.project2061.org/tools/atlas/sample/toc.htm](http://www.project2061.org/tools/atlas/sample/toc.htm). You may want to purchase this book if you are a science major; the URL is [http://www.project2061.org/tools/atlas/default.htm](http://www.project2061.org/tools/atlas/default.htm)

** Additional resources are available for your use on the CTools course website.**
Course Requirements and Grading

The percentages listed here are approximate, but will give you a sense of the relative weight of each assignment. Expectations for these assignments will be discussed in more detail in class, and detailed assignment sheets will be provided. All written work should be uploaded to the corresponding assignment folder in the ED421 CTools site by the specified due date.

Class Attendance, Participation and Additional Written Assignments (20%)

Attendance and participation are expectations in this class as a form of professionalism. We expect you to attend every class, to arrive on time for a prompt start, to stay till the end, and to participate in and contribute to class. It is vital that you attend every class session if at all possible. If you cannot be present for a class session, let your instructor know by e-mail by 8:00AM the day of class. Acceptable absences include absences due to religious holidays; please let your instructor know at the start of the semester if you will miss class for this reason. While it will not be possible to recreate a missed class, please make arrangements with your instructor to complete alternative work that will support the learning you missed. Your instructor will specify the due date for this alternative assignment. More than one absence from the class will make successful learning of the material in the course challenging and put you in danger of not being able to complete the course successfully. The Office of Teacher Education will be notified if there is more than one absence. As always, participation points will be deducted for absences and late arrivals.

"Participation" means that you need to be in the habit of speaking up and being engaged in whole class and small group discussions and activities. Appropriate use of electronic devices is also a part of your professional participation in our class. Using laptops or cell phones as tools for your learning is acceptable, as long as it is not distracting to your colleagues or your instructor. Examples of acceptable use of electronic devices include making records of your practice and consulting resources for work in class. Non-instructional texting, phone calls, social networking, shopping, and other non-instructional use of these devices are not acceptable in this class at any time, and will result in a reduction in your participation grade. If you are concerned about your ability to meet this professional expectation, please discuss your concern with your instructor. Please let your instructor know if there is an emergency that affects your need for a phone in class.

Additionally, you will have one or more small written assignments such as the science teaching conversation with your mentor teacher or reflections after each segment of the peer teaching assignment.

Peer Teaching in ED421 (three times) (10% each time, or 30% total)

Each peer teacher will have a chance to lead their peer “students” through each of the following three elements of a science lesson: engage with an investigation question, experience the scientific phenomenon associated with the investigation, and explain the phenomenon with evidence to his/her peer teaching team. We refer to these three elements of science teaching as the “EEE framework for science teaching”.

Experience Element in the Field (one time) (20%)

Teaching the Experience element of a lesson will involve co-teaching a science lesson with your mentor teacher in your field placement classroom. The goal is to apply ideas being learned in ED421 to practice small elements of science teaching, sometimes in low-stakes environments, so that when you are teaching entire science lessons (with multiple elements), you will have already developed some expertise. You should plan to teach the “experience” element of an investigation lesson in your field placement classroom.

Reflective Teaching Assignment (30%)

You will teach a full science lesson in your practicum classroom. For the reflective teaching (RT) assignment, you will analyze a science lesson plan using the lesson design considerations framework,
develop your version of the science lesson plan using the instructional planning template, teach the lesson to children, reflect on your teaching using your video record, and analyze some student work.

**Class Policies and Additional Information**

*Contacting Us*

Email is the best way to reach us. You can also call us, come to our office, or leave something in our mailboxes.

*Grading and Late Work*

If you cannot complete an assignment on time, please contact your instructor by email in advance of the due date and request an extension. Typically we will give an extension of one week; after that, the work will be counted as late and your grade will be affected. Unexcused late work will impact your grade in correspondence with how late the work is submitted (for example, points may be lost for each day of lateness). You may request a re-grade on any assignment. The request must be made via email and you must turn in the revision within one week of the assignment being handed back.

*Readings*

You are expected to do all the reading in advance of class. Our work in class depends on it.

*Written Assignments*

For turning in your written assignments, you will use the drop box area in the CTools site. Please turn in your Saturday assignments by 10:00pm on the Saturday evening they are due, and the in-class assignments before class (8:29am) on the day they are due.

*Video Assignments*

For turning in videos that accompany written assignments, you will use Edthena. Always allow “Admin Download” when uploading videos.

*Participating in Program Evaluation and Research*

You received information last year about teacher education program evaluation and research. If you have any questions, please ask us or your field instructor. You or your mentor teacher have also received a letter to the parents or guardians of the children in your classroom. Please make sure you follow the instructions you receive about signing, copying, and distributing these letters.

*Class start time and procedures*

Class will begin promptly at 8:30am, and will release at 11:30am. We will also take a ten-minute break during the three-hour class period. Please sign in, and pick up materials for the class period when you arrive.

*Accommodations for Students with Disabilities*

If you think you need an accommodation for a disability, please let me know at your earliest convenience. Some aspects of this course, the assignments, the in-class activities, and the way the course is usually taught may be modified to facilitate your participation and progress. As soon as you make me aware of your needs, we can work with the Office of Services for Students with Disabilities (SSD) to help us determine appropriate academic accommodations. SSD (734-763-3000; http://ssd.umich.edu) typically recommends accommodations through a Verified Individualized Services and Accommodations (VISA) form. Any information you provide is private and confidential and will be treated as such.

*Questions, Comments, or Concerns*

If you have any questions, comments, or concerns about the class, please do not hesitate to contact us! We’re looking forward to working with you this semester!
<table>
<thead>
<tr>
<th>Week &amp; Date</th>
<th>Today's In-Class Topic</th>
<th>Readings &amp; Videos for Today</th>
<th>Assignment due Saturday prior to class</th>
<th>Assignments due at start of class</th>
<th>Peer teaching today...</th>
<th>Field assignments</th>
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<tbody>
<tr>
<td>(1) M 10/6</td>
<td>Our visions of science teaching Overview of the EEE framework</td>
<td>Zembal-Saul (Z-S) Chapter 1 (all) and Chapter 2 (pgs 19-26) Watch Zembal-Saul video 5.1 and 5.2 GLCEs for Science NGSS Front Matter &amp; grade level NGSS Appendix F (pgs 1-3) Peer teaching lesson you were assigned (energy or stems)</td>
<td>Pre-Planning for P-T (due Saturday 10/18)</td>
<td>Science conversation with MT due in class M (10/20), T (10/21)</td>
<td>Prepare for peer teach experiences this semester Prepare for <em>Engage</em> peer teach</td>
<td>Science conversation with MT</td>
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<td>(3) M 10/27</td>
<td>Engage: Students' ideas in science and beginning an investigation lesson</td>
<td>Zembal-Saul Chapter 3 Watson &amp; Konicek Benchmarks ch. 15 (skim) MSTA misconceptions (skim) NGSS Appendix F (pgs.4-5)</td>
<td>Reflection for <em>Experience</em> P-T (due Saturday 11/8)</td>
<td>Experience peer teach</td>
<td>Experience peer teach</td>
<td>Experience element teach-in-field</td>
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<td>(4) M 11/3</td>
<td>Experience: Investigations as learning activities I (Establishing data collection)</td>
<td>RSS Chapter 6 Watch video 5.6 and revisit video 5.1 NGSS Appendix F (pgs. 6-9)</td>
<td>Reflection on Engage P-T (due Saturday 11/1)</td>
<td>Prepare for <em>Experience</em> peer teach</td>
<td>Experience peer teach</td>
<td>Experience element teach-in-field</td>
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<td>(6) M11/17</td>
<td>Explain with evidence: Closing an investigation lesson I</td>
<td>Zembal-Saul Chapter 4 Watch video 5.5, revisit video 5.6 NGSS Appendix F (pgs.11-16)</td>
<td>Reflection for Experience P-T (due Saturday 11/15)</td>
<td>Experience element teach-in-field due in class M (11/17), T (11/18)</td>
<td>Prepare for <em>Explain with Evidence</em> peer teach</td>
<td>RT</td>
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<td>(7) M 11/24</td>
<td>Explain with evidence: Closing an investigation lesson II</td>
<td>Zembal-Saul Chapter 6</td>
<td>Lesson plan for Explain with evidence P-T (due Saturday 11/22)</td>
<td>Explain with Evidence peer teach</td>
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<td>(8) M 12/1</td>
<td>Assessment</td>
<td>Zembal-Saul Chapter 6</td>
<td>Reflection for Explain with evidence P-T and revised P-T lesson plan (Due Saturday 11/29)</td>
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<td>(9) M 12/8</td>
<td>Putting it all together</td>
<td>NSTA connections</td>
<td><em><strong>Reflective Teaching due Friday December 12</strong></em></td>
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Tentative Course Schedule and Assignments

The schedule on the following pages is likely to change as the course progresses! Homework assignments may be assigned in addition to the assignments listed here. Readings other than chapters in the Zembal-Saul book are posted on CTools.

Week 1 Monday, October 6, or Tuesday, October 7 What is our image of science teaching?

Goals for today: Introduce the course, think about personal experiences as science learners, and introduce dimensions of science proficiency in the Next Generation Science Standards. Begin to establish a culture of intellectual respect. Think about your goals for yourself as a science teacher. Develop overview of EEE framework and ambitious, reform-oriented science teaching.

Connections: Reflect on your experiences learning science and ideas about what effective science teaching entails. What is your history as a science learner? What are your goals for yourself as a science teacher? How does effective elementary science teaching connect to effective teaching in other subjects?

Science teaching practices to work on: Introducing the Engage, Experience, and Explain with Evidence elements of a science lesson.

Equity in science teaching and learning:
• Making science accessible to all learners is one of the key goals you must have as an elementary teacher. As you begin this course, consider what you can do to help all learners succeed with science. Observe and talk with your mentor teacher to gain insight.

What to work on in the field this week: This week, get familiar with your classroom. How is science visible? How has the teacher established a culture of intellectual respect? Does the physical layout allow all students to participate equitably in science? Use your conversation with your mentor teacher (due M 10/20, T 10/21) to learn more about how s/he thinks about and works on science teaching.

No class Monday, October 13, and Tuesday, October 14 Fall break!

Week 2 Monday, October 20, or Tuesday, October 21 EEE: Engage & Standards

Goals for today: Begin to understand what integrating science practice with disciplinary core ideas might look like in an elementary classroom as called for in the standards documents. Begin to be able to envision a science investigation lesson. Discuss strategies for eliciting kids' ideas in science and establishing an investigation question or problem. Begin planning for your peer teaching lessons.

Connections: In Teaching with Curriculum Materials and other year 1 classes, you explored the GLCEs and the Common Core; here, we’ll zero in on the science GLCEs as well as the Next Generation Science Standards. In your social studies methods class, you worked a lot on representing how history is done. Investigation of natural phenomena is one characteristic that makes science unique. As in history, students will use evidence to support claims in science. The expectations about evidence will be a little different!

Science teaching practices to work on: Analyzing and modifying science lesson plans; recognizing and identifying common patterns of student thinking in science

Science practices to focus on: Asking questions or defining problems
**Equity in science teaching and learning:**
- How does having clear standards and using these to guide your instruction help you make science accessible to all learners? What do you need to do to be able to recognize the strengths in all children's science ideas? How can you build on these ideas in your instruction?

**Readings for today:**
- Michigan Grade Level Content Expectations (GLCEs) for science
- Next Generation Science Standards Front Matter and Standards for your grade level
- Zembal-Saul et al. Chapter 1 and Chapter 2 pgs. 19-26
- Watch Zembal-Saul videos 5.1 and 5.2
- NGSS Appendix F pgs. 1-3
- Peer teaching lesson you were assigned (energy or stems)

*Focus questions as you read:* Think about how the readings support, extend, and challenge your thinking about what the priorities should be for science learning and teaching. Jot down some examples from the reading and from your experiences.

*Focus questions as you watch the video:* How do the teachers integrate science content, science practices, and cross-cutting concepts in the lessons? What parts of the EEE framework do you see in the lessons? How do the teachers help the students share the initial ideas about the science topics?

**Peer teaching in class today:**
- Plan entire peer teach lesson (big picture overview)
- Prepare for the *Engage* peer teach

**Assignment due Saturday (10/18):**
- Pre-Planning for Peer Teaching

**Assignments due today:**
- Science conversation with your mentor teacher
- Contact your instructor before today if you will miss class(es) for any religious holidays this semester. We may be able to schedule make-up classes.

**What to work on in the field this week:**
- Observe science lesson(s) if possible. Do you see elements of the EEE framework, even if it's not explicit?

**Week 3 Monday, October 27, or Tuesday, October 28**  
EEE: *Engage & Students' ideas*

**Goals for today:** Envision portions of a science investigation lesson. Develop strategies for finding out about and working with kids' ideas in science. Learn how to support students in making predictions about phenomena.

**Connections:** You learned about the importance (and resilience!) of students' ideas in Children as Sensemakers, ed psych and your other classes. Think back to Children as Sensemakers from last fall. How can you elicit, identify, and work with kids' ideas in science? Were the children's ideas surprising to you? Were they interesting?

**Science teaching practices to work on:** Using discourse moves to elicit students' ideas in science; leading whole-class discussions; recognizing and identifying common patterns of student thinking in science

**Science practices to focus on:** Asking questions or defining problems
Equity in science teaching and learning:
• How does your own use of specific discourse moves help to support students in learning the academic language or academic register of science? How can you explicitly support children in being able to use precise, clear, accurate language in science? What kinds of scaffolding can you provide?

Readings for today:
• Zembal-Saul et al. Chapter 3
• Watson & Konicek (1990): Teaching for Conceptual Change
• Benchmarks Chapter 15: The Research Base (skim)
• MSTA misconceptions lists (physical science, earth science, life science) (skim)
• NGSS Appendix F pgs. 4-5

Focus questions as you read: As you read, identify 3 or more typical alternative ideas or misconceptions students are likely to have related to the content you are focusing on for your peer teaching lesson. In addition, consider, why do you think it's especially important to anticipate, elicit, interpret and help to develop students' ideas in science? What can you say or do to help you do this?

Assignment due Saturday (10/25):
• Lesson Plan for Engage Peer Teaching

Peer teaching in class today:
• Engage peer teach: Establish purpose through a question or problem; share initial ideas to connect lesson to students' ideas, knowledge, and experiences

What to work on in the field this week:
• Working on getting a date secured and begin planning for your experience in the field assignment. Remember it must be completed by November 17 or 18.

Week 4 Monday, November 3, or Tuesday, November 4 EEE: Experience – Data collection

Goals for today: Continue to develop skill in teaching a lesson involving an investigation. Learn how to support students in collecting, recording, and organizing data.

Connections: Continue to apply your knowledge about teaching (in general) to thinking about science teaching. Also, as with mathematics (and other subjects sometimes as well), you need to think about how you will make physical materials available to students without causing distractions. Remember the work you did in Managing to Teach around the management of materials.

Science teaching practices to work on: Supporting students in making predictions; modeling and scaffolding data collection and recording; leading whole-class discussions; setting up and managing small group work for investigations in science

Science practices to focus on: Planning and carrying out investigations

Equity in science teaching and learning:
• In what ways does investigation help to make science accessible to a broader range of learners? In what ways might some children be disadvantaged, and how can you work to mitigate those disadvantages? (Consider, for example, the kinds of discourse moves we've been working on; consider also how you might use flexible roles in collaborative groupwork; consider even the physical layout of your classroom.)
Readings for today:
- Ready Set Science! chapter 6
- Watch Zembal-Saul video 5.6 and revisit video 5.1
- NGSS Appendix F pgs. 6-9

Focus questions as you read: What strikes you about the advantages and challenges in using representations and investigations to promote students' learning of science? As teachers, how might you address some of the challenges?

Focus questions as you watch the video: What elements of the experience element of the EEE framework do you see in the videos? How does the teacher help the students begin to identify patterns and trends in the data to prepare to answer the investigation question?

Assignment due Saturday (11/1):
- Reflection on Engage Peer Teaching

Peer teaching in class today:
- Prepare for the Experience peer teach

What to work on in the field this week:
- You may teach your Experience element teach-in-field assignment this week. It must be completed by November 17 or 18.

Week 5 Monday, November 10, or Tuesday, November 11  EEE: Experience – Investigations

Goals for today: Continue to develop skill in teaching a lesson involving an investigation. Learn how to support students in analyzing, interpreting, and representing data.

Connections: Continue to apply your knowledge about teaching (in general) to thinking about science teaching. You may have taught a "visual inquiry" lesson in social studies. Investigations are an element of scientific inquiry. How is interpreting data similar to and different from interpreting a historical image? Also, remember the work you did on circulating in Managing to Teach. What do you want to look for in your students' work in your peer teaching lesson? What would be productive questions to ask them?

Science teaching practices to work on: Supporting students in collecting and recording data; supporting students in making sense of data while investigating; circulating during investigations and scaffolding student thinking through questions; establishing norms and routines for classroom discourse and work that emphasize the use of evidence to support claims; setting up and managing small group work for investigations in science

Science practices to focus on: Planning and carrying out investigations

Equity in science teaching and learning:
- What kinds of scaffolding will help support students in recording their data in such a way that they'll be positioned to make sense of it? What kinds of questions can you ask small groups while they're engaged in small-group investigative work to support their thinking about the phenomena they're exploring (not just address groupwork, behavioral, or materials-related issues)? How can norms and routines for classroom discourse help work to mitigate gaps in students' prior experiences that might otherwise make them less prepared for ambitious science learning?

Readings for today:
- NGSS Appendix F pg. 10
- NGSS Appendix F pgs. 17-32

Focus questions as you read: How do the scientific practices that students are learning in your peer teaching lesson fit within the learning progression? How might the investigation support students’
learning of these scientific practices? How will you plan for supporting students to develop richer understandings of these scientific practices over time?

**Assignment due Saturday (11/8):**
- Experience Peer Teaching Lesson Plan

**Peer teaching in class today:**
- *Experience* peer teach: Establish data collection; carry out investigation to support sensemaking

**What to work on in the field this week:**
- You may teach your *Experience* element teach-in-field assignment this week. It must be completed by November 17 or 18.

**Week 6 Monday, November 17, or Tuesday, November 18 EEE: Explain – Claims & evidence**

**Goals for today:** Continue to develop skill in teaching a lesson involving an investigation. Learn how to support students in making sense of data that have been collected. Learn how to support students in making claims based on evidence.

**Connections:** In social studies methods, you learned about primary and secondary sources. These are sort of like "data" or "evidence" in science. How could you help students learn about scientific practices and historical inquiry? How could you help them see connections between the two subject areas?

**Science teaching practices to work on:** Compiling student (or group) data and supporting students in looking for patterns; supporting students in developing claims based on evidence; leading whole-class discussions; establishing norms and routines for classroom discourse and work that emphasize the use of evidence to support claims

**Science practices to focus on:** Analyzing and interpreting data, constructing explanations, engaging in argument from evidence

**Equity in science teaching and learning:**
- We’ve been working on establishing norms and routines for classroom discourse. How can emphasizing the use of evidence to support claims help all children learn science? How can the work of compiling student or group data help make visible some of the hidden "steps" of data interpretation?

**Readings for today:**
- Zembal-Saul et al. Chapter 4
- Watch Zembal-Saul video 5.5, revisit video 5.6
- NGSS Appendix F pgs. 11-16

**Focus questions as you read:** How are collecting, recording, and interpreting data, constructing scientific explanations, and argumentation related to one another? Why is it important to ask students to support their claims with evidence? What kinds of supports will you want to put in place to help them interpret the data collected by the class and be positioned to support claims with evidence? Why is it important to use a sensemaking discussion, including making claims supported by evidence, to conclude an investigation?

**Focus questions as you watch the video:** How do the teachers facilitate discussions that enable students to answer the investigation question by generating evidence-based claims? What types of scaffolding do the teachers provide?

**Peer teaching in class today:**
- Prepare for the *Explain with Evidence* peer teach
Assignment due Saturday (11/15):
  • Reflection for Experience Peer Teaching

Assignments due today:
  • Experience element-in-the-field is due today.

What to work on in the field this week:
  • Make sure you are set for teaching your Reflective Teaching lesson in the next few weeks. It must be completed by December 12.

Week 7  Monday, November 24, or Tuesday, November 25  EEE: Explain – Applying knowledge

Goals for today: Continue to develop skill in teaching a lesson involving an investigation. Learn how to design opportunities for students to apply their knowledge to new situations.

Connections: How is applying knowledge to a new situation in science similar to how you tie ideas together in other subjects?

Science teaching practices to work on: Supporting students in applying scientific knowledge to new situations; explaining core content; establishing norms and routines for classroom discourse and work that emphasize the use of evidence to support claims

Science practices to focus on: Analyzing and interpreting data, constructing explanations, engaging in argument from evidence

Equity in science teaching and learning:
  • Supporting students in applying their scientific knowledge to new situations is one way of seeing how students are understanding the science. It can, however, be problematic if the new situations aren't chosen very carefully to build on students' prior experiences. How can learning about your students and their community help you be better positioned to do this well?

Assignment due Saturday (11/22):
  • Lesson Plan for Explain Peer Teaching

Peer teaching in class today:
  • Explain peer teach: Identify patterns in data; generate claims supported by evidence; apply knowledge.

What to work on in the field this week:
  • You may teach your Reflective Teaching lesson this week. It must be completed by December 12.

Week 8  Monday, December 1, or Tuesday, December 2  Assessing students' understanding

Goals for today: Develop skill in looking at students' written work over time. Practice assessing student work in science via constructed response opportunities. Practice interacting with parents about student learning. Continue working on how making real-world connections can help make science accessible.

Connections: You've learned about assessment in many of your classes. Here, we'll be focused on closely examining student work in science—particularly via constructed response questions and performance assessments—and being able to make claims about their development over time.
Science teaching practices to work on: Assessing students' ideas; recognizing and identifying common patterns of student thinking in science

Equity in science teaching and learning:
- Consider how you can use assessment as a way of positioning students to be successful in science. How can different forms of assessment support students?

Readings for today:
- Zembal-Saul Chapter 6
  *Focus question as you read:* What types of assessments are used in your classroom around learning science? Based on the Zembal-Saul chapter and knowledge from other classes, describe the types of assessments you could likely use in your science instruction to assess students’ learning, explain why you will use them, and give specific examples of when you could use them (You might think ahead to an assessment for your Reflective Teaching.)

Assignments due Saturday (11/29):
- Reflection for Explain Peer Teaching with Updated Lesson Plan

What to work on in the field this week:
- You may teach your Reflective Teaching lesson this week. It must be completed by December 12.

Week 9 Monday, December 8, or Tuesday, December 9 Putting it all together

Goals for today: Discuss how to make connections to science and other content areas. Pull back to consider the broader implications of what we've learned about effective science teaching.

Connections: Think about how what you've learned this semester about effective science teaching connects to what you've learned in your other teacher ed coursework and in the field. What do you want to make sure to work on during student teaching?

Equity in science teaching and learning:
- Reflect back on the semester. What have you learned that can help position you to be able to make science accessible for all students? What do you need to keep working on?

Readings for today:
- NSTA Connections
  *Focus question as you read:* How do math and language arts complement science? How might you make connections to other subject areas in your science instruction?

Assignments due today:
- Reflective Teaching assignment is due on Friday, December 12th. (both cohorts).