

## **Teaching Elementary Science Education 421 Fall 2019**

### **Course Information**

Instructor: Professor Betsy Davis  
Office: 4112 SEB  
Email: [betsyd@umich.edu](mailto:betsyd@umich.edu)  
Phone: 734.717.8292 (cell)  
(Please don't call or text before 7AM or after 9PM. Thanks!)

Betsy's office hours: Typically Tuesdays 12:15-2:00PM and Fridays 8:30-11:00AM  
4112 SEB or virtual; please email to arrange a plan.

Class time: Mondays 9:00-12:00  
Classroom: 2241 SEB  
Class TA: Adam Bennion  
3003 SEB  
[abennion@umich.edu](mailto:abennion@umich.edu)  
Adam's office hours (if Betsy's not available): TBA / by appointment

If you have special needs for which accommodations may be needed, please inform us 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 us know during the first or second week of class.

## Course Objectives and Organization

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:

- describe and recognize the three dimensions of the Next Generation Science Standards (NGSS) – disciplinary core ideas, science and engineering practices, and crosscutting concepts.
- incorporate the three dimensions of the NGSS into effective elementary science teaching to support students as they *engage*, *experience*, and *explain and argue with evidence* through science investigations. Specifically, you will work on high-leverage science teaching practices such as:
  - appraising and modifying science lesson plans 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
  - supporting students in constructing scientific arguments and explanations
  - enacting science lessons or portions thereof to support a specific learning goal
- identify and enact instructional practices that help you make science accessible to *all* students. We will work to “teach science for justice” by:
  - addressing low expectations and opportunity gaps
  - making every child a doer of science
  - addressing structural inequities
- learn how to prepare, teach, and analytically reflect on elementary school science investigation lessons

Throughout the semester, we will work on these goals. We'll read chapters and articles that can help us unpack the ideas related to these, and we'll 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 and argue with evidence*. (We call this the EEE+A Framework.)

In this class, we are going to focus on *using investigations* to help students learn science content and scientific practices. This is our focus because teaching science through investigation is challenging but crucially important; this is the main form of instruction we hope you will engage in with your students. That said, we'll also talk about and explore ways in which the EEE+A framework can be applied to other kinds of lessons.

What are possible ways to engage, experience, and explain and argue 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. 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. They 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 and argue 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** (in addition to materials on Canvas)

**Zemal-Saul, C., McNeill, K. L., & Hershberger, K. (2013). *What's Your Evidence?: Engaging K-5 Students in Constructing Explanations in Science*. Pearson Education.**

*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.

### **Next Generation Science Standards**

The Next Generation Science Standards (NGSS) integrate the disciplinary core ideas in science, science practices, and crosscutting concepts. The Next Generation Science Standards are available at <http://www.nextgenscience.org>.

### **Michigan Department of Education. *Michigan Science Standards*.**

The Michigan Department of Education has recently adopted a set of standards for teaching science in Michigan, available at [https://www.michigan.gov/documents/mde/K-12\\_Science\\_Performance\\_Expectations\\_v5\\_496901\\_7.pdf](https://www.michigan.gov/documents/mde/K-12_Science_Performance_Expectations_v5_496901_7.pdf). These are based on and very similar to the Next Generation Science Standards (NGSS).

**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 and online resources to be useful, as well. At least portions of these books are available online. Most are linked from the Canvas site, as are other useful resources.

On Twitter: Consider following @NGSS\_tweeps, @NSTA, and/or @STEMTeachTools for science teaching resources and ideas, @edutopia for general teaching resources ideas, and @dog\_feelings if you need occasional uplifting.

National Research Council (NRC) (2012). *A framework for K-12 science education: Practices, crosscutting concepts, and core ideas*. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

The *Framework*, as this document is called, is the foundation for the Next Generation Science Standards and the Michigan standards. The Framework is available at [http://sites.nationalacademies.org/DBASSE/BOSE/Framework\\_K12\\_Science/index.htm](http://sites.nationalacademies.org/DBASSE/BOSE/Framework_K12_Science/index.htm).

Common Core State Standards Initiative (2010). *Common Core State Standards for Mathematics*.  
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.

Love, B. (2019). *We want to do more than survive: Abolitionist teaching and the pursuit of educational freedom*. Boston: Beacon Press Books.

You'll be reading parts of the Bettina Love book in your math methods class and possibly in other coursework as well. Our justice for science teaching framework is based in part on ideas from the Love book. Although we aren't going to read the book in our class, we encourage you to draw on ideas from the book throughout your planning, enactment, and reflection on science teaching.

## **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 submitted by the specified due date. All components of assignments including video (i.e., the SLICE described below) will be submitted to the appropriate Exploration on Edthena. Other assignments (such as the conversation with the mentor teacher and the pre-planning assignment for the peer teaching) will be submitted via Canvas.

### ***Class Attendance, Participation and Additional Small Assignments (20% or 60 points)***

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 us know by e-mail by 8:00AM the day of class. Acceptable absences include absences due to religious holidays; please let us 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, by a specified due date, some alternative work that will support the learning you missed. 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 completing the course successfully. The Office of Teacher Education will be notified if there is more than one absence. Participation points will be deducted for absences and late arrivals. Three absences—excused or unexcused—is grounds for failing this course.

"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, 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 us. Please let us know if there is an emergency that affects your need for a phone in class.

Plan to have a short "get to know each other" meeting with Betsy. (A signupgenius link will be sent out soon after the first class session.) Additionally, you will have one or more small written assignments such as the science teaching conversation with your mentor teacher, as well as post-class quick-writes.

### ***Peer Teaching in ED421 (three times) (10% each time, or 30% total, or 90 points 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 and make an argument*. We refer to these three elements as the "EEE+A framework for science teaching".

### ***Science Lesson in the Classroom Experience (SLICE) Assignment (30% or 90 points)***

You will teach a full science lesson in your practicum classroom. For the SLICE assignment, you will analyze a science lesson plan using the instructional planning 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.

### ***Pushing Your Practice (PYP) Assignments (20% or 60 points)***

You will receive a checklist for keeping track of your accomplishments this semester. In addition to the assignments and expectations described above, you will have some additional work to do to help you push your thinking further in the peer teaching and SLICE lessons. You'll have choice about the timing and specific focus of these. You'll be expected to complete PYP assignments in three areas: reading, science practices, and teaching for justice in science. The checklist describes each of these briefly.

## **Class Policies and Additional Information**

### *Contacting Us*

Please come to office hours! Other than that: email is the best way to reach us. You can also call or text (not before 7AM or after 9PM), or talk to us after class.

### *Grading and Late Work*

If you cannot complete an assignment on time, contact us 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 each day). You may request a re-grade on any assignment. Make the request via email and turn in the revision within one week of the assignment being handed back.

### *Readings & Assignments*

You are expected to do all the reading and assignments in advance of class. Our work in class depends on it. Please turn in your assignments before class (by 9 AM) on the day they are due, to either Canvas or Edthena (as specified on the assignment description). For turning video-based assignments, you will use Edthena. Always allow "Admin Download" when uploading videos.

### *Our Classroom*

Our space is at a premium in room 2241. When we are in this room, please place your backpack and coat at the cubbies (by the door) or in the other designated space for materials. For safety and comfort, we need to be able to walk around the room freely. Our extra room for peer teaching is 2218.

### *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 9:00 AM, and will release at 11:50. 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. Make sure you are signed in, seated, and ready to go before 9:00.

### *Accommodations for Students with Disabilities*

If you think you need an accommodation for a disability, please let us 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 us 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.

### *Remind.com reminders*

If you would like to receive text reminders of key assignments, go to <https://www.remind.com/join/ed421f19> or text @ed421f19 to the number 81010.

### *Life happens*

Everyone experiences challenges in life. Betsy and Adam do, and we know you do, too. If you are facing something difficult that makes it hard for you to focus on science teaching or be the best teacher (or student) you can be – email or text or call Betsy. We will help you get through it. We can give you an extension, help you think about a problem, connect you with resources on campus, brainstorm creative solutions with you, or help you catch up. If you drop off the radar, or seem like you're not yourself, we will worry about you, and we will reach out. Just let us know if you need a little help.

### *Questions, Comments, or Concerns*

If you have any questions, comments, or concerns about the class, please contact us! We're looking forward to working with you this semester!

**Summary of Assignment Due Dates (see Canvas and handouts for more complete explanations)**

<b>Week &amp; Date</b>	<b>Today's In-Class Topic</b>	<b>Readings for Today</b>	<b>Assignments due at start of class</b>	<b>Peer teaching today...</b>	<b>Field assignments</b>
<b>week 1 10/7</b>	Our visions of science teaching Overview of the EEE+A framework				Science conv. with MT
<b>week 2 10/21</b>	What should be taught and learned in elementary science? Exploring NGSS and identifying the big idea. EEE+A framework: Zooming in on E+A and figuring out where you are going Introducing the Justice for Science Teaching framework (focus on addressing low expectations and opportunity gaps). Getting familiar with the science practices Engage: Asking an investigation question and eliciting students' ideas	<i>Heavy reading week! Plan accordingly!</i> Read through all assignments & watch powerpoint explanation videos NGSS Front Matter & grade level Skim NGSS Appendix F Zemba-Saul Chapter 1 Read peer teaching lesson you were assigned (Energy or Stems)	Science conversation with MT due in class Get to know you meeting by this week. Pre-planning for peer teaching lesson (Energy or Stems) due in class (watch Identifying the Big Idea ppt video for help with this!)	Prepare for peer teach experiences this semester Prepare for <i>Engage</i> peer teach	
<b>week 3 10/28</b>	Engage: Students' ideas in science and beginning an investigation lesson	Arias & Davis Predictions article Zemba-Saul Chapter 2 Watson & Konicek Benchmarks ch. 15 (skim) MSTA misconceptions (skim)		<i>Engage</i> peer teach	
<b>week 4 11/4</b>	Experience: Investigations as learning activities I (Establishing data collection) Extending the Justice for Science Teaching framework (focus on making every child a doer of science)	Arias & Davis Observations article Zemba-Saul Chapter 3		Prepare for <i>Experience</i> peer teach	
<b>week 5 11/11</b>	Experience: Investigations as learning activities II	Safety in Science Classroom		<i>Experience</i> peer teach	
<b>week 6 11/18</b>	Explain and argue with evidence: Closing an investigation lesson I	Zemba-Saul Chapter 4 and Chapter 5		Prepare for <i>Explain+Argue with Evidence</i> peer teach	<i>Plan for (or possibly teach) SLICE</i>
<b>week 7 11/25</b>	Explain and argue with evidence: Closing an investigation lesson II	Zemba-Saul Chapter 6		<i>Explain+Argue with Evidence</i> peer teach	<i>Teach SLICE</i>
<b>week 8 12/2</b>	Putting it all together I Extending the Justice for Science Teaching frmwk (addressing structural inequities).	Cervetti & Barber Text in science article			<i>Teach SLICE Last day in field 12/5</i>
<b>week 9 12/9</b>	Putting it all together II		*** <i>SLICE</i> due date – Th. 12/12***		