Teaching Elementary Science
Education 528 Winter 2014

Course Information
Instructor: Anna Arias
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Email: aarias@umich.edu
Class time: 1-4pm in 2241 SEB
Office hours: Tuesday and Wednesday noon-12:30 pm or by appointment in 2241 SEB

If you have special needs for which accommodations may be needed, please inform your instructor as soon as possible. If you will be missing class due to a religious holiday, 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:

• describe the three dimensions of the Next Generation Science Standards – Disciplinary Core Ideas, Science Practices, and Crosscutting Concepts.
• 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:
  o appraising and modifying science lesson plans and activities to address a specific learning goal
  o setting up and managing small-group investigative work
  o establishing norms and routines for classroom discourse and work that are central to science (such as asking children for evidence to support their claims)
  o choosing and using representations, examples, and models of science content
  o explaining core content and supporting students in constructing scientific explanations
  o 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:
  o selecting and enacting the activities with care, including through connecting science to students’ lives
  o using scientific language in accessible and accurate ways, and helping children to do so
  o using multiple representations of the ideas and making connections between representations
  o considering a broad conception of scientific expertise
  o 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 lessons

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 the strategies discussed by the authors.

Ready, Set, Science! (abbreviated in the syllabus as RSS!) presents a discussion of reform-oriented science teaching. The book focuses on how you can incorporate scientific practices into your elementary science teaching. Written for practitioners, it includes lots of nice descriptions of effective science teaching at the elementary level. You can purchase or access Ready, Set, Science! free online: http://www7.nationalacademies.org/bose/TSS_RSS_FAQ.html.

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.

Next Generation Science Standards
The Next Generation Science Standards is a new set of standards for teaching science (released in 2013) that integrate the core disciplinary ideas in science, science practice, and cross-cutting concepts. The Next Generation Science Standards are available at 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 Framework, as this document is called, is the foundation for the Next Generation Science Standards and available at http://www7.nationalacademies.org/bose/Standards_Framework_homepage.html.
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).


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.


Washington, DC: American Association for the Advancement of Science.

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).

** 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 ED528 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. I 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 me know by e-mail by 8:00AM the day of class. Acceptable absences include absences due to religious holidays; please let me 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 me to complete alternative work that will support the learning you missed. I will specify the due date for this alternative assignment. More than two absences 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. Three absences—excused or unexcused—is grounds for failing this course. 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. 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 in class.
Science Ideas Conversation (15%)
You will plan for and conduct a conversation with another person about their science ideas around two content areas. Then, you will complete the short interpretation and reflection for the assignment. This assignment will allow us to consider how children’s prior ideas and experiences may be involved in science learning.

Peer Teaching in ED528 (three times) (35% 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”.

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 student work.

Class Policies and Additional Information

Contacting
Email is the best way to reach me. You can also call, come to my office, or leave a note in my mailbox.

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 two days after that, the work will be counted as late and your grade will be affected. 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 and Videos
You are expected to do all the reading and video viewing in advance of class. Our work in class depends on it. Readings and video other than the Zembal-Saul book at posted on Ctools.

Written and Video Assignments
For turning in your written assignments, you will use the assignment area on the CTools site. For turning in videos that accompany written assignments, you will use Edthena.

Participating in Program Evaluation and Research
You received information 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.

Accommodations for Students with Disabilities
If you have special needs for which accommodations may be needed, please inform me as soon as possible.

Class start time and procedures
Class will begin promptly at 1:10 pm, and will release at 4:00pm. We will also take a ten-minute break during the three-hour period. Please sign in and pick up materials for the class period when you arrive.

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!
## Outline of Course and Assignments

<table>
<thead>
<tr>
<th>Class</th>
<th>Topics and Goals</th>
<th>Homework: Assignments and readings due for next class (Readings in Ctools -Weekly Readings for next class)</th>
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</thead>
<tbody>
<tr>
<td>Class 1</td>
<td><strong>Introduction to Course</strong>&lt;br&gt;Goals: Begin to think about your identity as a science teacher. Introduce the course and assignments.</td>
<td><strong>Readings:</strong> Watson and Konicek; Ready, Set, SCIENCE! Ch. 5</td>
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<tr>
<td>Tues.</td>
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<td>Jan. 7</td>
<td><strong>Students’ Ideas, Facilitating Discussions</strong>&lt;br&gt;Goals: Develop strategies for finding out about and working with ideas in science. Discuss discourse moves that support students in sharing ideas and making sense during a science discussion.</td>
<td><strong>Readings:</strong> Framework Ch. 2, NGSS Executive Summary (p. 1-3); Read Appendix E, F, or G in NGSS and be ready to share&lt;br&gt;&lt;br&gt;<strong>Assignments:</strong> Science Ideas Conversation Due Sun. Jan. 12 at 10 pm&lt;br&gt;Date and subject for Reflective Teaching Lesson Due Monday Jan. 13 at 1pm</td>
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<tr>
<td>Wed.</td>
<td><strong>The 3 Dimensions, Standards, What is Science</strong>&lt;br&gt;Goals: Discuss what integrating science practice with core disciplinary ideas and cross-cutting concepts might look like in an elementary classroom as called for in the standards documents. Discuss the cyclical nature of science.</td>
<td><strong>Readings:</strong> Zembal-Saul 1, 2; 3; Read your lesson for Peer Teaching&lt;br&gt;&lt;br&gt;<strong>Video:</strong> Zembal-Saul 2.1&lt;br&gt;&lt;br&gt;<strong>Assignments:</strong> Science Ideas Conversation Due Sun. Jan. 12 at 10 pm&lt;br&gt;Date and subject for Reflective Teaching Lesson Due Monday Jan. 13 at 1pm</td>
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<td>Jan. 8</td>
<td><strong>Science Ideas Interview, Adapting Curriculum Materials</strong>&lt;br&gt;Goals: Interpret and look for patterns across learners’ ideas about science. Develop strategies for adapting curriculum materials for your learners.</td>
<td><strong>Readings:</strong> Zembal-Saul 5; ELECTS Predictions and Questions&lt;br&gt;&lt;br&gt;<strong>Video:</strong> Zembal-Saul 5.2&lt;br&gt;&lt;br&gt;<strong>Assignments:</strong> Lesson Plan Analysis for Peer Teaching Lesson Due Tuesday, Jan. 14 at 1 pm</td>
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<td>Mon.</td>
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<td>Jan. 13</td>
<td><strong>Engage Element, Investigation Questions</strong>&lt;br&gt;Goals: Discuss strategies for eliciting ideas in science and establishing an investigation question or problem. Begin planning for peer teaching lessons.</td>
<td><strong>Assignments:</strong> Engage Peer Teaching Lesson Plan Due Thurs., Jan 16 at 10 pm</td>
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<td>Tues.</td>
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<td>Jan. 14</td>
<td><strong>Engage Peer Teaching</strong>&lt;br&gt;Goals: Enact the “engage” portion of a science investigation lesson and reflect on your teaching.</td>
<td><strong>Readings:</strong> Review Zembal-Saul 5; ELECTS Observations and Investigations&lt;br&gt;&lt;br&gt;<strong>Video:</strong> Zembal-Saul 5.4&lt;br&gt;&lt;br&gt;<strong>Assignments:</strong> Engage Peer Teaching Reflection Due Sunday, Jan. 19 at 10 pm</td>
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<td>Fri.</td>
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<td>Jan. 17</td>
<td><strong>Experience Element, Observations and Investigations</strong>&lt;br&gt;Goals: Continue to develop skill in teaching a lesson involving an investigation with focus on collecting and recording data.</td>
<td><strong>Readings:</strong> NSTA Life Science or Physical Science Learning Progression&lt;br&gt;&lt;br&gt;<strong>Assignments:</strong> Experience Peer Teaching Lesson Plan Due Thursday, Jan. 23 at 10 pm</td>
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<td>Class 8</td>
<td>Experience Peer Teaching</td>
<td>Readings: Zembal-Saul 4; Ready, Set, Science! 6, ELECTS Explanations, Discussion, Representations</td>
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<td>Friday</td>
<td>Goals: Enact the “experience” portion of a science investigation lesson and reflect on your teaching.</td>
<td>Video: Zembal-Saul 4.1</td>
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<td>Jan. 24</td>
<td>Assignments: Experience Peer Teaching Reflection Due Sunday, Jan. 19 at 10 pm</td>
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<td>Class 9</td>
<td>Explain Element, Explanations and Representations</td>
<td>Assignments: Explain Peer Teaching Lesson Plan Due Tuesday, Jan. 28 at 1 pm</td>
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<tr>
<td>Monday</td>
<td>Goals: Continue to develop skill in teaching a lesson involving an investigation with focus on making sense of data and making claims based on evidence.</td>
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<td>Jan. 27</td>
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<td>Class 10</td>
<td>Explain Peer Teaching</td>
<td>Readings: Zembal-Saul 6</td>
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<td>Tuesday</td>
<td>Goals: Enact the “experience” portion of a science investigation lesson and reflect on your teaching. Continue working on how making real-world connections can help make science accessible.</td>
<td>Video: Zembal-Saul 6.1</td>
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<td>Jan. 28</td>
<td>Assignments: Explain Peer Teaching Reflection and Revised Lesson Plan with Assessment Due Thursday, Jan. 30 at 10 pm</td>
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<td>Reflective Teaching Analysis of Original Plan and Revised Lesson Plan in Template Due Friday, Jan. 31 at 10 pm.</td>
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<td>Class 11</td>
<td>Assessments and Units</td>
<td>Assignments:</td>
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<td>Friday</td>
<td>Goals: Develop skill in looking at students' written work over time. Practice assessing student work in science. Practice interacting with parents about student learning. Continue working on how making real-world connections can help make science accessible.</td>
<td>Reflective Teaching Analysis of Original Plan and Revised Lesson Plan in Template Due Friday, Jan. 31 at 10 pm.</td>
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<td>Jan. 31</td>
<td>Readings: NSTA Connections Math or ELA</td>
<td>Reflective Teaching Final Reflection with Video due Friday, Feb. 10 at 10 pm.</td>
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<td>Class 12</td>
<td>Making Connections</td>
<td>Assignments:</td>
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<td>Monday</td>
<td>Goals: 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.</td>
<td>Reflective Teaching Final Reflection with Video due Friday, Feb. 10 at 10 pm.</td>
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<td>Feb. 3</td>
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