

EDUC267E:

Development of Scientific Reasoning and Knowledge I

Stanford University, Pre-Fall 2019

Tuesdays 8/20-9/17 3:30-5:50pm CERAS 204, 9/24-10/15 1:00-2:50pm CERAS 308

Instructors

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Course Description:

Development of Scientific Reasoning and Knowledge I is the first of two courses you will take to investigate aspects of science in the elementary classroom. The course will help you integrate science into your teaching. We hope that you will see science as the wonderful, all encompassing, fascinating subject that it is and can be. Like us, our children are so interested in the world around them and they are fantastic question askers. We want to explore how we can facilitate this questioning and investigating of the world and to see what it looks like in our classrooms.

As we explore objects and phenomena, we will listen to ourselves describe, classify, explain, and predict in order to hear what scientific understanding sounds like. We will argue, use scientific models and write about our investigations as a model for what we can do with students. Our discussions will focus on how teaching can foster such understandings in children. We will also discuss how all children can wonder and think about the world we live in and the phenomena they experience every day. Unfortunately, there are many students who are marginalized in science despite their interest and creativity. Some of these learners are not given access to robust and rich science curriculum. Throughout this course, we will be focusing our lens on aspects of equity and how all students can engage in and access scientific content and practices.

In this class we will delve into the Next Generation Science Standards and their strong connections with the Common Core Standards in Math and Language Arts. The emphasis will particularly be on thinking about how we can support literacy in science education. Additionally, we will focus on how you as teachers can build up your own content knowledge.

Course Requirements

Students are required to attend classes regularly and to complete all readings prior to each class. The course will be highly collaborative, and active participation is essential. Attendance is extremely important and is required at all class meetings. Students are expected to arrive on time, refrain from leaving prior to the end of the class, and participate actively in class activities and discussions. Classes will include mini-lectures, small group activities, presentations, and discussions of key themes from the assigned readings. We expect that people will remain off of their phones and social media during class and stay focused and engaged with your classmates.

Grading Policy:

Our intention is that all teacher candidates will become more comfortable teaching science and in their own science understandings. Assignments which do not meet criteria will be returned for revision. Please communicate questions or concerns with Polly and Greses directly. We encourage you to ask for extensions in advance as needed.

Assignments:

ASSIGNMENT 1: Content Analysis of your Grade Level and your Students Due Sept 17

The goal of this assignment is to help you increase your own content knowledge in the standards for your current placement grade level. In this assignment we will ask you to both think about how you understand science content as well as creating engaging hooks and context for your particular students. You will need to give your students a pre-assessment to help you think through grade level pre and mis-conceptions held by your students about your chosen content. There are 4 parts to this assignment, parts 1-3 will be completed with other teacher candidates teaching in the same grade level as you. Part 4 will be completed individually and a final analysis will be uploaded to canvas.

ASSIGNMENT 2: Final Project Due Oct 15 on Canvas and In-class (Presentation)

The purpose of this assignment is for you to investigate a topic of your choosing which will help you to plan instruction and increase your own understanding. This is a very open ended assignment. You can interpret this in the broader sense as any context, technology, teaching moves/actions, as well as students' responses to class events. Among many possibilities, this could include a: k-12 classroom, a digital technology for teaching and learning, a strategy such as 4-corners or argumentation, specific populations of students and their scientific writing needs, etc. You should choose a setting or strategy that you have access to, such as is used in your placement or a broadly used digital application. You will submit updates of your project for feedback. Once you have received feedback for your project you should begin conducting observations, gathering data, talking with others (e.g. students, teachers, administrators, support people, community members) and reading about it. We strongly encourage you to use the class readings as you think about your project. Examples of data you could collect include but are not limited to: Lesson plans, student work, screenshots of digital platforms for learning, student reports, teacher and student interviews, surveys, observations etc. Final projects can take any form: for example videos, demonstrations, posters, written papers, presentations, art pieces. We will share projects in small groups on the last day of class.

Proposal idea by week 2: Due 8/27

Feedback returned by week 3: 9/4

Update 1, week 4: Due 9/10

Update 2, week 7: Due 10/01

Sample projects are included on canvas. Previous projects have included: Analysis of student language use in their science talk, connections your school has between support personnel and science class, professional development opportunities in the Bay Area, drawings of "What is a scientist?" from kinder students, connections between a school garden program and the NGSS standards.

ASSIGNMENT 3: Group Discussion Facilitation (variable dates)

This assignment provides students with practice in engaging others in productive discussions based on the class readings for the week. Students will work in small groups to facilitate the discussion of one of the assigned readings. Please make sure to meet with the TA at least a week in advance of your presentation. Students should pose relevant guiding questions, facilitate group discussion, and make explicit connections between their selected reading, relevant course topics, and placements. Students should form groups and select week on the first day of class. More detailed guidelines are available on Canvas.

HONOR CODE:

Students are expected to adhere to Stanford's honor code. According to the Office of Judicial Affairs (OJA) website, "For purposes of the Stanford University Honor Code, plagiarism is defined as the use, without giving reasonable and appropriate credit to or acknowledging the author or source, of another person's original work, whether such work is made up of code, formulas, ideas, language, research, strategies, writing or other form(s)."

For further information, please consult the OJA website:

<http://www.stanford.edu/dept/vpsa/judicialaffairs/students/plagiarism.sources.html>

STUDENTS WITH DOCUMENTED DISABILITIES:

Students who may need an academic accommodation based on the impact of a disability must initiate the request with the Office of Accessible Education (OAE). Professional staff will evaluate the request with required documentation, recommend reasonable accommodations, and prepare an Accommodation Letter for faculty dated in the current quarter in which the request is made. Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations. The OAE is located at 563 Salvatierra Walk (phone: 723-1066, URL: <http://studentaffairs.stanford.edu/oae>).

SUGGESTED TEXT: (But mostly because we think it is a great reference for later)

Questions, Claims and Evidence: The Important Place of Argument in Children's Science Writing. Edited by: Brian Hand, Lynn Hockenberry, Kim Wise and Lori Norton-Meier. NSTA press book, 2008. All readings will be provided on the Canvas course site.

DETAILED SESSION INFORMATION (All of this is on canvas linked to each specific day)

Session 1: HOW DO I THINK AND BEHAVE AS A SCIENTIST?, Aug 20, CERAS 204, 3:30-5:50

Questions/Goals for Today

What is a scientist? How can we make scientific practices more authentic and inclusive?
Equity Focus: Access to science matters.

Tasks/Class Activities

1. Unpacking the Scientific Practices
2. Practice: Asking questions (using plants and seeds)
3. Introduction to the frameworks we will use in class.
4. Using nature journals as a practice of observation
5. Review syllabus, hand out assignments.

NSTA probes: Needs of Seeds

Readings

A Framework for k-12 Science Education. Chapter 3, pp 41-53. National Academies Press.
Overview of the practices: Watch Asking Questions /Designing Problems and Planning and Carrying Out Investigations

<http://www.bozemanscience.com/next-generation-science-standards/>

Assignment Updates

Read assignments 1 and 2. Consider what you are interested in and what you might like to do for your final project as well as the content you would like to think about for assignment 1.

Session 2: PRIOR KNOWLEDGE Aug 27 CERAS 204, 3:30-5:50

Questions/Goals for Today

How can we use pre assessment and children's questions to assess what they are already bringing to the classroom? How can we as teachers ask better questions? How do we develop objectives based on pre-assessment?

Equity Focus: Funds of Knowledge

Tasks/Class Activities

1. Who do we know what our students know? Where did they develop that knowledge?
2. Introduction to NSTA probes.
3. Practice: Planning and carrying out investigations. What do seeds need to grow? Seed dissections.
4. Assignment questions look at rubrics.
NSTA probe: Giant Sequoia

Readings

Moll, Cathy et al. "Funds of Knowledge for Teaching: Using a Qualitative Approach to Connect Homes and Classrooms". Theory into Practice, Vol. 31, No. 2, Qualitative Issues in Educational Research (Spring,1992), pp. 132-141

Keeley, P. Eberle, F., and Dorsey, C. (2005). "Introduction." Uncovering Student Ideas in Science: Another 25 formative assessment probes, Volume 3, pp 1-11. NSTA Press.

California Science Framework. <https://www.cde.ca.gov/ci/sc/cf/cascienceframework2016.asp>
California Science Standards. <https://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp>

Assignment Updates

Assignment 2: Write a brief prospectus, 1 paragraph, about your idea.
Read assignment 1 and 2. Come with questions.

Session 3: ASKING QUESTIONS AND DESIGNING INVESTIGATIONS Sept 3 CERAS 204, 3:30-5:50

Questions/Goals for Today

What is the big idea? How can we pick the deeper underlying understanding behind the science topics we want to teach?

Equity: How do we define equity in our classroom?

Tasks/Class Activities

1. Designing and planning investigations. How are your seeds?
2. Writing big ideas, creating a rubric and analyzing data.
3. Worktime – pre-assessment design practice (rocks or environment) and questions
4. Choosing probes

Readings/Questions

Elstgeest, Jos. "The Right Question at the Right Time."

Jelly, Shelia. "Helping Children Raise Questions and Answering them."

Assignment Updates

Assignment 1: Continue to complete template.

Assignment 2: Continue working on your final project

Session 4: FIELD BASED SCIENCE Sept 10 Jasper Ridge

Questions/Goals for Today

How can we use our local area to develop a sense of place?

Equity focus: How can field based science teaching advance social and environmental justice?

Tasks/Class Activities

Field Trip to Jasper Ridge (check google doc for carpools – wear closed toed shoes & bring water)

1. Science: Ecology
2. Scientific Practices: Inquiry, designing and carrying out an investigation.
3. Nature journaling: mapping and sense of place

Readings

[John Muir Laws Nature Journaling Curriculum](#), available as a free download. Please download and check out this wonderful resource.

[About the Jasper Ridge Biological Preserve](#)

Assignment Updates

Continue working on Assignment 1 and 2 as needed.

Session 5: HANDS ON SCIENCE & ENGINEERING, Sept 17 CERAS 204, 3:30-5:50

Questions/Goals for Today

What are we talking about? How can we use anchoring experiences that all students have and then build out from there?

Equity Focus: Who gets to do hands on science?

Tasks/Class Activities

1. Discuss context commentary and review big ideas.
2. Science: Engineering
3. Practices: Designing solutions
4. Mini Lesson: Integrating Engineering into your classroom?
5. Worktime: Science statement and sharing resources

Readings/Questions

Select two of the following NSTA brief articles:

Sneider, C. (2012). Core Ideas of Engineering and Technology: Understanding A Framework for K-12 Science Education

Meeteren, B.V. (2018). Elementary Engineering: What is the focus?

Martin, S., Sharp, J., & Zachary, L. (2004) Thinking Engineering

Assignment Updates

Work on your final assignment. Assignment 1 due today. Upload to Canvas.

Session 6: CULTURAL EXAMPLES OF SCIENCE INSTRUCTION/Reflection Day Sept 24 CERAS 308, 1-2:50

Questions/Goals for Today

Tasks/Class Activities

Connection of previous work and readings to your own experiences.
Mindfulness

Reading

Bang, M., Medin, D.L., & Atran, S. (2007). Cultural mosaics and mental models of nature. Proceedings of the National Academy of Sciences, 104 (35), 13868-13874.

Pick one of the following:

Quigley, C., Cook, K.L., Escobedo, A., and Buck, G. (2011) All About Me/All About Gary: Kindergartens use cameras to share the results of their localized research.

Eick, C., Tatarchuk, S., & Anderson, A. (2013) Vision + Community = Outdoor Learning Stations: Local partners can provide the expertise, labor and even funding to transform your school's outdoor areas into outdoor learning stations

Slowing down to Learn: Mindful pauses that can help student engagement. KQED Media.

Assignment

None due today.

Session 7: TALKING SCIENCE, Oct 1 CERAS 308, 1-2:50

Questions/Goals for Today

What does academically productive talk look like in science? How can I create a learning environment where students can engage in academically productive talk?

Equity focus: Ensuring equitable small group discussions

Tasks/Class Activities

1. Science (fishbowl using talk moves)
2. Scientific Practices: Obtaining, Evaluating and Communicating information
3. Productive talk moves, setting discussion norms, and equitable small group discussions
4. Worktime: What questions did your students have in their pre-assessment? How can you use this to consider planning and engagement?

Readings

Gallas, Karen. Chapter 8. Building a Curriculum from Children's Questions. Pp. 69-81

Talk Moves

Osborne & Patterson. Argumentation.

Assignment Updates

Submit an update on the status of your project (what you have done so far up to this point). Bring in your student work!!!

Session 8: READING AND WRITING SCIENCE, Oct 8 CERAS 308, 1-2:50

Questions/Goals for Today

Why is it important to support and focus on literacy during science?

What does it look like and how can we support it across the grade levels?

Equity focus: Teaching students how to read science texts **is** equitable science instruction.

Tasks/Class Activities

Difficulties of science texts

Framework for teaching reading in science

The science writing heuristic. Using evidence and claims to write scientific understandings

Video: High Quality science teaching

Readings/Questions

Lee, Quinn and Valdez.

Question, Claims and Evidence.

Find the common core standards for reading. Look under "Reading Informational Texts" for your grade level. Link to Common Core ELA.

Assignment Updates

None

Session 9: WRAPPING UP AND PRESENTATIONS October 15, CERAS 308, 1-2:50

Questions/Goals for Today

What have we learned about scientific literacy (integrating reading, writing, talking, and doing science) and equity? How will you apply what you have learned to your teaching next quarter? What will next quarter look like in STEP science?

Equity Focus: What barriers exist in your classroom for science participation?

Tasks/Class Activities

Presentations of final projects

Equity Reflection

Concept mapping and applying what we have learned to our teaching

Readings/Questions

NO reading for today, resources listed on canvas

Assignments

UPLOAD FINAL PROJECT (and/or link) to CANVAS and final project google doc