ED 267D | Spring 2026 Elective
CURRICULUM & INSTRUCTION IN SCIENCE

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Course Overview
This course will focus on preparing pre-service teachers to transfer their current understanding of teaching in one subject matter to the specific pedagogical strategies used in teaching science. We expect that teachers in this course will not necessarily be subject matter experts, therefore they will be drawing on their experience as teachers to apply their understanding to the exciting and wonderful ideas of science. We hope that our teacher candidates might be able to use this course in many ways: to get an additional credential in science, to develop and consider how to teach integrated units connected to science, and/or to increase their knowledge about a different way of thinking as a scientist.

In this intensive introduction to the teaching of science we expect students:

- To read and interpret the Next Generation Science Standards (NGSS) in order to effectively plan learning experiences in science content.
- To design and present their rationale for teaching a lesson plan in a scientific area, which eventually, would lead to planning learning segments and unit plans based on students' skills, backgrounds and needs.
- To analyze and assess pre-assessments for/of student learning in an effort to create, revise and improve their classroom instruction.
- To compare and contrast the teaching of science with their understanding of teaching in another content area.
- To consider how their own positionality affects their teaching practice and what this looks like in science classes.
- To connect science to social justice and sense of place in order to support student engagement.

Course Expectations
This course is designed to create a collegial culture in which we can all learn from one another. To facilitate this culture, we expect everyone to come to class having completed the readings for that session and to be prepared to participate in activities and discussions. Candidates are expected to demonstrate the same level of professionalism as demanded of any credentialed teacher with respect to time management, communication, and integrity. We also expect people to listen carefully and respectfully to their colleagues. Our collective engagement in class activities and discussions will facilitate your learning; we therefore assume regular attendance. All assignments will be used in class on the day they are due, so you will need to have them ready to upload by the start of class.

Course Assignments (due for use in class on the date listed)

Teach us something assignment	**Day will vary (Tuesdays, sign up)**
Cross Content Observation	**Tuesday May 12, Week 7**
Final Project	**Tuesday June 2, Week 10**

Meeting Times

Class will meet for 10 consecutive weeks on Tuesdays in the block of time between 3:15-7:15pm in CERAS 308; March 31 - June 2, 2026. We may plan one additional optional class period at Jasper Ridge Biological Preserve.

Grading

Our expectation is that everyone will achieve mastery of the material taught in the course. To that end, we will invite you to revise and resubmit assignments in a timely manner if mastery is not the outcome upon the first submission. The other major component of the grade is participation and engagement during class time. Please read each week's reading carefully and fully before coming to class and have it readily accessible during each class. Assignment extensions will be granted, if requested.

Students with Documented Disabilities

Stanford is committed to providing equal educational opportunities for disabled students. Disabled students are a valued and essential part of the Stanford community. We welcome you to our class.

If you experience disability, please register with the Office of Accessible Education (OAE). Professional staff will evaluate your needs, support appropriate and reasonable accommodations, and prepare an Academic Accommodation Letter for faculty. To get started, or to re-initiate services, please visit **oae.stanford.edu**.

If you already have an Academic Accommodation Letter, we invite you to share your letter with us. Academic Accommodation Letters should be shared at the earliest possible opportunity so we may partner with you and OAE to identify any barriers to access and inclusion that might be encountered in your experience of this course.

Honor Code

The Honor Code is an undertaking of the students, individually and collectively:

- that they will not give or receive aid in examinations; that they will not give or receive unpermitted aid in class work, in the preparation of reports, or in any other work that is to be used by the instructor as the basis of grading;
- that they will do their share and take an active part in seeing to it that others as well as themselves uphold the spirit and letter of the Honor Code.

The faculty on its part manifests its confidence in the honor of its students by refraining from proctoring examinations and from taking unusual and unreasonable precautions to prevent the forms of dishonesty mentioned above. The faculty will also avoid, as far as practicable, academic procedures that create temptations to violate the Honor Code.

While the faculty alone has the right and obligation to set academic requirements, the students and faculty will work together to establish optimal conditions for honorable academic work.

COURSE CALENDAR

Date	Topic	Readings for this class
Day 1: 3/31	**Introductions** **How do we know what we know?** - How is scientific thinking different? - Goals for ourselves and the course - Science time - how do we know? And creating a sense of place - How are the current science standards organized and how do you read them? - Nature Journaling and Setting up a notebook	Before class: Choose one to read, listen to or watch. Read Asters and Goldenrods by Robin Wall Kimmerer (9 pages) Watch: Gifts of the Land: A guided nature tour with Robin Wall Kimmerer (20 min video) Listen On Being: Intelligence in all kinds of life with Robin Wall Kimmerer (50 min podcast - listening to ½ will give you the general idea) Resources for later: How to Read the Next Generation Science Standards. Video resource http://www.nextgenscience.org/resources/how-read-next-generation-science-standards After Class: Review the section of the chapter of the recently adopted CA State Science standards that you are most interested in. Chapter 7: Three course model The Living Earth pg 11-122 Chemistry in the Earth System pg 123-219 Physics in the Universe pg 220-343 Chapter 5: Middle School, integrated science Nature Journaling Curriculum: Free curriculum available for download, also instructional videos and resources
Day 2: 4/7	**Why and how to teach Science?** - How have the opinions of teachers and society changed over time and changed our focus on how and what to teach in science classrooms? - Science Time: Climate Change - A vision for science instruction, your own positionality and one idea of how through Ambitious Science Teaching Assignment: Plan for my final project and sign up for a teach day	Alexis Patterson & Salina Gray (2019) Teaching to Transform: (W)holistic Science Pedagogy, Theory Into Practice, 58:4, 328-337, DOI: 10.1080/00405841.2019.1626616 Osborne, J., & Pimentel, D. (2022). Science, misinformation, and the role of education. *Science*, *378*(6617), 246-248.DOI: 10.1126/science.abq8093 Resources for later or if you want more: Two practitioner articles based on the WSP: Moreno, C. 16 February 2022. My students wanted hope in the curriculum. I found the answer in wholistic science pedagogy. EdSurge.

		Patterson Williams, A and Gray, S., September/October 2021. (W)holistic Science Pedagogy: Teaching for Justice. The Science Teacher. Ambitious Science Teaching - An Overview Climate Change Resources (in class and also if you want to review in advance) Stem Teaching Tool. Brief 12. Scientific literacy involves understanding global climate change and what people can do about it. https://stemteachingtools.org/brief/12 Stem Teaching Tool. Brief 84. Let's talk climate! Bridging climate justice learning and action across school, home and community. https://stemteachingtools.org/brief/84
Day 3: 4/14	**Asking Questions: Context in Science** - What do students wonder about science in their everyday lives? - How does where we are and what we already know affect our science learning? -How do we choose effective phenomena? -Science Time: GMOs (in class resources: NY Times Article BigPurpleTomato)	These first two readings are both about the Question Formulation Technique, but with slightly different formats, read until you feel like you have a good idea about how QFT works: ● The Right Questions. By Dan Rothstein and Luz Santana. Educational Leadership. ● NPR Story: How Helping Students To Ask Better Questions Can Transform Classrooms. Published 5/21/18 Additional Resources: Reiser, B. J., Brody, L., Novak, M., Tipton, K., & Adams, L. (2017). Chapter 5: Asking questions. *Helping students make sense of the world using next generation science and engineering practices*, 87-108. Using Phenomenon in NGSS – linked, from the NGSS website

Day 4: 4/21	**How does it all fit together? Cross cutting Concepts and Disciplinary Core Ideas:** - How are the 3 dimensions of science woven together to make a stronger science education? - Why is it important to know the wrong answers? or How can you find the right in the wrong answers? -What is the role of backwards planning in science? -How can we overcome some of the inherent biases in the standards to teach better science?	Daniel Morales-Doyle, Tiffany Childress Price, Mindy J. Chappell. Chemicals are contaminants too: Teaching appreciation and critique of science in the era of Next Generation Science Standards (NGSS), Science Education, 10.1002/sce.21546, 103, 6, (1347-1366), (2019). Wiley Online Library A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Peruse Chapter 4: Dimension 2 Cross Cutting Concepts NPR Story: Why Teachers Need to Know the Wrong Answers? Additional Resources: Bang, M., Brown, B., Barton, A. C, Rosebery, A., & Warren, B. (2017). Chapter 3: Toward more equitable learning in science: Expanding relationships among students, teachers, and science practices. *Helping students make sense of the world using Next Generation Science and Engineering Practices*, p 33–58.
Day 5 4/28	**Language and Literacy in Science:** - How do we support the development of scientific literacy? - What are some reading strategies we can use to support our students as they read scientific text? - What are the 'talk moves' and how can we utilize them in our classroom -Interdisciplinary Connections (climate change and novels) (Poetry/writing nature journaling)	Both of these papers also have a video version by Alexis. Please read or watch. Alexis D. Patterson Williams Jennifer M. Higgs Steven Z. Athanases, (2019). Noticing for Equity to Sustain Multilingual Literacies, https://doi.org/10.1002/jaal.1025 Alexis D. Patterson Williams, Chauncey Monte-Sano. (2020) Sustaining Disciplinary Literacy in Science: A Transformative, Just Model for Teaching the Language of Science. *Journal of Adolescent & Adult Literacy* 64:3, pages 333-336. https://doi.org/10.1002/jaal.1100 Burnett, Veronica. (2018) Edsurge. How the 5 E Model Makes Science Meaningful for Bilingual Students Talk Moves

Day 6 **5/5**	**Modeling and Interpreting Data:** - What is considered a model in science? - When do we interpret data in real life? What counts as data? - What limitations of models? Plus a bit on **Planning and Organizing Investigations**	Modeling: Allowing Students to Show What they Know. Tools for Ambitious Science Teaching. Rivet, A., & Ingber, J. (2017). Chapter 8. Analyzing and interpreting data. *Helping students make sense of the world using next generation science and engineering practices*, 159-180 Passmore, C., Schwarz, C. and Mankowski, J. (2017) Chapter 6: Developing and Using Models. *Helping students make sense of the world using next generation science and engineering practices*, 109-134
Day 7: **5/12**	**Discourse and Argumentation:** - Why argumentation and why in science? - Why is it important to look at misconceptions and to talk in science? Assignment Due: Cross Content Observation	Berland, Leema, Katherine McNeill, Pamela Pelletier and Joseph Krajcik. (2017) Chapter 11: Engaging in Argument from Evidence. *Helping students make sense of the world using next generation science and engineering practices*, 229-258 TedED: Derek Muller, The founder of Veritasium. Video series. http://ed.ted.com/on/rTahZlkM#watch Additional Resources: The Argumentation Toolkit
Day 8: **5/19**	**Investigations with Anything** **What does inquiry look like when you are asking your own questions?** - What types of problems can we solve with science and engineering? - How can we facilitate activities for answering a scientific question or proposing a solution to a problem? Science time: Nature journaling - experimental design	Windschitl, Mark, C. (2017). Chapter 7. Planning and carrying out investigations. *Helping students make sense of the world through next generation science and engineering practices*, 135-158 Pathways to Learning. Exploratorium.

Day 9: 5/26	**Science and Society:** - What is going on with science and society? - When do we think about science and how does this connect to scientific literacy and why it would be important? - Where do people learn science outside the classroom? -How can we use our instruction to support anti-racist and gender inclusive content and language?	Sheth MJ. (2018) Grappling with racism as foundational practice of science teaching. Science Education.. 2018;1–24. https://doi.org/10.1002/sce.21450 Davis, Lea. (17 March, 2021) Human Genetics Needs an Anti-Racism Plan. Scientific American. Long, S., Steller, L. and Suh, R. (Sept/Oct 2021.) Gender Inclusive Biology: An Inclusive Framework. The Science Teacher. Long, S. Stellar, L., Suh, R. Butler, K and Slattery, K. (June 2021) How do we present gender, sex, and sexuality as part of inclusive and accurate science teaching? STEM Teaching Tools. https://stemteachingtools.org/brief/76 Additional Resource: Falk, J., & Dierking, L. (2010). The 95 Percent Solution: School is not where most of Americans learn most of their science. American Scientist, 98, 486-493. Vedantam, Shankar. (March 14, 2017) Why piling on facts may not help in the battle against fake news. (audio news story) NPR.
Day 10: 6/2	**Lesson Plan Project Sharing** **Assignment Due: Final unit/lesson project**	Madkins TC, McKinney de Royston M. Illuminating political clarity in culturally relevant science instruction. Science Education. 2019;103:1319–1346. https://doi.org/10.1002/sce.21542 https://onlinelibrary.wiley.com/doi/pdf/10.1002/sce.21542 Final project due