ED 267D | Spring 2021 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 - especially with distance learning, 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	**Days will vary**
Video analysis	**In class (if you miss class there will be makeup)**
Final Project (plus sharing on last day)	**June 1**

Meeting Times

Class will meet for 10 consecutive weeks on Tuesdays in the block of time between 3:30-6:20pm over Zoom; March 30 - June 1, 2021. There will be both synchronous and asynchronous activities for each class session.

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

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). Students should contact the OAE as soon as possible since timely notice is needed to coordinate accommodations.

Honor Code

1. The Honor Code is an undertaking of the students, individually and collectively:
    a. 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;
    b. 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.
2. 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.
3. 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.

Violations of the Honor Code

Examples of conduct that have been regarded as being in violation of the Honor Code include:

- Copying from another's examination paper or allowing another to copy from one's own paper
- Unpermitted collaboration
- Plagiarism
- Revising and resubmitting a quiz or exam for regrading, without the instructor's knowledge and consent
- Giving or receiving unpermitted aid on a take-home examination
- Representing as one's own work the work of another

- Giving or receiving aid on an academic assignment under circumstances in which a reasonable person should have known that such aid was not permitted

COURSE CALENDAR

Date	Topic	Readings for this class
Day 1: 3/30	**Introductions** - 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?	None for before class 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
Day 2: 4/6	**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 - 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 Ambitious Science Teaching - An Overview

Day 3: 4/13	**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?	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 This podcast talks about our relationship with place from an indigenous perspective, you can also find something else to read about Kimmerer: Podcast: NPR'S ON BEING: Robin Wall Kimmerer — The Intelligence of all Kinds of Life | ON BEING Additional Resources: Barton, A. C. (2002). Urban science education studies: A commitment to equity, social justice and a sense of place, Studies in Science Education, 38(1), 1-37. (Pretty long – skim this one and LOOK at the chart of page 8) 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 Brown, J.; Collins, A.; and Duguid, P. (1989) Situated Cognition and the Culture of Learning. Educational Researcher, 18, 32-41.
Day 4: 4/20	**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?	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? 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 **4/27**	**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	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 **5/4**	**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?	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: 5/11	**Discourse and Argumentation:** - Why argumentation and why in science? - Why is it important to look at misconceptions and to talk in science?	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: 5/18	**Planning and Carrying out Investigations** - 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?	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
Day 9: 5/25	**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?	Genomics Literacy Matters. Biological Sciences Curriculum Studies, Brian Donovan study on genetics curriculum. https://vimeo.com/370945475 (focus on the first 15 minutes, but by all means watch all if you would like), here is a link to the paper it is based on if you like reading instead Sheth MJ. Grappling with racism as foundational practice of science teaching. Sci Ed. 2018;1–24. https://doi.org/10.1002/sce.21450 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. NPR. March 14, 2017. Why piling on facts may not help in the battle against fake news. (audio news story)

Day 10: 6/1	**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

Add

Learning in Places?

Sheth MJ. Grappling with racism as foundational practice of science teaching. Sci Ed. 2018;1–24. https://doi.org/10.1002/sce.21450

Patterson, A., Morrison, D., & Schindel, A. (2017). What's science got to do with it? Possibilities for social justice in science classroom teaching and learning. In S. M. Pennell, A. S. Boyd, H. Parkhouse, & A. LaGarry (Eds.), *Possibilities in practice: Social justice teaching in the disciplines* (pp. 145–158). New York, NY: Peter Lang Publishing, Inc. (article in a book - can we get a chapter?)

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

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 Patterson & Salina Gray (2019) Teaching to Transform: (W)holistic Science Pedagogy, Theory Into Practice, 58:4, 328-337, DOI: 10.1080/00405841.2019.1626616

Bang, M., Brown, B., Barton, A. C, Rosebery, A., & Warren, B. (2017). 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 (pp. 33–58). Arlington, VA: National Science Teachers Association

Boutte, G., Kelly-Jackson, C., & Johnson, G. L. (2010). Culturally relevant teaching in science classrooms: Addressing academic achievement, cultural competence, and critical consciousness. International Journal of Multicultural Education, 12(2), https://doi.org/10.18251/ijme.v12i2.343

Medin, D. L., & Bang, M. (2014). Who's asking?: Native science, western science, and science education. Cambridge, MA: MIT Press

Paris, D. (2012). Culturally sustaining pedagogy: A needed change in stance, terminology, and practice. Educational Researcher, 41(3), 93–97. https://doi.org/10.3102/0013189X12441244

Rodriguez, A. J. (2017). How do teachers prepare for and respond to students' evoked emotions when addressing real social inequalities through engineering activities? Theory Into Practice, 56, 263–270. https://doi.org/10.1080/00405841. 2017.1350497

Tuck, E., & Yang, K. W. (2018). Toward what justice? Describing diverse dreams of justice in education. New York: Routledge.

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

Bryan A. Brown (2019) Science in the City: Culturally Relevant STEM Education

Daniel Morales-Doyle, Maria Varelas, David Segura, Marcela Bernal-Munera, Access, Dissent, Ethics, and Politics: Pre-service Teachers Negotiating Conceptions of the Work of Teaching Science for Equity, Cognition and Instruction, 10.1080/07370008.2020.1828421, (1-30), (2020).

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

Alberto J. Rodriguez, Deb Morrison, Expanding and enacting transformative meanings of equity, diversity and social justice in science education, Cultural Studies of Science Education, 10.1007/s11422-019-09938-7, (2019).
Crossref

Daniel Morales-Doyle. Justice-centered science pedagogy: A catalyst for academic achievement and social transformation, 2017, https://doi.org/10.1002/sce.21305