Stanford | GRADUATE SCHOOL OF EDUCATION *Syllabus*

EDUC 267 b Fall C&I
The Art & Joy of Lesson Planning

	COURSE INFORMATION
	Curriculum and Instruction in Science Education Tuesdays CERAS 300 Course Website: http://canvas.stanford.edu 3:15pm- 5:50pm

INSTRUCTOR INFORMATION	
Bryan Brown, Ph.D. *Associate Professor – Science Education* Office: 228 CERAS (650) 725-4662 brbrown@stanford.edu Office Hours: by appointment	**Elizabeth Harris** *Science Educator & Ph.D. Candidate* harrislz@stanford.edu Office Hours: by appointment

COURSE GOALS

This course will focus on preparing pre-service teachers to plan learning segments and curricular units to be used for science teaching. The course is designed to achieve the following goals:

- To prepare all students to design learning segments based on their understanding of students' skills, backgrounds and needs,
- To prepare all pre-service teachers to design lesson plans, learning segments, and curricular units that create deeply integrated learning segments that enable students to understand and apply their conceptual understanding, and
- To prepare all students to analyze and assess the impact of their planning strategies on student learning in an effort to revise and improve their instructional performance.

COURSE OVERVIEW

The process of teaching is more complicated than it may appear. Very few of the intricate details of teaching are visible to the common observer. Teachers make hundreds of decisions everyday. As a science teacher you will develop a theoretical framework for effective science teaching and learn how to translate that framework into instructional decisions. The summer quarter of C&I series placed an emphasis on

planning for instruction. This quarter will focus on creating learning segments especially designed for your students. During this quarter, we will work between theory and practice, and between individual aspects of teaching and the whole group learning.

In this way, the fall quarter differs from traditional science courses where you "finish" a topic and move on. During this quarter, you will explore the iterative process that is teaching and learning. We will focus on the iterative process of teaching by planning learning segments and revising them as we come to understand their effectiveness. We will also learn new concepts and revisit them as we come across alternative understandings. In this sense, our planning and learning will involve constant revision and reflection on new concepts and instructional strategies. This approach is designed to model the instructional cycle that includes *Planning, Teaching, Analyzing, Adjusting, and Reevaluating*.

Using this cyclical instructional approach will enable us to truly integrate our learning experiences with the experiences we are gaining as interns. Our weekly working sessions will enable us to build a strong connection between our practical and theoretical education. To highlight this process we have implemented four themes for our course:

Theme #1: *Teaching as Cycles*
Teaching is a nested set of teaching cycles where you plan, teach and assess, analyze, and adjust, and plan again.

Theme #2: *The Planning Junction*
Decisions about teaching require an interrelated knowledge of students, subject matter, and logistics.

Theme #3: *Meaningful Participation*
Successful science teaching requires the development of a classroom culture that promotes participation in meaningful ways.

Theme #4: *Iterative Science Instruction*
Science is an iterative process of observing/taking data, finding patterns in the observations, and explaining the patterns (*see the theme diagrams below*).

Reviewing these themes suggests that successful teaching requires development of a balance of knowing **what** to teach, knowing **how** to teach, and knowing **how to assess** students' learning. In order to

accomplish this, teachers must develop a dynamic understanding of classroom learning that integrates knowing the subject matter, skillfully using assessment, and creating productive learning communities.

Knowing subject matters and how to teach them

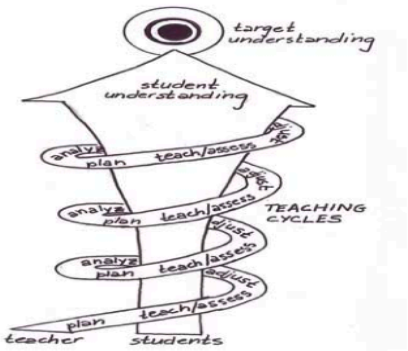
We review this issue of identifying what big ideas of science you will choose to teach and how you can have students apply these ideas. In doing this you may find yourselves reorganizing your own understanding of science so that it is more useful for you as a teacher. Then we will consider how to teach. You will have many opportunities to work through teaching cycles where you plan, teach and assess, then reflect and adjust your teaching. In this course our semester will be centered on planning a single unit.

Assessing and working with students

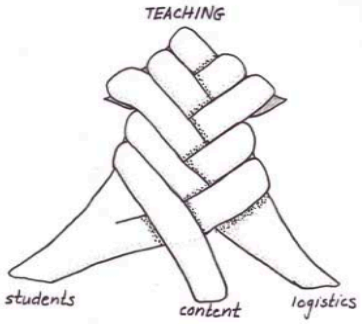
Through your field experience, you will have opportunities to work with many students, many of whom will be different from the student that you were. You will learn how to assess students' understanding every time you teach and how to plan lessons taking into account how and what students are learning. You will have to observe individual students and gain insight about their understanding of science and what their social issues are.

Creating and managing a learning community

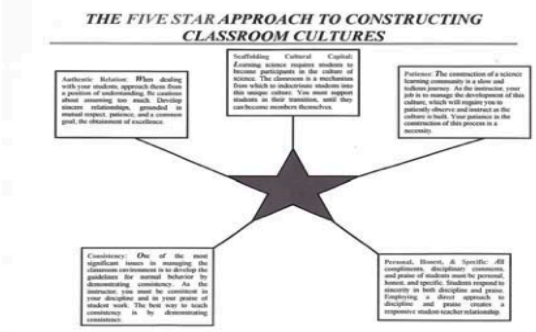
We will work on understanding what makes individual students tick and identify routines and policies that support a well-managed classroom. Management and motivation will be issues that we address every time we consider a new teaching technique. We will identify how many aspects of teaching affect management and the quality of a classroom learning community.



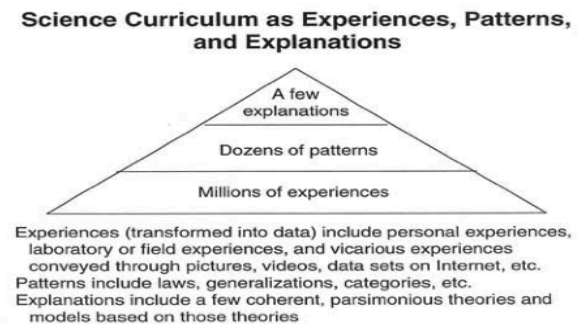
Teaching is a nested set of teaching cycles where you plan, teach and assess, analyze and adjust, and plan again. This approach requires more work than copycat teaching or teaching without planning, but it will enable you to learn from and adapt to any situation you encounter during your teaching career.



Decisions about teaching require knowledge of students, subject matter, and logistics. In your field and lab experiences, all three aspects are at play all of the time and you will learn how to look for each aspect. In class we will work on these aspects separately before you learn to weave them together.



Successful science teaching requires the **development of a classroom culture that promotes participation** in meaningful ways. The challenge of managing students' behavior, while nurturing a rich communicative environment becomes an important component of your instructional objectives. This complicated task requires a



Science is an iterative process of observing/taking data, finding patterns in the observations, and explaining the patterns. We need to teach all of the scientific process.

***Special Thanks to Dr. Joyce Parker & Dr. Any Anderson for the above images*

'Doing' towards understanding

In addition to our emphasis on these basic themes of teaching, we will organize this course around three basic tasks. First, you will continue to collect and use multiple sources of information to pre-assess students in an order to design an effective student-learning environment. To do this you will complete a

detailed analysis of your students that includes video-based analyses of students' engagement and students' learning.

Second, you will demonstrate your understanding of how to design learning segments by creating a detailed lesson plan for a single lesson plan. This lesson plan will be designed to reflect your students' interest, prior knowledge, and skills.

Third, you will design a complete unit plan that provides a detailed plan for an extended series of lesson plans. This unit plan will provide a detailed map of how to plan to engage students in fruitful learning activities that extend over several days of instruction. There are 7 assignments this quarter:

ASSIGNMENTS CALENDAR

#	DESCRIPTION	Assigment Discussion Date	Due Date
1	Assignment #1: Response to The Syllabus	*Discussed 9/23/2025*	9/30/2025 3:00pm
2	Assignment #2: 60 -Minutes Lesson Plan	*Discussed 9/30/2025*	10/7/2025 3:00pm
3	Assignment #3: Learning Newsletter	*Discussed 10/7/2025*	10/14/2025 3:00pm
4	Assignment #4: 90- Minute Converted NGSS Lesson Plan	*Discussed 10/21/2025*	10/28/2025 3:00pm
5	Assignment #5: Social Justice or Culturally Relevant Pedagogy LP	*Discussed 10/28/2025*	11/4/2025 3:00pm
6	AI Lab Teaching Project	*Discussed 11/4/2025*	12/2/2025 3:00pm

Assignment #1: Response to the Syllabus

This initial assignment is designed to help you engage deeply with the structure and goals of the course. You will carefully review the syllabus, including the descriptions of all major assignments, and write a one-page summary of your reflections. Your response should highlight your understanding of the themes of lesson planning, the big ideas emphasized in the course, and the broader goals of effective instructional design. As part of your reflection, please address the following guiding questions: (1) What are the core themes of the course, and how do they align with your personal goals as an instructor? (2) How do the lesson plan assignments support your development as a lesson designer? (3) After reviewing the assignments and readings, what

remains unclear, and what would you like clarified? (4) What additional aspects of lesson planning are you interested in exploring? This assignment will be evaluated on the clarity of your writing, the depth of your reflection, and the degree to which you engage thoughtfully with the course objectives.

Assignment #2: 60-Minute Lesson Plan

For this assignment, you will design and submit a complete 60-minute lesson plan that demonstrates your ability to organize meaningful learning experiences. Your plan should begin by identifying the appropriate Next Generation Science Standards (NGSS) that align with the lesson's goals. You must also include a clear list of required instructional materials to ensure that the lesson can be effectively implemented. The heart of this assignment is the instructional agenda, which should provide a detailed, time-specific breakdown of activities and learning tasks. Be sure to describe how each activity contributes to student understanding and skill development. Additionally, include a detailed outline of instructional needs, such as technology, classroom setup, or differentiation strategies. The lesson plan will be evaluated on its alignment with standards, the clarity and feasibility of the instructional sequence, and the degree to which the activities are purposeful, engaging, and developmentally appropriate for students.

Assignment #3: Learning Newsletter

This assignment focuses on translating key concepts of learning theory into a format that is accessible, engaging, and informative. Drawing on assigned course readings, you will create a two-page, visually appealing newsletter intended for your future students. The newsletter should explain central ideas about how learning works and illustrate why these ideas matter in the classroom. Your task is to communicate not only what students will be asked to do but also why those activities are designed to promote learning. For example, you might highlight the role of active engagement, practice, or collaboration in deepening understanding. The newsletter should balance scholarly accuracy with student-friendly language, making complex concepts clear without oversimplifying them. Visual design, such as layout, graphics, or images, should support comprehension and engagement. This assignment will be evaluated on the clarity of explanations, the integration of course readings, and the overall design quality, including both organization and creativity.

Assignment #4: 90-Minute Converted NGSS Lesson Plan

For this assignment, you will select an existing science lesson from a reputable online source and adapt it into a 90-minute lesson using the Cognitive Apprenticeship model. This approach emphasizes modeling, scaffolding, and guided practice to help students develop both content knowledge and problem-solving skills. Your revised lesson must align with the NGSS standards and follow the course lesson plan template. Be sure to include detailed timing, clear learning

objectives, a sequence of instructional activities, and opportunities for students to apply their knowledge in meaningful ways. Your plan should demonstrate how you have expanded or restructured the original lesson to fit the extended time frame while also incorporating the principles of apprenticeship—such as making expert thinking visible, encouraging collaborative learning, and gradually releasing responsibility to students. Evaluation will be based on the creativity and rigor of your adaptation, fidelity to the Cognitive Apprenticeship framework, and overall clarity and completeness of the lesson plan

Assignment #5: Social Justice or Culturally Relevant Pedagogy (CRP) Lesson

In this assignment, you will design a science lesson that explicitly integrates social justice or culturally relevant pedagogy (CRP) into its framework. Begin with a problem or question rooted in a meaningful, real-world issue that connects directly to students' lives and requires them to engage deeply with scientific content. Throughout the lesson, formative assessments should prompt students to articulate their understanding of the science while making connections to the social issue at hand. The final assessment should require students to both demonstrate mastery of the scientific concept and critically analyze how it relates to the chosen social justice theme. Your lesson should foster both scientific inquiry and civic engagement, helping students see science as a tool for understanding and addressing pressing issues in their communities. The assignment will be evaluated on the depth of the science content, the authenticity of the social connection, and the degree to which assessments support both conceptual understanding and critical reflection.

Assignment #6: AI Lab Teaching Project

This action research project asks you to examine how different instructional tools shape student learning experiences. Working with your cooperating teacher, you will teach the same pre-written lesson on protein synthesis in two different formats. In one class, you will implement the laboratory activity using a smartphone-based AI lab application. In the second class, you will conduct the same lesson using a traditional pen-and-paper laboratory format. Following instruction, you will gather feedback and observe student engagement, noting differences in participation, understanding, or interaction across the two settings. The goal of this assignment is to compare how technology-enhanced and traditional approaches influence learning and to reflect on the affordances and limitations of each. You will submit a written report summarizing your observations, supported by examples from class discussions or student work. Evaluation will be based on the thoroughness of your data collection, the depth of your analysis, and the clarity of your written reflection.

ASSIGNMENT DATES

#	ASSIGNMENT	Due Date
1	**Response to the Syllabus**	9/30/2025 3:00pm
2	**60 Minute Lesson Plan**	10/7/2025 3:00pm
3	**Learning News Letter**	10/14/2025 3:00pm
4	**90 Minute NGSS Lesson Plan**	10/28/2025 3:00pm
5	**Social Justice or CRP Lesson**	11/4/2025 3:00pm
6	**AI Lab Teaching (app vs. pen & paper)**	12/2/2025 3:00pm

Reading Schedule (to be done before class!)		
Week 1	**Physical Reading**	**Commute Reading**
1	No Reading	No commute reading
2		Luehmann, A., Zhang, Y., Boyle, H., Tulbert, E., Merliss, G., & Sullivan, K. (2024). Toward a justice-centered ambitious teaching framework: Shaping ambitious science teaching to be culturally sustaining and productive in a rural context. Journal of Research in Science Teaching, 61(2), 319-357. https://doi.org/10.1002/tea.21917
3	"Brown, J.; Collins, A.; & Duguid, P. (1989) Situated Cognition and the culture of learning. Educational Researchers, 18, 32-41.	Wilson, B. G., & Myers, K. M. (2000). Situated cognition in theoretical and practical context. In D. H. Jonassen & S. M. Land (Eds.), Theoretical foundations of learning environments (pp. 57-88). Mahwah NJ: Erlbaum.
4	No Reading	No commute reading

5		
6	No Reading	No commute reading
7	Lee, O. (2020). Start with phenomena: Making everyday phenomena phenomenal. Science and Children, 58(1), 56-61. https://doi.org/10.1080/00368148.2020.12315793	No commute reading
8	Reiser, B. J., Novak, M., & McGill, T. A. (2017). Coherence from the students' perspective: Why the vision of the framework for K-12 science requires more than simply "combining" three dimensions of science learning. In Board on Science Education Workshop "Instructional Materials for the Next Generation Science Standards (Vol. 6, No. 27, p. 2017).	Pierson, A. E., Brady, C. E., & Lee, S. J. (2023). Emotional configurations in STEM classrooms: Braiding feelings, sensemaking, and practices in extended investigations. Science Education, 107(5), 1126-1162.
9	No commute reading	No commute reading
10	No commute reading	No commute reading

Week 2: Read About Abititous Science Teaching + Social Justice Teaching

Commute & Listen - Luehmann, A., Zhang, Y., Boyle, H., Tulbert, E., Merliss, G., & Sullivan, K. (2024). Toward a justice-centered ambitious teaching framework: Shaping ambitious science teaching to be culturally sustaining and productive in a rural context. Journal of Research in Science Teaching, 61(2), 319-357. https://doi.org/10.1002/tea.21917 **(LINK TO THE PODCAST)**

Week 3: Read About Learning

Read - Brown, J.; Collins, A.; & Duguid, P. (1989) Situated Cognition and the culture of learning. *Educational Researchers,* 18, 32-41.

Commute & Listen - Wilson, B. G., & Myers, K. M. (2000). Situated cognition in theoretical and practical context. In D. H. Jonassen & S. M. Land (Eds.), Theoretical foundations of learning environments (pp. 57-88). Mahwah NJ: Erlbaum. **(LINK TO THE PODCAST)**

Week 7: Read About Centering Science Phenomena

Read - Okhee Lee (2020) Start With Phenomena: Making Everyday Phenomena Phenomenal, *Science and Children,* 58:1, 56-61, DOI:10.1080/00368148.2020.12315793

Week 8: Read About NGSS Teaching

Read - Reiser, B.; Novak, M.; & McGill, T. (2017) Coherence from the Students' Perspective Why the Vision of the Framework for K-12 Science Requires More Than Simply "Combining" Three Dijensions of Science Learning. Proceeding from the Boad on Science Education Workshop, "Instructional Materials for the Next Generation Science Standards, 06/27/2017

Commute & Listen - Pierson, A. E., Brady, C. E., & Lee, S. J. (2023). Emotional configurations in STEM classrooms: Braiding feelings, sensemaking, and practices in extended investigations. Science Education, 107(5), 1126-1162. **(LINK TO THE PODCAST)**

Week 9: Read About Grading

Read - Feldman, J. (2019) Chapter 1. What makes grading so difficult to talk about and ever harder to change? Grading for Equity: What it is, Why it Matters, & How it Can Transform Schools and Classrooms. New York, NY: Sage Publishers

Commute & Listen - Feldman, J. (2019) Chapter 3. How traditional grading stifles risk-taking and

supports the commodity of grading. Grading for Equity: What it is, Why it Matters, & How it Can Transform Schools and Classrooms. New York, NY: Sage Publishers (LINK TO THE PODCAST)

1. 9/23
2. 9/30
3. 10/7
4 10/14
5. 10/21
6. 10/28
7 11/4
8. 11/11
9. 11/18
10. 12/2