Science Education Curriculum & Instruction
Fall 2009

Course Information
Curriculum and Instruction in Science Education Tuesdays CERAS Room 300 3:15pm- 6:15pm

Instructor Information		
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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 integrate learning segments that enable students to understand and apply their conceptual understanding
- 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 to the common observer. Very few of the intricate details of teaching are visible to the 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 designing 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 serving 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:

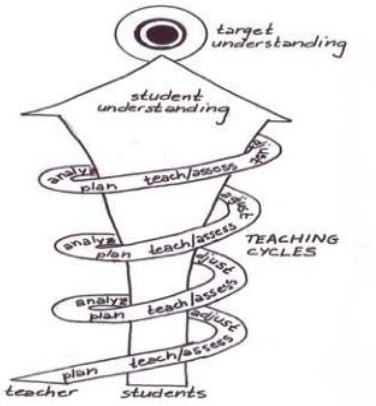
Theme #1: *Teaching as Cycles*
Teaching is a nested set of teaching cycles where you plan, teach and assess, analyze, and adjust, and plan again.

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

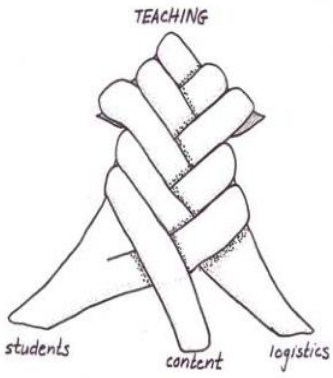
Theme #3: *Meaningful Participation*
Successful science teaching requires the development of a classroom culture that promotes participation in meaningful ways.

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*).

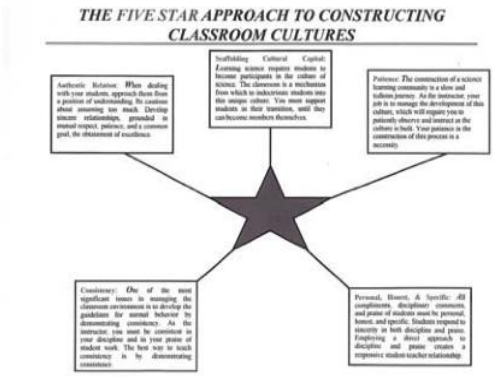
COURSE THEMES



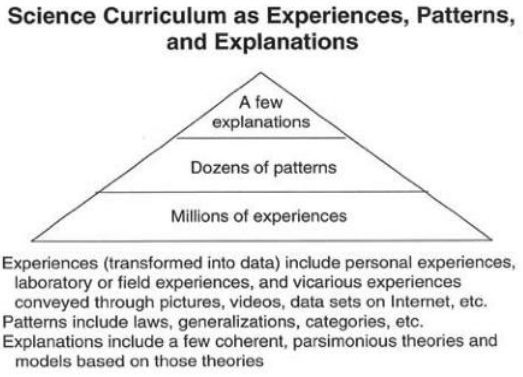
Teaching is a nested set of teaching cycles where you plan, teach and assess, analyze and adjust, and plan again. This approach requires more work than copycat teaching or teaching without planning, but it will enable you to learn from and adapt to any situation you encounter during your teaching career.



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*

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 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 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.

'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 extended over several days of instruction.

ASSIGNMENTS AND EVALUATION

There are 6 assignments this quarter:

#	ASSIGNMENT NAME	DESCRIPTION	EVALUATION TYPE	% OF TOTAL
1	**Reading Assignments #1-3**	You will provide a series of analyses of the readings assigned to you. You will be required to complete different reading tasks in weeks 2, 3, & 4	Credit / No Credit	**15%**
2	**UNDERSTANDING YOUR STUDENTS**	You will provide a 2-page analysis of your students. You will analyze both the entire class and select 2 students to focus on. You will provide a description of how you will design instruction to meet the needs of all of your students.	Credit / No Credit	**15%**
3	**VIDEO ANALYSIS A: Student Engagement**	You will record an episode of a learning activity where your students are engaged in an activity. The video episode is no longer than 5 minutes long and must focus on what the students are doing.	Credit / No Credit (Complete the analysis form)	**15%**
4	**VIDEO ANALYSIS B: Evidence of Student Understanding**	You will record an episode that provides evidence of your students' learning. The video is no longer than 5 minutes long and must capture evidence of students learning.	Credit / No Credit (Complete the analysis form)	**15%**
5	**PLAN FOR A SINGLE LEARNING SEGMENT**	You will design a complete lesson plan for a single learning segment.	Graded by Rubric	**15%**
6	**UNIT PLAN**	You will design a unit plan that designs a series of learning segments to be taught over the course of an extended period of time.	Graded by Rubric	**25%**

ASSIGNMENT 1: 3 Reading Assignments (5% per assignment)

In weeks 2 through 4, you will be asked to complete a reading assignment based on the information you gain from reading each of the articles assigned for class. These reading activities are based on the notion that developing understanding of a reading processing the content in meaningful ways. To accomplish this, the second 3 weeks of the course will involve a series of reading assignments. Once you complete the reading you will engage in the following exercises:

READING ACTIVITY 1 [Due: September 29, 2009]

Week 2: Using Language to Know when "they" Know

In response to the 3 readings from Lee, Wellington & Osborne, & Lemke, you will create a **2-page** document that will analyze a series of problems and propose a set of solutions derived from your reading of these articles. The collection of articles review a set of key ideas associated with how language practices shape learning. After reading the articles generate a list of key problems discovered from your reading. In response to each of these problems, please write a description of how this particular problem can be addressed through changes in your classroom practice. This writing should be a minimum of 1 page and a maximum of 2 pages in length (single spaced). The first page of the text can be used for describing the potential problems associated with teaching the language of science, while the for second page can offer details about your plans to solve those particular problems.

READING ACTIVITY 2 [Due: October 6, 2009]

Week 3: Explain it So They Know

The second series of articles explores a series of research discussing some basic principles about how students' come to know. These learning articles provide a list of principles about how students' come to understand phenomenon. In connection with the ideas associated with Metacognition, you will generate a newsletter that is to be distributed to the students you will be teaching next year. You will create a 1-2 page newsletter that explains some basic ideas about how they learn. This document will use the references to the articles we read, explanations of key learning concepts, and descriptions of the knowledge derived from reading the articles. This will offer your students a simple introduction to how learning happens in your classroom. To provide them a sense of structure, your newsletter will **must also explain** how what you have students do in class is connected to these theories of learning.

READING ACTIVITY 3 [Due: October 13, 2009]

Week 4: When you read…. You will Get it

This week will provide an analysis and exploration of a series of issues and strategies associated with learning through reading. In response to this series of readings, you will generate a list of reading activities that you can use in your classroom to promote students' retention. These reading strategies and activities are based on your reflections of the articles you read in this week's readings. In each of these reading strategies, provides a reference to which of these articles provided support for your thinking about design reading activities. This writing should be a minimum of 1 page and a maximum of 2 pages in length (single spaced).

ASSIGNMENT 2: UNDERSTANDING YOUR STUDENTS

In line with our assumption that excellent teaching occurs in those situations where we truly understand our learners, this assignment involves your conducting a detailed analysis of your student in order to design instruction to meet their specific needs. This assignment will require you to complete a 2-page analysis sheet that involves a series of questions associated with your students. This analysis will provide a large-scale analysis of **ALL** of your students, but will also take a specific focus on **2** of your students. We will use this document as a working-document throughout the quarter. The handout will be made available online.
[Due in class October 20, 2009]

ASSIGNMENT 3: VIDEO ANALYSIS A: STUDENT ENGAGEMENT

You will record an episode of your students engaged in learning science. You are asked to bring a 3-5 minute video segment to C & I. This clip should be unedited and continuous video clip of some of your students engaged in learning science. This may include small group interactions. You will submit both a video clip and a written analysis of the video. These question templates for the written analysis are available online.

[Due in class October 27, 2009]

ASSIGNMENT 4: VIDEO ANALYSIS B: EVIDENCE OF STUDENT UNDERSTANDING

You will record an episode of your teaching that provides evidence of some of your students' learning. The video episode is no longer than 5 minutes long. You are asked to bring a 3-5 minute video segment to C & I. This clip should be an unedited and continuous video clip of your students learning science. You will also bring a written piece that answers questions associated with the analysis. You will submit both a video clip and a written analysis of the video. These question templates for the written analysis are available online.
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[Due in Class November 3, 2009]

ASSIGNMENT 5: PLAN FOR A SINGLE LEARNING SEGMENT

You will write a single learning plan. This plan will include a detailed description of the pan for students' learning that will include the following components:

Part 1: What will they come to understand:

(a) A Reference to state a content Standards
(b) A list of the goals for understanding for the learning segment
(c) A list of content and support vocabulary

Part 2: What will they do to get there:

(d) A list of activities to be engaged in during the lesson
(e) A list of resources needed

Part 3: How will I know what they understand:
(f) A description of a formative assessment plan

Part 4: A pacing guide

(g) An agenda of the time for the things to be done *(both teacher and student)*

[Due in class November 10, 2009]

ASSIGNMENT 6: PRE- CURRICULUM UNIT

You will create a curriculum unit patterned after, but not limited to, the model developed by Wiggins and McTighe, both in process and in content. It will have the following components:

Context description This section provides a **detailed description** of the context of your learning environment. You will provide an explanation of *who* your students are and what broader *issues and resources* shape the teaching of this particular unit. This should include your *Rationale(s)* and any *data or information* that helped shape the unit plan in any way.

Learning Goals These will be presented as a set of science statements.

A final performance task This task would be administered and completed in, or due in, a class 'hour' immediately following the lesson plan sequence; so feedback from it might be available to the students within 48 hours.

The assessment guide This pertains to the final performance assessment and will be both a grading scheme and the rationale for it, or a rubric of some sort that tells the students why they earn what on the task. It could involve peer and/or self assessment components as well as the teacher assessment.

An essential question(s) This could look like a "Unit Question" (see Wiggins and McTighe)

[Due November 24, 2009]

DUE DATES

WEEK #	DATE	ASSIGNMENT DUE
1	September 22, 2009	No Assignments Due
2	September 29, 2009	Reading Assignment #1
3	October 6, 2009	Reading Assignment #2
4	October 13, 2009	Reading Assignment #3
5	October 20, 2009	Understanding your students
6	October 27, 2009	Video Analysis A: Student Engagement
7	November 3, 2009	Video Analysis B: Evidence of Student Learning
8	November 10, 2009	Learning Plan
9	November 17, 2009	No Assignments Due
10	November 24, 2009	Pre-Unit Plan

COURSE READING

SESSION 2 READINGS: Language

Lee (1996). Literacy Skills in Science Learning Among Linguistically Diverse Students. Science Education, Vol. 80, No. 6, pp. 651-671.

Lemke, J. (1991): Talking Science: Chapter 2: A Lot of Heat and Not Much Light (pp. 28-43)

Wellington, J. & Osborne, J. (2001) *Language and Literacy in Science Education*. London, UK: Open University Press

SESSION 3 READINGS: Learning

Bransford, J. (2000) How People Learn (Chp 3.) Learning & Transfer. Washington, DC: National Academies Press

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

SESSION 4 READINGS: Reading

Glynn & Muth (1994) Reading to Learn Strategies. Journal of Research in Science Education, 31, 1057-1073.

Norris, S.; Phillips, L.; Smith, M.; Guilbert, S.; Stange, D.; Baker, J.; & Weber, A. (2007) Learning to Read Science Text: Do Elementary School Commercial Reading Programs Help?

Robertson, B. (2007) How is reading science books different from reading other kinds of books? Science Scope