

**Course Syllabus, Spring 2009 (preliminary)**  
**Biology 452: Concept Development & Integration (3 units)**  
**Thursdays 2-3:40 pm, AH 1112 (and times to be arr)**

Instructor:

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Office hr Wed 8:30-9:30 and just about any other time by appt.  
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Course Description: Development and integration of biological science content knowledge, introduction to learning theory, and transformation of knowledge. Designed for students preparing for the single subject teaching credential in life sciences, this class aims to deepen participants' understanding of both major science concepts and the challenges involved in making those concepts accessible to students of all ages. This can be helpful to any students taking general science exams (like the Biology GRE, CSET, or MCAT).

Biology 452 is open to science majors in who are interested in becoming a science teacher, doing formal, informal, or non-formal education, but focusing on those aiming to teach in middle or high schools. It applies as an upper division elective for General Biology majors. Students will observe/assist a science teacher in grade 7 – 12 (or college) for part of the semester and complete several other projects as part of the independent weekly *activity*. Topics will be geared to participant/school subject areas (biology, physics, chemistry, geology).

Desired Student Learning Outcomes:

Upon completion of this course you should be able to:

- explain how prior knowledge influences learning,
- appreciate the value of eliciting students' prior knowledge,
- be prepared to build on what students already know,
- analyze ways to challenge students' common alternative conceptions,
- compare similarities between processes of science & that of teaching/learning.
- analyze various teaching situations and describe effective science teaching;
- develop an awareness of different learning styles;
- describe ways to analyze students' preconceptions and misconceptions concerning science;
- develop activities which will assist students in conceptualizing their science knowledge;
- recognize the need to accurately assess student learning and understanding;
- analyze textbooks and ancillary materials.

Regular Class Meeting: Thursdays 2-3:40 pm, and times to be arranged. Some meetings will be via the internet – meeting in virtual time and space.

You will do a "field experience" as required for application to the SSTC program, which will require additional time each week (activity).

Class participation:

Informed and thoughtful class discussion is a critical component of this course. Your active participation in these discussions is therefore important and valuable.

Challenging concept areas for focus:

Natural Selection  
Osmosis and Diffusion  
Cell Division/Meiosis and Mitosis  
Energy and Matter Transfer (Photosynthesis/Metabolism)  
Nature of Science

Graded Activities

1. DISCUSSION & APPLICATION. During most weeks, students will read one or more papers from the literature or websites on major misconceptions in biology and then participate in discussion of the misconception in class. Each student will also briefly describe how he or she would apply the main idea of the readings in teaching concepts related to the naive conception of the week.
2. ACTIVITY. The “activity” portion of the course will be independent (outside class) and will involve three components.
  - a) OBSERVATION. Students will observe an experienced (and preferably outstanding) biology teacher in middle or high school or college for 30 hours, and submit a weekly report of two key observations. Students will may work in pairs to make and/or discuss observations.
  - b) TEACHING/LEARNING (TL) STRATEGIES. Students will identify a set of key concepts and become TL experts on those topics, then practice strategies on other students to help others learn those concepts. Reflections of “teacher and learners” will be the assessment.
  - c) INTERVIEWS. Students will work in pairs to interview middle or high school or college students about a particular concept to be assigned, using props to elicit and/or challenge students’ thinking. The interview results will be presented in class and summarized in a 1-2 page paper that includes:
    - Evidence that the chosen concept was difficult (or not) for the interviewed students
    - Explanation for nature of questions and choice of props
    - Summary of results
    - Reflection on what was learned
    - Detailed notes recorded in the interviews

Proposed Grading Scheme: (% of grade)

Discussions of readings and application to TL strategies In class participation and reflections in journal. Instructions to be announced in class (journal reviewed 3 times during semester)	30
Classroom observation report [due May 5] Use instructions in the Early Field Experience Guide	20
Interview summary [due Mar 14] You will interview at least 1 adult (students, teachers, friends) about 3 of 5 misconception foci (Natural Selection, Cell Division, Osmosis and Diffusion, Energy and Matter, and Nature of Science). You will probe their understand for 20 minutes, having them describe pictures or by asking them questions and having them explain their responses. You will record the interviews, transcribe them, and prepare a 1-2 page evaluation of the level of understanding of the interviewee. Your evaluation will be scored based on your understanding of the subject as exemplified by the questions you of your subject and your assessment of their knowledge. The summary will provide your approach to your interviews and include the questions and/or pictures you’ll ask your subjects to describe of explain.	10
Interview transcripts [due Mar 3] Transcripts of interviews due with evaluations.	10
Text book review [due Mar 10] Examine at least 5 high school or college biology textbooks and using an example from one textbook, each, evaluate the way they present material on 3 of the 5 major misconception areas (Natural Selection, Cell Division, Osmosis and Diffusion, Energy and Matter, and Nature of Science). For each conception topic, make sure you give 3 strengths OR 3 weaknesses of the way the text deals with the topic. Give supporting evidence (graded using a std 6 point rubric)	10
Final reflection [due May 5] Assignment to come later.	20
	100

In the end you will have a portfolio of your work, including small quiz results.