

EDCI 470 Learning and Teaching in Science
Benjamin 2212, Tuesday. 5:00-7:45 pm

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Course Overview

This course is the second in a sequence for prospective science educators in the undergraduate teacher certification program. It coincides with the year-long internship that you will spend observing and assisting in middle and high school classrooms. The purpose of this course is to help you begin to develop practices of instruction. During this course, we will focus attention on student learning and make the transition to think about the relationships and interactions between student learning and instructional strategies.

Goals

- To engage in critical discussion of research on learning and teaching in science
- To analyze student thinking in ways we began in EDCI 411, as evidenced in interviews, samples of written work, and classroom video.
- To develop and critically reflect upon potential affordances and limitations of instructional and assessment strategies, tools, and curricula in the classes you are teaching or observing, with particular focus on supporting student thinking
- To plan, implement, and reflect on your own teaching

In EDCI411, you began to consider research on science learning. We will briefly review ideas from that course, and then continue from there to focus on the craft of teaching.

Assignments and Requirements

During this course, you are expected to:

- attend and participate in seminar discussions
- read minimum of 30-50 pages per week
- weekly, post a critical response to the course readings on blackboard
- conduct one student interview OR focus group discussion, with 4-6 pages of written analysis;
- plan, implement, and reflect on one science lesson, with 4-6 pages of analysis
- write a unit plan, informed by the interview, curriculum analysis, and lesson plan assignments
- read, observe, and comment on other students' work

Assignments (More detail to follow throughout the semester)

Weekly Responses to Class Readings (~weekly; 7 total):

The primary purpose of this assignment is to enrich our discussion of the course readings. The content of these writings is relatively open, but you must provide thoughtful reflection on the ideas presented in the course readings. In your response, you may draw on other course readings, ideas in other students' postings, as well as your experiences in science and science classrooms. (You will NOT be required to submit these responses on the weeks when other writing assignments are due.) **Please post your ~1 – 2 (300 – 500 word totals) paragraph responses on blackboard 24 hrs before class so that other students have time to read them.**

[EC 4 – Reflection; EC 7 – Specialist Competence; CF Learners]

Paper #1: Interview or Focus Group (1): 20% of grade

This assignment builds on an assignment from EDCI 411. You will pose a science question (e.g. “Where does all the weight come from, when an acorn grows into a tree?” or “If I leave a wet towel on a rack, and it dries, what happens to the water?”) to middle or high school students and interview the students about their thinking. You will be required to record the interview, and then select an interesting ~3-minute snippet for transcription and further analysis. In your analysis, make claims about the substance of students' thinking and reasoning around the question (4-6 pages, double-spaced). The purposes of the assignment are (1) to develop abilities for eliciting and listening to student reasoning, (2) to gain insight into that reasoning, and in the case of the focus group, to (3) to develop abilities for facilitating a science talk.

[EC 4 – Reflection; EC 6 – Responsible and Ethical Action; EC 7 – Specialist Competence; CF Learners]

Paper #2 – Lesson Plan Analysis and Teaching (1): 20% of grade

This assignment asks you to plan a lesson, which you will teach as part of your fall experience in schools. You will submit, discuss, and revise your plan, and then teach the lesson, finally preparing 4-6 pages, double-spaced of reflection on what took place (including an analysis of student work and ideas). This work anticipates the case study assignments you will complete in the third course in the sequence in the spring semester. You will do this in both your middle and high school placement.

[EC 1 – Equity and Diversity; EC 4 – Reflection; EC 3 – Internationalization; EC 5 – Innovation and Creativity; EC 6 – Responsible and Ethical Action; EC 7 – Specialist Competence; CF Subject Matter; CF Pedagogy; CF Educational Goals & Assessment; CF Social & Cultural Contexts]

Paper #3 - Unit plan (1): 30% of grade

As a follow-up of the lesson plan assignments, you will write a unit plan. Your unit plan must include anticipated student ideas, as well as the multiple ways (“next moves”) that you might use to foster sustained inquiry over the course of the unit. You must also include a final section that discusses your philosophy of science teaching and learning. This will be the final assignment of the course.

[EC 1 – Equity and Diversity; EC 4 – Reflection; EC 3 – Internationalization; EC 5 – Innovation and Creativity; EC 6 – Responsible and Ethical Action; EC 7 – Specialist Competence; CF Subject Matter; CF Pedagogy; CF Educational Goals & Assessment; CF Social & Cultural Contexts]

Peer review

To help the class along the writing process, Papers 1, 2, and 3 will all be read as drafts in class. Please submit a draft ONE WEEK before the actual due date. Even if the draft is still in rough condition, please have something down on paper for review. It could still be just the outline of the paper, a sketch of an idea, or just the rough transcript you'd like to review. **ALL PAPERS MUST BE PEER REVIEWED AS PART OF THE WRITING GRADE!**

Grading

Grades are determined based on 7 weekly responses (20%), 2 written assignments (Papers 1 and 2: 20% each), 1 final paper (Paper 3: 30%) and participation in the seminar and discussion board (10%). If your work is not satisfactory, I will ask you to revise it. *To earn an "A" in the course, you must complete all assignments in a timely fashion, following the guidelines given in class. You must also demonstrate that you can attend to the substance of student thinking in the course assignments. Evidence of attention to student thinking is when you make a claim about student reasoning that is supported by evidence in the data, that is, in a video, transcript, or student written work. It is not sufficient evidence of attention to student thinking for the claim simply to identify whether the student is correct or incorrect; the claim and support must concern the sense of the student's thinking from the student's perspective. We will discuss this at greater length on the first day of class.*

Readings and Videos

Readings are posted on *Blackboard* (www.elms.umd.edu). You can access the course website by logging into the ELMS site using your university ID and password. Most of the readings are also available electronically via UMD's research port, accessed on the University Libraries webpage: <http://www.lib.umd.edu/>.

TIMMS Video <http://timssvideo.com/user/register>

- TIMMS contains a series of videos from science and mathematics classrooms. In order to watch the videos, you must sign up for an account.

Class Meetings

The exact order and content of our class meetings will vary each week, but in general we will:

- do science [*CF Subject Matter; Learners; Curriculum*]
- watch and discuss classroom videos/transcripts [*CF Pedagogy; Learners; Educational Goals and Assessment*]
- discuss course readings [*CF Learners; Social and Cultural Contexts; Technology*]
- review classmates' work
- analyze student work, lesson plans, and curricula [*CF Pedagogy; Learners; Curriculum; Educational Goals and Assessment*]
- write lesson plans and curricula [*CF Pedagogy; Curriculum; Educational Goals and Assessment; Technology*]

Important Due Dates

- Monday, September 10 - Weekly response #1 due at 5:00 pm
- Monday, September 17 - Weekly response #2 due at 5:00 pm
- Tuesday, September 25 - **Paper #1: Bring draft into class for peer review**

- Tuesday, October 02 - **Paper #1: Interview / focus group due October 01, 2012**
- Monday, October 08 - Weekly response #3 due at 5:00 pm
- Monday, October 15 - Weekly response #4 due at 5:00 pm
- Monday, October 22 - Weekly response #5 due at 5:00 pm
- Monday, October 29 - Weekly response #6 due at 5:00 pm
- Tuesday, November 06 - **Paper #2: Bring draft into class for peer review**
- Tuesday, November 13 - **Paper #2 – Lesson Analysis and Teaching**
- Monday, November 19 - Weekly response #7 due at 5:00 pm
- Tuesday, November 27 – Revisions to papers (Responses 1 – 7, Paper 1-2) due
- Tuesday, December 04 - **Paper #3: Bring a draft into class for peer review**
- Tuesday, December 11 - **Paper #3 - Unit Plan analysis due**

Relevant student policies

Religious Observance: The University System of Maryland policy "[Assignments and Attendance on Dates of Religious Observance](#)" provides that students *should not be penalized because of observances of their religious beliefs; students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances.*

We are a diverse community and enroll students of many religions; pursuant to policy, we will do what we can when there are students' requests for excused absences and make-up test requests due to reasons of religious observances. *It is the student's responsibility to inform the instructor of any intended absences for religious observances in advance. Notice should be provided as soon as possible but no later than the end of the schedule adjustment period.*

Honor Code: Throughout this course, you are expected to abide by the university's code of academic integrity. The full text of the code is available on the web at www.inform.umd.edu/campus/info/departments/jpo/code_acinteg.html

Individual Needs Accommodation: The University is legally obligated to provide appropriate accommodations for students with documented disabilities. In order to ascertain what accommodations may need to be provided, students with disabilities should inform the instructors of their needs at the beginning of the semester. The instructor will then consult with [Disability Support Services](#) (314-7682). DSS will make arrangements with the student to determine and implement appropriate academic accommodations.

EDCI 470: Learning and Teaching in Science
Tentative Calendar: Fall 2012

Week 01 - September 4, 2012 - Introduction

- Go over syllabus
- Tips on how to read journal articles and respond to them
- Introduce Paper #1 - Interview / focus group assignment
- Introduce Paper #2 – Lesson planning and teaching assignment
- Assignment:

Readings for Week 02

Parker, N. & Timpane, J. (1989). "Writing to persuade," in Authors, *Writing worth reading*, Second edition, pp. 122-133. New York: St. Martin's Press. (Note: this article is meant to help you write your papers and responses. **We will only discuss this article later more in Week 05**)

Strike, K. A., & Posner, G. J. (1992). A revisionist theory of conceptual change. In R. A. Duschl & R. J. Hamilton (Eds.), *Philosophy of Science, Cognitive Psychology, and Educational Theory and Practice* (pp. 147-176). Albany: State University of New York Press.

Smith, J.P., diSessa, A.A., and Roschelle, J. Misconceptions reconceived: A constructivist analysis of knowledge in transition. (1993). *Journal of the Learning Sciences*, 3, 115-163 (**Note: Read from pages 1 – 23 for background on misconceptions**)

Writing for Week 02

Weekly response #1 due on September 10, 2012 at 5:00 pm.

Week 02 – September 11, 2012 – Conceptual Change and Misconceptions

- Discuss Strike & Posner (1992)
- Science question
- Q & A time
- Assignment

Readings for Week 03

Smith, J.P., diSessa, A.A., and Roschelle, J. Misconceptions reconceived: A constructivist analysis of knowledge in transition. (1993). *Journal of the Learning Sciences*, 3, 115-163 (**Note: Read from pages 24 - 74**)

Hammer, D. & Elby, A. (2003). Tapping epistemological resources for learning physics. *Journal of the Learning Sciences*, 12(1), 53-91

Writing for Week 03

Weekly response #2 due on September 17, 2012 at 5:00 pm.

Week 03 – September 18, 2012 – Misconceptions and Epistemological Resources

- Discuss Smith et al. (1993) and Hammer & Elby (2003)
- Video analysis from TIMMS

- Q & A time
- Assignment

Readings for Week 04

Harrison, A., Grayson, D., & Treagust, D. (1999). Investigating a Grade 11 student's evolving conceptions of heat and temperature. *Journal of Research in Science Teaching*, 36(1), 55-87.

Louca, L., Elby, A., Hammer, D. & Kagey, T. (2004). Epistemological resources: Applying a new epistemological framework to science instruction. *Educational Psychologist*, 39(1), 57-68. (**Note: Read starting on page 62**)

Writing for Week 04

Paper #1: Bring draft into class for peer review

Week 04 – September 25, 2012 – The Substance of Students' Ideas

- Discuss Harrison et al. (1999)
- Watch and analyze the “Orange” video
- Assignment

Readings for Week 05

Driver, R., Newton, P., & Osborne, J. (2000). Establishing the norms of scientific argumentation in classrooms. *Science Education*, 84(3), 287-312.

Kuhn, D. (1993). Science as argument: Implications for teaching and learning scientific thinking. *Science Education*, 77(3), 319-337.

Writing for Week 05

Paper #1: Interview / focus group due October 02, 2012

Week 05 – October 02, 2012 – Science as Argumentation

- Discuss Driver et al. (2000) and Kuhn (1993)
- Discuss Paper #2 – Lesson planning analysis and teaching.
- Work together to plan lessons and / or discuss analysis
- Assignments

Readings for Week 06

Hammer, D. (1997). Discovery learning and discovery teaching. *Cognition and Instruction*. 15(4): 485-529.

Russ, R.S., Coffey, J.E., Hammer, D., & Hutchison, P. (2009). Making classroom assessment more accountable to scientific reasoning: A case for attending to mechanistic thinking. *Science Education*. 93(5), 875-891.

Writing for Week 06

Weekly response #3 due on October 08, 2012 at 5:00 pm.

Week 06 – October 09, 2012 – Attending to Students’ Thinking

- Discuss Hammer (1997) and Russ et al. (2009)
- Video of students

Assignments

Readings for Week 07

Chinn, C. & Malhotra, B. (2002). Epistemologically authentic inquiry in schools: A theoretical framework for evaluating inquiry tasks. *Science Education*, 86(2), 175-218

Windschitl, M. (2004). Folk theories of “inquiry:” How preservice teachers reproduce the discourse and practices of an atheoretical scientific method. *Journal of Research in Science Teaching*, 41(5), 481-512

Hammer, D., Russ, R., Mikeska, J., & Scherr, R. (2008). Identifying inquiry and conceptualizing students’ abilities. In R. Duschl & R. Grandy (Eds). *Establishing a Consensus Agenda for K-12 Science Inquiry*. Rotterdam, NL: Sense Publishers.

Writing for Week 07

Weekly response #4 due on October 15, 2012 at 5:00 pm.

Week 07 – October 16, 2012 – What is Inquiry and Why Should We Care?

- Discuss Chinn & Malhotra (2002), Windschitl (2004), and Hammer et al. (2008)
- Develop strategies for inquiry in class lessons

- Assignments

Readings for Week 08:

Black, P. (2003). The importance of everyday assessment. In J. M. Atkin & J. E. Coffey (Eds.), *Everyday Assessment in the Science Classroom* (pp. 1-12). Arlington, Va.: NSTApress.

Coffey, J., Hammer, D., Levin, D.M., & Grant, T. (2011). The missing disciplinary substance of formative assessment. *Journal of Research in Science Teaching*, 48(10), 1109-1136.

Writing for Week 08

Weekly response #5 due on October 22, 2012 at 5:00 pm.

Week 08 – October 23, 2012 – Inquiry and Assessment

- Discuss Black (2003) and Coffey et al. (2011)
- Look over and discuss student work and sample assessments
- Assignments:

Reading for Week 09

Calabrese-Barton (1998). Teaching science with homeless children: Pedagogy, representation, and identity. *Journal of Research in Science Teaching*, 35(4), 379–394

Steele, C. M. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52 (6), 613-629.

Writing for Week 08

Weekly response #6 due on October 29, 2012 at 5:00 pm.

Week 09 – October 30, 2012 – Science and Social Justice

- Discuss Calabrese-Barton (1998) and Steele (1997)
- Check in on placements / Q & A time

- Assignments

Readings for Week 10

Delpit, L. (1995). *Other people's children: Cultural conflict in the classroom*. New York: Norton.

Warren, B., Ballenger, C., Ogonowski, M., Rosebery, A.S., & Hudicourt-Barnes, J. (2001) Rethinking diversity in learning science: The logic of everyday sense-making. *Journal of Research in Science Teaching*, 38(5), 529-552

Writing for Week 10

Paper #2: Bring draft into class for peer review

Week 10 – November 06, 2012 – Science and Diversity

- Discuss Delpit (1995) and Warren et al. (2001)
- Real life case studies of students

- Assignments

Readings for Week 11

Enyedy, N., & Goldberg, J. (2004). Inquiry in interaction: How local adaptations of curricula shape classroom communities. *Journal of Research in Science Teaching*, 41(9), 905-935.

Squire, K. D., MaKinster, J. G., Barnett, M., Luehmann, A. L., & Barab, S. L. (2003). Designed curriculum and local culture: Acknowledging the primacy of classroom culture. *Science Education*, 87(4), 468-489.

Writing for Week 11

Paper #2 – Lesson Analysis and Teaching due November 13, 2012

Week 11 – November 13, 2012 – Adaptation of Science Curriculum

- Discuss Enyedy and Goldberg (2004) and Squire et al. (2003)
- Watch Mr. Jones and Mr. Davidson video

- Assignment

Reading for Week 12

Ahn, J. (2012). Teenagers' experiences with social network sites: Relationships to bridging and bonding social capital. *The Information Society*, 28, 99-109

Ryoo, K. & Linn, M. (2012). Can dynamic visualizations improve middle school students' understanding of energy in photosynthesis? *Journal of Research in Science Teaching*, 49(2), 218-243

Writing for Week 12

Weekly response #7 due on November 19, 2012 at 5:00 pm.

Week 12 – November 20, 2012 - Technology in the Science Classroom (Visualizations and Social Networks)

- Discuss Ahn (2012) and Ryoo & Linn (2012)
- Try different technologies and brainstorm what works and what does not in your classrooms.
- Assignments:

Readings for Week 13

No readings, take a break.

Writing

NO OFFICIAL WRITING OVER BREAK. However, if you have makeup work, it will be due on November 27, 2012.

Week 13 – November 27, 2012

- Begin working on Unit Plan analysis and Self-reflection
- Assignments:

Readings for Week 14

Wiggins, G. (1989). The futility of trying to teach everything of importance. *Educational Leadership*, 44-59.

Labaree, D. (1997). Public goods, private goods: The American struggle over educational goals. *American Educational Research Journal*, 34(1), 39-81.

Writing for Week 14

Paper #3: Bring a draft into class for peer review

Week 14 – December 04, 2012 – Science, school, and education, SO WHAT??

- Discuss Wiggins (1989) and Labaree (1997)
- Work on Unit Plan analysis
- Assignments:

Writing for Week 15

Paper #3 - Unit Plan analysis due December 11, 2012

Week 15 – December 11, 2012 – **Final wrap up**

- Course evaluations
- Final discussions