RUTGERS
Graduate School of Education

Learning and Teaching
Graduate School of Education
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Biology and Society
15:256:550 (1)
3 Credits

Instructor: Melissa Czerwinski	melissa.czerwinski@rutgers.edu
Phone Number: (732) 932 7496 ext 8355	Waller Hall, 59 Lipman Dr., New Brunswick Room 108
Monday, 4:50 -7:30 pm Office Hours: by appointment	Prerequisites or other limitations: Open to students already admitted into the Biological Education Program with Certification, and students in the Science Ed. M program. Other students may be admitted with permission.
Mode of Instruction: ___ Lecture __X_ Seminar ___ Hybrid ___ Online ___ Other	Permission required: _x_ No __Yes See box above.

Learning Goals

1. Students will be able to describe the processes by which scientists develop scientific knowledge, referencing core practices such as modeling and argumentation.
2. Students will be able to apply the process described above to scientific research they read or conduct.
3. Students will become familiar with the NGSS and NJCCCS relevant to life science. Students will be able to apply this knowledge to evaluate whether a lesson addresses the standards.
4. Students will develop a vision for teaching inquiry in the classroom as well as a set of criteria that they will use to critique and design lesson plans.
5. Students will become familiar with strategies that can be used to effectively manage a science classroom.

Course catalogue description

This course is an introduction to the nature of scientific knowledge and practice in the biological sciences, and the implications for instruction. Science is a knowledge-building endeavor. It is about using observations and experimentation to construct evidence-based models that are creative, dynamic and in many ways subjective. These models are subject to critique and argumentation by the scientific community. In this course, we will learn about scientific inquiry and develop a vision of how an inquiry-based classroom operates.

We will therefore begin with an exploration of the nature of scientific inquiry in biology and why we should teach it. We will also examine the goals of biology education and related standards at the national and state level. During the course of the semester we will learn about inquiry-based approaches to science education that emphasize not only the learning of scientific concepts but also learning about the scientific practices involved in scientific knowledge building. Many course activities and assignments will involve group or pair work.

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Class materials:
Scientific American - You will subscribe to this magazine and be required to read and review an article from this journal.

Science News (optional) – This is another source of information on current developments in various scientific disciplines. The website also has useful, interesting information (www.sciencenews.org).

Websites with current standards
NJ Core Curriculum Content Standards http://www.state.nj.us/education/cccs/standards/5/index.html
Next Generation Science Standards http://www.nextgenscience.org/next-generation-science-standards

Reading List:

Week	Readings
1	Donovan, M. J., & Bransford, J. D. (2005). How Students Learn: Science in the Classroom. Washington, DC: National Academy Press. Introduction and (1-21) Chapter 9 (397-416). Read to 411.
2	Windschitl, M. (2008). What is inquiry? A framework for thinking about authentic scientific practice in the classroom. In Science as inquiry in the secondary setting. (pp. 1-20). Eds. Luft, J., Bell, Gess-Newsome, J. NSTA press, Arlington, Virginia.
3	National Research Council. (2011). A framework for K-12 science education: Practices, crosscutting concepts, and core ideas. Washington, DC: National Academy Press. Read chapter 2 and half of chapter 3 (pages 23-49). Download free PDF from National Academies web site http://www.nap.edu/catalog.php?record_id=13165
4	Lucas, D., Broderick, N., Lehrer, R., & Bohanan, R. (2005). Making the grounds of scientific inquiry visible in the classroom. Science Scope, 29 (3), 39-42. Windschitl, M & Thompson, J. Teaching about science ideas as models. University of Washington (1-11)
5 & 6	Donovan, M. J., & Bransford, J. D. (2005). How Students Learn: Science in the Classroom. Washington, DC: National Academy Press. Chapter 12 (475-515)
7	Collins, H. M., & Pinch, T. J. (1993). The Golem: What You Should Know about Science. Cambridge, United Kingdom: Cambridge University Press. Read the chapter entitled: Edible knowledge: The chemical transfer of memory. Duesberg, Peter. Scientific American, "Chromosomal Chaos and Cancer," May 2007, p. 52-59 [access online via library].

8 Black, P., & Wiliam, D. (1998). Inside the black box: Raising standards through classroom assessment. Phi Delta Kappan, 80(2), 139-148.

Shavelson, R. J., Yin, Y., Furtak, E. M., Ruiz-Primo, M. A., Ayala, C. C., Young, D. B., et al. (2008). On the Role and Impact of Formative Assessment on Science Inquiry Teaching and Learning. In J. Coffey, R. Douglas & C. Stearns (Eds.), Assessing Science Learning (pp. 21-36). Arlington, VA: NSTA Press.

9 Mirsky, S. (2006 Feb). Teach the Science. Scientific American. http://www.scientificamerican.com/article.cfm?id=teach-the-science

Scott, E. C., and Matzke, N. (2007). "Biological design in science classrooms." Proceedings of the National Academy of Sciences. 104(suppl. 1), 8669-8676. May 15, 2007. Part of the v. 104 supplement, "In the Light of Evolution I: Adaptation and Complex Design."

10 Tang, X., Coffey, J., Elby, A., & Levin, D.M. (2010). Scientific inquiry and scientific method: Tensions in teaching and learning. Science Education, 94 (1), 29-47

11 Passmore, C. & Stewart, J. (2002). A modeling approach to teaching evolutionary biology in high schools. Journal of Research in Science Teaching, 39(3), 185-204.

12 Windschitl, M. (January, 2006). Why we can't talk to one another about science education reform. Phi Delta Kappan. 87 (05), 348-355.

13 TBD

Grading and Activities

Assignment	Tentative due date	Grade
Participation (individual)	Throughout the course	35%
Scientific article review (individual)	Throughout the course	10%
Lesson critiques and design (individual & group)	Throughout the course	40%
Individual reflection paper (individual)	Week 14	15%

Description of activities

Participation: Your participation in class counts heavily towards your grade. It is therefore important that you actively participate in class activities and discussions. Learning is an active process: the more you participate the more you learn. As part of your participation you are expected to read assigned readings, actively engage in class discussion and group work activities.

Readings: There will be assigned readings for each class session; you are expected to read them and be prepared to discuss them in class (part of participation grade). I will often assign a few questions to guide and focus your thinking as you read the assigned papers. On occasion, an additional reading may be assigned or a new reading may be substituted for an existing one.

Scientific article review: As a science educator you are expected to stay well informed of scientific developments in biology. Towards that end, you are asked to subscribe (for the duration of one year and in your name) to Scientific American. During the course you will be expected to read and review a major article in this journal (from current or past issues). The review needs to identify the scientific model that is at the heart of the report, the evidence in support of the model and any counter-arguments. You will conduct a brief presentation on the article in class (Power Point slides will be graded). I also recommend subscribing to Science News a weekly magazine with science updates in short articles that are great for the classroom.

Project: There is one major three-part activity in this course that will help you develop a better understanding of science, and begin to develop your ability to design effective instruction. This activity involves critiquing and revising existing lessons. As a class we will develop criteria for judging the merits and shortcomings of inquiry-based lessons. You will then design a lesson using the class criteria as well as information and scaffolds that I will give you.

Individual reflection paper: The last assignment of this course is an individual 3-5 page reflection paper in which you reflect on what you have learned in this course. This reflection should be based on the contribution of the readings, class activities, and lesson project to your developing understanding of what it means to teach biology effectively.

"In the Classroom" Assignments/ "Real Life" Component: You are taking this course in order to learn how to become an effective teacher in the science classroom. To that end, we will focus on strategies that will help you become a better teacher. I will model some strategies and we will discuss ideas, questions and concerns. There will be small assignments associated with this goal, such as pre-assessments, reflections and/or question generation.

Note: All effective teachers are flexible. They are aware of their students' needs and are willing to adapt and change their instruction to meet these needs. As a result, I may change assignments and dates in response to your needs and unforeseen logistical issues. Please join me in being flexible.

Specific instructions for assignments (listed and not listed) will be provided in class closer to the assignment due date.

Post-bacc students are required to complete a teaching philosophy paper for their portfolio as part of this course.

Academic integrity: Make sure that you provide proper citations for all materials that you use in your lesson and unit plans.

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Tentative list of topics for discussions (by week)

Week	Topic(s)	Assignment
1	Introductions Logistics Pre-assessment	Subscribe to Scientific American http://www.sciam.com/ Subscribe to Science News (optional) http://www.sciencenews.org/ Donovan & Bransford – to 411 NJ Standards assignment Write Teaching Philosophy Paper for post bacc students (Due Sep 16)
2	Nature of science I (Black box activity) Current Standards	Windschitl – What is inquiry? Next Generation Science Standards Assignment
3	Nature of science II (What counts as inquiry? and Modeling activity)	National Research Council. A framework for K-12 science education - chapter 2 and half of chapter 3 (23-49)
4	Nature of science III (Argumentation activity)	Windschitl & Thompson – Teaching about science as models Lucas et. al.
5	Lesson Critique I Discussions in the Science Classroom	Donovan & Bransford – Chapter 12, first half Lesson Critique I (due Oct. 13 at 8 am)
6	Cancer Inquiry I (model criteria and practice with modeling)	Donovan & Bransford – Chapter 12, second half
7	Cancer Inquiry II (evidence and modeling)	Duesberg Collins & Pinch

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Week	Topic(s)	Assignment
8	Cancer Inquiry III (consensus modeling and connections to the classroom)	Black & William Shavelson et. al.
9	Lesson Critique II and Assessment	Scott & Matzke Mirsky Lesson critique II (due Nov. 10, 8 am)
10	Evolution in the Classroom (debate and activity)	Tang et. al.
11	Lead Unit I (hook and initial models)	Passmore & Stewart
12	Lead Unit II (analyze and test models)	Windschitl, - Why we can't talk to one another about science education reform.
13	Lead Unit III (revise models and reflect on unit)	Reflection Paper (due Dec. 8, 7 pm) *do not be late*
14	Writing a lesson procedure (use what you learned during the semester to design an inquiry lesson)	Lesson is due at the end of class
15	Share lessons and final class reflection	