RUTGERS
Graduate School of Education

Learning and Teaching
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Rutgers The State University of New Jersey

15:256:553:01 & 11:300:453:01 TEACHING LIFE SCIENCE
Spring 2015
Mondays 10:55-1:30
71 Lipman Drive, New Brunswick (Lipman House)

Instructor Name Ravit Duncan	Email address: ravit.duncan@gse.rutgers.edu
Phone Number: 848-932 0792	Location and times: 71 Lipman Drive, New Brunswick (Lipman House) Mon 10:55-1:30
Office Hours: by arrangement 10 Seminary Place; Room: 222	Prerequisites or other limitations: Taking *Biology and Society* prior to this course is strongly recommended
Mode of Instruction:[1] ___ Lecture _x_Seminar ___ Hybrid ___ Online ___ Other	Permission required: _x_ No __ Yes Directions about where to get permission numbers:

Rutgers University welcomes students with disabilities into all of the University's educational programs. In order to receive consideration for reasonable accommodations, a student with a disability must contact the appropriate disability services office at the campus where you are officially enrolled, participate in an intake interview, and provide documentations: https://ods.rutgers.edu/students/documentation-guidelines. If the documentation supports your request for reasonable accommodations, your campus's disability services office will provide you with a Letter of Accommodations. Please share this letter with your instructors and discuss the accommodations with them as early in your courses as possible. To begin this process, please complete the Registration form on the ODS web site at: https://ods.rutgers.edu/students/registration-form.

LEARNING GOALS

- Become familiar with the Next Generation Science Standards. Be able to identify relevant standards for chosen topic and map standards to unit and lesson plans
- Analyze students' responses to interview questions and written assessments. Be able to identify relevant prior knowledge and students' alternative conceptions about core science ideas and practices.
- Become familiar with and apply design frameworks to the design of unit and lesson plans
- Develop appropriate formative and summative assessments for unit and lesson plans
- Develop Student Growth Objectives (SGOs) to assess student progress in learning science ideas and practices
- Design, implement (with students) and reflect on a model-based inquiry lesson

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COURSE CATALOG DESCRIPTION:

This course explores current trends and research in science education focusing on innovative approaches to science teaching. Course readings will combine studies of student reasoning, studies of science teaching practice, and new paradigms for learning environments in science. The course is organized around a major project: the development of inquiry-based biology units. Students will work in small groups to develop a set of learning goals around a given topic, analyze student conceptions in the domain (through clinical interviews and literature review), and develop a modeling-based inquiry curriculum unit. Four themes are at the core of this course:

- *Scientific practices:* How can we design instruction to foster students' engagement with and understanding of the nature of science and of key scientific practices such as modeling and argumentation?
- *Students' prior conceptions:* Students' existing ideas about scientific content and process influence their understanding of new material. How can we find out about students' prior knowledge, beliefs, and expectations? How can we account for that in our teaching?
- *Assessing students' knowledge:* What are effective ways of assessing students' knowledge and helping students progress in their understanding?
- *The design of learning environments:* How can we design coherent units in biology for high school students? What are some of the design principles that can guide this process?

GRADING POLICY:

Assignment	Tentative due date	% of Grade
Participation (individual)	Throughout the course	10%
Observations (individual)	Throughout the course	10%
Various benchmarks for projects (group)	Throughout the course	35%
Teaching experiment (group & individual)	Week 12	25%
Individual reflection paper (individual)	Week 15	20%

ACADEMIC INTEGRITY POLICY:

Any violation of academic honesty is a serious offense and is therefore subject to an appropriate Penalty. Refer to http://academicintegrity.rutgers.edu/integrity.shtml for a full explanation of Policies.

ASSIGNMENTS:

Readings: There will be assigned readings for each class session; you are expected to read them and be prepared to discuss them in class. On occasion an additional reading may be assigned or a new reading may be substituted for an existing one.

Participation: Your participation in class counts 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. Interviews are included in your participation grade.

Education journal subscription: Professions have professional associations that, as their name indicates, are associated with them. The teaching profession is no exception. As a science educator you are expected to be an active member of a professional association that is relevant to your work. Towards that end you are asked to subscribe (for the duration of one year) to The Science Teacher (journal of the National Science Teachers Association). You may also subscribe to the American Biology Teacher (the journal of the National Association of Biology Teachers), but you may have to read Science Teacher articles through the library. You will be expected to read and be prepared to discuss articles from your journal.

Teaching experiment: As part of your observations in science classrooms, you will be expected to prepare and teach a lesson within the context of a unit that includes the core scientific practices of modeling and/or argumentation. You will then be expected to write a 3-5 page reflection on the lesson. You are expected to videotape the lesson so that you can better reflect on what occurred and so that you can provide evidence for any claims you make (quotes from students etc.). You are expected to do this assignment sometime during the last 2 weeks of April, so be sure to discuss this with your cooperating teacher. This is an assignment for your portfolio and it involves videotaping the lesson and reflecting on the enactment. You will not get a final grade in the course until these are submitted this assignment.

Course project: As noted above, this course is organized around the development of a 1-2 week long inquiry-based biology unit. The design work will be conducted in small groups and will take place both during class and "off-line" between classes. The design will progress in stages and there will be graded and non-graded assignments associated with these stages. The following is a brief description of each stage and the relevant assignment:

Defining the learning objectives: Each group will identify a few key learning objectives for their assigned topic and submit a one-page description of the learning objectives, what students should be able to do if they achieved them, what understandings are entailed in such learning, and what the supporting standards are for these objectives.

Defining the project/problem context: Each group will choose a project or problem context and prepare a one-page proposal of the project in which learners will be engaged. The proposal should include a justification of how the chosen context will foster learning of the defined objectives (how it develops a need to know).

Uncovering students' existing understandings: For the first project, each group will prepare and conduct clinical interviews with high/middle school students or adults (12 interviewees per group) about the assigned topic focusing on the participants' understandings of concepts related to the learning objectives and the problem context. Interviews should be approximately 20-30 min long and audiotaping is highly recommended. In addition to the interviews, student groups will prepare a similar analysis based on reading existing literature (at least 3 articles) in science education about students' understanding of the topic (use can your subscription for this assignment). Groups will prepare a 5-page summary and analysis of all collected interviews and readings, and the implications for instructional design.

Constructing the project backbone: Each group will outline the lessons of the unit. Groups will prepare a 3-5-page description of their project to date. This should include the learning objectives and their rationale (and standards), a synopsis of the interview analyses and how they informed the design of the project, the choice of a project context and its rationale, and an outline of the unit.

Mid point critique: Each group will critique the project backbone of another group using the criteria developed in Biology and Society (criteria may be revised).

Assessment outline: Each group will figure out how to embed assessment in the unit and prepare rubrics.

Lesson design: Groups will design lessons to fill in the project backbone. Each group will prepare one sample lesson for review. These lessons will be reviewed and critiqued by other groups.

Final design: Each group will design all remaining lessons in their project (if need be, additional lessons will be reviewed and critiqued). Groups will prepare their curriculum binder, which should include: motivation and rationale for unit, learning objectives, an overview of the unit, assessment maps and rubrics, and unit lessons (to be submitted as a binder with a corresponding CD). Each group should prepare a 20 min presentation on their curriculum design.

Classroom observations: As part of the course you will spend 30 hours observing one or more science classrooms. Each week there will be an assignment associated with the observations. Occasionally the assignment will involve more than observation of the class (e.g. interviewing students or the teacher, teaching a lesson, analyzing student work). You are expected to prepare a short oral report on your observations each week (using guiding questions that will be provided).

Individual reflection paper: The last assignment of this course is an individual reflection paper 5 pages long in which you reflect (individually) on what you have learned in this course. This reflection should be based on the contribution of the readings, class activities, and final project to your developing understanding of the design of effective biology instruction.

COURSE SCHEDULE

Assignments are due by the end of that week –Friday at 8pm on Sakai unless otherwise indicated. This syllabus is TENTATIVE, readings and assignments (and due dates) may change according to the progress of the class at the instructor's prerogative.

Week 1 [1-25]-: Introduction

To Do:

1. Become a member of NSTA (National Science Teachers Association) (http://www.nsta.org)

Readings for students who have not taken Biology and Society (other assignments will be added as needed):

Donovan, M. J., & Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press. Chapter 9 (397-416)

Donovan, M. J., & Bransford, J. D. (2005). *How Students Learn: Science in the Classroom*. Washington, DC: National Academy Press. Chapter 11 (475-515)

Windschitl, M & Thompson, J. Teaching about science ideas as models. University of Washington (1-11)

Windschitl, Mark. (2008) "What is Inquiry? A Framework for Thinking About Authentic Scientific Practice in the Classroom." In J. Luft, R.L. Bell & J. Gess-Newsome (Eds.) *Science as Inquiry in the Secondary Setting.* (1-20). NSTA Press.

Reiser, B.J., Berland, L.K, & Kenyon, L**. (**2012). Engaging students in the scientific practices of explanation and argumentation. *Science Scope*, *35*, 6-11.- optional download from library.

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Week 2 [2-1]- Learning Goals and Project Context

Edelson, D. C. (2001). Learning-for-Use: A Framework for the Design of Technology-Supported Inquiry Activities. *Journal of Research in Science Teaching*, 38 (3), p355-85

Wiggins, G. & McTighe, J. (1998). Understanding by Design. Association for Supervision and Curriculum Development: Alexandria, Virginia.

- *Project goals and problem context due (2-5) Fri at 8pm*

Week 3 [2-8]- Project Context and Backbone

Kanter, D.E. (2010). Doing the project and learning the content: Designing project-based science curricula for meaningful understanding. Science Education, 94(3), 525-51.

Work on project backbone

Week 4 [2-15]- Project backbone Cont,

Driver, R., Squires, A., Rushworth, P. and Wood-Robinson, V. (1994). Chapters: Introduction, 1& 21. In *Making sense of secondary science: Research into children's ideas*. London: Routledge.

Hammer, D. (1996). Misconceptions or P-Prims: How may Alternative perspectives of cognitive Structure Influence Instructional Perceptions and Intentions? *The Journal of the Learning Sciences*, 5 (2), pp. 97-127.

- *Draft of project backbone due (2-19) Fri @ 8pm*

Week 5 [2-22]- Clinical Interview

Read at least 3 articles about student conceptions regarding your topic

- *Draft of interview protocol due (2-26) Fri @ 8pm*
- *Plan to conduct interviews week of 29th and week of 7th*

Week 6 [2-29] - Clinical Interview Revised

Shwartz, Y., Weizman, A., Fortus, D., Sutherland, L., Merritt, J., & Krajcik, J. (2009). *Classroom discussions and their role in inquiry-based learning environments*. The Science Teacher *76*(5), pp. 44-47

Revise clinical interview in class
Revise backbone

- *Revised backbone due Mon 3-7 by class, bring two hard copies*

- *Conduct Interview this week. Individual summaries due next week*

Week 7 [3-7]- Unit Critique and Interview Summary

Handbook of the LS Chapter 20: Making Authentic Practices Accessible to Learners

Critique other group's backbone
Conduct interviews

- *Unit critique due Fri 3-11 @ 8pm email copy to respective group*
- *Individual clinical interview summary due to group mates by Fri (3-18) and online by 8pm* ***everyone*** *should read each other's summaries before class on Mon*

No class 3-14 Spring Break

Week 8 [3-21] – Group Interview Summary and SGOs

Reading from Science Teacher TBD

Compile interviews and combine with lit review to create a group interview summary

- *Group interview summary due (3-25) Fri by 8pm*
- *Revised backbone due in class Mon 3-28 and online by 5pm (Mon)*
- *Select topic for teaching experiment*

Week 10 [3-28]- Interlude- Teaching Experiment Preparation and Danielson

Kapur, M.**,** & Toh, P.L.L (2013). Productive failure: From an experimental effect to a learning design. In T. Plomp, & N. Nieveen (Eds.), *Educational design research – Part B: Illustrative cases* (pp. 341-355). Enschede, the Netherlands: SLO.

http://ideas.time.com/2012/04/25/why-floundering-is-good/

Continue work on group unit

- *Draft of teaching experiment lesson due Fri 4-1*

Week 9 [4-4]- Assessment Plan

Wilson, M., & Sloane, K. (2000). From Principles to Practice: An Embedded Assessment System. *Applied Measurement in Education,* 13 (2), p181-208.

Develop assessment plan

- *Assessment plan due (parts 1 and 2 - variables and rubrics) due (4-8) Fri by 8pm*
- *Revise individual teaching experiment lesson- prepare to teach during weeks 11 and 12 (no later than 4-22)*

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Week 11 [4-11]- Lesson Plans - online

Ladson-Billings, G. (1995a). But that's just good teaching! The case for culturally relevant pedagogy. *Theory Into Practice*, 34(3), 159-165.

Continue work on lesson plans

- *One unit lesson plan due Fri 8pm (4/15)*

Week 12 [4-18]- Lesson Plans Continued - Online

Reading from Science Teacher Magazine TBD

Revise assessment plan and continue work on lessons

- *Two lesson plan due by Fri 22nd @ 8pm*
- *Upload video by Mon 25th! Reflection due Wed 27th!*

Week 13 [4-25]- Lesson Plans Continued and Unit test

Reading – Chapter 7- Inquiry-based science instruction for students with disabilities. Kathy Trundle.

Develop unit test

- *Individual lesson reflection (teaching experiment) due Wed (27thh) by 8pm*
- *Be prepared to discuss in class on 5-2*
- *Unit test draft due Fri 29th by 8pm*

Week 14 [5-2]- Teaching Experiment Debrief

Geier, R., Blumenfeld, P.C., Marx, R.W., Krajcik, J.S., Fishman, B., Soloway, E., & Clay-Chambers, J. (2008). Standardized test outcomes for students engaged in inquiry-based science curricula in the context of urban reform. *Journal of Research in Science Teaching*, 45(8), 922-939.

Discuss teaching experiment
Finalize units

- *Final unit (binder and CD) due 5-9 in class*
- *Prepare 20-minute presentation on your unit.*

Week 15 [5-9]- Final Unit Presentations

No Reading

- *Reflection paper due Wed 5-11 by 5 pm.*