UMass | Dartmouth

Department of STEM Education & Teacher Development

Instructor: Rosemary Rak, Ph.D., Part-time Lecturer
Location: Tuesday, 4-6:30pm, Fairhaven High School
Contact: rrak@umassd.edu; rrak@mits.org
Department of STEM Education & Teacher Development, UMD 508-979-4051

SCI 553: Environmental Aspects in Biology for Secondary Science Educators

Fall 2017

This syllabus is a guide and every attempt is made to provide an accurate overview of the course. However, circumstances and events may make it necessary for the instructor to modify the syllabus during the semester and may depend, in part, on the progress, needs, and experiences of the students. Changes to the syllabus will be made with advance notice.

Mission Statement

The STEM Department is committed to the preparation of educators who have sensitivity toward multicultural issues, an awareness of the particular concerns of urban education, knowledge of the unique needs and styles of individual learners, and a conscious knowledge of the role of schools in promoting social justice in the 21st Century. Our mission is to deliver clearly defined teacher preparation programs at the undergraduate, post baccalaureate, and graduate levels. In addition to a rigorous preparation in subject-matter fields, teacher candidates develop their ability to apply pedagogical theory to practice and reflect on the complexities inherent in their craft.

I. COURSE DESCRIPTION

Environmental Aspects in Biology for Secondary Science Educators

A content course designed to gain an understanding of the basic processes accounting for environmental changes. The fundamental question of why the natural world is the way it is will be addressed with topics that support how students can be facilitated in exploring the natural world and making educated decisions pertaining to natural resource and environmental issues.

II. PURPOSE OF THE COURSE

The student should use course content and experiences to develop the following:

1. An understanding of recent trends in science education policy and goals.
2. An awareness of the diversity of curricular approaches available to school science educators, including environmental, inquiry, and interdisciplinary curricula.

3. An ability to design lessons and units that are developmentally appropriate and sensitive to the needs, values, and interests of a diverse group of science students.
4. An ability to construct assessment plans that are compatible with teaching goals and methods and that allow for multiple ways of representing knowledge.
5. An ability to use diagnostic observation skills, instructional strategies to promote science learning in small group or whole-class settings.
6. An ability to use multimedia technologies to support meaningful learning.
7. An awareness of organizations and resources (human, environmental, and technological) that serve the professional development of teachers.
8. An ability to establish rules and procedures that ensure the physical safety of children.
10. An understanding of reflection in professional development and lifelong learning.

III. COURSE OBJECTIVES/OUTCOMES

Each course objective/outcome is followed by a list of relevant standards from *Guidelines for the Professional Standards for Teachers*, January 2015, retrieved from: **http://www.doe.mass.edu/edprep/advisories/TeachersGuidelines.pdf**

A. In the area of Scientific Thinking, the candidate will be able to:

1. Articulate environmental science concepts and principles by utilizing different curriculum tools. (1(a), 1(b), 2(a), 2(b), 2(c), 2(d), SEI Indicators: (a), (b), (c), & (d))
2. Ask questions about natural phenomena; objects and organisms; events. (1(a), 1(b), 2(a), 2(d), SEI Indicators: (a), (b), (c), & (d))
3. Use concepts from the 2016 *Massachusetts Science and Technology/ Engineering Curriculum Framework* (retrieved from: *http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf)* to explain a variety of observations and phenomena. (1(a), 2(a), 2(d), SEI Indicators: (a), (b), (c), & (d))
4. Work individually and in teams to collect and share information and ideas. (4 (a), 4(c), 4(e))

B. In the area of Scientific Tools and Technologies, the candidate will be able to:

1. Use technology and tools (e.g., computers, rulers, balances, thermometers, watches, magnifiers, and microscope) to gather data and extend senses. (1(a), 1(b), 2(a), SEI Indicator (a))
2. Collect and analyze data using concepts and techniques in math such as averages, data displays, graphing, variability, and sampling (A1, A3, A6, B1c, B1d, B2b, B2c). (1(a), 1(b), 2(a), SEI Indicator (a))

C. In the area of Scientific Communication, the candidate will be able to:

1. Represent data and results in multiple ways, such as tables, graphs, and drawings. (1(a), 1(b), 2(a), 2(b), 2(d))
2. Use facts to support conclusions. (1(a), 1(b), 2(a), 2(b), 2(d))
3. Produce both written and oral explanations using data. (1(a), 1(c), 2(a), 2(b), 2(c), 2(d), SEI Indicators (a), (b), (c))

D. In the area of Scientific Investigation, the candidate will be able to:

1. Make systemic observations of a variety of natural phenomena in the world. (1(a), 2(a), SEI Indicators (a), (b), (c))
2. Construct a hypothesis from observations. (1(a), 2(a), SEI Indicators (a), (b), (c))
3. Design a controlled experiment to test the hypothesis. (1(a), 2(a), SEI Indicators (a), (b), (c))

E. In the area of Science Instructional Planning, the candidate will be able to:

1. Develop inquiry-based lesson plans and science activities for diverse learners. (1(a), 1(b), 2(a), 2(b), 2(c), 2(d), SEI Indicators (a), (b), (c)).
2. Develop a curriculum planning file of environmental science resources. 1(a), 1(b), 2(a), 2(d), 2(e).
3. Evaluate science inquiry skills through authentic assessment. (1(b), 1(c), SEI Indicator (b)).

IV. REQUIRED READING:

2016 Massachusetts Science and Technology/ Engineering Curriculum Framework, *http://www.doe.mass.edu/frameworks/scitech/2016-04.pdf*

A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas (2011) The National Academies Press.
http://www.nap.edu/catalog.php?record_id=13165#toc

TEXT: deNapoli, Dyan (2010). *The great penguin rescue*. New York, NY: Free Press. ISBN: 978-1-4391-4818-1

ARTICLES: Reading assignments will be provided via Education Resources Information Center (ERIC),) EBSCO, Proquest, and National Science Teachers Association (NSTA*) databases. *Visit http://www.nsta.org/ to set up a free account to access collections of articles and other resources for class assignments.

V. Methods of Assessment

Each assessment category is followed by a list of relevant standards from *Guidelines for the Professional Standards for Teachers*, January 2015, retrieved from: **http://www.doe.mass.edu/edprep/advisories/TeachersGuidelines.pdf**

A. Interactive Reflective Journaling (IRJ) (16%):

Students will use interactive reflective journaling (IRJ) to document their investigation, exploration, and evaluation of weekly course topics addressed in assigned readings, class experiences, including investigations and homework assignments. Entries will include identification of potential research-based materials, and projected methods for planning, implementation, and evaluation of subject themes.

Since class activities will include discussions of students' reflections, it is essential that students complete weekly entries of their reflections **prior to the next class meeting.** This requirement will be assessed by participation in class discussions. (4(a), 4(b), 4(c))

Students will submit their journals four times during the course, with 25% of the points for this assignment category awarded each time. A rubric will be provided.

B. Participation (10%):

Students will actively engage in class activities, laboratory investigations, and discussions each week. Collaboration and interactive experiences are integral aspects of the learning environment. Half of the points for this category will be awarded for each half of the semester. (1(a), 4(c))

C. Investigations (I) (18%):

Products from various learning activities, including laboratory and/or field experiences, will be evaluated during the semester. These assignments will be collected three times, with 6 points awarded each time. (1(a), 2(a), 2(d), 4(b). SEI Indicator: (a)

D. Lesson Plans (LP) (18%):

Three standards-based lesson plans will be developed; each worth 6 points. The lessons plans will demonstrate students' understanding of selected environmental science concepts and will apply specific pedagogical approaches. For all three lessons, students will demonstrate the ability to design instruction specific to the appropriate MA Learning Standard(s). The *TaskStream* Lesson Plan template will be used for the assignment, and rubrics will be provided.
(1(a), 1(b), 2(a), 2(b), 2(c), 2(d), 2(e), 2(f), SEI Indicators (a), (b), (c), (d))

- *Inquiry-based, hands-on Lesson Plan* (6%): Students will produce an inquiry-based, hands-on investigation for middle or high school student learning.

Students may modify an existing lesson plan or create an inquiry-based lesson plan.

- *Scientific Modeling Lesson Plan* (6%): Students will produce a middle or high school lesson plan that uses scientific modeling for instruction and assessment for middle or high school students. In addition to the written lesson plan, there will be a presentation to the class.

- *Socio-scientific Issues Lesson Plan* (6%): Working individually or with a partner, students will plan, design and create a 5-E Learning Cycle lesson plan addressing an environmental science topic through the lens of its relationship to human society. The lesson should illustrate the NGSS Science Practices of *Engaging in Argument from Evidence* and *Obtaining, Evaluating, and Communicating Information.* Students will present their lesson plans to the class.

E. Midterm Assessment (8%):
Students' preliminary work on the culminating assignment for the course will be evaluated at mid-semester. Students will submit draft content for Stage 1 (*Identify Desired Results)* and Stage 2 (*Determine Acceptable Evidence)* of the *Understanding by Design* (UbD) Unit Plan for evaluation and feedback. See *Assessment G* below for additional information about the culminating assignment. (1(a), 1(b), 2(a), 2(b), 2(d), 2(e), SEI Indicators (a), (b), (c), (d))

F. Content Assessment (10%):
Students' understanding of environmental science concepts addressed during the semester will be assessed using an open response instrument. (1(a))

G. Understanding by Design (UbD)Unit Plan (20%):
This assignment is the culminating project for the course. It is imperative that guidelines for its organization and presentation are followed. The online template available on *TaskStream* will be used for the assignment; an evaluation rubric will be provided.

Description:
The unit plan with follow the *Backward Design* model described by Wiggins and McTighe (2005). The intent is for the student's plan to be implemented in his/her classroom in the future. In addition to the required components of the UbD plan, the comprehensive 5 – 7 day unit plan will include:

- An explanation of how the unit plan addresses the needs of diverse learners
- MA Standards that inform the unit
- NGSS Science Practices that are integrated in the unit
- An integrated plan of formative and summative assessment that will provide evidence of student learning

- Relevant science safety practices included in lesson plans
- A description of how appropriate instructional technology is used to enhance student learning

(1(a), 1(b), 2(a), 2(b), 2(d), 2(e), SEI Indicators (a), (b), (c), (d))

VI. Course Policies

A. Assessment Procedures

Grades will be computed using the following scale:

Grade	Scale	Grade	Scale
A+	99%-100%	C	73% - 76%
A	93%-98%	C-	70% - 72%
A-	90%-92%	D+	67% - 69%
B+	87%-89%	D	63% - 66%
B	83%- 86%	D-	60%- 62%
B-	80%- 82%	F	BELOW 60%
C+	77% - 79%		

The incomplete policy for this course is that at least 70% of the course must be already completed and an exceptional circumstance (e.g. medical issue) must exist. If you feel you require an incomplete for an exceptional reason, you need to email me and state your reasons for the incomplete in writing. We will then decide on a course of action.

B. Attendance Policy

Attendance and punctuality are required attributes for teachers. Students are expected to be involved and stay involved. This may include involvement in an online learning community. Each class adds some new dimensions to one's ability to teach in the classroom and to complete the performance projects. Students may have points deducted from their final grade commensurate to the hours missed and/or delays in postings of online activities.

C. Policies Related to Students with Disabilities

Section 504 and the American Disabilities Act of 1990 offer guidelines for curriculum modifications and adaptations for students with documented disabilities. Any student with disabilities must register through the UMass Dartmouth offices (located in the Counseling Center on the Dartmouth campus).

D. Academic Integrity

All UMass Dartmouth students are expected to maintain high standards of academic integrity and scholarly practice. The University does not tolerate academic dishonesty of any variety, whether as result of a failure to understand proper academic and scholarly procedure, or as an act of intentional dishonesty.

Plagiarism: In any situation, plagiarism is a serious offense and may result in a failing grade in this course. Since much of your work in this class requires the use of an outside source, the citation of sources is mandatory.

For a thorough explanation of the University's Policy on Academic Integrity see: http://www.umassd.edu/policies/activepolicylist/academicaffairs/academicintegritypolicyandreportingform/

E. Safety Policy

This class is conducted in a science laboratory classroom; some class sessions may be held at a field site. All standard laboratory safety practices for laboratory and field site learning experiences must be followed. These practices include the proper use of personal protective equipment, closed-toe footwear, and no eating or drinking in the lab environment.

F. Changes to the Course Outline

The course outline provides an overview of the intended topics and the schedule for the submission of assignments. However, circumstances and events, including the needs and/or interests of the students, may warrant adjustments to the schedule. In such cases, advance notice of the changes will be provided.

G. Electronic Communication

Students are expected to check their standard UMD e-mail address (@umassd.edu) regularly throughout the semester and use that email address to communicate with the instructor.

COURSE OUTLINE: SCI 553 Environmental Science for Secondary Educators

Note: The outline is tentative; adjustments will be announced during the semester, if needed.

Date	Topics	Assessments and Assignments Due*	MA Science Content Standards	
			6-8	9-10
9/12	Course Introduction - Themes & Essential Questions Syllabus Review Nature of Science Introduction to Phenology Study	In class pre-assessment tasks	7.MS-LS2-1. 8.MS-LS1-5.	HS-LS2-7.
9/19	Marine Environment Field Investigation: • Modeling Food webs • Asking Questions Phenology Study: Leaf Drop data collection	Begin reading *The Great Penguin Rescue*	7.MS-LS2-1. 7.MS-LS2-2. 7.MS-LS2-3. 7.MS-LS2-4. 8.MS-LS1-5.	HS-ESS2-6. HS-LS2-2.
9/26	Freshwater Environments: • Macroinvertebrates as Water Quality Indicators Developing UbD Unit Plans Phenology Study: Leaf Drop data collection	IRJ #1: *Reconnecting with Your Environment*	7.MS-LS2-1. 7.MS-LS2-2.	HS-LS2-2.
10/3	Freshwater Environments: • Effect of Temperature on Dissolved Oxygen Discussion of *The Great Penguin Rescue* Phenology Study: Leaf Drop Data Collection	I #1	7.MS-LS2-1. 7.MS-LS2-4.	HS-LS2-7

10/10	Freshwater Environments: • Aquatic Primary Productivity – Day 1 Phenology Study: Leaf Drop Data Collection	IRJ #2	7.MS-LS2-1. 7.MS-LS2-2.	HS-LS2-2.
10/17	Freshwater Environments: • Aquatic Primary Productivity – Day 2 Phenology Study: Leaf Drop Data Collection	I #2	7.MS-LS2-1.	HS-LS2-2.
	BHEC: Boston Harbor Educators Conference 10/21			
10/24	Terrestrial Environments: • Wrap up Phenology Investigation • Effects of Habitat Fragmentation and their Solutions Discussion of *The Great Penguin Rescue*	Mid-Semester Assessment of Unit Plan	7.MS-LS2-4. 7.MS-LS2-5.	HS-ESS3-3. HS-LS4-5
10/31	Lesson Plan #1 Presentations Matter and Energy in Ecosystems • The Hydrologic Cycle & Climate Change • The Carbon Cycle & Climate Change	LP #1	7.MS-ESS2-4. 7.MS-LS2-3. 8.MS-ESS2-6. 8.MS-ESS3-5.	HS-ESS2-2 HS-ESS2-6. HS-LS1-5. HS-LS2-5.
11/7	Population and Community Biology • Estimating population size • Interactions among organisms in a community Biodiversity	I #3	7.MS-LS2-5. 7.MS-LS2-6(MA).	HS-ESS3-3. HS-LS2-1. HS-LS2-2. HS-LS2-6.

11/14	Socio-scientific Issues Lesson Plan (#2)	LP #2	7.MS-LS2-5. 7.MS-LS2-6(MA).	HS-LS2-7
11/21	Group Presentations of SSI Lesson Plans Matter and Energy in Ecosystems: • Modeling Energy Flow Discussion of *The Great Penguin Rescue*	IRJ #3	7.MS-LS2-3.	HS-ESS3-1. HS-LS2-4. HS-LS2-7
11/28	Climate Change	LP #3	7.MS-LS2-5. 7.MS-LS2-6(MA). 8.MS-ESS2-6. 8.MS-ESS3-5.	HS-ESS2-2. HS-ESS3-1. HS-LS2-7
12/5	UbD Unit Plan Peer Review Content Assessment	UbD Unit Plan Draft		
12/12	Culminating assignment	UbD Unit Plan		

**Assignments are to be submitted by midnight of the Wednesday following the class date on the course outline.*