

**COURSE APPROVAL DOCUMENT**  
Southeast Missouri State University

Departments: \_\_\_Biology, Chemistry, Physics\_\_\_\_\_

Course No. BI/CH/PH 320/520\_\_\_\_\_

Title of Course: \_Engaging Learners in Science \_\_\_\_\_

Date: \_\_3-2-17\_\_\_\_\_

Please check     New  
                           Revision

I. Catalog Description (Credit Hours of Course):

Interested in teaching science? Try your hand at engaging peers in lab and classroom guided by research on learning. Two lectures and one two-hour lab. (3)

II. Co- or Prerequisite(s):

Declared major in biology, chemistry or physics (course is not available for Physics minors).

Sophomore standing, Completion of 100 level courses in your science major, interest in teaching.

Open to graduate students in the sciences

III. Purposes or Objectives of the Course (optional):

- 1) Provide BS science majors who are interested in education, but are not in BS Ed degree programs, an opportunity to learn about teaching and have hands-on practice with classmates.
- 2) Provide BS Ed majors in the sciences (high school level) an opportunity to work on teaching with COSTA-based science educators and in authentic science teaching settings.
- 3) Provide interested science graduate students the opportunity to learn about teaching and have hands-on practice with classmates.
- 4) Understand the NGSS (Next Generation Science Standards) “scientific and engineering practices,” how they can be implemented in laboratory and classroom, and how they are connected to evidence based reasoning.
- 5) Practice with online simulations useful for learning science concepts and/or doing investigations and implement one simulation in peer teaching.
- 6) Understand and locate research on constructivism and be able to intentionally implement it in science peer teaching episodes.
- 7) Understand the importance of using real-life problems to engage students in science learning and how to help learners analyze such problems.

IV. Course Learning Outcomes (Minimum of 3):

- 1) Students will be able to design a science lesson around a computer simulation and use it to teach a concept to peers.
- 2) Students will be able to design a science laboratory-based lesson and teach to peers to illuminate and correct a naïve or incorrect understanding.
- 3) Students will be able to write a reflective essay that links constructivist principles to their teaching decisions.

V. Optional departmental/college requirements:

*n/a*

VI. Course Content or Outline (Indicate number of class hours per unit or section):

<i>Topic</i>	<i>Hours (64 total)</i>
How people learn science and what that means for teaching: Constructivist understandings	4
NGSS science and engineering practices: bringing Nature of Science and inquiry skills into learning	8
Encouraging evidence-based reasoning	4
Encouraging participation in labs: questioning skills for critical thinking.	4
Transforming verification exercises into open investigations.	4
Identifying and using students' naïve ideas and prior knowledge to engage learners. AAAS database. Exploring and locating research on misconceptions	16
Engaging students with real world problems: Problem-based, project-based, and case-based learning	8
Using online simulations for investigations, concept development, with peer teaching	16

For BI/CH/PH 520 (graduate students) they will develop an original case study and activities or read and analyze 10 papers in science teaching in their discipline related to dealing with specific misconceptions.

Please Attach copy of class syllabus and schedule as an example

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Chair

Signature: \_\_\_\_\_ Date: \_\_\_\_\_  
 Dean

**Departments:** Biology, Chemistry, Physics and Engineering Physics  
BI/CH/PH 320 / 520

## Engaging Learners in Science Spring 2018

Dr. Rachel Morgan-Theall      [rmtheall@semo.edu](mailto:rmtheall@semo.edu)      RH 206F

Office hours: M Th F 12-1      Phone: 573 651-2381

Class meets in MG 124, T, Th 4-6 pm

Welcome to Engaging Learners in Science. This course is an opportunity for science majors who are interested in education to have an early experience with science teaching in a safe, peer teaching and coaching setting. Experienced science educators in the College of Science Technology and Agriculture offer concepts and strategies based on research and their practice as science teachers. This course does NOT replace the SE320 methods course required for BS Ed majors in the sciences.

### **I. Catalog Description (Credit Hours of Course):**

Interested in teaching science? Try your hand at engaging peers in lab and classroom guided by research on learning. Two lectures and one two-hour lab. (3 credit hours)

### **II. Co- or Prerequisite (s):**

Sophomore standing, Completion of 100 level courses in your science major, interest in teaching  
Required for all BS Ed High school Science majors in Biology, Chemistry or Physics.  
Open to graduate students in the sciences.

### **III. Purposes or Objectives of the Course**

- 1) Provide BS science majors who are interested in education, but are not in BS Ed degree programs, an opportunity to learn about teaching and have hands-on practice with classmates.
- 2) Provide BS Ed majors in the sciences (high school level) an opportunity to work on teaching with COSTA-based science educators and in authentic science teaching settings.
- 3) Provide interested science graduate students the opportunity to learn about teaching and have hands-on practice with classmates.
- 4) Understand the NGSS “scientific and engineering practices,” how they can be implemented in laboratory and classroom, and how they are connected to evidence based reasoning.
- 5) Practice with online simulations useful for learning science concepts and/or doing investigations and implement one simulation in peer teaching.
- 6) Understand and locate research on constructivism and be able to intentionally implement it in science peer teaching episodes.
- 7) Understand the importance of using real-life problems to engage students in science learning and how to help learners analyze such problems.

### **IV. Course Learning Outcomes (Minimum of 3):**

- 1) Students will be able to design a science lesson around a computer simulation and use it to teach a concept to peers.
- 2) Students will be able to design a science laboratory-based lesson and teach to peers to illuminate and correct a naïve or incorrect understanding.

- 3) Students will be able to write a reflective essay that links constructivist principles to their teaching decisions.

### Course Materials and Equipment

No textbook required.

Must have access to windows-based computer for online resources. (Some tablets are available for short term loan).

### Grading Scale and Assessments

Undergraduates	%	Graduates	%
Peer teaching using simulation	10	Peer teaching using simulation	10
Peer teaching of laboratory	10	Peer teaching of laboratory	10
Peer teaching of case analysis	10	Peer teaching of case analysis	10
Reflective essay on integrating constructivist ideas in lessons	10	Reflective essay on integrating constructivist ideas in lessons	10
Identification of research on misconceptions	10	Identification of research on misconceptions	10
In class activities	30	In class activities	20
Participation	10		
Final exam	10	Final exam	10
		Either: develop an original case study and activities OR Read and analyze 10 papers in science teaching in your discipline related to dealing with specific misconceptions	20

Grading scale:

Undergraduate

A = 90-100%

B = 80-89%

C = 70-79%

D = 60-69%

F = < 60%

Graduate

A = 90-100%

B = 80-89%

C = 70-79%

F = <70%

### UNIVERSITY POLICIES

#### Academic Honesty

- The official statement about academic honesty, including plagiarism, may be accessed at: <http://www.semo.edu/pdf/stuconduct-code-conduct.pdf>
- Additional information may be accessed at: [http://www.semo.edu/pdf/old/2014\\_Admissions.pdf](http://www.semo.edu/pdf/old/2014_Admissions.pdf) starting on page 15 of this document, And <http://www.semo.edu/faculty/senate/handbook/5d.html>
- Penalties for academic dishonesty range from failing the assignment and/or failing the course to expulsion from the University.

#### Civility and Harassment

- A major determinant of a successful educational experience is a shared sense of respect among and between the students and their instructor. We all share responsibility for creating and maintaining a climate of mutual respect and an environment free from harassment.
- Adhering to generally accepted standards of behavior will help facilitate a positive experience for all.
  - ***Please turn off all electronic devices during class.*** When your cell phone rings, for example, it distracts others and may throw a great discussion off course.

- *If you need to leave the room, try to wait for a moment that is least distracting.*
  - *When we have class discussions, don't attack people but, instead, constructively and reflectively respond to the ideas being expressed. One of the important reasons for engaging in discussion is that by advancing our ideas in a public forum, our ideas get better. Through dialogue we have the opportunity to learn new things and, potentially, change old beliefs. In order to accomplish this, we need to work together to maintain a climate of mutual respect.*
- *More specific information about the Student Code of Conduct which governs student behavior can be found by clicking on the "[Statement of Student Rights and Code of Student Conduct](http://www.semo.edu/pdf/stuconduct-code-conduct.pdf)" link found at <http://www.semo.edu/pdf/stuconduct-code-conduct.pdf>*

### **Disabilities**

*Southeast Missouri State University is committed to making every possible educational accommodation for students with disabilities. Many services and accommodations which aid a student's educational experience are available for students with various types of disabilities. Students may obtain official information about disabilities from Learning Assistance and Disability Support Services, located at: <http://www.semo.edu/ds/>. Or by phone at 651-5927*

**Questions, comments or requests regarding this course should be taken to your instructor. Unanswered questions or unresolved issues involving this class may be taken to Dr. Morgan-Theall as the course director. If your issue is with Dr. Morgan-Theall and you have talked with her but have unresolved issues, you may talk with Dr. Crawford, the chair of Chemistry.**

### **V. Course Content or Outline (Indicate number of class hours per unit or section):**

<i>Topic</i>	<i>Hours (64 total)</i>
How people learn science and what that means for teaching: Constructivist understandings	<i>Week 1</i>
NGSS science and engineering practices: bringing Nature of Science and inquiry skills into learning	<i>Weeks 2 and 3</i>
Encouraging evidence-based reasoning	<i>Week 4</i>
Encouraging participation in labs: questioning skills for critical thinking.	<i>Week 5</i>
Transforming verification exercises into open investigations.	<i>Week 6</i>
Using online simulations for investigations, concept development, with peer teaching	<i>Weeks 7-10</i>
Identifying and using students' naïve ideas and prior knowledge to engage learners. AAAS database. How to locate research on misconceptions.	<i>Weeks 11-14</i>
Engaging students with real world problems: Problem-based, project-based, and case-based learning.	<i>Weeks 15-16</i>
<i>Final Exam: At the time determined by the Registrar</i>	<i>MG124</i>