

**COURSE APPROVAL DOCUMENT**  
**Southeast Missouri State University**

**Department: Middle & Secondary Education**  
**Title of Course: Techniques of Teaching Science**

**Course No. SE 320**  
**Date: Nov. 3, 2015**  
**Please check:  New**  
 **Revision**

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

Research based methods for engaging students in science, development of a unit with aligned standards, lessons and assessments. Safety issues. (3 credit hours)

Note: this course is taught as two labs and one lecture, a total of 5 hours of contact time per week.

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

Admission to Teacher Education Program, Completion of SE360 or SE365 Pedagogy II and SE355 Field 2 or permission of instructor. Co-requisites: SE 380 Field 3, SE 385 Pedagogy 3, and SE 390 Reading Deficits

**III. Purposes and Objectives of the Course:**

Teacher candidates will:

- 1) Demonstrate their knowledge of science content, including nature of science and tools of scientific inquiry, by their contributions to class activities and by appropriately selecting content for teaching experiences. A minimum of one lesson must overtly include the nature of science and an online simulation. **(MoSPE 1.1, 1.2, 1.3, 4.1, 4.2, 5.2, 6.4) (NSTA 1a, 1b, 1c)**
- 2) Link their professional understanding of student learning to plan instruction, including consideration of student prior knowledge and relevance of topics to students' lives outside of school. **(MoSPE 1.5, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.2, 3.3, 5.3, 6.2) (NSTA 2a, 2c)**
- 3) Develop, and incorporate into a unit, a variety of teaching strategies and methods specifically to enhance science learning consistent with a constructivist approach, such as inquiry strategies, investigative experiences in lab and on computers, case-based or problem-based methodologies, and concept attainment approaches. **(MoSPE 1.1, 1.2, 1.3, 2.5, 4.1, 4.2, 4.3, 6.2) (NSTA 2b, 3a, 3b)**
- 4) Locate a broad range of teaching resources relevant to a unit of instruction, including electronic resources and community resources for field trips, materials and speakers. Demonstrate awareness of technology resources for science teaching and learning. **(MoSPE 5.3, 6.4, 9.3) (NSTA 3a, 3b)**
- 5) Consider ways to develop an environment that supports an inquiring community of diverse learners, including safety considerations, ways to manage time and resources,

ways to foster positive social interactions, and physical space considerations. **(MoSPE 1.5, 2.6, 4.1, 4.3, 5.1, 5.2,5.3, 6.1, 6.2, 6.4) (NSTA 3a, 3b, 3d, 4a, 4b, 4c)**

- 6) Align instruction with Missouri and national standards, such as the Next Generation Science Standards, and align assessments (formal, informal and performance) with goals and instruction. **(MoSPE 3.1, 3.2, 7.1, 7.2, 7.4) (NSTAA 1c, 2c, 3c, 5a)**
- 7) Continue to develop their skills of self-assessment and reflection through preparation of reflective analyses of lessons and teaching experiences, completion of a MoPTA. **(MoSPE 8.1, 8.2) (NSTA 5a, 5b, 5c)**
- 8) Engage in professional science educator activities, including judging science fairs and completion of a professional development plan in preparation for student teaching. Joining a science teacher association is optional. **(MoSPE 8.2, 9.1, 9.3) (NSTA 6a, 6b)**

#### **IV. Student Learning Outcomes**

- 1) Students will demonstrate chemical, classroom, field, and animal safety.
- 2) Students will align instruction with state and national standards, including the Missouri and National standards (e.g., NGSS)
- 3) Students will use a variety of teaching strategies and methods specifically to enhance science learning consistent with a constructivist approach, e.g., the learning cycle, POE and/or discrepant events

#### **V. Optional departmental/college requirements** None

**VI. Course Content or Outline.**

A. Overview, preassessments, lesson plan format, expectations for unit and MoPTA	3
B. Nature of Science and integrating it into lessons (with peer teaching)	14
C. Navigating and using Standards: Missouri and Next Generation Science Standards	3
D. Developing appropriate assessments for science, writing tests, aligning assessments, goals, standards and lessons, analyzing evidence of student learning.	9
E. Professional development activities (judging science fair, Professional Development plan for student teaching)	6
F. Learning of science: constructivism, Piaget, alternative conceptions and prior knowledge, meaningful and rote learning.	3
G. Teaching methods to promote science learning: Learning cycle, 5E model, Predict/Observe/Explain, Inquiry in lab, computer-based resources and lessons, problem-based learning. With peer teaching	24
H. Science safety and the legal responsibilities of science teachers	6
I. Teaching evolution and other controversial subjects	3
Exams	4
	Total 75

Please Attach copy of class syllabus and schedule as an example

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

Date \_\_\_\_\_

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

Date \_\_\_\_\_

Department approved 11/4/15

**SE 320 Techniques of Teaching Science**  
**Department of Middle and Secondary Education Southeast Missouri State University**

**Dr. Margaret Waterman, RH 205, 651-2381, [mwaterman@semo.edu](mailto:mwaterman@semo.edu)**

**Office Hours: M, W, F at 11 or happily by appointment**

Welcome to Techniques of Teaching Science and Advanced Field Experience. Dr. Morgan-Theall and I are excited to be working with you!!

Techniques of Teaching Science is the core science education course for pre-service science teachers at the middle and secondary levels. It also begins the process of career development for science teachers. Based on research on how people learn science, students in this course will learn and practice teaching approaches that

- engage students in scientific investigation,
- encourage active learning,
- build on prior knowledge, and
- put science knowledge into social and everyday contexts.

Science curriculum, performance assessments, and science safety are other key topics. This course addresses the NSTA and MoSTEP standards and corresponds with the Conceptual Framework for the Preparation of Teachers of the College of Education.

1. We will meet in class every day for an intensive 5 weeks at the beginning of the semester and do most of the SE320 work.
2. For SE 380- Your field placement will be in a local high school or middle/junior high school. In the middle of the semester, your SE320 class time will become your field experience time. You will be going to the schools every day for 2-3 periods a day, for 6 weeks between 8-11 a.m. You must be at the school a total of 60 class periods.
3. Most of the last 4 weeks of the course will be devoted to completing the MoPTA as well as some remaining techniques topics.

**I. Catalog Description and Credit Hours of Course:**

Research based methods for engaging students in science, development of a unit with aligned standards, lessons and assessments. Safety issues. (3 credit hours)

Note: this course is taught as two labs and one lecture, a total of 5 hours of contact time per week. However, we will be doing all of SE320 before you go out to the Field. So, we will meet every day for five weeks from 8-10:50, and have a final exam for a total of 75 hours.

**II. Prerequisites:**

Admission to Teacher Education Program, Completion of SE360 or SE365 Pedagogy II and SE355 Field 2 or permission of instructor. Co-requisites: SE 380 Field 3, SE 385 Pedagogy 3, and SE 390 Reading Deficits.

### III. Purposes and Objectives of the Course:

Teacher candidates will:

- 1) Demonstrate their knowledge of science content, including nature of science and tools of scientific inquiry, by their contributions to class activities and by appropriately selecting content for teaching experiences. A minimum of one lesson must overtly include the nature of science and an online simulation. **(MoSPE 1.1, 1.2, 1.3, 4.1, 4.2, 5.2, 6.4)**
- 2) Link their professional understanding of student learning to plan instruction, including consideration of student prior knowledge and relevance of topics to students' lives outside of school. **(MoSPE 1.5, 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 3.2, 3.3, 5.3, 6.2)**
- 3) Develop, and incorporate into a unit, a variety of teaching strategies and methods specifically to enhance science learning consistent with a constructivist approach, such as inquiry strategies, investigative experiences in lab and on computers, case-based or problem-based methodologies, and concept attainment approaches. **(MoSPE 1.1, 1.2, 1.3, 2.5, 4.1, 4.2, 4.3, 6.2)**
- 4) Locate a broad range of teaching resources relevant to a unit of instruction, including electronic resources and community resources for field trips, materials and speakers. Demonstrate awareness of technology resources for science teaching and learning. **(MoSPE 5.3, 6.4, 9.3)**
- 5) Consider ways to develop an environment that supports an inquiring community of diverse learners, including safety considerations, ways to manage time and resources, ways to foster positive social interactions, and physical space considerations. **(MoSPE 1.5, 2.6, 4.1, 4.3, 5.1, 5.2, 5.3, 6.1, 6.2, 6.4)**
- 6) Align instruction with state and national standards, and align assessments (formal, informal and performance) with goals and instruction. **(MoSPE 3.1, 3.2, 7.1, 7.2, 7.4)**
- 7) Continue to develop their skills of self-assessment and reflection through preparation of reflective analyses of lessons and teaching experiences, completion of a MoPTA. **(MoSPE 8.1, 8.2)**
- 8) Engage in professional science educator activities, including judging science fairs and completion of a professional development plan in preparation for student teaching. Joining a science teacher association is optional. **(MoSPE 8.2, 9.1, 9.3)**

### IV. Student Learning Outcomes

- 1) Students will address chemical, classroom, field, and animal safety.
- 2) Students will align instruction with state and national standards, including the Missouri and National standards (e.g., NGSS)
- 3) Students will use a variety of teaching strategies and methods specifically to enhance science learning consistent with a constructivist approach, e.g., the learning cycle, POE and/or discrepant events

**V. Expectations of Teacher Candidates:**

- A. Attend all sessions, complete all assignments and participate in all class activities.
- B. Conduct oneself in a professional manner at all times.
- C. Prepare a complete unit plan, aligned with state and national standards, with individual lessons and aligned assessments for one-two weeks of instruction.
- D. Plan, prepare, present in peer teaching, and self-evaluate at least two science lessons.
- E. Complete safety readings and exercises.
- F. Prepare a Professional Development Plan for use in Block IV.

**VI. Textbook:**

None. This course is using an extensive set of online resources, many of which are creative commons open educational resources (OER). See Moodle page.

**VII. Basis of Student Evaluation SE320:**

Peer teaching, lesson plans, reflective analyses  
(including assessments, instructional decision making, analysis of learning) = 20%

In class activities = 20%

Unit plan with aligned assessments = 30%

Assignments on alternative conceptions = 10%

Professional Development Plan (final) =10%

Participation and professionalism = 10%

**University Policies**

**Academic Honesty**

- The Undergraduate Bulletin defines academic dishonesty as "...those acts which would deceive, cheat, or defraud so as to promote one's scholastic record...", and states that "[v]iolations of academic honesty represent a serious breach of discipline and may be considered grounds for disciplinary action, including dismissal from the university". Students are expected to understand and abide by the rules governing academic honesty.
- The official statement about academic honesty, including plagiarism, may be accessed at: <http://www.semo.edu/bulletin/>.
- Additional information may be accessed at: <http://www6.semo.edu/judaffairs/>.

### **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 unless asked for. 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" link found at <http://www6.semo.edu/judaffairs/>.
- Judicial Affairs is responsible for addressing disciplinary matters related to breaches of accepted civility and harassment standards. Information about this process is available at: <http://www6.semo.edu/judaffairs/>.

### **Accessibility**

- 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 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 Dr. Waterman. Unanswered questions or unresolved issues involving this class may be taken to Dr. Simin Cwick, chair of Middle and Secondary Education.

**SE 320 2015 Tentative Course Schedule**

<b>Date and Day</b>	<b>Work due this date</b>	<b>Topic</b>	<b>Assignment</b>
Tues 1/20		<ul style="list-style-type: none"> <li>• Introductions.</li> <li>• MoPTA and SE370</li> <li>• Pre-assessments</li> <li>• Nature of science (NOS)</li> <li>• NGSS</li> <li>• Science Processes</li> </ul>	<p>Find free iPad apps that are useful for scientific inquiry</p> <p>Post at least one to the Glossary</p>
Wed 1/21		<ul style="list-style-type: none"> <li>• Learning goals: integrating NOS</li> <li>• MO Science Standards and NOS</li> <li>• NGSS</li> <li>• Simulations and Science</li> </ul>	<p>Get Peer Teaching 1 assignment:</p> <p>15 minute lesson on nature of science/ process skills, hands on with activity and debriefing.</p>
Thur 1/22		<ul style="list-style-type: none"> <li>• Assessment writing</li> <li>• Science inquiry skills continued</li> <li>• Block III lesson plan</li> </ul>	<p>Prepare lesson plan aligned to individual learning goals, also GLE or CLE aligned</p> <p>Make sure your lesson objectives are aligned to MO GLE or CLE AND the NGSS</p>
Fri 1/23	Draft of NOS lesson	<ul style="list-style-type: none"> <li>• Peer review of NOS lessons in class</li> <li>• Introduction to the Big Unit assignment</li> </ul>	<p>. Work on revisions to your lesson</p> <p>Prepare draft of pre and post tests</p>
Mon 1/26	Draft of pre and post test	Peer Review assessments	
Tues 1/27	Have a completed lesson plan, pre and post assessments aligned to individual learning goals, also GLE or CLE aligned.	P-T 1-1	Reflection packet for P-T 1 includes: Lesson plan, reflection of a decision you made that worked, one that didn't and what you would do differently, evidence of learning results and interpretation. Also include all evaluations you received.
Wed 1/28	Have a completed lesson plan, pre and post assessments aligned to individual learning goals, also GLE or CLE aligned	P-T 1-2	Include, for each student, their score on each learning goal. Organize your pre and post data from your PT as a table to use in class and have it in a spreadsheet.



Date and Day	Work due this date	Topic	Assignment
Thur 1/29	Have a completed lesson plan, pre and post assessments aligned to individual learning goals, also GLE or CLE aligned	PT1-3	
Fri 1/30	Bring in organized data in a spreadsheet to use in class with excel or numbers	<ul style="list-style-type: none"> <li>• Quiz, nature of science, sci process skills</li> <li>• Work on Evidence of Learning</li> <li>• How to judge science fairs</li> </ul>	Be working on reflection of PT-1
Mon 2/2	<b>P-T -1 reflection packets due in class</b>	<ul style="list-style-type: none"> <li>• How people learn</li> <li>• Learning of Science: Piaget, and constructivism. Meaningful and rote</li> <li>• Learning Cycle on electricity</li> </ul>	Examine misconceptions list and choose three to discuss
Tues 2/3		<ul style="list-style-type: none"> <li>• Misconception/ alternative conceptions</li> <li>• Teaching methods that promote learning: the Learning Cycle, 5E model, POE.</li> <li>• Candle burning POE/ Learning cycle</li> <li>• Rubrics</li> </ul>	Get Peer Teaching 2 assignment: Discrepant event lesson. 25-30 minutes.
Wed 2/4		<ul style="list-style-type: none"> <li>• Learning cycle on sound</li> <li>• Making verification labs into inquiry labs – diffusion</li> </ul>	
Thur 2/5		Judge Science Fair at Nell Holcomb	Prepare drafts of PT-2 lesson and assessments for Tuesday

Department approved 11/4/15

Date and Day	Work due this date	Topic	Assignment
Fri 2/6	.	<ul style="list-style-type: none"> <li>Safety</li> </ul>	
Mon 2/9		<ul style="list-style-type: none"> <li>Safety</li> </ul>	
Tues 2/10	Draft of P-T 2 lessons and assessments due in class	<b>Peer review of lessons and assessments</b>  <b>Preparing to teaching discrepant events! Get materials. Practice.</b>	PRACTICE your labs!
Wed 2/11	Have a completed lesson plan WITH THE QUESTIONS YOU PLAN TO ASK, pre and post assessments aligned to individual learning goals, also GLE or CLE aligned	Peer Teaching 2-1	<a href="http://virtualurchin.stanford.edu/microscope.htm">http://virtualurchin.stanford.edu/microscope.htm</a> Check out the "misconceptions button" in this tutorial. What do you think?
Thur 2/12		Peer Teaching 2-2	
Fri 2/13		Peer Teaching 2-3	
Monday 2/16		Peer Teaching 2-4	
Tues 2/17		<ul style="list-style-type: none"> <li>Teaching Evolution</li> <li></li> </ul>	
Wed 2/18		<ul style="list-style-type: none"> <li>Teaching other controversial topics</li> </ul>	
Thur 2/19		<ul style="list-style-type: none"> <li>Problem-based learning</li> </ul>	P-T 2 reflection packet. Same as PT 1, except you do the analysis of learning independently
Fri 2/20 SE 370	<b>Getting ready for field</b>	Pick up packets of information and evaluations for your cooperating teachers	

Mon 2/23	<b>Probable first day in field</b>		!
Fri 4/10	<b>LAST POSSIBLE FIELD DAY</b>		
Monday May 13	<b>Final exam</b>	MG 124	