



Northern Illinois  
University

College of Liberal Arts and Sciences

**Science Teaching Methods 1 - Interdisciplinary Teaching of Science**  
**GEOL 483/ENVS 483x/BIOS 402x/CHEM 493x/PHYS 493x**

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**Text:** Konick-Moran, R., & Keeley, P. (2015). *Teaching for Conceptual Understanding in Science*. Arlington, VA: NSTA Press.

**Course description:** An introduction to the methods and theory of teaching of interdisciplinary science in grades 6-12. The nature and purpose of science and its underlying assumptions, the social and cultural challenges in science teaching, and the potential solutions to these challenges are explored through research, discussion, and reflection. Requirements include using state and national science standards to develop student learning objectives and to design inquiry-based lesson plans, micro-teaching, construction and the use of assessment rubrics, and ongoing development of a professional portfolio.

**Course objectives:**

All students will:

1. Begin to develop their philosophy of science teaching. In particular, students will be able to describe and demonstrate a variety of teaching methodologies and will be able to incorporate them into their lessons.
2. Develop a working knowledge of how to teach for conceptual understanding leading to conceptual change in students, including identification of pre/misconceptions through diagnostic and formative assessment.
3. Demonstrate knowledge and performance of safety issues in the science classroom. They will be able to successfully pass a safety course and successfully identify and address potential safety issues in their lesson plans.
4. Demonstrate a detailed knowledge of inquiry in the science classroom by (1) planning active inquiry-based lessons and (2) performing teaching demonstrations illustrating their mastery of leading an activity appropriate to a high school or middle school science classroom.
5. Demonstrate the ability to develop lesson plans incorporating a variety of hand-on/minds-on instructional activities appropriate for the teaching of life, physical, and/or earth sciences. During this process, students will become aware of the Next Generation Science Standards and demonstrate their ability to address these standards through three-dimensional instruction.
6. Continue to develop their skills as a classroom teacher by performing in-class teaching demonstrations. Students will also continue to develop as a reflective practitioner through goal-setting, self-reflection, and post-demo conferences.

## **Course Standard Alignment:**

The course is aligned to the following AMLE standards:

### **Standard 2: Middle Level Curriculum**

2A) Middle level teacher candidates demonstrate a depth and breadth of subject matter content knowledge in the subjects they teach (e.g., English/language arts, mathematics, reading, social studies, health, physical education, and family and consumer science). They incorporate information literacy skills and state-of-the-art technologies into teaching their subjects.

2B) Middle level teacher candidates use their knowledge of local, state, national, and common core standards to frame their teaching. They draw on their knowledge of these standards to design, implement, and evaluate developmentally responsive, meaningful, and challenging curriculum for all young adolescents.

2C) Middle level teacher candidates demonstrate the interdisciplinary nature of knowledge by helping all young adolescents make connections among subject areas. They facilitate relationships among content, ideas, interests, and experiences by developing and implementing relevant, challenging, integrative, and exploratory curriculum. They provide learning opportunities that enhance information literacy (e.g., critical thinking, problem solving, evaluation of information gained) in their specialty fields (e.g., mathematics, social studies, health).

### **Standard 4: Middle Level Instruction and Practice**

4A) Content Pedagogy: Middle level teacher candidates use their knowledge of instruction and assessment strategies that are especially effective in the subjects they teach.

4B) Middle Level Instructional Strategies: Middle level teacher candidates employ a wide variety of effective teaching, learning, and assessment strategies. They use instructional strategies and technologies in ways that encourage exploration, creativity, and information literacy skills (e.g., critical thinking, problem solving, evaluation of information gained) so that young adolescents are actively engaged in their learning. They use instruction that is responsive to young adolescents' local, national, and international histories, language/dialects, and individual identities (e.g., race, ethnicity, culture, age, appearance, ability, sexual orientation, socioeconomic status, family composition).

4C) Middle Level Assessment and Data-informed Instruction: Middle level teacher candidates develop and administer assessments and use them as formative and summative tools to create meaningful learning experiences by assessing prior learning, implementing effective lessons, reflecting on young adolescent learning, and adjusting instruction based on the knowledge gained.

4D) Young Adolescent Motivation: Middle level teacher candidates demonstrate their ability to motivate all young adolescents and facilitate their learning through a wide variety of developmentally responsive materials and resources (e.g., technology, manipulative materials, information literacy skills, and contemporary media).

The course is aligned to the following NSTA Standards for Science Teacher Preparation (2012):

### **Standard 2: Content Pedagogy**

2A) plans multiple lessons using a variety of inquiry approaches that demonstrate their knowledge and understanding of how all students learn science.

2B) includes active inquiry lessons where students collect and interpret data in order to develop and communicate concepts and understand scientific processes, relationships and natural patterns from empirical experiences. Applications of science-specific technology are included in the lessons when appropriate.

2C) designs instruction and assessment strategies that confront and address naïve concepts/preconceptions.

### **Standard 3: Learning Environment**

3A) uses a variety of strategies that demonstrate the candidates' knowledge and understanding of how to select the appropriate teaching and learning activities – including laboratory or field settings and applicable instruments and/or technology – to allow access so that all students learn. These strategies are inclusive and motivating for all students.

3B) develops lesson plans that include active inquiry lessons where students collect and interpret data using applicable science-specific technology in order to develop concepts, understand scientific processes, relationships and natural pattern from empirical experiences. These plans provide for equitable achievement of science literacy for all students.

3C) plans fair and equitable assessment strategies to analyze student learning and to evaluate if the learning goals are met. Assessment strategies are designed to continuously evaluate preconceptions and ideas that students hold and the understandings that students have formulated

3D) Plans a learning environment and learning experiences for all students that demonstrate chemical safety, safety, procedures, and the ethical treatment of living organisms within their licensure area.

### **Standard 4: Safety**

2A) designs classroom activities that demonstrate the safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used within the laboratory.

2B) designs lessons that demonstrate an ability to implement emergency procedures and the maintenance of safety equipment, policies and procedures that comply with established state and/or national guidelines. Teacher candidate ensures all labs and activities are safe and appropriate for the abilities of all students.

2C) designs classroom activities that demonstrate ethical decision-making with respect to the treatment of all living organisms in and out of the classroom. They emphasize safe, humane, and ethical treatment of animals and comply with the legal restrictions on the collection, keeping, and use of living organisms.

**Expectations:** We will set a standard of professional behavior, including attendance, dress, participation, courtesy, and the submission of assignments by the due date are both expected and **required**. Professional demeanor, of the type that we expect in the educational workplace, is required at all times in this course. Please silence your cell phone and other electronic devices during class. If you need to check your phone, please do that during a break outside of the classroom.

**Attendance/Participation:** You are expected to attend every class, arrive to class on time, and remain for the duration. In case of emergency, please notify instructor in writing (email is fine) with as much advance notice as possible. Failure to notify the instructors in writing of an absence will be regarded as an unexcused absence and **there will be no make-up assignments, quizzes, or tests.**

In addition, 10 attendance points will be given for each class period that you *fully* attend and participate in. If you are late or have to leave early, only 5 points will be awarded for the period. If you are absent, 0 points will be awarded for that period. There will be no make-up for lost attendance points.

**Assignments:** You will be expected to complete a number of assignments throughout the semester. The assignments have clear deadlines and must be handed in on time before the start of class. Assignments turned in **within one week of the deadline will receive half credit.** NO assignments will be accepted after one week after the deadline. **The teacher licensure program is a standards-based program. You MUST show competency in the following standards before progressing in the licensure program. Competency is a grade of C (70%) or better in the course.** Additionally, all lesson plans, teaching demonstrations, and safety tutorials must receive a score of 70% or better to pass the course.

### **Grading and Assignments:**

*Listed below are the assignments and their percentage of overall grade. This list is tentative and is subject to change.*

*Teaching demo 1	25%
- Lesson plan	25%
- Demo	50%
- Self-reflection	25%
*Teaching demo 2	25%
- Lesson plan	25%
- Demo	50%
- Self-reflection/ post-demo conference	25%
*Individual lesson plans	15%
Discussion boards/Reflections	10%
Focused observation form	10%
Content test verification	5%
*Flinn Safety course completion	5%
Attendance	5%

\* Must pass with a 70% or higher to successfully complete course.

The following grading scale will be used:

93-100%: A  
90-92%: A-  
87-89%: B+  
83-86%: B  
80-82%: B-  
77-79%: C+  
70-76%: C  
60-69%: D  
below 60%: F

## Course Schedule

*This schedule is tentative and subject to change by the instructor.*

Date	Spring 2018	Readings/HW
<b>Jan 18: Week 1</b>	Course Intro -Theory/Research/Practice of teaching -Teaching cycle as “practice-centered inquiry” -UBD as a planning framework -Long term goal/Objectives short term goals/objectives, learning targets -Blooms taxonomy	HW: Introduction, Chapter 1, & Chapter 6 with reflection HW: Discussion board
<b>Jan 25: Week 2</b>	Reading review/discussion NGSS 3D learning vs inquiry ANHM case studies: student vs teacher centered instruction Modifying a confirmation lab	<b>Discussion board and reflection Due</b> HW: Chapter 2 & 3
<b>Feb 1: Week 3</b>	Reading review/discussion Inquiry review Ways to support inquiry Challenges to implementing inquiry in the classroom Finish and present Inquiry lab modification activity	HW: Chapter 4 and 5 HW: <u>Constructivism and Conceptual Change</u> Prepared Practitioner Part I and II by Alan Colburn from <i>The Science Teacher</i> , 2007 HW: Reflection on constructivism and conceptual change
<b>Feb 8: Week 4</b>	Reading review/discussion Misconceptions/alternative conceptions “Minds of Our Own” (0:00-17:37) POE demonstration, assignment, schedule and rubric Lesson plan format and rubric.	<b>Reflection Due</b> HW: Chapter 9 HW: POE lesson plan HW: Flinn Safety Tutorial (Due April 19 <sup>th</sup> )
<b>Feb 15: Week 5</b>	Reading review/discussion Peer Review of POE lesson plan Assessment -purpose, goals (assessment OF vs assessment FOR learning) -formative assessment feedback loop -examples/specifics NGSS formative assessment vignettes AMNH case studies “points of assessment”	HW: Prepare diagnostic or formative assessment strategy oral presentation HW: Box et. al. (2015) <i>A case study of teacher Personal Practice Assessment Theories and Complexities of Implementing Formative Assessment</i> . American Educational Research Journal. HW: Make revisions to POE lesson plan. Final lesson plan DUE next class
<b>Feb 22: Week 6</b>	Reading review/discussion Finish AMNH case studies Focused observation form assignment Formative/diagnostic assessment strategy presentations	<b>Final POE lesson plan due</b> HW: Assessment Focused observation form

<b>Mar 1: Week 7</b>	Goals for Learning student vs teacher actions gallery walk  <b>POE demos (3 demos)</b>	HW: Chapter 7 & 8  HW: Teaching strategy research and presentation - signup for strategy on Google doc
<b>Mar 8: Week 8</b>	Presentations on teaching strategies  <b>POE demos (3 demos)</b>	<b>Teaching strategy research and presentation Due</b>  HW: Anticipatory set/discrepant event lesson plan and presentation
<b>Mar 15</b>	<b>SPRING BREAK</b>	
<b>Mar 29: Week 9</b>	edTPA, Judy Boisen  Teaching Strategy Demo Assignment, schedule, and rubric  <b>POE demos (3 demos)</b>	Focused observation forms due next week  Anticipatory set/discrepant event lesson plans due next week
<b>April 5 : Week 10</b>	Lesson plan presentations  Discussion - focused observation forms  Video Case Study – Earth and Space science class – viscosity and lava composition  <b>POE demos (3 demos)</b>	<b>Focused observation form Due</b>  <b>Anticipatory set/discrepant event lesson plan lesson plans due</b>  HW: Teaching Demo lesson plan
<b>Apr 12: Week 11</b>	Peer Review of Teaching strategy lesson plan  Start “ABC-CBV” model group lessons	<b>Teaching Demo lesson plan Due</b>  HW: Flinn Safety Tutorial DUE Next class  HW: Revise and finish teaching Demo lesson plan
<b>Apr 19: Week 12</b>	Continue “ABC-CBV” model group lessons  <b>Teaching Strategy Demo (4 demos)</b>	<b>Flinn Safety Tutorial Due</b>  HW: Chapter 10
<b>Apr 26: Week 13</b>	Reading review/discussion  Finish and present “ABC-CBV” model group lessons  <b>Teaching Strategy Demo (4 demos)</b>	
<b>May 3: Week 14</b>	<b>Teaching Strategy Demo (4 demos)</b>  Wrap up semester	
<b>May 10: Week 15</b>	Student teaching panel	

**Accessibility:** If you need an accommodation for this class, please contact the Disability Resource Center as soon as possible. The DRC coordinates accommodations for students with disabilities. It is located on the 4th floor of the Health Services Building, and can be reached at 815-753-1303 (V) or [drc@niu.edu](mailto:drc@niu.edu). Also, please contact me privately as soon as possible so we can discuss your accommodations. The sooner you let us know your needs, the sooner we can assist you in achieving your learning goals in this course.

**Academic Integrity:** As detailed in the current NIU undergraduate catalog: *Good academic work must be based on honesty. The attempt of any student to present as his or her own work that which he or she has not produced is regarded by the faculty and administration as a serious offense. Students are considered to have cheated if they copy the work of another during an examination or turn in a paper or an assignment written, in whole or in part, by someone else. Students are responsible for plagiarism, intentional or not, if they copy material from books, magazines, or other sources without identifying and acknowledging those sources or if they paraphrase ideas from such sources without acknowledging them. Students responsible for, or assisting others in, either cheating or plagiarism on an assignment, quiz, or examination may receive a grade of F for the course involved and may be suspended or dismissed from the university.*

*A faculty member has original jurisdiction over any instances of academic misconduct that occur in a course which the faculty member is teaching. The student shall be given the opportunity to resolve the matter in meetings with the faculty member and the department chair. If the facts of the incident are not disputed by the student, the faculty member may elect to resolve the matter at that level by levying a sanction no greater than an F for that course. The faculty member shall notify the student in writing whenever such action is taken, and the **Office of Community Standards and Student Conduct** shall receive a copy of the Academic Misconduct Incident Report indicating final disposition of the case, which will be placed in the student's judicial file. In all matters where the charge of academic misconduct is disputed by the student or if the faculty member feels a sanction greater than an F in the course is appropriate (such as repeated offenses or flagrant violations), the faculty member shall refer the matter to the Office of Community Standards and Student Conduct making use of the Academic Misconduct Incident Report. Additional sanctions greater than an F in a course can be levied only through the University Judicial System. With regards to finding the student either responsible or not responsible for his or her action, the ruling of the Judicial Hearing Board shall be binding. In cases where there is either a finding of responsibility or an admission of responsibility by the student, any recommendations by the hearing board regarding the course grade are non-binding on the instructor, who remains solely responsible for assigning a course grade, consistent with the policies set forth in the course syllabus.*