

**Teaching Science in the Elementary/Middle School**  
**CIEP 439**  
**Fall, 2011/2012**

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Class Meetings: Mondays 11:30-2:00  
Cudahy Hall 314  
Office Hours: before or after class,  
or by appointment

**I. Course Description**

This course is designed to help elementary and middle school teachers develop the theoretical background, practical knowledge, and skills essential for successful science teaching. Students are also provided with opportunities to practice instructional skills in peer teaching lessons for special needs, exceptionalities, and for cultural and ethnic diversity. Focus will also be on instructional planning, implementation considerations of various teaching methods, development of instructional activities, and assessment of student learning.

**Course objectives**

1. Students will reflect on various aspects of how people learn and then design and revise instructional and assessment materials that embody some of that research.
3. Students will design and revise instructional and assessment materials that engage ALL students.
4. Students will prepare assessment instruments aligned with instructional objectives and teaching approaches.
5. Students will develop knowledge, skills and dispositions about science that will allow them to reflect critically on their teaching.

**Course Standards**

This course is aligned to the following standards:

1. Loyola University of Chicago – School of Education – Conceptual Framework (CF) standards
  - a. CF 1: Candidates demonstrate an understanding of a current body of literature and are able to critically evaluate new practices and research in their field.
  - b. CF 5: Candidates demonstrate technological knowledge and skills that enhance education.
2. The Association for Childhood Education International (ACEI) and The National Council for the Accreditation of Teacher Education (NCATE) standards:
  - a. 2.2: Science: Candidates know, understand, and use fundamental concepts in the subject matter of science—including physical, life, and earth and space sciences—as well as concepts in science and technology, science in personal and social perspectives, the history and nature of science, the unifying concepts of science, and the inquiry processes scientists use in discovery of new knowledge to build a base for scientific and technological literacy.

- b. 3.1: Integrating and applying knowledge for instruction: Candidates plan and implement instruction based on knowledge of students, learning theory, subject matter, curricular goals, and community.
- c. 3.2: Adaptation to diverse students: Candidates understand how elementary students differ in their development and approaches to learning, and create instructional opportunities that are adapted to diverse students.
- d. 3.3: Development of critical thinking, problem solving and performance skills: Candidates understand and use a variety of teaching strategies that encourage elementary students' development of critical thinking, problem solving, and performance skills.
- e. 3.4: Active engagement in learning: Candidates use their knowledge and understanding of individual and group motivation and behavior among students at the K-6 level to foster active engagement in learning, self motivation, and positive social interaction and to create supportive learning environments.
- f. 3.5: Communication to foster learning: Candidates use their knowledge and understanding of effective verbal, nonverbal, and media communication techniques to foster active inquiry, collaboration, and supportive interaction in the elementary classroom.

### **Conceptual Framework**

This course embodies the conceptual framework of the School of Education (SOE) at Loyola University Chicago, *Professionalism in Service of Social Justice*. The four components of the SOE's conceptual framework are service, skills, knowledge, and ethics.

Teaching and service go hand and hand because teaching is one answer to the following question: How does my action serve others? It is my stance that as educators, we serve the youth in our classrooms, their families, and our communities – local and global. Teaching is an ethical act and science teaching is no exception. We will explore what it means to be an ethical teacher in the context of science learning and teaching. With respect to skills and knowledge, we will also explore current best practices in science education and some of the research undergirding those practices. We will do this and attempt to interrogate those practices in light of authentic scientific practice, social justice, and youth culture. This is all in service of becoming a community of practitioners who are committed to serving youth, their families, and our communities and committed to studying our own practice in order to continue reflecting on our teaching.

### **Academic Honesty**

Academic honesty is an expression of interpersonal justice, responsibility and care, applicable to Loyola University faculty, students, and staff, which demands that the pursuit of knowledge in the university community be carried out with sincerity and integrity. The School of Education's Policy on Academic Integrity can be found at: [http://www.luc.edu/education/academics\\_policies\\_integrity.shtml](http://www.luc.edu/education/academics_policies_integrity.shtml). For additional academic policies and procedures refer to:

[http://www.luc.edu/education/academics\\_policies\\_main.shtml](http://www.luc.edu/education/academics_policies_main.shtml)

### **Accessibility**

Students who have disabilities which they believe entitle them to accommodations under the Americans with Disabilities Act should register with the Services for Students with Disabilities (SSWD) office. To request accommodations, students must schedule an appointment with an SSWD coordinator. Students should contact SSWD at least four weeks before their first semester or term at Loyola. Returning students should schedule an appointment within the first two weeks of the semester or term. The University policy on accommodations and participation in courses is available at: <http://www.luc.edu/sswd/>

### **Harassment (Bias Reporting)**

It is unacceptable and a violation of university policy to harass, discriminate against or abuse any person because of his or her race, color, national origin, gender, sexual orientation, disability, religion, age or any other characteristic protected by applicable law. Such behavior threatens to destroy the environment of tolerance and mutual respect that must prevail for this university to fulfill its educational and health care mission. For this reason, every incident of harassment, discrimination or abuse undermines the aspirations and attacks the ideals of our community. The university qualifies these incidents as incidents of bias.

In order to uphold our mission of being Chicago's Jesuit Catholic University-- a diverse community seeking God in all things and working to expand knowledge in the service of humanity through learning, justice and faith, any incident(s) of bias must be reported and appropriately addressed. Therefore, the Bias Response (BR) Team was created to assist members of the Loyola University Chicago community in bringing incidents of bias to the attention of the university. If you believe you are subject to such bias, you should notify the Bias Response Team at this link: <http://webapps.luc.edu/biasreporting/>

### **Technology**

Blackboard will be used as a communication and a learning tool. Students are encouraged to utilize technological tools for research and presentation purposes. At another level, we will discuss and practice how to effectively utilize technology for teaching and learning in the science elementary and middle school classroom.

### **Diversity**

Experiences are provided for candidates to acquire and apply the knowledge, skills, and dispositions necessary to help all students learn. Candidates will discuss and explore issues of race, class, and culture and their impact of students, schools and schooling.

## **II. Textbooks and Materials**

- a. Michaels, S., Shouse, A. & Schweingruber, H. (2008). *Ready, Set, Science!: Putting Research to Work in the K-8 Science Classroom*. Washington, D.C.: National Academies Press.
- b. American Association for the Advancement of Science (1993). *Benchmarks for science literacy*. New York: Oxford University Press. (BM)  
<http://www.project2061.org/tools/benchol/bolintro.htm>
- c. National Research Council (1996). *National science education standards*. Washington, D.C.: National Academy Press. (NSES)  
[http://www.nap.edu/catalog.php?record\\_id=4962#toc](http://www.nap.edu/catalog.php?record_id=4962#toc)

- d. Illinois State Board of Education (2003). *Illinois Learning Standards*. Springfield, IL: ISBE. <http://www.isbe.state.il.us/ils/science/standards.html/>
- e. Various handouts and reading materials will be distributed throughout the course.

### **III. Assignments**

- a. All reading assignments are to be completed before the class meeting for which they are assigned.
- b. All written and verbal assignments are to be submitted on or before the due date.
- c. All late work has a half-life of 24 hours.
- d. All assignments must be typed using double-space and 12 point Times New Roman font (attending closely to spelling and grammar). If referencing course or other textual materials, please follow American Psychological Association style guidelines (APA 6th edition). You can access the APA style manual through Loyola University Chicago's libraries or online at <http://www.apastyle.org>.

### **IV. Evaluation**

Grades will be based upon total points received from:

Attendance, Participation, and In-Class Activities- 5 points

Lesson Plan - 20 points

Reflection Paper– 10 points

Microteaching and self-evaluation - 20 points

Field-Based Case Study Project - 25 points

Final Exam – 20 points

### CIEP 439

Dates	Topics/Activities	Assignments
Session 1	Course Introduction What is Science?	Feynman, R. (1969). What is science? The Physics Teacher, 7(6), 313-320.
Session 2	-Strands of Science Learning -Goals and Curricula Reform	Ch. 2 (Michaels et al.) Ch. 13 (BM) Overview, Ch. 1&2, p. 1-26 (NSES) <b>Case Study Topic Draft</b>
Session 3	-Instructional Planning -Instructional Methods/Strategies (Lect., Discussion, Demo., Lab) Questioning	Ch. 4 (Michaels et al.) Ch. 3 (NSES)
Session 4	-Inquiry Teaching and Learning I -Argumentation in the Classroom	Ch. 5 & 6 (Michaels et al.)
Session 5	-Assessment and Evaluation	Ch. 5 (NSES) Ch. 8 (Michaels et al.)
Session 6	Inquiry Teaching and Learning II	Ch. 7 (Michaels et al.) <b>Lesson Plan Due</b>
Session 7	Nature of Science	Article & handouts will be provided in class
Session 8	Nature of Science	<b>Reflection Paper Due</b>
Session 9	-Constructivism Conceptual Change <b>-Microteaching</b>	Ch. 3 (Michaels et al.)
Session 10	-Effective Science Teaching Models <b>-Microteaching</b>	<b>Case Study Due</b>
Session 11	-Technology Integration <b>-Microteaching</b>	
Session 12	<b>-Microteaching</b>	<b>Final Exam</b>

-The course instructor retains the right to revise the syllabus as needed.

## VI. Assignments

### a. Lesson Plan -20 points

Your task is to design a 50-min lesson that should accurately illustrate a concept from your content area as well as provide some focus on inquiry and/or the nature of science. The lesson plan assignment involves a very comprehensive and detailed account of a science lesson that you select for elementary/middle grade level.

In your lesson plan, you need to identify the target grade and describe the target group and the relevance of the lesson for this group. You need to describe the specific behavior that the students will perform, the conditions under which it will be performed, and the criteria for assessing mastery. You need to include connections to both local (Illinois) and national (National Science Education Standards) standards. You need to present fundamental science concepts that are accurate, and design a lesson that is inquiry-oriented and conveys the nature of science. You need to include all materials including electronic files that are needed for the lesson. You need to describe all segments of the lesson with the estimated time of each, making sure there is consistency among different segments. You need to describe the lesson so that another teacher could understand it and implement it without your presence. The lesson needs to include multiple strategies that will promote critical thinking and problem solving. You need to describe the assessment measure for determining whether the lesson's objectives were met. You need to integrate technology into your lesson plan. The lesson needs to be intrinsically motivating, and builds on students' prior beliefs, knowledge, experiences, and interests. The lesson needs to include accommodations designed to achieve maximum congruity with the learning styles, abilities, and cultural factors of students.

	<b>Target</b>	<b>Acceptable</b>	<b>Unacceptable</b>
<b><u>Target Grade/ Subject</u></b> Identify and describe the target grade and group. Describe the relevance of the lesson for this group. (2 pts)	The target grade and group are very clear <u>and</u> the appropriateness of the lesson is obvious. (2pts)	Description of target group is general <u>and</u> the appropriateness of lesson is somewhat clear. (2-1pts)	Description of target group is vague and/or, the appropriateness of the lesson is not convincing. (1-0 pts)
<b><u>Objective(s)</u></b> Connect lesson to Standards. Describe the specific behaviors students will perform, conditions under which they will be performed, and criteria for assessing mastery. (2 pts)	Lesson is aligned with Standards. Behavior, criteria, and conditions are clearly communicated and clearly <u>and</u> concisely written. (2 pts)	Lesson is somewhat aligned with Standards. OR OR Two of the three (behavior, criteria, and/or conditions) are apparent. (2-1 pts)	Lesson is not aligned with Standards. OR Behavior, criteria, and/or conditions are unclear or missing. (1-0 pts)
<b><u>Content</u></b> Present science concepts that are accurate. Design a lesson that is inquiry-oriented and	Science concepts are accurate. The lesson is inquiry-oriented and conveys the NOS.(2 pts)	Science concepts are generally accurate. The lesson is generally inquiry-oriented and	Science concepts are inaccurate. The lesson is generally not inquiry-oriented and

conveys the nature of science (NOS) (2 pts)		conveys the NOS.(2-1 pts)	does not convey the NOS (1-0 pts)
<b><u>Materials and Safety</u></b> Include all materials (e.g., PowerPoint presentation or handouts) and explain their use. Safety guidelines are included (2 pts)	Materials are provided and explained. A detailed safety plan is enclosed (2 pts)	All materials are included but how they are used is not clear. Some safety guidelines are provided (2-1 pts)	All materials are not included and/or their use is unclear. No safety guidelines are provided (1-0 pts)
<b><u>Lesson Description</u></b> Describe all segments of the lesson with estimated time of each. Include all planned questions during the lesson, specify what to do with student responses and consider what to be done if desired response is not received. Include multiple strategies to promote critical thinking and problem solving. (4 pts)	-Description is sufficiently clear to enable another teacher to try it out. -All the required components are explicitly addressed. -Lesson includes multiple strategies to promote critical thinking and problem solving. (4 pts)	-Description is fairly clear. -Two or more required components are explicitly addressed. -Lesson includes multiple strategies yet do not promote critical thinking and problem solving. (4-2 pts)	-Description is unclear and difficult to follow. -Less than two components of the lesson plan are addressed. -Lesson does not include multiple strategies (2-0 pts)
<b><u>Evaluation Procedure</u></b> Describe the assessment measure to determine whether lesson's objectives were met. (2 pts)	The behavior assessed exactly matches the behavior described in the objectives and the lesson. (2 pts)	The behavior assessed closely resembles that described in the objectives and the lesson. (2-1 pts)	The behavior assessed is inconsistent with that described in the objectives and the lesson. (1-0 pts)
<b><u>Technology Support</u></b> Integrate technology into your lesson in a meaningful way as a tool. (2 pts)	Technology supports and enhances the lesson objectives in a meaningful way. (2 pts)	Technology is integrated but does not support the lesson in a meaningful way. (2-1 pts)	Technology does not support the lesson or is not integrated. (1-0 pts)
<b><u>Motivating Lesson</u></b> Engage and motivate students with lesson, and build on their prior beliefs and experiences. (2 pts)	Lesson is engaging and motivating. It builds on students' prior beliefs and experiences. (2 pts)	Lesson is somewhat engaging and motivating. It builds on prior beliefs and experiences. (2-1 pts)	Lesson is dry and boring. It does not build on prior beliefs and experiences.(1-0 pts)
<b><u>Accommodations</u></b> Include accommodations in lesson designed to achieve maximum congruity with students' learning styles and abilities (2 pts)	Lesson includes several accommodations to address different learning styles and abilities. (2 pts)	Lesson includes few accommodations to address different learning styles and abilities. (2-1 pts)	Lesson does not include any accommodations to address different learning styles and abilities (1-0 pts)

**b. Reflection Paper -10 points**

Reflect on nature of science (NOS) issues based on the activities and the readings you have experienced in class. In your reflection, you need to answer the following two questions: (a) How will you incorporate the ideas of NOS into your classroom practice? Give two ways that you can fulfill that, (b) What two questions do you have about NOS issues that you would like to inquire about?

	Target	Acceptable	Unacceptable
NOS in the classroom (5 pts)	Two ways are given and justified for incorporating NOS into classroom practice. (5 pts)	Two ways are given but not justified for incorporating NOS into classroom practice. OR Only one way is given and justified. (4-2)	No way is given or justified for incorporating NOS into classroom practice. (2-0)
Questions about NOS (5 pts)	Two questions are given and justified in relation to the issues about NOS. (5 pts)	Two questions are given but not justified. OR Only one question is given and justified. (4-2)	No question is given or justified in relation to the issues about NOS. (2-0)

**c. Microteaching: Demonstration presentation and self-evaluation - 20 points**

Select a demonstration from one of your science teaching resources. The demonstration should accurately illustrate a concept from your content area as well as provide some focus on inquiry and/or the NOS. The demonstration and its explanation should take about 20-25 minutes.

You are also required to submit a written self-reflection of your demonstration (2-3 pages double space) the next class meeting following your presentation. Your written evaluation needs to address the strengths and weaknesses of your teaching experience taking into consideration the feedback you got from your instructor and peers, as well as describing how you can improve in the future.

	Target	Acceptable	Unacceptable
Content Knowledge (4 pts)	Content is accurate and student elaborated on key concepts. Student made appropriate connection to students' life experience. (4 pts)	Content is generally accurate and student elaborated on most key concepts. Student attempted to make connection to students' life experience. (3-2 pts)	Content is inaccurate and student elaborated on few key concepts. Student did not make connection to students' life experience. (2-0 pts)
Pedagogical Knowledge (6 pts)	Student used highly appropriate teaching strategies and provided exceptionally clear and concise instruction. Student effectively engaged their peers and monitored their understanding. (6 pts)	Student used appropriate teaching strategies and provided clear and concise instruction for the most part. Student attempted to engage their peers and monitor their understanding. (5-2 pts)	Student did not use appropriate teaching strategies and did not use clear or concise instruction. Student did not engage their peers nor monitor for their understanding. (2-0 pts)
Delivery	Student appeared well-	Student appeared	Student appeared unprepared

(4 pts)	prepared and had all materials ready. The apparatus was visible for all students. The activity followed a logical sequence and was completed in the required time. Student looked relaxed and confident. (4 pts)	prepared for the most part and had most materials ready. The apparatus was not visible for all students. The activity followed a fairly logical sequence and was nearly completed in the required time. Student looked somewhat relaxed and confident. (3-2 pts)	and did not have all materials ready. The apparatus was not visible for all students. The activity did not follow a logical sequence and was not completed in the required time. Student did not look relaxed or confident. (2-0 pts)
Handout (2 pts)	Handout identified all the components: title, source, materials, procedure, and an explanation. (2 pts)	Handout identified only some of the specified components. (2-1 pts)	Handout does not include the specified components. (1-0 pts)
Self-reflection (4 pts)	Self-reflection addressed all one's teaching strengths, weaknesses, and ways to improve. (4 pts)	Self-reflection addressed some of one's teaching strengths, weaknesses, and ways to improve. (3-2 pts)	Self-reflection does not address one's teaching strengths, weaknesses, and ways to improve. (2-0 pts)

**d. Field-Based Case Study Report-25 points**

Think of an educational subject that you want to explore. Read at least 4 articles in science education about the investigation you are targeting. Summarize these articles. Then select a student, from your field experience, who you think fits the subject you want to investigate (you should determine why the student is special to the subject – arguments should be related to issues in science education) and then design a tool that will help you in your investigation (exam (s), interview, etc.). You should also conduct a diagnostic interview with the student (s) (you may also need to meet other persons such as the mentor, or parents). The interview should be tape-recorded, transcribed and analyzed. A case study report about your findings should be submitted. The major components that will be taken into consideration in your report include: a) rationale for the topic you want to investigate; (b) rationale for selecting the student (s); c) quality of articles and their relationship to the investigation; (d) summaries of these articles; (e) methodology used to collect the data (documents, observations, interviews, exams, etc.); (f) conclusions and perspectives.

The paper is expected to be no more than 10 pages in length.

For the **Case Study Topic Draft**, you need to submit a one-page draft that discusses your topic and the rationale for selecting it.

**e. Final Exam- 20 points**

You will need to sit for a written final exam, where you will respond to one comprehensive essay question about any of the issues discussed in this course.