

**HUNTER COLLEGE
SCHOOL OF EDUCATION**

CHEM 660 Challenging Concepts in Chemistry
PGEOG 660 Challenging Concepts in Earth Science
PHYS 660 Challenging Concepts in Physics

4 Credits

Instructor: Prof. Stephen DeMeo
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Required Texts:

1. "Million Dollar Data: Building Confidence – Vol.1" by S. DeMeo (pdf in dropbox)
2. "Million Dollar Data: Respecting Uncertainty – Vol.2" by S. DeMeo (pdf in dropbox)
(go to Dropbox, enter sdemeo@hunter.cuny.edu and use password, hunterdropbox)

Goggles, bound notebook, and certain phone apps must be purchased.

Class Time: Thurs 4:30 – 8:30

Room: C111 (HN)

Office Hours: Tues 3:30 to 4:30; Thurs. 8:30 to 9:30

Course Description:

This course will allow teacher-candidates to develop multi-day hands-on science activities in the context of Science, Technology, Engineering, and Mathematics (STEM). We will examine 1) how to rigorously collect data that is based on confidence and uncertainty indicators, 2) use mathematics, statistics, laptops, and cell phones to collect and analyze data, 3) implement novel ways of keeping a laboratory notebook, writing lab reports, and making poster presentations. The chosen activities will also allow students to understand key concepts in the content areas of biology, chemistry, earth science, physics, and engineering. Experience with these activities, especially a focus on engineering and statistics, will meet the new Next Generation Science Standards (NGSS) recently adopted by New York State.

Assignments

1. On a weekly basis, students will be grouped into teams and be asked questions based on the readings assigned on the previous week.
2. Students' notebooks will be examined mid-semester to determine if the correct format is being followed. At the end of the term students will hand in xeroxed pages from their lab notebook that corresponds to a completed experiment. The excerpt must follow the format presented in class.
3. All experiments will require students to write up and hand in a lab report following the X-SAT format. There are 8 lab reports that are due. Students can work together but must write up their own individual reports.
4. Student teams will make a poster or PowerPoint presentation of an experiment they have performed. (Teams of 2-3 students will make the presentations; every team will present twice)
5. Student teams will find and direct an in-class quantitative experiment that uses different methods to measure a variable. The X-SAT format presented in class must be used and altered in ways that would be appropriate for specific grade levels. An uncertainty calculation must be able to be calculated.

Grading			
1. Team-based Reading Questions	20%	90-100%	A/A-
2. Lab Notebook Format Check	5% + 5%	80-89%	B+/B/B-
3. Lab Reports	40%	70-79%	C+/C/C-
4. Poster Presentations (2)	20%	60-69%	D
5. Student Presented Lab Activity (1)	10%	0-59%	F

Week to week topics with assignments

Session 1

- Syllabus
- Download text books: Confidence and Uncertainty discussion
- Creation of quiz teams
- Fake News and Truth making in Science
- Video: Reasons to Believe
- Authentic science learning environments
- Communication: lab notebook, posters, lab reports
- **1. Observation of a candle: rigor**
- **HW: Buy a non-spiral notebook and goggles**
- **Read: Confidence 1&2**

Session 2

- Take out notebooks
- **Rules for good notebook keeping (Ref: Uncertainty Chapter 5)**
- Problems with the traditional pre/lab/post lab format
- **2. The Gold Foil Experiment: replication**
- The 12 Confidence Indicators
- X-SAT (handout)
- Assigning of Poster presentation groups (x students / 4 = number in each group; each group goes twice)
- **Read: Confidence 3**

Session 3

- Take out notebooks
- **3. Two Different Salts – Using the Confidence Indicators**
- The Traditional Lab Report vs the X-SAT report
- Lab report due next week will follow X-SAT format
- **Read: Confidence 4**

Session 4

- **X-SAT lab report due and poster**
- **4. Reaction Time experiment**
- How to measure
- Dispersion of data (frequency distribution chart)
- Best Value: Mean, median or mode
- Other ways to measure reaction time: topendsports.com
- Making a report using X-SAT; examine one on the board
- **Read: Confidence 5**

Session 5

- **X-SAT lab report due and poster**
- Creating your own experiment in class (assigning of teams)
- **5. Density experiment**
- **Read: Confidence 6&7**

Session 6

- **X-SAT lab report due and poster**
- **6. Zinc and Iodine**
- **Read: Confidence 8**

Session 7

- **Zinc and Iodine continued**
- Notebook check
- **READ: Confidence 9&10**

Session 8

- **X-SAT lab report and poster due (2)**
- **Read in-class: Engineering paper handout**
- Engineering vs Science
- How to Design: The Ideo Video
- **Making a catapult (no lab report)**
- **READ: Uncertainty chapter 1,2**

Session 9

- **7. Chemical Boat Engineering Project – 1st Run**
- **READ: Uncertainty chapter 3**

Session 10

- **Chemical Boat Engineering Project continued – Redesign**
- Idea Day
- **READ Uncertainty chapter 4**

Session 11

- **X-SAT Lab report and poster due**
- Respecting Uncertainty Vol. 2
- Uncertainty; Instrumental and Variable
- Greatest Percent Instrumental Uncertainty, Range, Percent Error, Percent Average Deviation
- **8. Calculation of gravity constant by accelerometer, free fall of an object, and pendulum**
- **READ Uncertainty chapter 6**

Session 12

- **X-SAT lab report and poster due**
- Uncertainty worksheets; show model (file in dropbox)
- **9. Calculation of speed of sound constant by iphone app and timer.**
- **READ Uncertainty chapter 7&8**

Session 13

- **X-SAT lab report and poster due**
- Student Presentations of Activity demonstrating Confidence and Uncertainty using X-SAT
- No lab reports required; feedback provided
- Groups 1 and 2
- How to use X-SAT with different age groups
- Must be quantitative
- Use multiple methods to measure
- Uncertainty calculation
- **Read Uncertainty chapter 9 & 10**

Session 14

- Student Presentations of Activity demonstrating Confidence and Uncertainty using X-SAT
- No lab reports required
- Groups 3 and 4

Session 15

- Revisiting Authenticity, Siloed Curricula vs Vertical Alignment
- What is Fake News and how to tell what is scientifically true
- The Seven Commandments of Fake News; NY Times Video

Class Policies:

1. Class Participation: Since this is a constructivist-based class where meaning is generated in class as well as outside the classroom, your participation in discussions is very important. Therefore, read the assigned chapters or articles before class and be prepared to ask a question or make a comment. Grading papers or performing unrelated work while in class will not be tolerated.
2. Student presentations must be completed on assigned dates; a deduction in grade will be imposed if a student does not concur.
3. Please notify me immediately if you require any special adaptations to meet the requirements of this course. Arrangements can be made to accommodate a variety of needs to ensure the success of all students.
4. Attendance to all class meetings is required. I will accept 2 absences. On the third, your grade is lowered by 2/3 of a letter grade. On the fourth absence, you have to retake the course. There are no exceptions. Illness and parent-teacher nights are built into the allowed absences. I will allow students to recover 1 absence by doing an independent project that is mutually agreed upon.
5. Incompletes will only be given for major medical reasons.
6. All assignments must be completed to pass the course.
7. If plagiarism is proven, it will result in an F and/or an F in the course.
8. Lateness: If you are over half an hour late to class it counts as ½ of an absence; if you leave half an hour or more before the end of the class it also counts for ½ of an absence.
9. Please do not use your laptops or cell phones for anything that does not directly pertain to the present lesson. No surfing the Internet, no personal calls, no doing day job work. The second warnings will result in a lowering of your final grade by one letter grade.

Academic Integrity

Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The college is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures.

It also resolved, "that the faculty at Hunter College are encouraged to use commercial and non-commercial devices to prevent and detect some forms of plagiarism and to educate and promote student commitment to academic integrity." One commercial product that is available to faculty is Turnitin.com. If you choose to use this product or any other instrument, then the students in your classes must be so informed. Several issues with respect to copyright and other legal questions have been raised by students and faculty. Many of these issues are addressed in the Turnitin.com website <http://www.turnitin.com/>. Click on "Legal" and then "U.S. Legal Document". To view the entire Hunter College Academic Integrity Policy and Procedure, please go to the Hunter College Senate homepage at <http://www.hunter.cuny.edu/senate/> and click on "Documents". If you have any questions about college policies and procedures concerning academic integrity, please contact the college's academic integrity officer, Dean Michael Escott: extension - x4876 or e-mail: michael.escott@hunter.cuny.edu.

Expectations for Written Proficiency in English

Students must demonstrate consistently satisfactory written English in coursework. The Hunter College Writing center provides tutoring to students across the curriculum and at all academic levels. For more information, see <http://rwc.hunter.cuny.edu>. In addition, the School of Education offers a reading/writing workshop during the semester to students who need additional work honing their reading and writing skills. To register for this course, students must obtain permission either from the Chair of Curriculum & Teaching or the Associate Dean.

Office of AccessABILITY. In compliance with the American Disability Act of 1990 (ADA) and with Section 504 of the Rehabilitation Act of 1973, Hunter College is committed to ensuring educational parity and accommodations for all students with documented disabilities and/or medical conditions.

It is recommended that all students with documented disabilities (emotional, medical, physical and/ or learning) consult the Office of AccessABILITY located in Room HE1124 to secure necessary academic accommodations. For further information and assistance please call (212-772-4857)/ TTY (212- 650- 3230). **You must be registered with the Office of AccessABILITY to qualify for the accommodations.**

b. Hunter College Policy on Sexual Misconduct. In compliance with the CUNY Policy on Sexual Misconduct, Hunter College affirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationship. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. **Sexual Violence:** Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444)

b. **All Other Forms of Sexual Misconduct:** Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry(colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Room HE 1123.

The CUNY Policy on Sexual Misconduct Link

is: <http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf>

Hunter College Conceptual Framework

Preparation of reflective, knowledgeable and highly effective teachers, counselors, and administrators

Evidence-Based Practices

The School of Education grounds its course content in the best field-based research and practice. Faculty review findings from their respective disciplines to provide our candidates with the strategies needed for effective instruction. Our candidates master the theory and practice of effective pedagogy in their subject areas, and acquire the tools for reflection on and improvement of their professional work. They achieve a solid foundation in the history, philosophy, psychology, sociology and methodology of education that enriches their teaching. Candidates gain expertise in analyzing and using assessment of student performance to guide their instruction and create optimal learning environments for students.

Integrated Clinical Experiences

The School of Education ensures that its candidates understand and experience the realities of school contexts. We establish strong connections with partnering schools in New York City and surrounding areas. We provide extensive fieldwork with supportive supervision in these schools. Our candidates engage in carefully sequenced and comprehensively assessed clinical experiences prior to their graduation

Educating a Diverse Student Population

The School of Education provides its candidates with the critical skills and understanding necessary to be responsive to the multiple challenges of all learners: students with a wide range of backgrounds, cultures, abilities and prior knowledge. We teach candidates to create humane and ethical learning communities in their classrooms and schools. They gain the ability to collaborate successfully with parents, families, community members, school faculty and staff in order to provide this support.

Use of Technology to Enhance Learning

The School of Education prepares candidates with the practical and theoretical knowledge of effective and judicious uses of technology in a variety of school settings and for a broad spectrum of learners. Formative and summative assessments of our candidates' technology competencies are a critical component of preparing them for tomorrow's schools. We believe that appropriate uses of educational technology enhance learning, assessment and communication.

Integration of Conceptual Framework:

Evidence-Based Practices: Innovations in laboratory curriculum design
Integrated Clinical Experiences: Migration of select topics into the field
Educating a Diverse Student Population: Cooperative learning laboratory groups
Use of Technology to Enhance Learning: PowerPoint, Internet, Proeware

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The federal document 21 CFR 58 which is entitled "Good Laboratory Practices for Non-Clinical Laboratory Studies" can be found at <https://www.gpo.gov/fdsys/pkg/CFR-2011-title21-vol11/pdf/CFR-2011-title21-vol11-part58.pdf>

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