EARTH AND SPACE SCIENCE
SCI 6520 / SCI 0920

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Dates: Five days: 8:30 a.m. – 4:30 p.m.
Dates: June 21 – 25, 2010

Location: Northeastern University Boston Campus Berahkis Lab 605

Course website: http://serc.carleton.edu/spaceboston/index.html
(preliminary site: please note this may change)

Texts: *The Solar System* series of six books by Linda Elkins-Tanton will be given to each participant on the first day of class. Selected readings on teaching and learning will also be provided.

Course Description and Possible Outcomes: This course, aimed at middle school and high school teachers, will develop an understanding of planetary accretion and evolution and the place of the Earth in the solar system, and explore methods of inquiry-based teaching.

The science content will include the current state of understanding of a variety of Earth and planetary topics, describe the scientific methods used in recent studies, offer stories of the scientists involved, and provide discussion of the data used and the degree of certainty in the scientific conclusions obtained. Each topic covered will be described in the context of comparative planetology, including planets around other stars.

Course content will be driven by the Massachusetts Department of Education's *Science and Technology/Engineering Curriculum Framework* (2006) and the *National Science Education Standards* (1996). Each workshop day will begin with a presentation in one of the curriculum framework areas, followed by brainstorming in groups over how the material might be incorporated into the classroom.

Participants will develop teaching activities that will be presented to the class on the final day, uploaded to the course website, and piloted during the school year. Designing units is a major

course activity, and carrying them out with students is a central course goal. The website will serve as a point of connection among teachers beyond the course. Participants will be encouraged to upload to the website enhancements, additions, and notes on the effectiveness of activities or approaches. This material will be available for other teachers to use.

In the spring of 2011 course participants are expected to attend a one-day conference to present the results of implementing their units and to discuss and share further materials.

Topics: The following is a summary of the topics we expect to cover throughout the course. There will be additional mini-lectures in mathematics to go with each science topic.

	Monday June 21	Tuesday June 22	Wednesday June 23	Thursday June 24	Friday June 25
Science and Math	Length, Time, and Temperature Making a planet: From elements to dust to planetesimals Scale Viscosity	Planetary differentiation Comparative planetology using maps Dimensional analysis Units and conversions Exponents and scientific notation	Heat and mass transfer: Cooling, and crustal and atmospheric formation Radioactive elements Logarithms and half life Predicting earthquakes and volcanoes	The history of life so far: Paleontology, climate, other planets, and the future Error propogation Fossa, Sulci, and other terms for planetary landforms Random events come in clusters	Science summary and Q&A
Pedagogy	Engaging with the material world Critical Friends model	Student questions and teacher questions Writing and drawing that supports inquiry	Critical barriers phenomena Building a culture of collaboration	Seeing student thinking Facilitating dialogue Science reading	Discuss follow-up workshop
Teaching Activity Design	Design an inquiry-based initial teaching activity	Discuss plans for presentations	Outline unit plans.	Develop unit plans.	Present units

Course Requirements: Apart from standard familiarity with techniques of basic mathematics (algebra), there are no formal prerequisites for this course. Personal outcomes from the sessions are, of course, dependent on individual attentiveness and effort.

Assignments: Teachers will work in teams to develop teaching activities, to be completed and presented to class by the end of the week. Details of the presentation requirements will be discussed in class. All preparations for the presentation will be done during class hours or as homework during the week of classes.

Each teacher will hand in his or her own final own teaching activity, due *Saturday June 26*, by uploading the unit onto the course website. There is a dedicated web page for this purpose.

Daily assignments based on class material and exercises will include readings, written responses and draft plans for classroom activities. Some assignments will be completed in class, while others will require time after class.

Following grading and comments, each teacher is expected to revise his or her teaching activity on the course website, and then to incorporate it in teaching during the upcoming academic year. Finished teaching activities will be made available freely on the web.

The following spring, on a day to be announced, all teachers will return for a one-day follow-up workshop to demonstrate and discuss the successes and challenges of the curricular units. This workshop will be held either in at Northeastern University or at MIT, and plans will be discussed during class.

Class participation is essential. Absence, without prior consent of the instructor (barring emergency situations), of *any class meeting time* shall result in a failing grade.

Grades: Grading for the course, based on attendance and the assignments, will be pass/fail for those taking it for in-service credit.

Course grades for those seeking graduate credit shall be computed as follows:

1. Teaching activity team presentation:
   Score out of 100 based on clarity of presentation and completeness of unit presented.

2. Teaching activity (individual final version), handed in by uploading onto the course website as described above:
   Score out of 100 based on detailed, and executable content in the following outline:
   - Activity Title / Author
   - Summary
   - Goals
   - Context for Use
   - Background
   - Activity Description and Teaching Materials
     - In Class Activities
     - At Home Assignments
     - Materials List
   - Standards Addressed

Teaching Notes
Assessment
Resources
Vocabulary List
Keywords for internet searches that should find your activity

3. Nightly or in-class assignments:
Each given a score out of 10 as follows:
0 = not submitted
7 = partial or minimal work
10 = complete and thoughtful analysis

Course grade: SUM OF THESE SCORES, expressed here as percent:

93-100 = A
90-92 = A-
87-89 = B+
83-86 = B
80-82 = B-
77-79 = C+
73-76 = C
70-72 = C-
0 – 69 = F

Late Policy: Late assignments are accepted but will be docked 20% per day. If you know you are going to miss a deadline and believe you should not be penalized, you must contact one of the teachers *before* the deadline.

Keep in Mind: Consider attending, or even presenting at, the Northeastern – North Central Geological Society of America Meeting, in Pittsburgh PA, 20-22 March 2011. Prof. Tanya Furman from PennState is convening a session on innovation in K-12 teaching. See her workshop site at http://teachscience.psu.edu/index.html.

Academic Honesty and Integrity Statement

The University views academic dishonesty as one of the most serious offenses that a student can commit while in college and imposes appropriate punitive sanctions on violators. Here are some examples of academic dishonesty. While this is not an all-inclusive list, we hope this will help you to understand some of the things instructors look for. The following is excerpted from the University's policy on academic honesty and integrity; the complete policy is available at http://www.osccr.neu.edu/policy.html.

- *Cheating* – intentionally using or attempting to use unauthorized materials, information or study aids in an academic exercise. This may include use of unauthorized aids (notes, texts) or copying from another student's exam, paper, computer disk, etc.

- *Fabrication* – intentional and unauthorized falsification, misrepresentation, or invention of any data, or citation in an academic exercise. Examples may include making up data for a research paper, altering the results of a lab experiment or survey, listing a citation for a source not used, or stating an opinion as a scientifically proven fact.
- *Plagiarism* – intentionally representing the words or ideas of another as one's own in any academic exercise without providing proper documentation by source by way of a footnote, endnote or intertextual note.
- *Unauthorized collaboration* – Students, each claiming sole authorship, submit separate reports, which are substantially similar to one another. While several students may have the same source material, the analysis, interpretation and reporting of the data must be each individual's.
- *Participation in academically dishonest activities* – Examples include stealing an exam, using a pre-written paper through mail order or other services, selling, loaning or otherwise distributing materials for the purpose of cheating, plagiarism, or other academically dishonest acts; alternation, theft, forgery, or destruction of the academic work of others.
- *Facilitating academic dishonesty* – Examples may include inaccurately listing someone as co-author of paper who did not contribute, sharing a take home exam, taking an exam or writing a paper for another student.