

**ASTR/PTYS 455/555: Teaching College-Level Astronomy, Space, and Planetary
Sciences – Spring 2013
MF 1:00 – 1:50 pm
Steward 204**

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Office hours: MF 12:00-1:00 pm, or by appointment
Course Website: d2l.arizona.edu

Course Description

This is a course on the teaching and learning of astronomy, space, and planetary sciences. Although this course is grounded in the context of teaching these disciplines at the college level, much of this course is based on research into how people learn; the interactive learning strategies we discuss are adaptable for other environments (e.g., K-12, informal education) and for other disciplines. We will read and discuss many foundational works in education, astronomy and physics education research, and cognitive science. We will also learn how to make classes interactive by effectively implementing research-validated activities, such as Think-Pair-Share, interactive demonstrations, tutorials, and ranking tasks. This course is appropriate for anyone who plans to someday teach and/or is interested in science education and education research.

Student Responsibilities

Weekly Readings and Homework: Most of our Monday classes (and a few of our Friday classes) will be devoted to discussing our weekly readings, which I will post each week on D2L (Note: Graduate students may have extra readings beyond what I require for the undergrads). Everyone enrolled in this course must complete the assigned readings and participate in the in-class discussions. In order to motivate and facilitate our in-class conversations, you are required to write three **substantial** questions/points of interest that *each* article raised for you. These questions/points of interest should be posted on the D2L discussion board no later than 5 pm on Saturday if our discussion is scheduled for Monday or 5 pm Wednesday if our discussion is scheduled for Friday. Additionally, you are required to read what your classmates posted and give a **substantial** response to one question or comment no later than 5 pm Sunday (for Monday discussions) or 5 pm Thursday (for Friday discussions). This ensures that everyone is ready to discuss the assigned readings by the time class begins.

What do I mean by “substantial”? A substantial posting is any posting that raises a serious question and/or helps advance our conversations about the readings. For example, simply saying “I liked/disliked this week’s reading” is not substantial, unless you follow your opinion with a discussion of what you liked/disliked.

In order to ground our readings in the context of teaching and learning astronomy, space, and planetary sciences, we will also be covering the content of an introductory, general education, college-level astronomy course. For classes in which we are not discussing readings posted to D2L, I will often ask you to read the relevant sections from

an introductory, general education astronomy book. I will typically give a short homework assignment that requires you to analyze what you read in your astronomy book using what we've learned through research into education and effective pedagogical practices. Alternatively, I may give a homework assignment that prepares you for an in-class micro-teaching event.

Please check the calendar on D2L periodically (*at least* once per week) for the most up-to-date information on readings, homework, and in-class activities.

Classroom Observations: If you are taking this class for 2 or 3 credits, you are required to make two classroom observations of science instruction here at UA **between February 25 and April 12**. One of these observations should be of Ed Prather's ASTR 170B1 class, held TTh from 12:30-1:45 pm in Centennial Hall (talk to me outside of class if you have a permanent conflict with this class's meeting times). The second observation must be of a different instructor teaching an ASTR, PTYS, or GEOL course; the course must be a freshman-level course for non-science majors. You should get permission from that course's instructor before you do your observation.

I will provide you with an observation protocol to use for both of your classroom observations. The purposes of these observations are to 1) make you thoughtfully reflect on the instructional styles, implementation choices, and pedagogical practices of two different instructors of Earth, astronomy, and space sciences; and to 2) give you practice gathering ethnographic data on classroom activities (which is important for many education research projects).

Within 24 hours after you make an observation, you must summarize your observations in 1-3 pages of fieldnotes. Your fieldnotes should include the following information:

- 1) basic information on the class you observed, such as the class name, instructor, observation date, length of class, approximate number of students present, and the topics covered;
- 2) a narrative description about what you observed from the time you arrived to the time you left (*e.g.*, what did the instructor do during class?, what did the students do?, how did the students and instructor react to various events during the class?); and
- 3) your reflections and interpretations on what happened (*e.g.*, what made a particular activity an effective/not effective learning event for students?).

Your fieldnotes for the second class you observe should also include your comparison of both classes to one another. Your fieldnotes and completed observation protocols for both classes are due no later than April 15 in class.

Final Project: If you are taking this class for 3 credits, then you must complete a final project in lieu of a final exam. Your final project is your opportunity to explore, in depth, a topic that interests you related to the teaching and learning of astronomy, space, and/or planetary sciences. Your final project is also an opportunity for you to demonstrate your mastery of what you learned this semester.

You have a significant amount of freedom to design a final project that fits your needs and interests. Two types of acceptable projects include a research project and a curriculum development project.

- 1) **Research Project** – One option for your final project is to collect and/or analyze some data relevant to the teaching and learning of astronomy, space, and planetary science. Your project should be big enough that it's worthy of an upper-division undergraduate/graduate-level course, but small enough that you can do it within a semester. Do something novel, but grounded in educational research. Your final report should be ~10 pages long (double spaced) or more. **Grammar, spelling, and the clarity of your presentation all count toward your grade. Your ability to ground your research project in the prior literature and your ability to draw conclusions that logically follow from your data and analysis also count toward your grade.** Your paper should have the following sections (roughly – feel free to add/combine sections in order to fit your narrative):
 - a. **Introduction** – presents your research question and area of investigation, situates your work within prior research, and briefly summarizes the structure of your paper
 - b. **Data** – describes what your data are and how they were collected
 - c. **Results** – describes your analysis (or analyses) of your data and what your data show (*e.g.*, do they support your hypothesis?)
 - d. **Discussion and Conclusions** – summarizes your paper, discusses the broader lessons that can be drawn from this work, and/or suggests future avenues for research

Write your paper as if you were submitting it to *Astronomy Education Review*, *Physical Review Special Topics – Physics Education Research*, *American Journal of Physics*, *International Journal of Science Education* or some other journal in which science education research studies are published.

- 2) **Curriculum Development** – Another option for your final project is to design a piece of curriculum that someone could use in a college-level astronomy, space, or planetary science course (at any level – undergraduate or graduate). Depending on the size and scope of the topic you want to develop curricula for, you may end up creating only a single tutorial, an entire suite of think-pair-share, tutorial, and ranking task activities for a single topic, or something entirely new. **In addition to submitting whatever curricular activity(ies) you develop, you must also include ~3 pages (or more) describing why you chose this (these) particular topic(s) and activity(ies), how you envision an instructor effectively implementing this (these) activity(ies), and how your activity(ies) have been influenced by prior curricula and/or research into how people learn.**

If you have an idea for a final project that doesn't fit into either of these categories, then come talk to me. *I want you to be creative!*

You are welcome (and encouraged!) to **collaborate** with one or more of your classmates on a final project. I will probably ask you to scale up your efforts, depending on your project and the number of people you plan to collaborate with.

At the end of the semester, everyone who does a final project will make a presentation to the class. You can adapt your presentation to whatever fits your project

the best (e.g., you might want to do a “formal” research talk if you did a research project, or a mock lecture if you developed some curricula,...or something else entirely). **Note: I expect graduate students to have more in-depth projects, write-ups, and presentations.**

Grading

My hope is we can focus on learning, rather than grades, in this class. Nevertheless, I am required to assign you a grade of A, B, C, D, or E. The table below shows how the various components of this class contribute to your final grade.

	Activity		
	Participation (in-class, discussion board postings, homework)	Classroom Observations	Final Project
1 Credit	100%	-	-
2 Credits	50%	50%	-
3 Credits	50%	25%	25%

I will evaluate your in-class participation on a 0-1 scale (1 = participated, 0 = did not participate). I will evaluate your online postings, homework submissions, and observation protocols and fieldnotes on a 0-2 scale (2 = submission is complete and thoughtful, 1 = submission is incomplete and/or superficial in content, 0 = no submission). For your final project, I will use the following rubric.

	Yes	Partially	No
Is this project situated with respect to prior research, curriculum development activities, etc. (i.e., does it show that you have mastered this course’s content)?	2	1	0
Did you make reasoned decisions and inferences in your design, analysis, etc.?	2	1	0
Can this project help improve the teaching and learning of astronomy, space, and/or planetary sciences?	2	1	0
Did you use correct spelling and grammar and did you clearly present what you did?	2	1	0
Did your presentation to the class accurately convey what you did?	2	1	0

This is how I will compile all information into your final grade:

- A 90-100%
- B 80-89%
- C 70-79%
- D 60-69%
- E 0-59%

If, for some reason, the above limits for letter grades are too harsh, I reserve the right to relax them. However, I will never make the criteria for a particular letter grade stricter.

Keep in mind that I want everyone to do well and I will do all I reasonably can to provide you the formative feedback you need to learn the material and succeed in this class.

Students with Disabilities

If you anticipate barriers related to the format or requirements of this course, please meet with me so that we can discuss ways to ensure your full participation in the course. If you determine that disability-related accommodations are necessary, please register with Disability Resources (621-3268; drc.arizona.edu) and notify me of your eligibility for reasonable accommodations. We can then plan how best to coordinate your accommodations.

Religious Observations

If you must miss class due to a religious observation or obligation, please let me know and I will be happy to help you make up any work you missed.

Code of Academic Integrity

Everyone participating in this course is subject to the University of Arizona's Code of Academic Integrity. For more information and for a copy of the code, see the following website: <http://deanofstudents.arizona.edu/academicintegrity>.

Important Dates

January 9 – First day of class

February 11 – 1 paragraph proposal for your research project due

February 25 – You may begin classroom observations

March 8 – Outline of final project due

April 8 – Rough draft of final project due

April 12 – Classroom observations must be complete

April 15 – Classroom observation protocols and fieldnotes due no later than this date

April 19-29 – Presentations of final projects

April 29 – Final projects due

April 29 – Final day of class

