PHYS 7170: How to Teach Physics
Syllabus
Professor Stephen Sekula
FALL 2017

Contents

Goals of this Course

This course is intended to introduce graduate students to the foundational skills and approaches in the modern physics education environment. Instruction in the class will be tied closely to the introductory physics cooperative problem-solving sessions (henceforth referred to as "Co-Op Sessions"). Students will learn to...

1. Understand the methods and applicability of the best researched physics teaching techniques;

2. Craft their own problem-solving approaches and then demonstrate physics problem solving approaches to undergraduates;
3. Engage undergraduates in a team-based problem-solving environment;
4. Improve their performance in the classroom environment (e.g. speaking, writing, and interaction/communication skills);
5. Engage professionally with undergraduates.

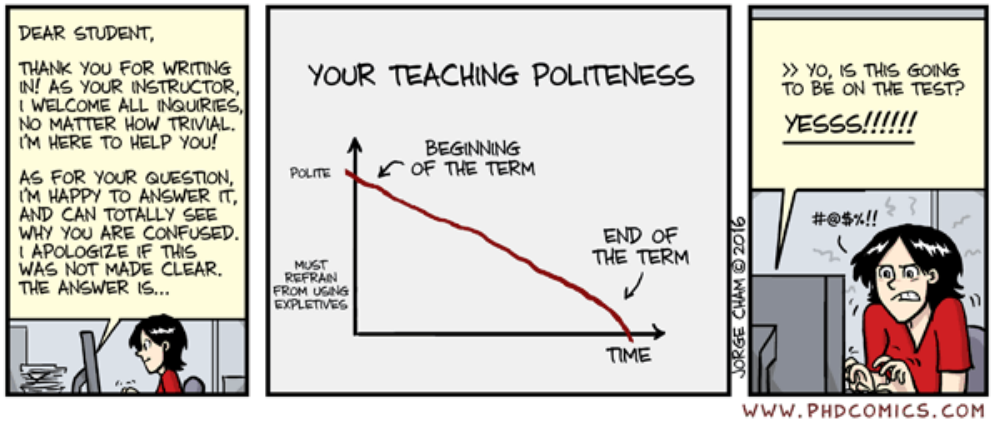

Figure 1: Teaching is an extremely difficult process, for both the instructor and the students. As part of this course, you will learn to define professional behavior inside and outside the classroom and develop strategies to maintain professionalism over the course of your instruction duties. Image copyright Jorge Cham.

Course Information

When/Where?	The course is held in Fondren Science 60 on Monday from 10:00am-10:50am
Instructor	Professor Stephen Sekula Office: Fondren Science 39 Phone: (214)-768-7832 E-mail: sekula@physics.smu.edu Facebook: stephensekula Twitter: drsekula Diaspora*: stephensekula@social.cooleysekula.net GNU Social: steve@chirp.cooleysekula.net Pump.io: steve@hub.polari.us

TOPIC	INFORMATION
Office Hours	Where: **My Office, FOSC 39** When: • **By appointment only** Please try to be courteous and request a meeting in writing at least a few hours before your proposed meeting time to allow for scheduling.
Prerequisite(s)	None
Textbook(s)	Readings from the texts and papers below will be provided by the instructor during the semester. • "Five Easy Lessons: Strategies for Successful Physics Teaching". Randall D. Knight. – ISBN Number: 0805387021 – ISBN-13: 9780805387025 • "Peer Instruction: Engaging Students One-on-One, All At Once". Crouch, C.; Watkins; J.; Fagen, A.; Mazur, E. • "Design principles for effective physics instruction: A case from physics and everyday thinking." Goldberg, F.; Otero, V.; Robinson, S. Published in "Teacher Education in Physics."

Course Topics

- Primarily, this will be a hands-on "just-in-time teaching" course, where graduate students will first be asked to simply demonstrate the solution to a typical undergraduate introductory physics problem and thus establish a baseline for the comfortability and ability in the teaching environment. Based on this, peers will assess each other based on what they felt worked or not, and the instructor will provide similar feedback. We will identify strengths and provide focus on the perceived weaknesses, to shore those up (thus the "just-in-time" part of the method), while also noting what they did that worked to reinforce positive aspects of their approach. This will result in an iterative process of "lessons learned" with each demonstration and should nudge each student away from their specific weakenesses in the teaching environment and toward mastery of the basic skills needed to teach physics.
- Supplementing this, and allowing the students to think more carefully about what it means to teach physics to new learners and assess their ability to utilize new information while retaining old information, we will employ key readings (books and papers) on modern physics education research. Students will be encouraged to try ideas they learn from these readings in their own problem solving demonstrations and in their interactions with undergraduates to encourage undegraduate peer-mentoring and nudge their own students toward learning goals.
- Embedding the graduate students in our Co-Op sessions is crucial to this, especially as we intend to give them greater responsibility as the semester proceeds to push them more and more outside their

comfort zone, until they are in command of their own session(s) (albeit under faculty supervision). This, more than anything, will provide lessons for each graduate student about what they are doing that works, and what does not, and whether or not physics education research indeed has the practical outcomes and applications that it promises.

Figure 2: You will learn to skillfully handle common situations that may arise in the teaching environment. Image is copyright Jorge Cham.

Attendance

Attendance is required. If you will miss class, please inform the instructor in advance. Since this course is tied to the introductory physics cooperative problem-solving sessions, you are also required to attend your assigned co-op sessions as part of your teaching assistant duties external to this course.

Homework

Homework will take one of a few forms during the semester:

- You will be asked to prepare a solution and solution demonstration for a problem and present your solution in the next class period. This will be typical near the beginning of the semester.
- You will be asked to read material intended to provide background on the best known physics teaching methodologies, and try to incorporate these into your teaching style.

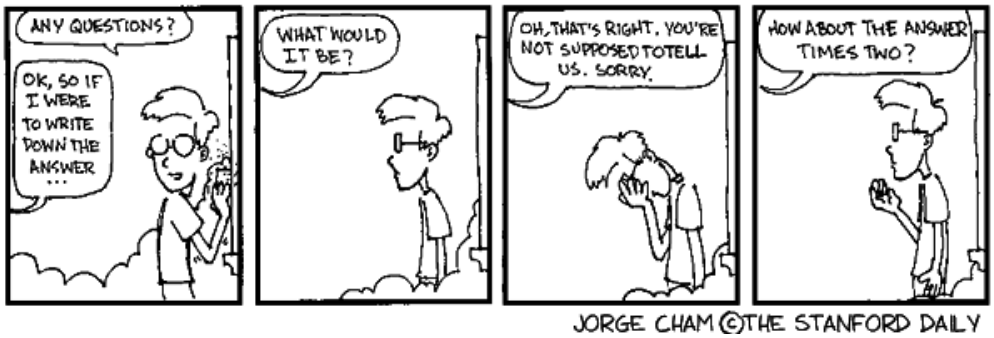

Figure 3: Teaching is more than just standing and addressing your students. It's also about learning to listen to their questions and know when (and when not) to answer directly. Image is copyright Jorge Cham.

Exams

There will be no exams. Assessment is discussed below.

Assessment and Grading

1. Student in-class problem solving and teaching exercises will be scored using a rubric containing, but not limited to, the following categories, each scored on a scale of 0-5. A total score will be computed for each in-class problem solving exercise and a weekly grade assigned based on that performance. You are expected to perform at a high level or improve to or above the required level throughout the semester. Students should be teaching at the level of a "B" or better on this grade scale at the end of the class to have demonstrated progress and prowess.

   (a) Organization of pre-class preparation for the problem-solving session
   (b) Accuracy of the application of physics principles in the demonstration
   (c) Speaking pace
   (d) Speaking clarity and orderliness
   (e) Writing pace
   (f) Writing clarity and orderliness
   (g) Engagement with the audience (eye contact, pausing to invite comments or questions, etc.)
   (h) Overall professionalism (ability to work within time constraints, ability to address audience respectfully and to invite, not end, discussion)

2. Undergraduate evaluations: At least twice during the semester, we will ask undergraduates in the Co-Op sessions to evaluate their embedded student-teacher. These evaluations will be similar, if not identical, to those used for faculty instructors. We will look for improvement from the earliest to the latest evaluation, and see how graduate student-teachers rank compared to departmental averages for introductory physics instruction. Undergraduate assessment will be considered at the "B" level if a graduate student is operating at least at the average of the department teaching level.

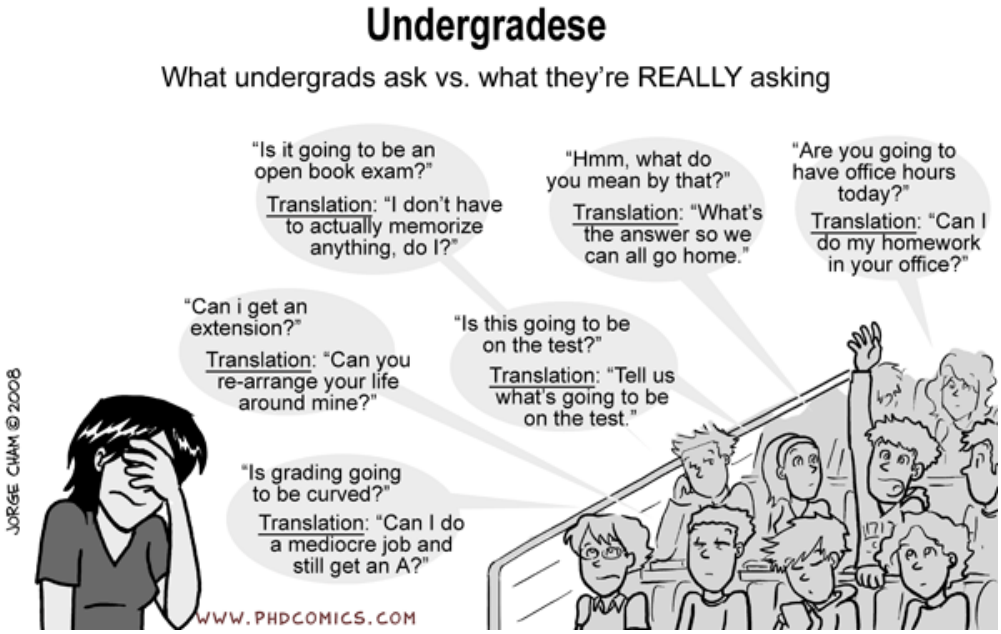

Figure 4: Undergraduates often ask questions that are not representative of the true question. You must learn to engage with them to find out what are the real issues in a class, and respond to those issues professionally. Their evaluations of you will be based on hidden assumptions that they make when interacting with you inside and outside the classroom, and you need to be ready for that. Image is copyright Jorge Cham.

University Honor Code

The student honor code can be found on page 32 of the 2014-2015 student handbook[1]. All students will be expected to adhere to it. Any student found cheating or plagiarizing another's work will be given a zero for that work and a complaint will be filed through the Vice President for Student Affairs Office. If you are uncertain of the definition of plagiarism as it regards independent works of mathematical and physical computation, documentation, and demonstration, it is your responsibility to speak with the instructor and understand these rules.

Disability Accommodations

Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

[1] http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook

University Policy on Religious Observance

Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

Excused Absences for University Extracurricular Activities

Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)