# PHYS 6160: Physics Teaching Practicum Syllabus Professor Stephen Sekula FALL 2019

| Goals of this Course                                       | 1 |
|--|---|
| Course Information   | 2 |
| Course Topics  | 3 |
| Attendance   | 4 |
| Homework   | 4 |
| Exams  | 5 |
| Assessment and Grading                                     | 5 |
| University Honor Code                                      | 7 |
| Disability Accommodations                                  |   |
| University Policy on Religious Observance                  |   |
| Excused Absences for University Extracurricular Activities |   |
| Student Academic Success Programs                          |   |

### 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 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) through problem solving demonstrations with peer/instructor review and feedback;
- 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 $10:00$ am- $10:50$ am |
|-------------|--|
| Instructor  | Professor Stephen Sekula   |
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|             | Pump.io: steve@hub.polari.us   |

| TOPIC           | INFORMATION  |
|-----------------|--|
| Office Hours    | Where: My Office, FOSC 39<br>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) | PHYS 3305 or similar; get permission from the instructor to take the course if you have fulfilled a similar requirement at this or another institution.                                |
| 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." |
|                 | • SMU-HEP-19-07: "SMU Introductory Physics: A Teaching Manual."<br>Stephen Sekula. 2019.   |
|                 | • SMU-HEP-19-10: "SMU Honors Physics: A Teaching Manual." Jodi Coo-<br>ley, Eric Godat, and Steve Sekula. 2019.  |

### **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.

• Performance in the Co-Op environment will be improved through interactions in this course and used as part of the assessment for this course.



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. The ideas from the readings (e.g. physics education research) will be utilized in subsequent class periods in various activities.



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. [30% of final grade] In-class teaching and teaching activity demonstrations will be scored using a rubric containing the following categories, each scored on a scale of 0-5 (where 0 is poor performance and 5 is outstanding performance). A total score will be computed for each in-class problem solving exercise, and a weekly grade will be assigned based on that performance. The key observation the course instructor has to make and then judge at the end is the overall level of improvement from the beginning to the end, not necessarily the average of these grades. Students should be teaching at the level of a "B" or better on this grade scale at the end to have demonstrated appropriate mastery.

#### **Rubric categories**

- (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. [50% of final grade] Teaching Journal: Students are not required, as teaching assistants, to keep a written record of their experiences as a teacher. This course requires that its participants keep such a record (a "journal"). This will be done using Canvas, SMU's learning management system. The journal

should contain observations from the teaching environment that are useful for classroom discussion, discussion with the instructor, or both. Based on the outcome of the discussion of those observations, strategies for addressing such observations will be provided. The student is expected to document their plan for handling these situations next time and then continue this process going forward. The journal will be graded as part of the assessment for the course using a rubric similar to the one above for teaching demonstrations:

- (a) Observations are recorded at least once per teaching session [0-5]
- (b) A plan of action is developed after each interaction with the instructor over observations [0-5]
- (c) The student records observations and writes their plan of action adhering to the rules of highquality written English communication [0-5]
- (d) The student provides summaries and assessments of previous plans of action to inform future decision-making in the classroom environment [0-5]

Again, "0" means the student was significantly deficient in this category (e.g. never records observations), a "5" means they have no discernable deficiencies, and scores in between mean there is at least 1 ("4"), 2 ("3"), etc. deficiencies. The scoring on the stages of journal is easily translated to a letter grade. The journalling activity will begin after week 7 of this course.

3. [20% of final grade] Co-Op evaluations: At least twice during the semester, we will ask undergraduates in the Co-Op sessions to evaluate their graduate teaching assistant based on categories involving clarity of communication, organization of the co-op session, availability and interactivity during the session, etc. Graduate students should have improved from earlier in the semester to later in the semester. The questions will be extremely similar to those used to assess faculty teaching, and students are expected to score above 2.5 (out of 4.0) to earn at least a B on this part of the assessment (undergraduate evaluations have a large root-mean-square variation from the mean, so latitude is provided here for our students).



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 student handbook<sup>1</sup>. 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/ SASP/DASS to begin the process. Once approved and registered, students will submit a DASS Accommodation Letter to faculty through the electronic portal DASS Link and then communicate directly with each instructor to make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

 $<sup>^{1}</sup> http://www.smu.edu/StudentAffairs/StudentLife/StudentHandbook$ 

### 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. (See 2018-2019 University Undergraduate Catalogue)

### Student Academic Success Programs

Students needing assistance with writing assignments for SMU courses may schedule an appointment with the Writing Center through Canvas. Students wishing support with subject-specific tutoring or success strategies should contact SASP, Loyd All Sports Center, Suite 202; 214-768-3648; https://www.smu.edu/sasp.