PHYS6160-001-1217

PHYS 6160

Teaching Introductory Physics: A Practicum

- **Start Here**
- **Syllabus**
- **Modules**
- **Grades**

Instructor Information

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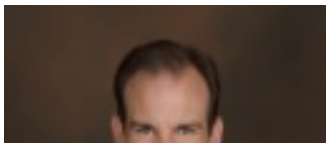
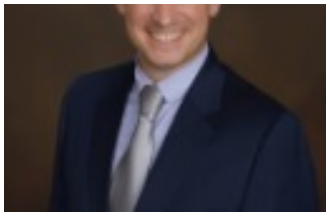
(214) 768-2500
FOSC 201
Sign up using your Canvas Calendar



Stephen Sekula
Professor of Experimental Particle Physics
Faculty Website (https://people.smu.edu/ssekula/)



ssekula@smu.edu (mailto:ssekula@smu.edu)
(214) 768-7832
FOSC 39
Sign up using your Canvas Calendar

Meeting Times & Location

Monday and Friday | 11:00am | FOSC 32

Course Information

Course Description

- 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 weaknesses 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 undergraduate 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.

Course Objectives

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...

- Understand the methods and applicability of the best researched physics teaching techniques;
- Craft problem-solving approaches and then demonstrate physics problem solving approaches to undergraduates;
- Engage undergraduates in a team-based problem-solving environment;
- 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;
- Engage professionally with undergraduates.

Course Structure

The course will be structured as follows:

- **Mondays:** Prof. Sekula will conduct the Monday class activities, and these will last for the first 7 weeks of the term (until the break). Mondays will be devoted to practical training for teaching introductory physics (e.g. cooperative problem-solving session management, interacting with undergraduates in such courses, etc.) as well as exercises that will help students to become better instructors and explore the best modern teaching approaches.
- **Fridays:** Prof. Olness will conduct Friday class activities, and these will persist for the whole semester. These activities will focus on the practical aspects of problem solving and the demonstration of problem solving, with emphasis on upper-level concepts that often challenge introductory-level students making the transition to higher-level material.

Course Materials

Available in canvas: **READING MATERIALS**

Readings from the texts and papers below will be provided by the instructors 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 Introductory Physics: A Teaching Manual. (https://smu.app.box.com/s/zdecp9n1er2q0tnj7833zlxyksfzmlvk)** Stephen Sekula.
- **SMU Honors Physics: A Teaching Manual. (https://smu.app.box.com/s/fardhumdjti9dea9mapc3ccctcveyqp0)** Jodi Cooley, Eric Godat, and Steve Sekula

Assignments

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. Emphasis will be on the way in which you structure your solution and how you then choose to present relevant information to an audience. This will strengthen your ability to train undergraduates in this activity, essential to physics. This will also help to illuminate areas where we can concentrate, at the intro level, to target student preparation for upper-level coursework. This will also help you to develop skills to mentor students in that transition.
- 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.

Grading Overview

1. **[40% of final grade]** Class discussions, participation, and related assignments. Students will be assigned readings, videos, and quizzes on this material. This is to be completed before class. Class periods will be used for discussions. Asynchronous participation is possible by using digital discussion boards to contribute your views and ideas to the discussion. Synchronous participation will be recorded for viewing by the asynchronous participants. Students will be asked to

learn about introductory physics courses at SMU, the cooperative problem-solving sessions associated with these courses, teaching pedagogy, applications of pedagogy at SMU, and other related topics and concepts. Application of knowledge will be emphasized, including the use of new pedagogical approaches to create course frameworks, lessons from cooperative problem-solving sessions and other teaching work, video or audio demonstrations of teaching approaches, and capturing of discussion notes in Canvas.

2. **[40% of final grade]** Problem-solving demonstration and discussion. The course will help students to identify common weaknesses encountered by undergraduates when transitioning from the fast-paced, shallow introductory courses to the deeper, less-broad upper-level courses. Emphasis will be on clarity of communication and structure of solution presentation (in any medium, e.g. written, spoken, etc.). This is best accomplished through immersion in problem-solving activities reflective of typical upper-level courses, identification of places where introductory courses fail to prepare students, and reflection on how to improve those gaps, weaknesses, and shortcomings.
3. **[20% of final grade]** Teaching presentation demonstrations (10%) and a final project involving the crafting of an activity for one of our introductory physics courses (10%)

PHYS 6160: Teaching Introductory Physics - A Practicum

Detailed Syllabus

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.

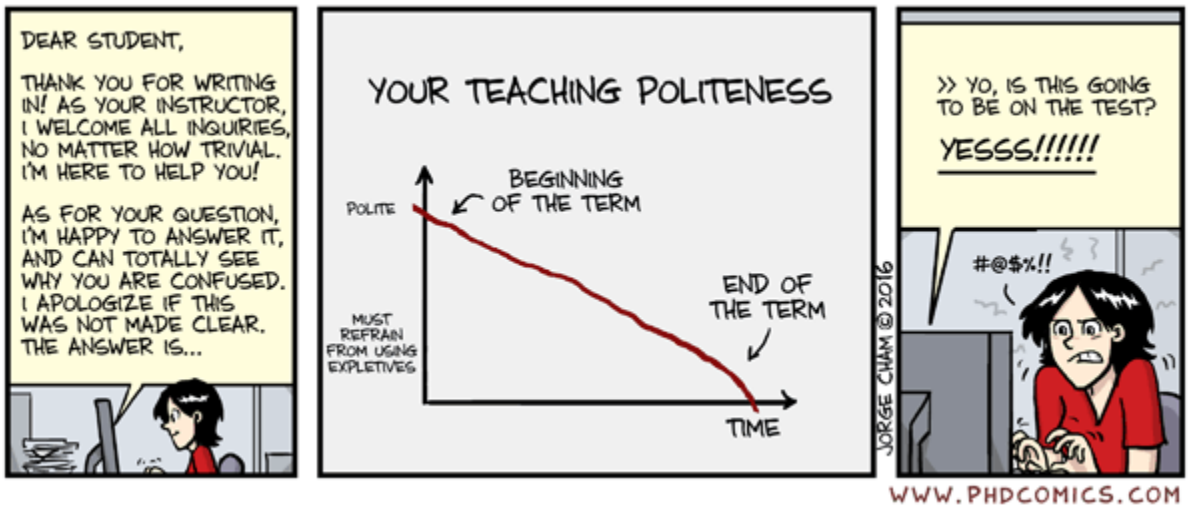


Figure 1: Teaching is an extremely difficult process, for both the instructor and the students. As part of this course, you will learn to define professional behavior inside and outside the classroom and develop strategies to maintain professionalism over the course of your instruction duties. Image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

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.

Assignments (“Homework”)

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

- You will be asked to read material, or watch a video (or both), to prepare you for the next class activity period.
- You will be asked to complete short quizzes on assigned material before class.
- You will be asked to write notes in a discussion board, either before class or to capture discuss after class.
- You will be asked to prepare video or audio files of you teaching a physics concept. These will be uploaded to Canvas for assessment and discussion.
- You will be asked to engage in problem-solving activities on upper-level material to aid in identifying problems in transitioning from the intro to the upper-level. You will be asked to present solutions and reflect on places where intro-level students will have difficulty transitioning to the upper level courses.
- You will be asked to use lessons from reading, videos, and class to develop experimental course content.

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 above.

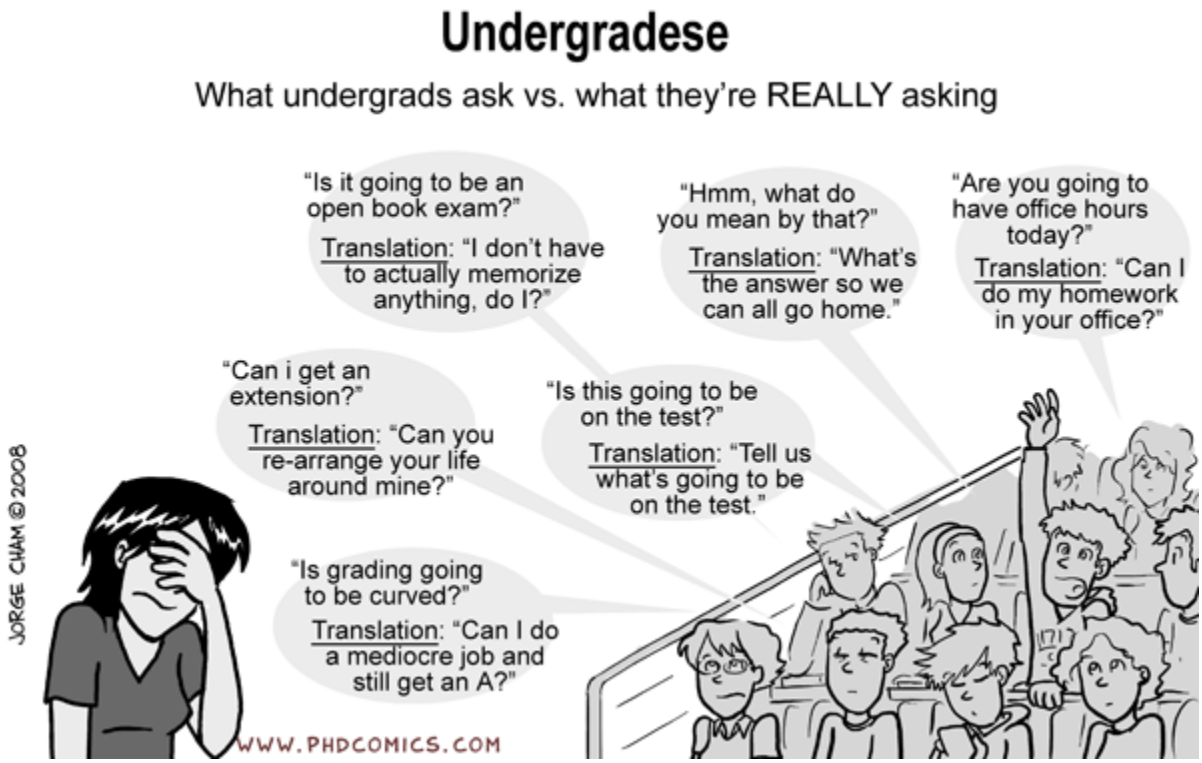


Figure 4: Undergraduates often ask questions that are not representative of the true question. You must learn to engage with them to find out what are the real issues in a class, and respond to those issues professionally. Their evaluations of you will be based on hidden assumptions that they make when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

Disability Accommodations	Students who need 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 (http://www.smu.edu/Provost/SASP/DASS)** to begin the process. Once they are registered and approved, students then submit a DASS Accommodation Letter through the electronic portal, *DASS Link,* and then communicate directly with each of their instructors to make appropriate arrangements. Please note that accommodations are not retroactive, but rather require advance notice in order to implement.
Sexual Harassment	All forms of sexual harassment, including sexual assault, dating violence, domestic violence and stalking, are violations of SMU's Title IX Sexual Harassment Policy and may also violate Texas law. Students who wish to file a complaint or to receive more information about the grievance process may contact Samantha Thomas, SMU's Title IX Coordinator, at **accessequity@smu.edu (mailto:accessequity@smu.edu)** or 214-768-3601. Please note that faculty and staff are mandatory reporters. If students notify faculty or staff of sexual harassment, they must report it to the Title IX Coordinator. For more information about sexual harassment, including resources available to assist students, please visit **www.smu.edu/sexualmisconduct (http://www.smu.edu/sexualmisconduct)**.
Pregnant and Parenting Students	Under Title IX, students who are pregnant or parenting may request academic adjustments by contacting Elsie Johnson (elsiej@smu.edu) in the Office of the Dean of Students, or by calling 214-768-4564. Students seeking assistance must schedule an appointment with their professors as early as possible, present a letter from the Office of the Dean of Students, and make appropriate arrangements. Please note that academic adjustments are not retroactive and, when feasible, require advance notice to implement.
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. **Click here for a list of holidays. (https://www.smu.edu/StudentAffairs/ChaplainandReligiousLife/ReligiousHolidays)**
COVID-19 and Other Medical-Related Absences	Students who test positive for COVID-19 and need to isolate, or who are notified of potential exposure, must follow **SMU's Contact Tracing Protocol (https://www.smu.edu/Coronavirus/Contact-Tracing) . (https://www.smu.edu/Coronavirus/Contact-Tracing)** To ensure academic continuity and avoid any course penalties, students should follow the same procedures described by their instructors as they would for any other medical-related absence in order to be provided with appropriate modifications to

	assignments, deadlines, and exams.
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 that were missed as a result of their participation. It is the responsibility of the student to make arrangements for make-up work with the instructor prior to any missed scheduled examinations or other missed assignments. (See **2020-2021 SMU Undergraduate Catalog (https://catalog.smu.edu/content.php?catoid=51&navoid=4645&hl=%22excused+absences%22&returnto=search)** under "Enrollment and Academic Records/Excused Absences.")
Final Exams	Final course examinations shall be given in all courses where appropriate, and some form of final assessment is essential. Final exams and assessments must be administered as specified in the official examination schedule. Exams cannot be administered or due during the last week of classes or during the Reading Period. Syllabi must state clearly the form of the final exam or assessment, and the due date and time must match the official SMU exam schedule. Final exams are not required to be provided online.
Student Academic Success Programs	Students needing assistance with writing assignments for SMU courses may schedule an appointment with the Writing Center through Canvas. Students who would like support for subject-specific tutoring or success strategies should contact SASP, Loyd All Sports Center, Suite 202; 214-768-3648; **https://www.smu.edu/sasp (https://www.smu.edu/sasp)**.
Caring Community Connections Program	CCC is a resource for anyone in the SMU community to refer students of concern to the Office of the Dean of Students. The online referral form can be found at **smu.edu/deanofstudentsccc (http://www.smu.edu/deanofstudentsccc)**. After a referral form is submitted, students will be contacted to discuss the concern, strategize options, and be connected to appropriate resources. Anyone who is unclear about what steps to take if they have concerns about students should either consult the **CCC Reference (https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure_CCC_Details_Concerned_about_an_SMU_Student.pdf?la=en) Guide (https://www.smu.edu/-/media/Site/StudentAffairs/StudentLife/PDF/Brochure_CCC_Details_Concerned_about_an_SMU_Student.pdf?la=en)** or contact the Office of the Dean of Students at 214-768-4564.
Campus Carry Law	In accordance with Texas Senate Bill 11, also known as the 'campus carry' law, and following consultation with entire University community, SMU chooses to remain a weapons-free campus. Specifically, SMU prohibits possession of weapons (either openly or in a concealed manner) on campus. For more information, please see:

http://www.smu.edu/BusinessFinance/Police/Weapons_Policy (http://www.smu.edu/BusinessFinance/Police/Weapons_Policy) . (http://www.smu.edu/BusinessFinance/Police/Weapons_Policy)

University Honor Code

The student honor code can be found on page 32 of the student handbook [1] (syllabus2.html#fn1x0) . 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.

Course Summary:

Date	Details	Due
Mon Aug 23, 2021	Learn about SMU's Introductory Physics Courses (https://smu.instructure.com/courses/91637/assignments/557787)	due by 10:59am
	Quiz on Cooperative Problem Solving Sessions (https://smu.instructure.com/courses/91637/assignments/557788)	due by 11am
	Quiz on SMU Introductory Physics Courses (https://smu.instructure.com/courses/91637/assignments/557790)	due by 11am
	Read the Cooperative Problem Solving Session Manual (https://smu.instructure.com/courses/91637/assignments/557792)	due by 11am
	Virtual Co-Op Training (https://smu.instructure.com/courses/91637/assignments/557800)	due by 11am

Date	Details	Due
	Introduction to the Course and Cooperative Problem Solving Training (https://smu.instructure.com/courses/91637/assignments/558182)	due by 11:59am
Mon Aug 30, 2021	Quiz on Knight and Introductory Physics Teaching Methodologies (https://smu.instructure.com/courses/91637/assignments/557789)	due by 11am
	Read Knight Ch. 1 and 2; Describe Your Introductory Physics Experience (https://smu.instructure.com/courses/91637/assignments/557784)	due by 11am
Fri Sep 10, 2021	Problem-Solving in Classical Mechanics (https://smu.instructure.com/courses/91637/assignments/558221)	due by 11:59pm
Mon Sep 13, 2021	Teaching Demonstrations (https://smu.instructure.com/courses/91637/assignments/557793)	due by 11am
Mon Sep 20, 2021	Knight, "Five Easy Pieces": Applying Lessons to Introductory Physics at SMU (Discussion) (https://smu.instructure.com/courses/91637/assignments/557782)	due by 11am
	Quiz on Strategies for Improving Introductory Physics Classes (at SMU) (https://smu.instructure.com/courses/91637/assignments/557791)	due by 11am

Date	Details	Due
Mon Sep 27, 2021	Learn about SMU Introductory Physics Adapted Using Modern Teaching Approaches (Discussion) (https://smu.instructure.com/courses/91637/assignments/557781)	due by 11am
Fri Oct 1, 2021	Problem-Solving in Electromagnetism (https://smu.instructure.com/courses/91637/assignments/558222)	due by 11:59pm
Mon Oct 18, 2021	Checkpoint: Introductory Physics Teaching Experiences for this Term (https://smu.instructure.com/courses/91637/assignments/557777)	due by 11am
Fri Oct 22, 2021	Problem-Solving in Quantum Mechanics (https://smu.instructure.com/courses/91637/assignments/558223)	due by 11:59pm
Fri Nov 12, 2021	Problem-Solving in Statistical Mechanics (https://smu.instructure.com/courses/91637/assignments/558224)	due by 11:59pm
Mon Dec 6, 2021	Checkpoint: Final Discussion of Introductory Physics Teaching Experiences for this Term (https://smu.instructure.com/courses/91637/assignments/557776)	due by 11am
	Develop a "Fermi Problem" for 1105 or 1106 (https://smu.instructure.com/courses/91637/assignments/557785)	due by 11:59pm