**PHYS 394**

**Pedagogy and Teaching Physics for Learning Assistants**

Spring 2024

**COURSE INFORMATION**

**Course Website:** <https://courses.physics.illinois.edu/phys394/sp2024/>

**Meeting Time:** Tuesday, 3:30PM – 4:50PM

**Meeting Locations:** Section LA1, 158 Loomis

Section LA2, 1043 Sidney Lu Mechanical Engineering Building

**Credit Hours:** 2

**Instructors:** Section LA1

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Section LA2

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**Office Hours: 11:00 AM – 12:00 PM Fridays at 408 Loomis**

**Prerequisites:** Lab LAs must have successfully completed PHYS101, PHYS102,

PHYS211, or PHYS212.

**Learning Objectives:**

Upon completion of the course, LAs should be able to:

* Demonstrate a knowledge of both general and discipline-specific pedagogy theories.
* Connect pedagogical theories and frameworks to their experience in the classroom.
* Critically evaluate new teaching methods through the lens of their own experience as teachers and students
* Utilize self-reflection to evaluate the efficacy of their approach to situations in the classroom.

**Course Description:**

PHYS394 is designed to support Learning Assistants (LAs) who are working as instructional aids in lab sections of the introductory physics courses. Students will study pedagogical strategies for instructor-student interaction and philosophies guiding lab design. Additionally, students in PHYS394 reflect upon specific challenges of lab activities sections for which the LAs provide student guidance. The course provides time in class to work on assignments, limiting the weekly time commitment outside of class to one hour or less.

**Course Format**

PHYS394 is divided into two components: 1) a pedagogical component that supports the LAs in their instructional roles in lab or discussion sections; and 2) a lab preparation component that primes the LAs to support students with lab problems in their sections. For the pedagogical component, students meet weekly for 70 minutes; for the lab preparation component, they meet each week for 50 minutes. The two components are described in more detail below.

**Pedagogical component**

The overarching goal of the LA pedagogy course is to provide new LAs with a base set of teaching knowledge and tools to allow them to succeed as instructors. By the end of the semester, LAs enrolled in the pedagogy component should be able to:

* Demonstrate a knowledge of both general and discipline-specific pedagogy theories.
* Connect pedagogical theories and frameworks to their experience in the classroom.
* Critically evaluate new teaching methods through the lens of their own experience as teachers and students
* Utilize self-reflection to evaluate the efficacy of their approach to situations in the classroom

The course will start with readings and in-class activities designed around developing effective questioning and active listening strategies, to prepare students for teaching in the lab setting. From there, we will continue to build on effective teaching practices through readings, reflections, and two inter-connected larger projects (interview project and lab design project.)

*Course Readings*

Course readings will be assigned 8-9 weeks per semester. Readings will consist of selected papers in education and Physics Education Research (PER). Students are expected to come to class ready to discuss the week’s readings. Before class each week, students will complete and submit a 1 paragraph “review” of the paper, in which they summarize their takeaways from the reading and how the reading material can be applied in their own teaching.

*Field Notes*

To encourage practicing new teaching strategies, students will be given an assignment to complete during their LA duties. Each assignment will differ slightly but will typically involve attempting to incorporate a new teaching strategy or paying attention to a specific dimension of student interactions. During their teaching session, LAs will take notes on how their interactions with students went, what teaching strategies worked best, and any other observations of interest. These field notes will be submitted weekly and graded by completion.

*Teaching Reflections*

Throughout the semester—usually every other week—students will be asked to use their field notes to discuss some teaching scenarios. These reflections are a chance for students to reflect on what practices and techniques they find effective or ineffective in the classroom, and to self-assess their progress as instructors. Reflections are graded based on completion.

*In-class Activities*

As a means of presenting or practicing new pedagogical methods, the course will include a variety of in-class activities. Activities can range from analyzing video clips of a successful or unsuccessful student-instructor interaction to analyzing upcoming assignments from lab/discussion. The goals of these activities will be to present new pedagogical techniques or to reflect on what might be successful about one specific technique versus another.

*Interview Project*

In the first half of the semester, LAs will complete an Interview Project. In this project, LAs first create a protocol for an interview about a physics topic or phenomenon and topics related to the pedagogy of teaching this physics content. The interview will elicit introductory physics students’ ideas about the topic/phenomenon and their way of learning it. The topic or the phenomenon is selected within the content of the course in which the LAs are assisting (e.g., LAs teaching mechanics may select a topic within kinematics, Newton’s Laws, etc.). Time will be allocated during the course for feedback and revision of the project as it progresses. The Physics Interview Project has three assignments: 1) Interview Protocol; 2) Revised Interview Protocol; and 3) Final Interview Report. The Final Interview Report builds upon the first two assignments about the interview protocol.

*Lab Design Project*

In the second part of the semester, LAs complete a Lab Design Project that is based upon their findings in the Interview Project. In developing a lab activity, the LAs define learning goals informed by Bloom’s Taxonomy and use Learning-Goals-Driven design to create lab activities that are aligned with learning goals they have crafted based on the information gathered in the Interview Project. At the end of the Lab Design Project, groups of LAs test and grade each other’s activities. The Lab project has three assignments: 1) Learning Goals and Evidence; 2) Lab Activity Proposal; and 3) Final Lab Design Report.

**Lab component**

In the Lab component of the course, LAs meet with the TAs and Lab Coordinators of their course to prepare for the lab section of the coming week. During this meeting, LAs and TAs work through the lab of the week, discuss the learning goals of the upcoming section, the different ways in which students may solve the lab task, and the kind of challenges that students may encounter. The lab component of PHYS394 ensures that the LAs (and TAs) are better prepared to support their students when they encounter these challenges.

**Prerequisites and Corequisites:**

Lab LAs must have successfully completed PHYS101, PHYS102, PHYS211, or PHYS212.

**Learning Resources:**

smartIllinois: free access  
Access to a Laptop, Tablet, or Smartphone

Access to iOLab software

Texts in the form of educational research papers and book excerpts are supplied by the course.

### Academic Integrity

All activities in this course are subject to the Academic Integrity rules as described in [Article 1, Part 4, Academic Integrity, of the Student Code](http://studentcode.illinois.edu/article1_part4_1-401.html).

Infractions include, but are not limited to:

* Cheating, plagiarism, fabrication
* facilitating infractions of academic integrity.
* academic interference
* computer-related infractions
* unauthorized use of university resources
* sale of class materials or notes

***Violations of any of these rules will be prosecuted and reported to the student's home college in compliance with the Student Code:*** [Article 1, Part 4, Academic Integrity, of the Student Code](http://studentcode.illinois.edu/article1_part4_1-401.html).

All aspects of the course are covered by these rules, including:

* homework
* projects
* documentation submitted for petition for an excused absence

**Overview of Course Requirements & Assessments**

Grading:

There are five types of assignments in the course:

1. Course Readings Summaries in smartIllinois due by start of class where reading is discussed.
2. Field Notes, i.e., notes on your lab experiences due by the end of week of lab that you are reporting on. Field Notes are uploaded to TEAMs.
3. Weekly Reflections in smartIllinois that are completed in class.
4. Sections of project reports:

Draft of Interview Protocol, due 2/21 by beginning of class

Revised Interview Protocol, due 2/28 by end of class

Learning Goals and Evidence for Lab Design Project, due 3/28 by beginning of class

Lab Activity Proposal for Lab Design Project, due 4/4 by beginning of class.

1. Final Reports

Interview Project, due 3/21 by beginning of class.

Lab Design Project, due 5/8

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| --- | --- | --- | --- |
| **Course Component** | **Number of Assignments** | **Number Dropped per Semester** | **Maximum Points per Semester** |
| Class Attendance & Participation | 15 | 2 | 240 |
| Lab Sections | 12 | 0 | 144 |
| Prep Meeting Attendance | 12 | 3 | 16 |
| Course Reading Summaries | 5 | 0 | 50 |
| Field Notes | 8 | 1 | 50 |
| smartIllinois Weekly Reflection (online) | 14 | 0 | 50 |
| Teaching observation | 1 | 0 | 50 |
| Interview Protocol | 1 | 0 | 25 |
| Revised Interview Protocol | 1 | 0 | 25 |
| Final Interview Report | 1 | 0 | 150 |
| Learning Goals and Evidence | 1 | 0 | 25 |
| Lab Activity Proposal | 1 | 0 | 25 |
| Final Lab Design Report | 1 | 0 | 150 |

Your final grade in Physics 394 will be based upon your total score on all the components of the course. The total possible score is 1000 points.

Final Grade:

The following table will be used to assign final grades.

|  |  |
| --- | --- |
| Final Grade | Minimum Points |
| A+ | 950 |
| A | 920 |
| A- | 900 |
| B+ | 880 |
| B | 860 |
| B- | 835 |
| C+ | 810 |
| C | 780 |
| C- | 750 |
| D+ | 720 |
| D | 690 |
| D- | 610 |
| F | <610 |

**Course Schedule**

Please note, that the lab prep meetings are a part of the course but take place at the weekly lab prep meetings with TAs and lab coordinators, *not* during the pedagogy class period.

|  |
| --- |
| **Class 1: Instructor-student interaction I** |
| Identify moves to facilitate group discussions  Identify moves to elicit student thinking |
| **Class 2: Instructor-student interaction II** |
| Equity in the Physics Classroom |
| **Class 3: Instructor-student interaction III** |
| Describe open and closed questions  Practice using open questions  Preparing Lab Section |
| **Class 4: Interview Project I** |
| Identify interview techniques that help elicit student thinking. Construct interview protocol  Bloom’s Taxonomy and interview questions  Preparing Lab Section |
| **Class 5: Interview Project II** |
| Productive talk in groups  Construct interview protocol Identify students’ ideas of physics topics chosen for interview  Preparing Lab Section |
| **Class 6: Interview Project III** |
| Perform practice interview  Revise interview protocol  Preparing Lab Section |
| **Class 7: Interview Project IV** |
| Reflect on practice interview Revise interview protocol  Final interview during this week  Preparing Lab Section |
| **Class 8: Interview Project V** |
| Write interview report  Survey on Interview Project  Categorizing Labs  Preparing Lab Section |
| **Class 9: Lab Design Project I** |
| Introdution to Lab Design Project  Learning-Goals-Driven design  Bloom’s Taxonomy and learning goals  Identify learning goals for Lab Activity  Preparing Lab Section |
| **Class 10: Lab Design Project II** |
| Lab Proposal  Rubrics  Uncertainty in measurements  Preparing Lab Section |
| **Class 11: Lab Design Project III** |
| Rubric Activity  Lab Handout and Rubrics  Preparing Lab Section |
| **Class 12: Lab Design Project IV** |
| Reflective Teaching Activity  Developing and testing lab activity  Preparing Lab Section |
| **Class 13: Lab Design Project V** |
| Developing and testing lab activity  Preparing Lab Section |
| **Class 14: Lab Design Project VI** |
| Performing each other’s labs  Writing Lab Design Project Report  Preparing Lab Section |
| **Class 15: End of Semester** |
| End of semester surveys  Expert LA information  Writing Lab Design Project Report |
| **Final exam week** |
| Final Lab Activity Report due Monday of Final exam week |

**Specific Schedules for Lab LAs SP2023:**

**SP2023:** https://courses.physics.illinois.edu/phys394/sp2023/schedule.html

**General Class & Assessment Schedule:**

W1 1/16 *Introduction to class*

1. Format
2. Assignments
3. Grading
4. LA expectations

*Instructor-student interaction - monologue, dialogue …* I

1. “Hello!” a video clip about how much to tell students.
2. “Depth” a video clip about bringing out students’ ideas.

101: No lab

102: No lab

211: Lab 1 and Preparing for Lab 1

212: Lab 1 and Preparing for Lab 1

1. **Homework:**

**Read Daane et al *Teaching About Racial Equity in Introductory Physics Courses***

W2 1/23 *Instructor-student interaction and student-student interaction – Equity* II

1. Equity in the Physics Classroom

101: No Lab

102: No Lab but Preparing Lab 1

211: Lab 2 and Preparing Lab 2

212: Lab 2 and Preparing Lab 2

W3 1/30 *Instructor-student interaction – monologue, dialogue…* III

1. Open and Closed Questions - activity
2. Univocal and Dialogic Discourse – discussion

101: Lab 1 and Preparing for Lab 1

102: Lab 1 and Preparing for Lab 2

211: Lab 3 and Preparing for Lab 3

212: Lab 3 and Preparing for Lab 3

W4 2/6 Project Part 1: *Interview Project I*

1. Introduction to project: Interviews and Designs
2. Choose a topic.
3. Bloom’s Taxonomy and interview questions
4. Interview protocol
5. **Homework: Read Talk Science Primer. TERC, pp 1-20.**

**Listing questions for interview**

1. LAs: Look for interview candidates

101: Lab 2 and Preparing for Lab 2

102: Lab 2 and Preparing for Lab 3

211: Lab 4

212: Lab 4

W5 2/13 Project Part 1: *Interview Project II*

1. Talk Science Primer
2. Questioning Activity: Productive talk in groups
3. Merging list of interview questions into protocols
4. **Homework: Draft of interview protocol, due 2/21**

101: No Lab

102: No lab, but Preparing Lab 3

211: No lab

212: No lab

W6 2/20 Project Part 1: *Interview Project III*

1. Practice Interview – discussion and reflection
2. Revise interview protocol
3. LAs: Continue to look for interview candidates
4. **Homework:**

**Read Redish *Implications of cognitive studies for teaching physics***

**Revised interview protocol (for feedback, due Fr. 2/24)**

101: Lab 3 and Preparing Lab 3

102: Lab 3 and Preparing Lab 4

211: Lab 5 and Preparing Lab 5

212: Lab 5 and Preparing Lab 5

W7 2/27 Project Part 1: *Interview Project IV*

1. Feedback to revised protocol.
2. Activity about mental models and physics learning. Based on Redish reading
3. **Due at the end of class:** **Revision of interview protocol**
4. **Homework:**

Reading: Etkina

FINAL INTERVIEW should happen during this week!

101: Lab 4 and Preparing Lab 4

102: Lab 4

211: Lab 6 and Preparing Lab 6

212: Lab 6 and Preparing Lab 6

W8 3/5 Project Part 1: *Interview Project V*

1. Writing Interview Report
2. Survey on Interview Project
3. Categorizing Labs – activity based on Etkina reading.
4. **Homework: Final Interview Report, due 3/19**

101: Lab 5 and Preparing Lab 5

102: No lab, but Preparing Lab 5

211: Lab 7 and Preparing Lab 7

212: Lab 7 and Preparing Lab 7

W9 3/12 SPRING BREAK

W10 3/19 Project Part 2: *Lab Design Project I*

1. Lab Project intro
2. Bloom’s Taxonomy and Learning Goals
3. Identify Learning Goals for Lab Activity
4. **Homework: Learning Goals and Evidence for Lab Activity, due 3/26**

101: No Lab

102: Lab 5 and Preparing Lab 6

211: No Lab

212: Lab 8 and Preparing for Lab 8

W11 3/26 Project Part 2: *Lab Design Project II*

1. **Lab Proposal**
2. Rubric writing
3. Uncertainty activity
4. **Homework for FRIDAY 3/29 Lab Proposal**

101: Lab 6 and Preparing Lab 6

102: Lab 6

211: Lab 8 and Preparing Lab 8

212: No Lab

W12 4/2 Project Part 2: *Lab Design Project III*

1. **Rubric Activity**
2. Lab handout and rubrics
3. Homework: Lab handout and Rubric

101: Lab 7 and Preparing Lab 7

102: No lab, but Preparing Lab 7

211: Lab 9 and Preparing Lab 9

212: Lab 9 and Preparing Lab 9

W13 4/9 Project Part 2: *Lab Design Project IV*

1. Reflective Teaching Activity
2. Testing lab activity

101: Lab 8 and Preparing Lab 8

102: Lab 7 and Preparing Lab 8

211: Lab 10 and Preparing for Lab 10

212: Lab 10 and Preparing for Lab 10

W14 4/16 Project Part 2: *Lab Design Project* *V*

1. Testing lab activity

101: No Lab

102: Lab 8 and Preparing for Lab Practical

211: Lab 11 and Preparing for Lab 11

212: Lab 11 and Preparing for Lab 11

W15 4/23 Project Part 2: *Lab Design Project VI*

1. Performing each other’s labs

101: Lab Practical and Preparing for Lab Practical

102: Lab Practical

211: Lab Practical and Preparing for Lab Practical

212: Lab Practical and Preparing for Lab Practical

W16 4/30 End of Semester

1. End of semester surveys and discussion
2. Becoming an Expert LA (ELA)!
3. Writing Lab Activity Report

101: No Lab

102: No Lab

211: No Lab

212: No Lab

W17 5/6 **Project part 2 due:** **Final 7Lab Design Report**