

**PHYS 5274**  
**Physics Pedagogy**  
**Fall 2011**

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**Schedule:** TBA

**Office Hours:** By appointment.

**Prerequisites:** none

**Course Text:** The text will consist of a series of readings which will be provided.

**Course Coverage:** Teaching methods for introductory courses and labs will be discussed, as well as teaching methods in general, including working with groups, student-centered pedagogy, discovery and inquiry-based methods, grading and other pedagogy. We will also read physics education research papers, in order to inform you of the science of teaching.

**The Nature of the Course:** Students will discuss the content and pedagogy of the laboratories and recitations they will be teaching, discussing teaching methods relevant to the materials, working through portions of laboratory and the recitation materials in order to illustrate instructional methods, pointing out areas of student difficulty, why the materials have been developed the way they are developed based on physics education research. There will also be time allotted for discussion of issues of grading, course administration and other topics.

**Expected Learning Outcomes:**

- 1) Students will be able to teach research-based laboratories effectively.
- 2) Students will be able to demonstrate their understanding of the nature of the materials, including the use of research-based materials, modeling, effective pedagogy for teaching physics concepts and calculations, interpretation of data, both in class and while teaching.
- 3) Students will understand various pedagogies, such as how to use interactive engagement, student-centered pedagogies and other teaching techniques.
- 4) Students will be able to develop and grade physics problems by a rubric, especially problems that require students to explain their reasoning and physics problems that require both conceptual and quantitative responses.

### Methods for Assessing Expected Learning Outcomes:

- 1) Students will be observed teaching introductory physics laboratories.
- 2) Students will be evaluated on their discussion of the nature of the materials in class.
- 3) Students will be evaluated on their discussion of the readings.
- 4) Students will be evaluated on their discussion of different teaching techniques in class.
- 5) Students' grading of undergraduate students' physics papers will be evaluated.

### Tentative List of Readings

1. "Guest Comment: How we teach and how students learn—A mismatch?" L.C. McDermott, *Am. J. Phys.* **61**, 4, 295 (1993).
2. "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses," R.R. Hake, *Am. J. Phys.* **66**, 64-74 (1998).
3. "Investigation of student understanding of the concept of velocity in one dimension," D.E. Trowbridge and L.C. McDermott, *Am. J. Phys.* **48**, 1020-1028 (1980).
4. "Investigation of student understanding of the concept of acceleration in one dimension," D.E. Trowbridge and L.C. McDermott, *Am. J. Phys.* **49**, 242-253 (1981).
5. "Research as a guide for curriculum development: An example from introductory electricity. Part I: Investigation of student understanding," L. C. McDermott and P. S. Shaffer, *Am. J. Phys.* **60**, 994 (1992); Erratum: *Am. J. Phys.* **61**, 81 (1993)
6. "Research as a guide for curriculum development: An example from introductory electricity. Part II: Design of instructional strategies," P. S. Shaffer and L. C. McDermott, *Am. J. Phys.* **60**, 1003 (1992).
7. "Millikan Lecture 1994: Understanding and teaching important scientific thought processes," F. Reif, *Am. J. Phys.* **63**, 17-32 (1995).
8. "Learning to think like a physicist: A review of research-based instructional strategies," A. van Heuvelen, *Am. J. Phys.* **59**, 891-897 (1991).
9. "Effectiveness of different tutorial recitation teaching methods and its implications for TA training," Kathleen M. Koenig, Robert J. Endorf, and Gregory A. Braun, *Phys. Rev. ST Physics Ed. Research* **3**, 010104 (2007).
10. "Initiation of student-TA interactions in tutorials," Rachel E. Scherr, Rosemary S. Russ, Thomas J. Bing, and Raymond A. Hodges, *Phys. Rev. ST Physics Ed. Research* **2**, 020108 (2006).
11. "More than misconceptions: Multiple perspectives on student knowledge and reasoning, and an appropriate role for education research," D. Hammer, *Am. J. Phys.* **64**, 1316-1325 (1996).
12. "Millikan Lecture 1998: Building a science of teaching physics," E.F. Redish, *Am. J. Phys.* **67** (7), 562-573 (1999).
13. "Tapping epistemological resources for learning physics," D. Hammer and A. Elby, *J. of Learning Sciences* **12**, 53-90 (2003).

14. "Teaching problem solving through cooperative grouping. Part 1: Group versus individual problem solving," P. Heller, R. Keith, and S. Anderson, *Am. J. Phys.* **60** , 637-644 (1992).
15. "Teaching problem solving through cooperative grouping. Part 2: Designing problems and structuring groups," P. Heller, M. Hollabaugh, *Am. J. Phys.* **60** , 627-636 (1992).

**Grades:** The grade will be weighted as follows:

Readings and class participation	25%
Prompt and consistent attendance of TA laboratory and recitation preparation meetings	25%
Evaluation of teaching	25%
Evaluation of grading	25%

Any student who, because of a disability, may require special arrangements in order to meet the course requirements should contact the instructor as soon as possible to make any necessary arrangements. Students should present appropriate verification from Student Disability Services during the instructor's office hours. Please note instructors are not allowed to provide classroom accommodations to a student until appropriate verification from Student Disability Services has been provided. For additional information, you may contact the Student Disability Services office in 335 West Hall or 806-742-2405.