

## Instructor's guide for "Ten essential readings in physics education research"

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### LEARNING GOALS

After participating in this course, students should be able to:

- Understand the distinctive intellectual history of physics education research as an application of cognitive psychology to problems of physics teaching and learning.
- Identify the theoretical and experimental foundations of physics education research articles they read in the future
- Be able to identify the research question, claim, evidence, and prevailing metaphor for learning in physics education research articles they read in the future
- Place influential physics education researchers in the landscape of the field (e.g., who is derived from whom, who opposes whom)
- Recognize that physics education research is a discourse, rather than a fixed body of knowledge
- Locate their own research in the larger discourse of physics education research

### COURSE PREPARATION

At least one week before the first class:

1. Finalize the list of readings. Our suggested ten readings are below.
2. Set up a blog for the course, probably with Wordpress.
3. Post the four starting blog posts below (after adjusting them to reflect the specifics of your course).
4. Invite all course participants to be "authors" of the blog (so that they can not only view and comment, but also post).

#### BLOG POST 1: WELCOME

Welcome to the course website for "Ten Essential Readings in Physics Education Research." This course is intended to introduce you to the shared cultural touchstones of our field, including how PER relates to other key disciplinary perspectives. Readings for this course include classic papers of the 1970s and early 1980s as well as "contemporary classics" from the early 2000s that have proven influential.

Each week you will read a paper or papers and respond in writing to assigned reading questions [insert link to "reading questions" post] by posting to this blog. Seminar time will be spent discussing the reading questions as well as your own questions. After class, you will comment in writing on each other's responses.

We look forward to studying these papers with you!

#### BLOG POST 2: READINGS

[If you indicate the date on which your class will be discussing each of these papers, the below will constitute a complete course schedule.]

1. [Arons](#), A. B., "Cultivating the capacity for formal reasoning," Am. J. Phys. 44 (1976) 834
2. [Posner](#), G., K. A. Strike, P. W. Hewson, W. A. Gertzog, "Accommodation of a scientific conception: Toward a theory of conceptual change," Sci. Educ. 66(2), 211-227 (1982)
3. [Trowbridge](#), D. E. and L. C. McDermott, "Investigation of student understanding of the concept of velocity in one dimension," Am. J. Phys. 48 , 1020-1028 (1980) AND [Trowbridge](#), D. E. and L. C. McDermott, "Investigation of student understanding of the concept of acceleration in one dimension," Am. J. Phys. 49 , 242-253 (1981)

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4. [Hestenes](#), D., M. Wells, and G. Swackhamer, "Force Concept Inventory," Phys. Teach. 30, 141-158 (1992) AND [Henderson](#), C., "Common concerns about the Force Concept Inventory," Phys. Teach., 40, 542 (2002). See also [PhysPort's FCI page](#).
5. [Chi](#), M. T. H, P. J. Feltovich, and R. Glaser, "Categorization and representation of physics problems by experts and novices," Cog. Sci. 5, 121-152 (1981)
6. [Hake](#), R. R., "Interactive-engagement versus traditional methods: A six-thousand-student survey of mechanics test data for introductory physics courses," Am. J. Phys. 66 , 64-74 (1998)
7. [Crouch](#), C. H. and E. Mazur, "Peer instruction: Ten years of experience and results," Am. J. Phys. 69 (9), 970-977 (2001)
8. [Redish](#), E. F. "Implications of cognitive studies for teaching physics", American Journal of Physics, 62, 796-803 (1994)
9. [Smith](#), J. P, A. DiSessa, and J. Roschelle, "Misconceptions reconceived: a constructivist analysis of knowledge in transition," Journal of the Learning Sciences 3 (2): 115–163 (1993-4)
10. Wenger, E. "Communities of practice: Learning, meaning, and identity," [Prologue](#) and [Chapter 1](#). (Cambridge University Press, 1998) (You can skip some parts of this text, marked in the PDF.)

### BLOG POST 3: READING QUESTIONS

We expect to answer the following questions about all the papers we read for this class, in addition to your questions. Your reading response should include answers to the first four of these questions (in bold), as well as a more personal response to the paper(s).

1. **What is the research question?**
2. **What is the claim?**
3. **What is the evidence?**
4. **What metaphor for learning is used?**
5. Who are the authors?
6. What is the goal of this kind of research – what are the authors trying to accomplish? What are the stakes?
7. What is the intellectual tradition that this paper is participating in – whose research is it continuing or opposing?
8. What has been the role of this research in the history of PER? How has it been interpreted (or misinterpreted)?

### BLOG POST 4: INSTRUCTIONS FOR COURSE PARTICIPATION

#### Before class

Reading responses are due at 5pm on Thursdays (before we discuss that paper in class) – except in the first two weeks, when responses are due at 5pm on Wednesdays (for class on Thursdays).

- Write a 500-word response that includes both answers to the [first four reading questions](#) and your own personal response to the paper(s).
- Submit your response by posting it to this blog.
- Title the post with a unique word or phrase from your response.
- Tag the post with (1) your first name and (2) the last name of the first author of the paper (e.g., Arons).

#### In class

Class meets at 1:30 on Fridays (except in the first two weeks, when it will meet at 1pm on Thursdays). In class we will pose and answer a combination of the [reading questions](#) and

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your own questions. Someone will have the job of publicly recording that day's questions and answers; these will be posted to this blog.

### **After class**

Comment on at least two other blog posts with a 100-word comment. Comments are due by 5pm on Mondays.

Note: To receive email notifications of blog posts and comments, go to your WordPress account, click "Reader" (top left), click the "Manage" button next to the "Followed Sites" tab on the left sidebar, click the ">" sign to the left of the name of this blog, and turn on email notifications.

### **IN CLASS**

The schedule below is for a one-hour seminar. If you have 90 minutes, so much the better.

1. (Before class) Write the reading questions on the board. Designate another space on the board for participants' own questions about the paper. Leave space to write answers during class.
2. (At the start of class) Choose a scribe to record the group's answers to all the questions on the board as they are generated.
3. (5 min) Invite people's own questions about the paper and write them on the board. Note which questions are about the paper (should be answerable based on what's in the paper) and which ones go beyond the paper. Don't start answering the questions yet; just collect them on the board.
4. (30 min) Participants collaborate to answer the first four reading questions. The scribe writes answers on the board as they're generated.
5. (10 min) Instructors answer the last four questions (unless participants know more!). The scribe writes answers on board.
6. (15 min) Decide which participant-generated questions the class will try to answer today, and in what order. (It's usually best to start with the ones that are within the scope of the paper.) Answer as many as you have time for.
7. (At the end of class) Have someone photograph the board and posts the photo(s) to blog, tagged with the name of the author being discussed that day.

### **PARTIAL ANSWERS TO READING QUESTIONS**

(in progress)