PHYS 390T: An Introduction to Principles of Active Learning in Physics Education

Weekly Schedule

Notes

This week-by-week schedule is based upon the independent study course I ran along a similar line during the spring of 2016 semester. Thus, some weeks only have two days due to holidays, readiness assessment tests (RATs), exams, etc. I ask P390T students to attend the first P131 RAT so that they can observe the process. However, given that I do not want the P131 students to subconsciously make connections between the students of P390T and their grade, I do not require P390T students to attend subsequent RATs. The prompts provided here are meant to be an indication of typical prompts.

The weekly meeting begins each week with a few minutes of questions and concerns before we get into discussion of the reading.

Week 1:

P131-class reflections:

- What do you think will be the biggest challenge with this format?
- Today, I would like you to keep track of the TIME. Mark down the time spent on each activity: how long do I talk during my Fermi example, how long do the students work on their Fermi-problem etc. Post it here.

No weekly meeting for first week.

Week 2:

P131-class reflections:

- Today we will form teams. How would you form them? Random? Should they be balanced in some way? Can you figure out what I did? We will talk more about this later in our weekly meetings, but I want you to think about it today as we form the teams
- As a student, what do you think of the fairness/length of today's RAT?

Weekly meeting:

- Reading – B. Toggerson. *A guide on the basics of engaging in the classroom*
- Prompt: Now that you have a bit of experience and have read my guide, what are your questions and concerns?
- During meeting: Question and answer as well as role-play on dealing with teams during P131 sections.

Week 3:

P131-class reflections:

- One thing that you will see is that students are frustrated in this class much more than in a lecture based class - because they are working on hard problems in class instead of just passively listening. Do you notice this? How do you think that we can help students see that they are learning by doing this?
- Today, we will do graphs - a topic that is often challenging for students. I want you to think about which aspect is the most difficult and how I (or Heath) could have perhaps done this better.
- So today we will finish the simulation activity. If *you* had to teach this over, what would you do differently? Also, I want to hear any insights you may have on what the students took away from the exercise, especially with regards to an ability to generalize to other problems, but any insights would be welcome.

Weekly meeting:

- Reading – P. Brown, H. Roediger, M. McDaniel. *Make it Stick: The Science of Successful Learning*. Chapter 1.
- Prompt: So Make it Stick is more a "for the public" article than a research paper, but it is a good place to start. Here are two prompts to think about:
    - What, if anything, was surprising to you about how people learn and remember?
    - If the most effective learning strategies, such as spaced and mixed retrieval practice, feel less productive than ineffective strategies like rereading and massed practice, how likely is it that learners will embrace them?

  If you are an instructor, how might you help your students learn effective study strategies and stick with them?
- During meeting: Discussion and more role-play

Week 4:

P131-class reflections:

- My goals for tomorrow's lesson are visible in the slides I have posted. I have talked to Heath and he seems to have similar goals. For those of you in my sections: Look at my goals in advance. Especially the graph ones as I am sure we will get there! During class, I want you to think about if I am meeting those goals or not. For those of you in Heath's sections: What do you think the goals of Heath's class were? Did he meet them?
- Today, I will talk a little about different study techniques for physics. Heath did some of these on Wednesday. What do you think about some of these perhaps unorthodox activities such as writing definitions?

Weekly Meeting:

- Reading – L. Michaelsen, M. Sweet. *The Essential Elements of Team-Based Learning*. Chapter 1
- Prompt: Which part of this paper do you find the most questionable / disagree with most strongly? Why?
- During meeting: Discussion

Week 5:

P131-class reflections:

- Today is more Newton's 2nd Law. What do you see as the biggest challenge to solving these problems?
- Today we did a lab on buoyant forces. What are your thoughts? What went well? What went poorly?

Weekly Meeting:

- Reading – Materials made by TEFD here at UMass on backwards design
- Prompt: One of the big aspects of backwards design is thinking about your audience. What do you want this population of students to get out of the class? What might be an objective that would be appropriate for p151 (engineers) or p181 (physicists) that would not be appropriate for this population? Is there something that would be appropriate for this population but not for p151/p181?
- During meeting: Discussion

Week 6:

P131-class reflections:

- I want to try the "timing" exercise again. This time, I will be a bit clearer on the instructions. I want you to take note exactly at what time each activity begins and ends. Also, I want you to take a note during each interval of what I am doing and what the students are doing. An example would be:
    - 9:25 - Start Class, review objectives
    - 9:30 - End objectives begin modeling book problem, students taking notes

  etc.
- Today we will be working with empirical laws again in the context of springs. This lab has a simulation component. I have taken your suggestion and asked them to work out the simulations on the board before doing it in excel. Is this better?

Weekly Meeting:

- Reading – G. Rieger, C. Heiner. *Examinations that Support Collaborative Learning: The Students' Perspective*
- Prompt: One of the most commonly voiced concerns with team or pyramid exams is that, "students can get through the course without actually knowing the material." I.e. there is less accountability for their individual performance. What are your thoughts on this concern? Does the potential learning gains offset it? How could you structure the class to mitigate this issue (or should you?)?
- During meeting: Discussion

Week 7:

P131-class reflections:

- In today's class there will be the team portion of last-night's exam. I don't really want you to interact with students today (we are not helping them here). I want you to observe the interactions in lieu of our conversation last Friday. What are you noticing? How does it relate to the paper we discussed?
- Today in class, I will be talking through the exam and then moving on to pressure doing pressure at depth as a Newton's 2nd Law problem followed up with some conceptual ABCD questions on the result. Our research predicts that team interaction and effectiveness goes up after the exam. I want you to keep an eye on this for the next few days as it will be your prompt for NEXT week sometime (After you have had a chance to gather some stats). For today, I want you to think about MY motivations for this extensive exam review. This takes time, why do I bother taking that much class time?

Weekly Meeting.

- Reading – J. Tuminaro, E. Redish. *Elements of a Cognitive Model of Physics Problem Solving: Epistemic Games.*
- This paper is quite dense. Instead of a reflection prompt, I set up a glossary on Moodle where students were required to define at least two terms they did not understand
- During meeting: Working as a team to better understand this paper

Week 8:

P131-class reflections:

- Continue to keep an eye on team performance. Today we are doing a lab based-upon a 400-level kinesiology course at the University of Southern California. Students have a hard time interpreting the F(t) graph. How can you use the ideas of changing epistemic games to help students better understand this graph?
- The first peer evaluations for the class have been released. What is the students' reaction? Are some angry? Who are they angry at?
- As mentioned las week, I wanted you to keep an eye on how teams performed after the exam. What are your conclusions?

Weekly meeting:

- Reading – The same paper as the previous week. The density of this paper requires two weeks to go through it.
- After last week's meeting to improve understanding, this week's prompt is: What do you think of this idea? Which games do you see our students playing? Which do you think they should play? Also provide at least one suggestion on how you could get them to switch games?
- No meeting this week as our meeting time was after the dorm's closed before the spring break.

Week 9:

P131-class reflections:

- Today I want you to make a note of at least one individual student which is struggling in your zone. Why do you think they are struggling? What could we do to help that student?
- Today I want you to make a note of the team in your zone which is struggling the most. Why do you think they are struggling? What could we do to help that student?
- Reply with suggestions to your peers from the last two days

Weekly meeting

At this point we are beginning to get into having students prepare for their mini-presentation in P131. I want them to arrive with a rough draft of their talk. We will spend the first few minutes discussing the struggling students and teams but most of the class will be peer evaluation of the rough drafts. A draft will be due to me during the beginning of the next week.

Week 10:

P131-class reflections:

- Take the feedback you received about one of your struggling students from your peers and last week's meeting and try to apply it. What did you do? What was the response? I am asking you to spend a bit of each P131 session working with these students. Make notes about your interactions. After a few weeks, I will ask you to reflect on the effectiveness of your efforts.
- Similar to last time but focusing on which team you identified as struggling.
- How effective have students been at connecting all of the different ideas in the Forces and… unit? What activities have helped them form a coherent picture? Which activities were less effective?

Weekly meeting

During this weekly meeting students will give practice versions of their mini-presentations before their peers.

Week 11:

P131-class reflections:

- If you gave your mini-presentation this week – complete your assigned reflection
- Thinking about some common requests of accommodation from disability services, are we in the unique P131 environment, meeting these needs or are we not?
- Today, I want you to pay particular attention to the participation of women and other under-represented minorities in class. Do you notice any differences?

Weekly meeting

During this weekly meeting students will give practice versions of their mini-presentations before their peers.

Week 12

P131-class reflections:

- If you gave your mini-presentation this week – complete your assigned reflection
- How do your observations of the team portion of the second exam compare with last time?
- How are the students you have identified as weak performing? What have you tried? What worked? What didn't?
- How successful are students at combining their knowledge of chemistry with what we are talking about here? (This skill is called "transfer").

Weekly meeting

- Reading: E. Redish et al. *NEXUS/Physics: An interdisciplinary repurposing of physics for biologists.*
- Prompt: This week we get into thermodynamics. Clearly there is not enough time to do everything. What would be your objectives for this unit? Defend your choices. How does that influence what topics you cover?
- During meeting: Discussion of paper and reflection of presentations.

Week 13:

For this week, instead of completing reflections, students will look back on the semester and write a thorough reflection of the entire experience and during the meeting we will have a discussion. Each day will be a different idea to observe and then, at the end of the week, students will be asked to compile all observations into one big post to be discussed at the weekly meeting.

- Look back at the biggest challenge you identified at the beginning of the semester, how did that work out?
- How did the teams merge and gel over the course of the semester?