

# Physics 500 (Intro)

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## Goal: Increase TA Effectiveness

- Approach, philosophy, and psychology
- Nuts-and-bolts tools
  - TritonED, Excel, LaTeX
- Lab TA Panel
- Dissection of problem presentation
  - experienced TAs will lead
- Practice problem presentation
  - meaningful feedback
    - from each other, experienced TAs, guest faculty
  - video for self-analysis
  - assignments geared toward constructive feedback

## TA Duties

- Lecture TA
  - discussion session
  - problem session
  - homework solutions
  - grading
  - office hours
  - tutorial center
- Lab TA
  - setup
  - session patrol/help
  - lab book grading
  - tutorial center
- Tutorial Center
- Grader
- Proctor

## Mission

- What is our mission in the classroom?
  - educate; student learning
- What does this translate into, physically?
  - neurons connecting in student's brain
- How do we best accomplish this?
  - guide student through thought process
- Don't chew a student's food for them

## Failure Modes (Interactive)

- What do instructors do that is *not* effective?
  - lecturing from book
  - mumbling
  - disorganized
  - answer with no explanation
  - speaking to the board
  - repeating material after question; no new angle
  - bad penmanship
  - PowerPoint ☹
  - math mistakes
  - expressing confusion
  - reading from slides
  - not posing questions to students
  - trivially; obviously; clearly

## Failure Modes (2016)

- What do instructors do that is *not* effective?
  - don't engage: just talk
  - don't justify assumptions; state facts
  - solving problem without context
  - from expert perspective
  - lack of communication and organization
  - not open for questions
  - no time for thinking/processing

## Failure Modes (2015)

- What do instructors do that is *not* effective?
  - math via powerpoint
  - spewing facts with no context
  - not engaging
  - abstract without examples
  - too fast
  - too slow
  - too many examples; no theory framework
  - not prepared
  - no time for questions
  - misunderstanding questions; truck on

## Success Modes (Interactive)

- What qualities/actions are seen in successful instructors?
  - stop and ask for clarity
  - adopt perspective of students; understand Q
  - motivating material
  - focused on subject matter
  - notation explanation
  - knowing students and background
  - involving students in problem solving process
  - open to feedback
  - good problem sets; right level
  - charismatic

## Success Modes (2016)

- What qualities/actions are seen in successful instructors?
  - asking questions of students
  - excellent presentation, with humor
  - organization of knowledge
  - build from previous lessons
  - relevant assignments/questions
  - motivate concepts: why important (context)
  - example problems for new concepts
  - read the audience
  - care about student learning

## Success Modes (2015)

- What qualities/actions are seen in successful instructors?
  - answer Q with leading Q
  - segue into next topic, leveraged off Q
  - engaging; personable
  - care about content/things exiting mouth
  - care about student learning
  - connect content with experience/context

## Impedance Matching

- A 50  $\Omega$  transmission line delivering a pulse to a short or open results in 100% reflection
  - $R = |z - z_0|^2 / |z + z_0|^2$
  - only when  $z = z_0$  (impedance match) is it all absorbed
- Requires understanding level/mentality of student
- Spend more time *in their head* than in yours
- Constantly ask self: "how did that sound to them?"
- Who's my audience; what *do* and *don't* they know?
  - this is also the key to good writing

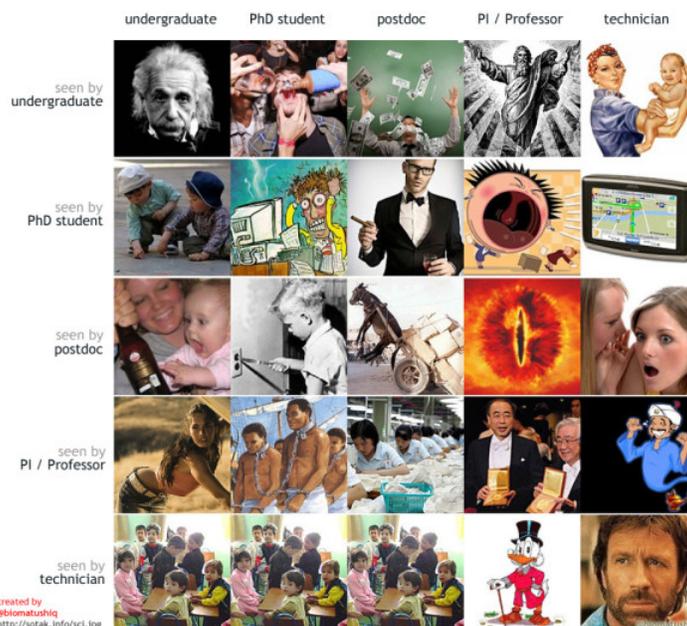
## Examples of Impedance Matching

- What might you do/try to match?
  - terminology
  - understand background
  - analogies
  - connections/context
  - starting off on same page
  - ask for feedback; is that clear

## Examples of Impedance Matching (2016)

- What might you do/try to match?
  - mini-quiz assessment at beginning
  - background and major/interests, etc.
  - conceptual questions and see how they think
  - possible language barriers/cultural references

### How people in science see each other



## The Many Layers Problem

- there's *you* standing in front (the *actual* you)
- there's a *student* sitting in the room (the *actual* student)
- there's the person you *think* the student is
  - often imagine more like yourself than they really are
- there's the person the student *thinks* you are
  - could think brilliant, moron, dork, clear, confusing, etc.
- there's the person you *want* the student to think you are
  - so you project an artifice to suit (expert, hip, godly)
- there's the person the student *wants* you to think they are
  - so they answer questions on pins and needles (conceal stupidity)
- there's the person you *think* the student thinks you are
  - based on projected image, imagining it works perfectly
- there's the person the student *thinks* you think they are
  - imagining their façade to be 100% effective
- there's the person the student thinks you think they think you are
  - they see through some façade: so this is how they imagine you see yourself reflected off their perception (“TA must think I’m buying the projection”)

Cut through the distracting/wasteful layers: be honest, true, real, humble—a servant

## Common Tendencies and Pitfalls

- Demonstrate *smarts*/prowess; *impress* students
  - dominate like Kramer in Karate with kids
- Deviating from class presentation to show how the *pros* do things
  - can be well-intentioned, but premature
- Finally get to be the *lecturer* (ego boost; power trip)
  - after all these years on receiving end
  - students don’t need do-over lecture of material
- Fear of looking a fool: *insecurity*
  - don’t underestimate this huge influence!
- Not interpreting/*clarifying* questions correctly
  - growing up in inarticulate setting is very useful!
- Imagining student is an earlier version of *you*
  - you’re special, though, remember
- Being the instructor you wish *you* had
  - again, you were likely an exceptional student: not doing this for *you*

## Direct Feedback: Difficult to Get

- “How am I doing?”
- Loaded question
  - impolitic to hurt TA’s feelings
  - don’t expect honest assessment
- Too confused to articulate suggestions
  - they’re not the pros: don’t know how to advise you on how to be an effective educator
- Insecurity: student feels personally at fault
  - may assume that problems are with them, not you
  - effective instructor promotes “I can actually do this”

## What are Forms of Indirect Feedback?

- How might you assess your performance?
  - do the students seem engaged/responsive?
  - test scores
  - attendance
  - office hours, etc.; tutorial center

## What are Forms of Indirect Feedback? (2016)

- How might you assess your performance?
  - anonymous survey
  - quiz assessment: gains in understanding
  - attendance
  - response/interaction/engagement

## Indirect Feedback

- Number of questions coming from students
  - helpful instructor will get lots if student has confidence that instructor can help them
- Attendance
  - students are pragmatic about time investment
  - a helpful session is a well-attended session
- Office Hours
- Smiles; glow of mastered material
- Test/HW performance
- But this is not about you: make it about them

## Accommodating Insecurity

- Rampant: student, TA, etc.
  - perceived “smartness” is most sensitive trait
  - we have elaborate protective mechanisms to shield us
- Brain cycles spent reflecting on abilities or lack thereof rob real thought
  - negative reflections are self-reinforcing
- Understand this in students, but also in yourself
  - short-circuit by forcing thought on problem at hand
  - stay focused on helping students learn

## Dealing with Feedback

- We love to hear that we’re great
  - seldom question the accuracy of praise
- We cringe to hear negative assessments
  - prone to dismiss validity
- Do something about it!
  - take in the feedback as valid/legitimate: **own it**
  - spend some time devising improvements
  - it’s more in your control than you think
  - seek advice/help from peers, faculty on how to improve

## Thinking about Thinking

- Often called metacognition: how do we approach problems
  - getting students to think about their thought process can be helpful
  - identify patterns in solving problems
- As instructor:
  - explain why you choose path in problem solving
  - role model for student thinking, if done “out loud”
  - even share internal missteps, however fleeting
    - “first I was tempted to think X, but then realized that was wrong” (and explain why)

## Being Uncertain is Not Bad

- Better than giving wrong or mis-information to save face
- Opportunity to model thought process/ approach
- Key strength of science: how do I know this is right?
  - how we approach uncertainty and work through it is an extremely valuable learning experience

## Accomplishing Mission (Interactive)

- What are some ways to accomplish our mission in teaching?
  - be responsible
  - prepare for each class; don't wing it
  - interact directly with students
  - enthusiasm for learning/physics
  - attention to detail/logistics
  - humble/humility
  - focus on skills not problems
  - care about student learning
  - point out resources
  - praise and motivation

## Accomplishing Mission (2016)

- What are some ways to accomplish our mission in teaching?
  - model presentation after likely most useful to them: not for us or our ilk
  - get feedback & assess if working
  - be willing to change in response to feedback
  - guide them through thinking: effective/ineffective ways
  - not trying to prove anything

## Assignments

- What, for you, was the most impressionable take-away from Lecture 1?
  - 1-2 paragraphs; due Oct. 9, in class
- Later assignments on LaTeX, Excel, and problem solving performance
- Website: [tmurphy home page]/phys500/
  - find my UCSD home page first...