Focusing on Concepts by Covering Them Simultaneously?

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Appropriate Technology Clickers:

1. Wrong
2. Wrong
3. Correct
4. Wrong

You were discussing:

1. Prep Videos
2. Parallel Pedagogy?
3. Flipped Classroom
4. Politics (Department, Cal Poly, National)
5. Mardi Gras/Weekend/Social
6. Other

Before we have a discussion about parallel pedagogy, please see

- The "welcome to PHYS 141" Email that Jen Klay and Pete Schwartz sent to the students the week before class began to let them know this was going to be a different kind of physics class.
- the intro video that all students see before the first day of class, and look at chapter.
- Please see the syllabus for this quarter's 121 class. In particular, please read the rubric by which all evaluated questions are graded.
- Please see the "4 lenses of mechanics" video, and read sections 1.1, 1.2, 1.3, and 1.4 in the 121 textbook/workbook.
- Please see the gyroscopic stabilization video and read section 7.5 in the 121 textbook/workbook to get an idea of how things develop later in the quarter.
- If you're interested in one more study indicating that the Socratic method is more effective than clear, concise lecturing, please see this video by PER Verritassium's Derek Muller, which our students see after the first day of class.

What portion of the assignment did you do?

0%
25%
50%
75%
100%

Your response is most closely:

1) This is good
2) Darn, I wish I had my HW.
3) Does he know that this isn't my only class?
4) *Really*? **You're** the one giving the talk. I want my money back!

Good Problem Solving:

A) Identifying concepts
B) Write variables, pick formula
C) Use formula from memory

What do Jenn and Pete do to guide students toward a conceptual approach?

What do you do?

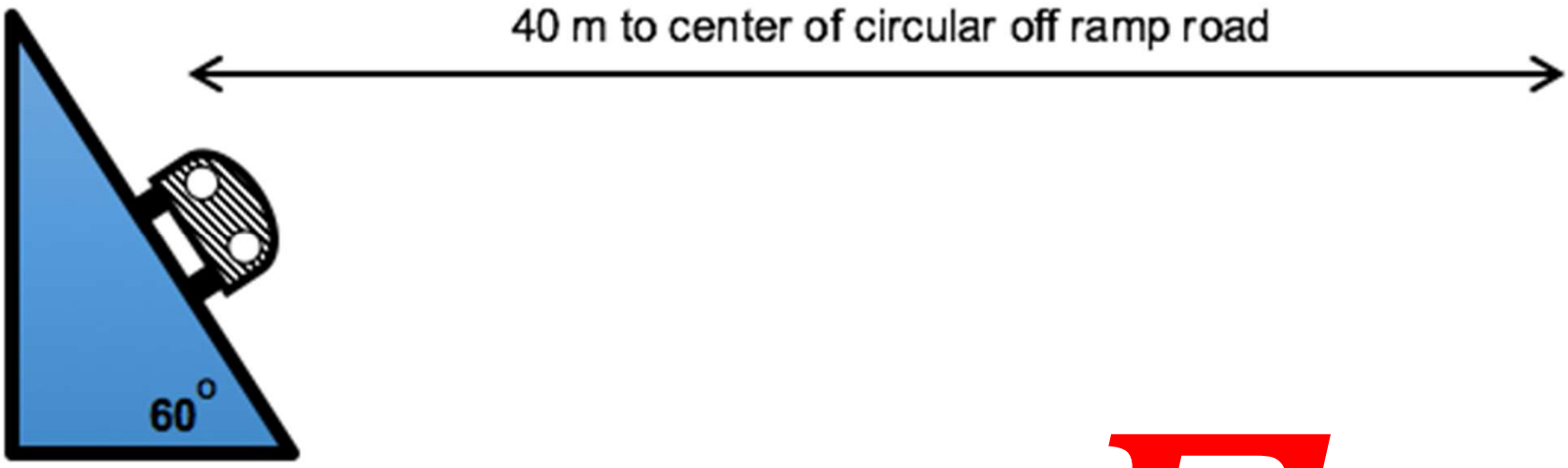
Do you have any recommendations for us?

I Think we train students to "Formula Hunt":

A) Teach concepts one at a time with appropriate practice problems.
B) Grade them on the answer.
C) Grade them for homework.

We focus on concepts:

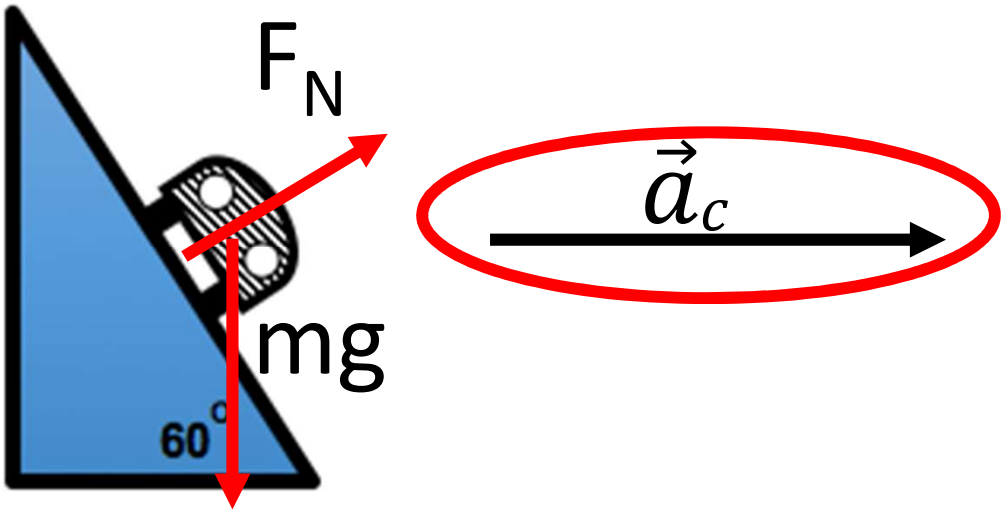
A) Introduce $\vec{p}$, E, $\vec{F}$, kinematics; build complexity
B) Grade on conceptual development
C) Grade determined by exams



$$Tan\theta = \frac{v^2}{rg}$$

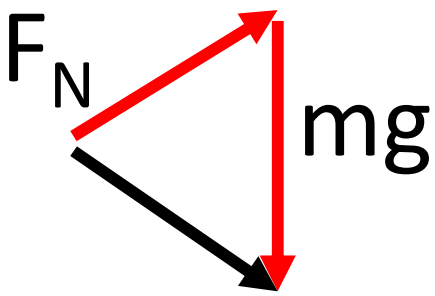
$$v = 24.3\ m/s$$

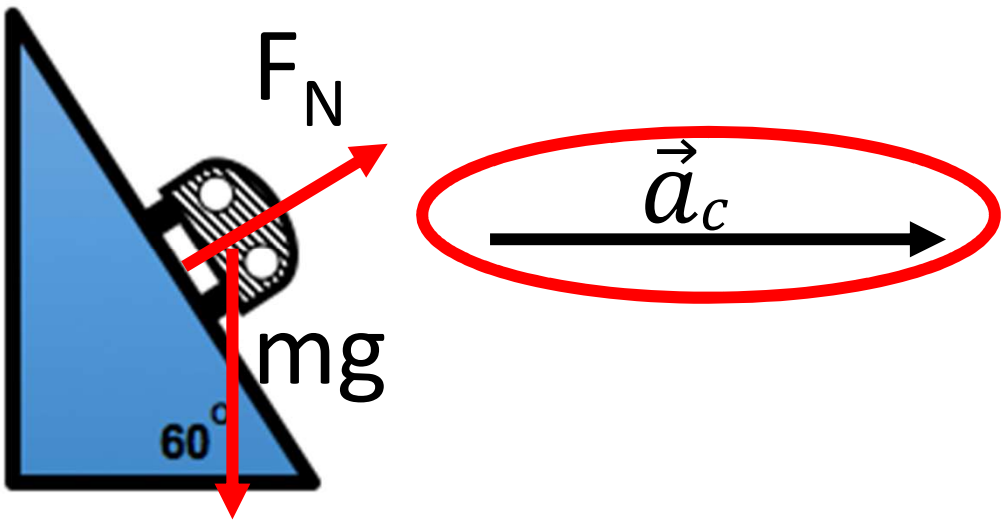
F



$$\boldsymbol{Dynamics}\ \ because\ Forces\ cause\ \vec{a}$$

$$\sum \vec{F} = m\vec{a}$$

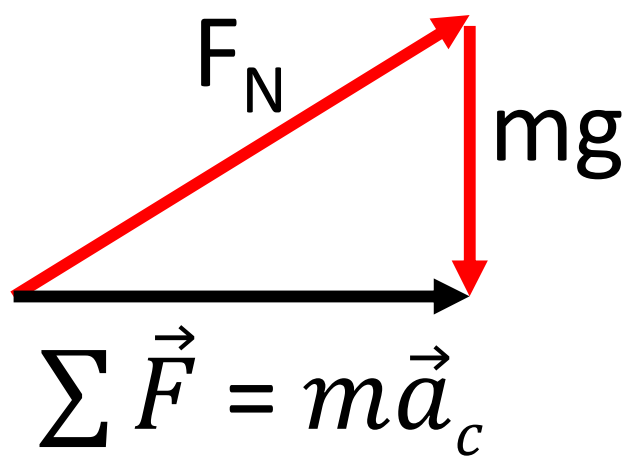




A

$\boldsymbol{Dynamics}$ $because\ Forces\ cause\ \vec{a}$

$$\sum \vec{F} = m\vec{a}$$



“I know about the CLASS measuring student perceptions”:

YES!

NO!

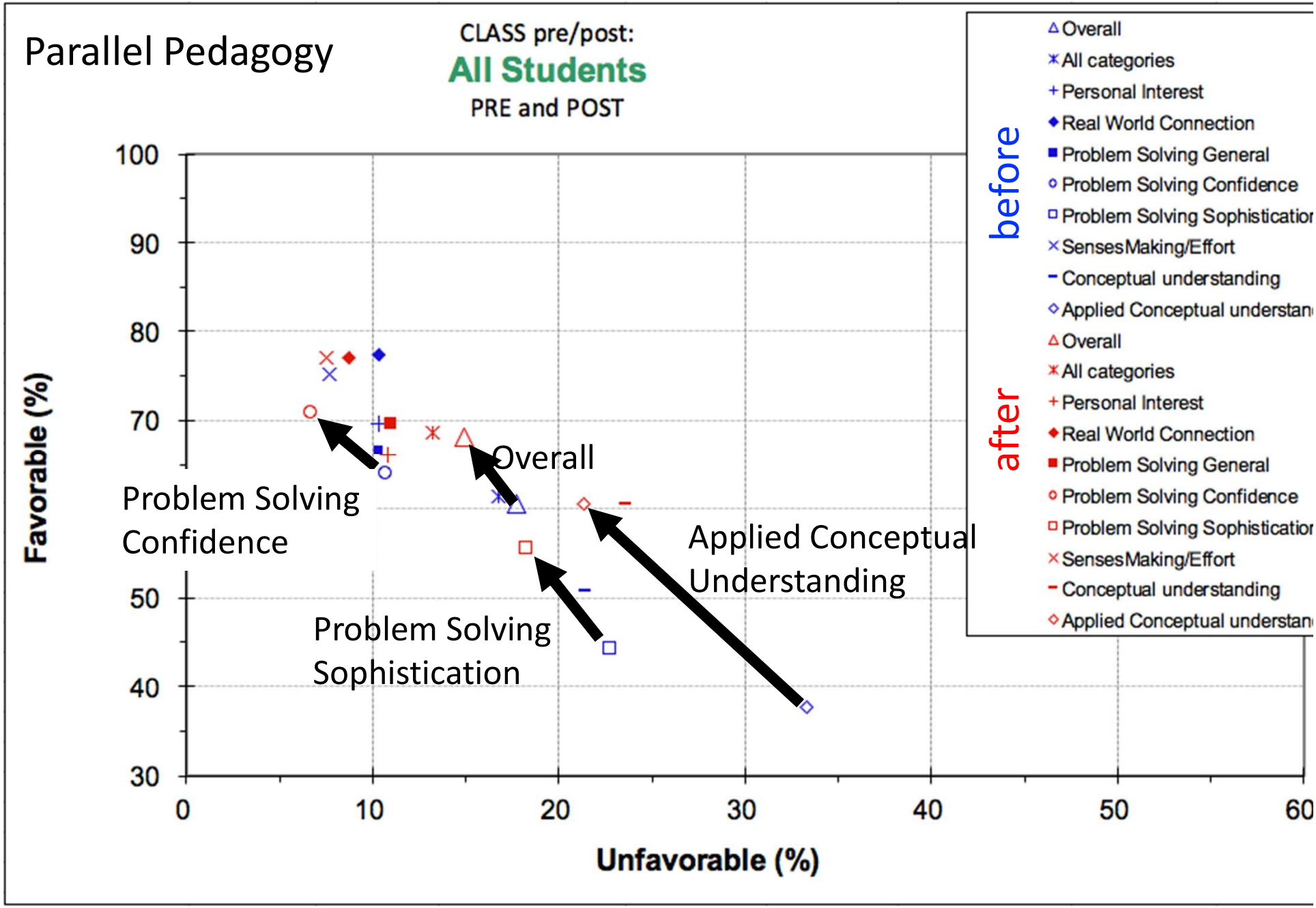
Favorable perception:

“I am not satisfied until I understand why something works the way it does.”

Unfavorable perception:

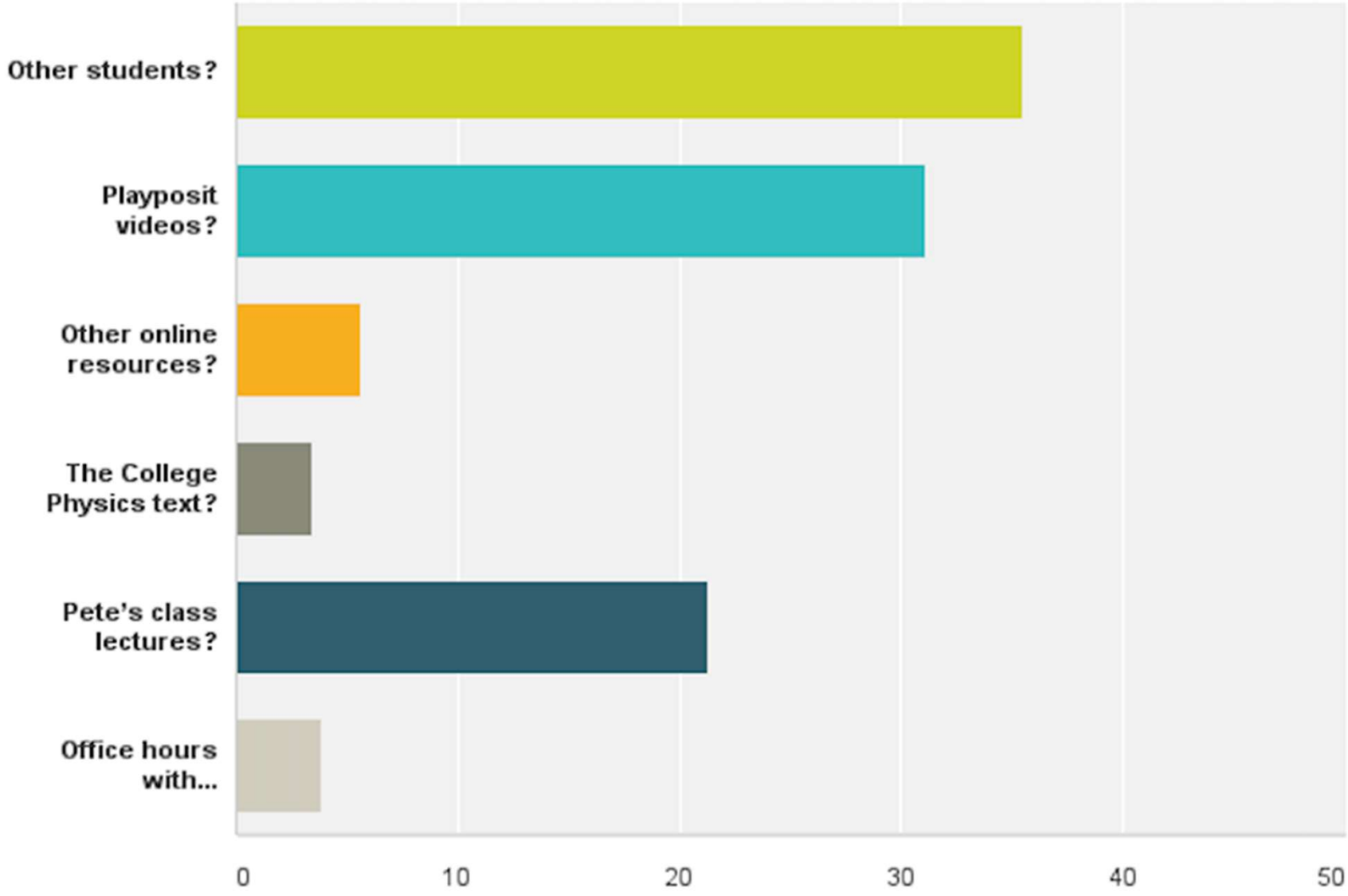
“Knowledge in physics consists of many disconnected topics.”

CLASS: 63 out of 96 students took surveys before and after



Q1 What percentage of your learning came from:

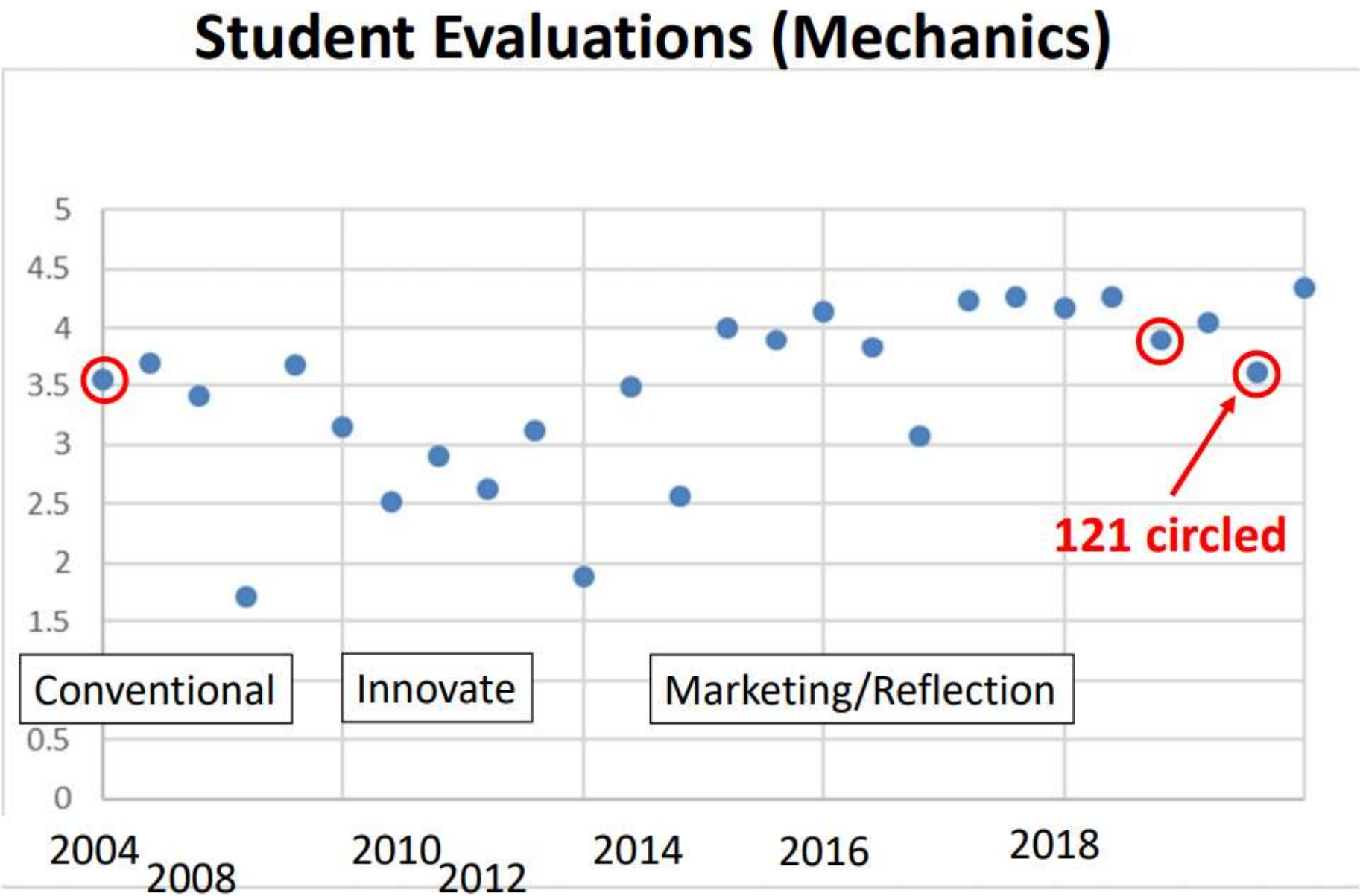
Answered: 58 Skipped: 0



Adoption by Students

"…it took about a week to get used to. The way it was taught made physics fun. I feel like a I made friends in this class."

"Lazy Teacher…The classroom is for learning. Not being forced to talk to those around you.. TEACH PLEASE TEACHER"



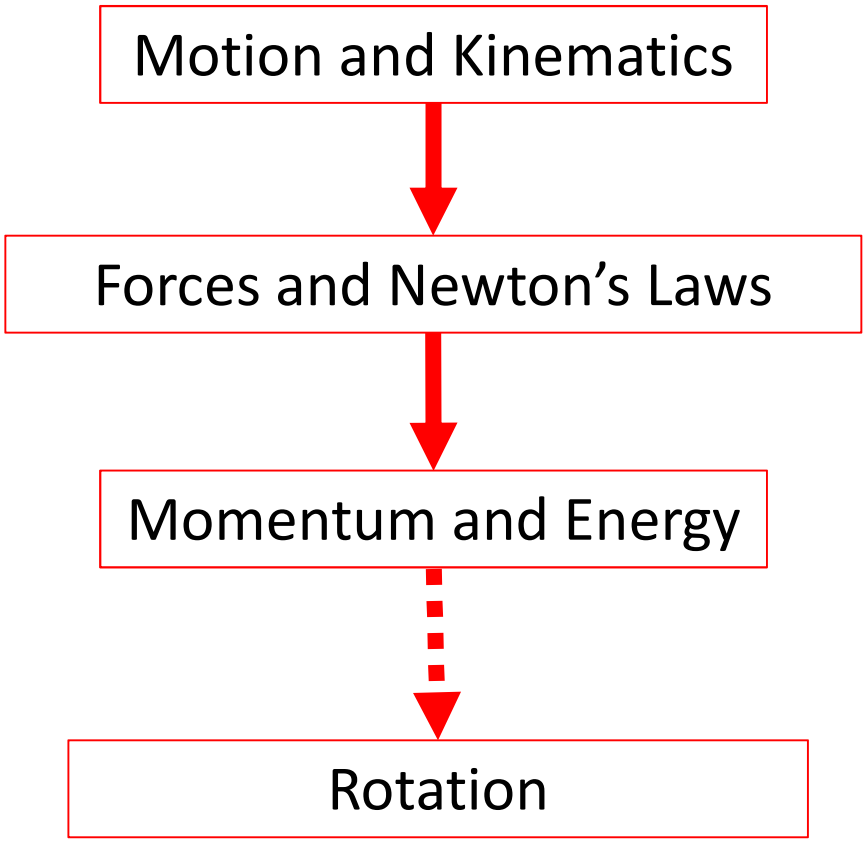
Renormalized to 5-point scale

Jenn’s Experience in adoption:

- Out performed Pete’s Class on the Final.
- “The way we’ve always done it” hasn’t worked for everyone, historically. Explore alternatives…
- I never expected teaching 141 could be so much fun
- My experience with PSC 101 prepared me well for this paradigm shift

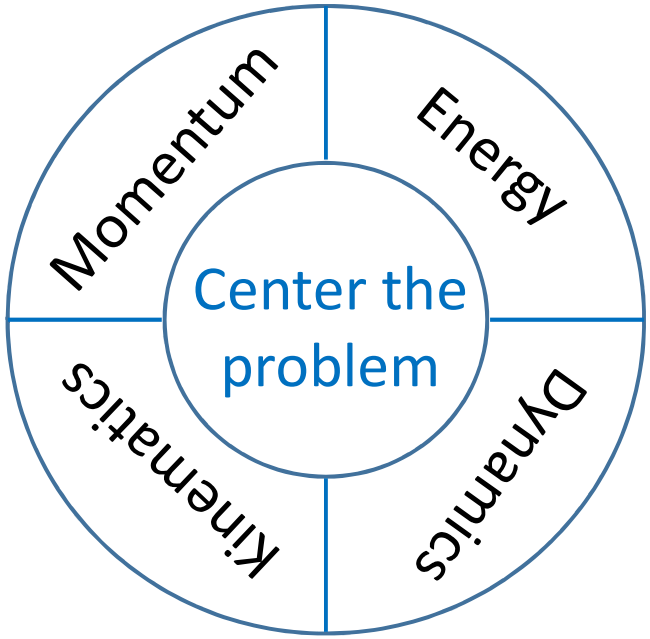
Jenn's Experience in adoption:

Serial pedagogy:



- scaffolded problems
- equation sheets
- concepts in isolation

Parallel pedagogy:



- Explore from each angle
- Identify most useful concept
- Solve and Assess

Build complexity over time:

- 1D → Rotation → 2D

Learn by doing… Projects

Jenn's Experience in adoption:

End of Day 4 Question: What happens to your stopping distance if you double your speed?

"NOT ENOUGH INFORMATION!"

"My physics tutor said this is not solvable."

<u>Serial Pedagogy approach</u>:
Look up formula that includes distance and speed…solve.

$$\Delta x = \frac{1}{2}(v + v_0)t$$

But I don't know what t is!

$$v^2 = v_0^2 + 2a\Delta x$$

But I don't know what a is!
There's not enough information to solve this!

<u>A Parallel Pedagogy solution</u>:
Stopping distance means I am accelerating and coming to a stop. My momentum and kinetic energy are also decreasing. If I am accelerating there must be a force acting opposite my motion. This force acting over some distance will do (negative) work on me, causing my energy to decrease.

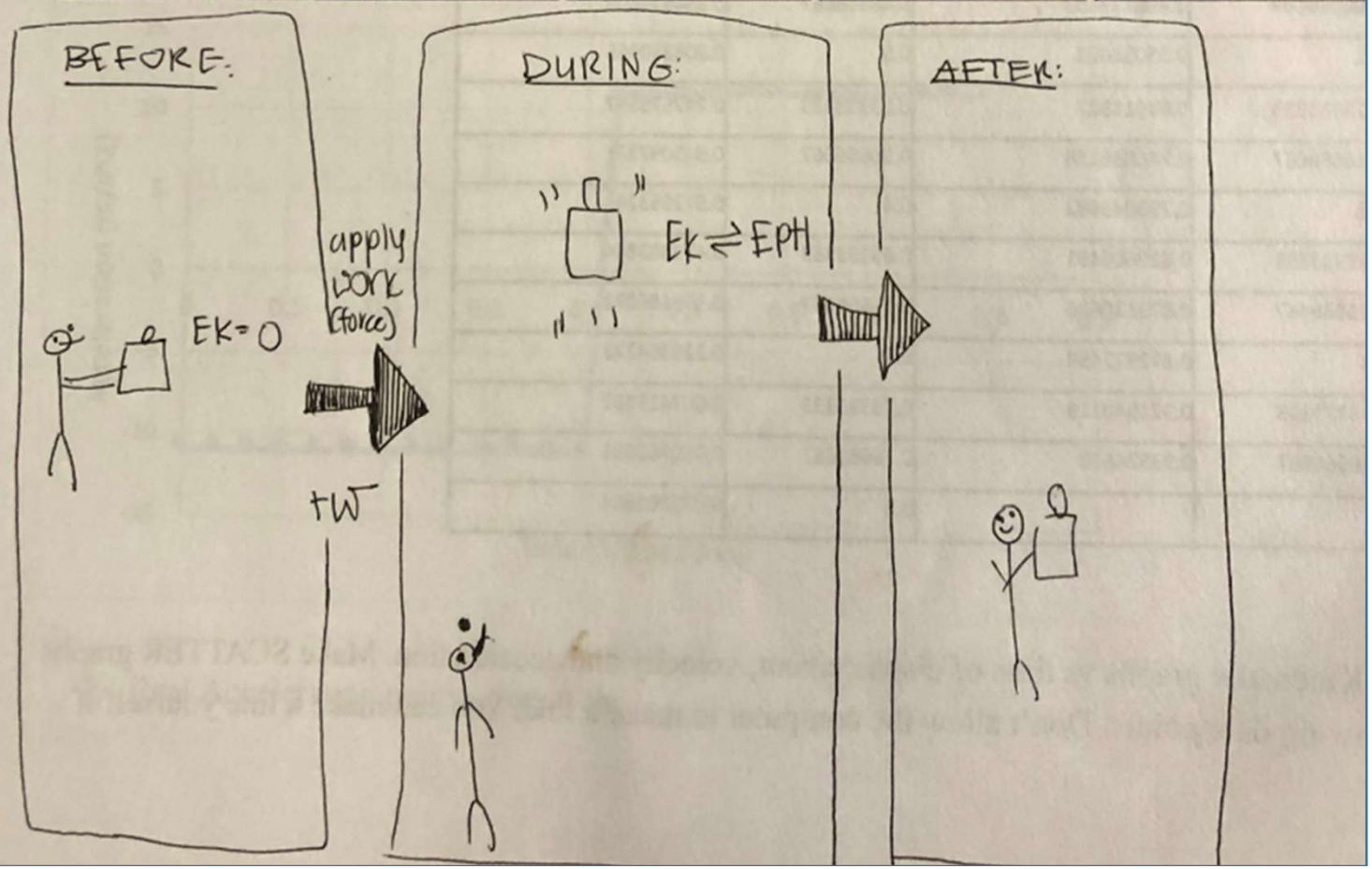
$$F\Delta x = \Delta KE = \cancelto{0}{\frac{1}{2}mv_f^2} - \frac{1}{2}mv_i^2$$

If I assume the force is the same in each case, the stopping distance increases by a factor of 4.

Projects and reflections

- Collecting, analyzing motion data
  - Team effort
  - Multiple revisions allowed (iterative learning)

2) A drawing depicting the activity and screen shot(s) from the video:



Projects and reflections

- Collecting, analyzing motion data
  - Team effort
  - Multiple revisions allowed (iterative learning)
- Making a video about physics
  - They discover it’s not so easy to make a perfect, polished video, but it is lots of fun!
- Precession Mini-Lab Activity
  - Bike wheels from ME, predict, then test
- Empathy Self-reflection
- Periodic anonymous wellness, perception check-ins, available to all

Jenn’s Experience in adoption:

- Biggest challenges:
  - First quarter freshmen!
  - 25/35 habits still forming
  - Fast turnaround on feedback
  - Being the first lecture of the day (no opportunity to observe Pete first)

- Biggest Rewards:
  - It is fun!
  - Connecting with the students differently
  - Emphasizing concepts leads to more interesting discussions

Food for thought…

Should we declare defeat and revert to conventional pedagogy?

- What are some other benefits of the different methods?
- What is correlation with PHYS 132 or PHYS 133?
- What factors within PP matter?
- Where might this go?
- Comments? Suggestions?

Food for thought…

Should we declare defeat and revert to conventional pedagogy?

1. We still don’t know what we’re doing.
2. Students become self learners.
3. Students develop social skills and work in groups.
4. Students develop friendships.

Learning Lab Collaboration

- The Mechanics of Inclusion and Inclusivity in Mechanics

  Sponsored by a grant from the government of California, the project establishes an interdisciplinary partnership across the California Community College, the California State University, and the University of California systems. This project seeks to eliminate equity and performance gaps in mechanics courses by (a) developing a suite of adaptive web-based tools that incorporate videos that illustrate why a topic is relevant to diverse professionals in the real world and adaptive tests, while (b) leveraging those cognitive tools and affective interventions to establish a sense of belonging, a strong STEM identity, and deep conceptual understanding. Parallel to these online efforts will be the implementation of evidence-based practices in the face-to-face classroom, such as the integration of Learning Assistants, implementation of hands-on, minds-on experiments, and development of a supportive, team-based learning environment, in which collaborative norms minimize micro-aggressions and toxic gendered interactions among team members.

  The project will disseminate its resources, a framework for faculty development focused on both the instructional materials and the design of inclusive classrooms, and results of its research throughout the California educational system, online, as well as through professional conferences and publications.

- Parallel Pedagogy is already doing much of this (synergistic not competitive).

Conclusion:

We changed everything and it wasn't a disaster…. And we're having fun.

All resources currently public at http://sharedcurriculum.peteschwartz.net/parallel-pedagogy/ but we are working on a Canvas shell to make adoption easier.

We welcome collaboration, volunteers who want to try PP will have the benefit of both our experiences and support.