PhysPort

Eleanor C Sayre,
Sam McKagan,
Adrian M Madsen

New Faculty Workshop
18 November 2016

esayre@ksu.edu

perg.phys.ksu.edu

www.physport.org

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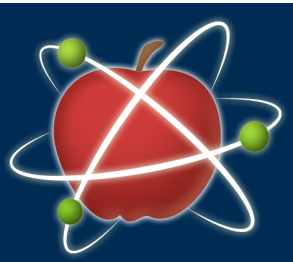
DUE-1347728,
PHYS-1461251



PhysPort

Supporting physics teaching
with research-based resources

What is PhysPort?

A web resource to support physics professors in using research-based teaching and assessment in their classes

www.physport.org

PhysPort Team

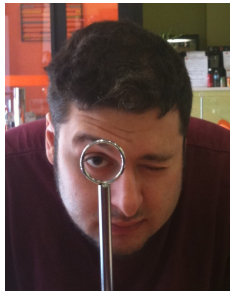
American Association of Physics Teachers




Sam McKagan (*Director*)
Adrian Madsen (*Assistant Director*)
Lyle Barbato (*development lead*)
Matt Riggsbee (*visual design*)

Kansas State University






Ellie Sayre (*Research Director*)
Bill Hsu (*development lead*)
Eugene Vasserman (*security lead*)
Josh Weese (*senior developer*)

Cognition Technology


Sandy Martinuk
Alex Bell
(*User Experience*)

Periscope Specialists


Rachel Scherr
Stephanie Chasteen

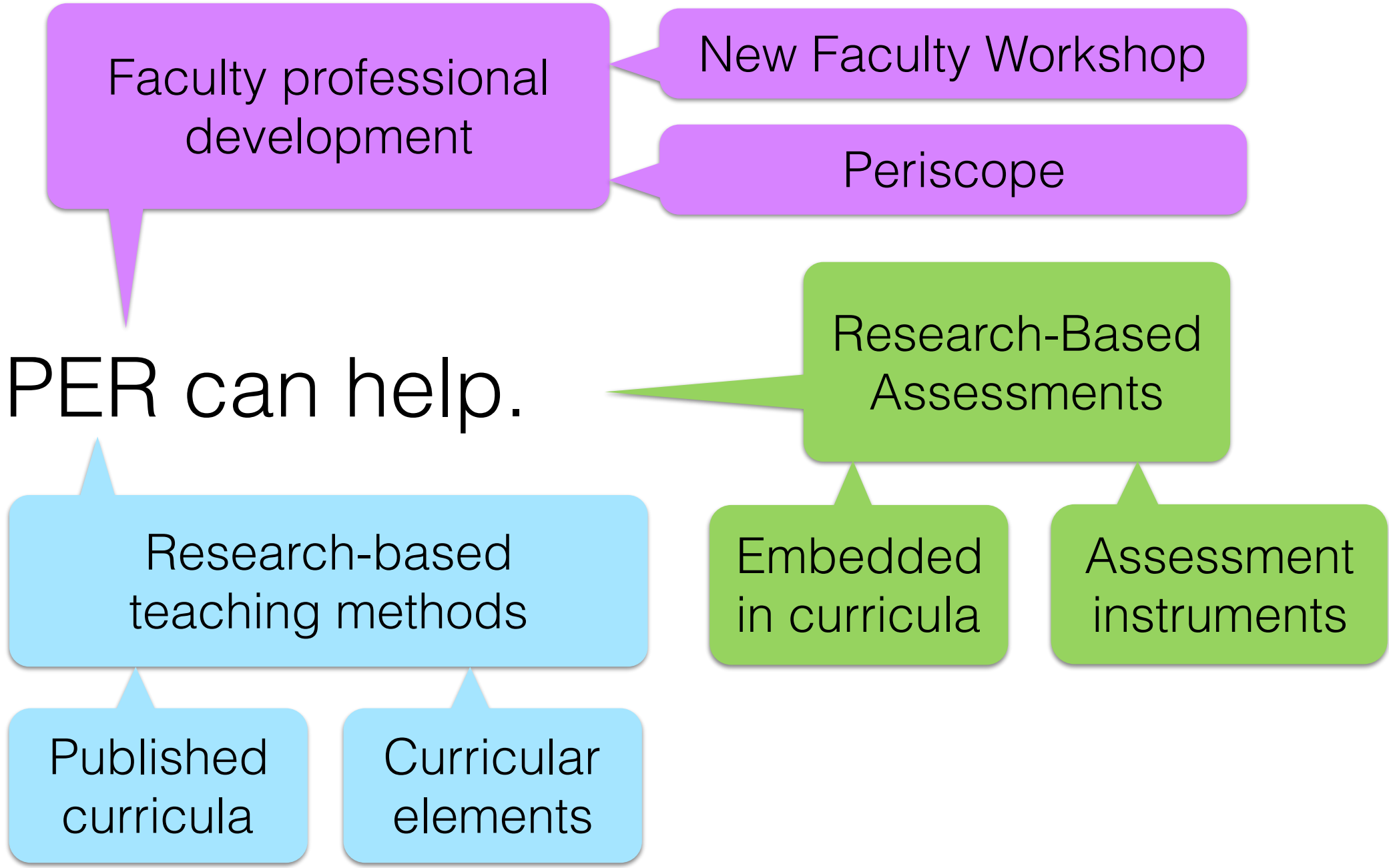
How do you know if students are learning?

Assessment is a gateway drug

Good teaching and assessment are important.

How to teach better?

How to help students learn more?


Faculty professional development
New Faculty Workshop
Periscope
PER can help.
Research-Based Assessments
Embedded in curricula
Assessment instruments
Research-based teaching methods
Published curricula
Curricular elements

Developer websites

Ask a colleague

Attend a workshop

PER resources are scattered.

How to compare teaching methods?

How do I support diverse learners?

Which assessment should I use?

What works best for my context?

course

program

PhysPort can help.

PhysPort can help.

Finding information and advice

Supporting physics teaching with research-based resources

Changing teaching practices

Synthesis research

Faculty-centered online resources

Interpret the results of diverse PER studies

Weighted combination of data from published studies

Synthesis research

More robust than single study

Vulnerable to publishing bias

100,000 students

Madsen, McKagan, & Sayre (2013). Gender gap on concept inventories in physics: What is consistent, what is inconsistent, and what factors influence the gap? *PhysRevST-PER*

Madsen, McKagan, & Sayre (2015). How Physics Instruction impacts students' beliefs about learning physics. *PhysRevST-PER*

Von Korff, *et al* (in press). Secondary Analysis of Teaching Methods in Introductory Physics : a 50k - Student Study. *AmJPhys*

What are Research-based Assessments?

Force Concept Inventory (FCI)

Force & Motion Conceptual Evaluation (FMCE)

and 80+ more

These are:

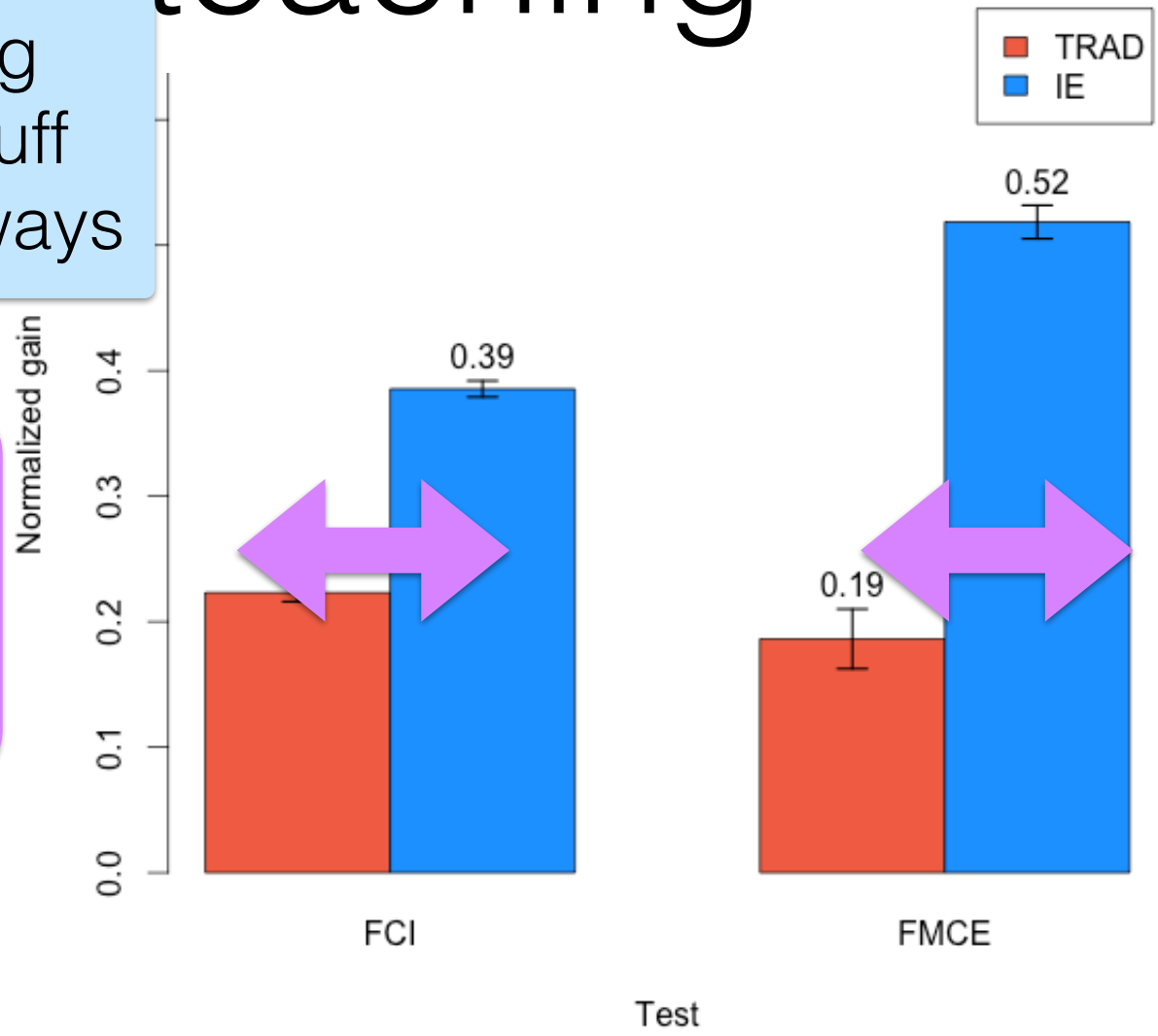
- Generally multiple-choice surveys
- Carefully crafted questions
- Conceptual topics across the physics curriculum
- Additionally: beliefs, problem-solving skills, affect

Mechanics teaching

active learning
students do stuff
many different ways

Interactive
engagement
is better than
traditional lecture

chalk-and-talk
sage on the stage
cookbook labs



50,000 Students

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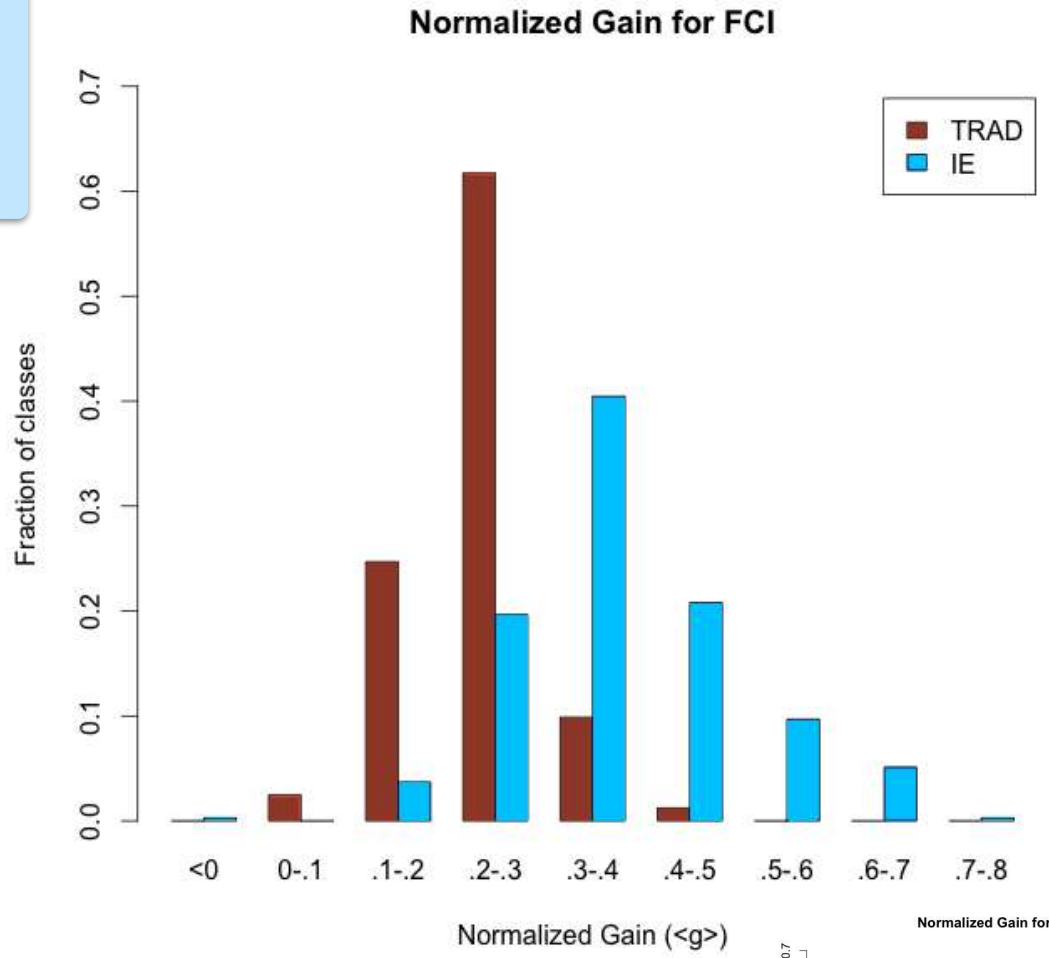
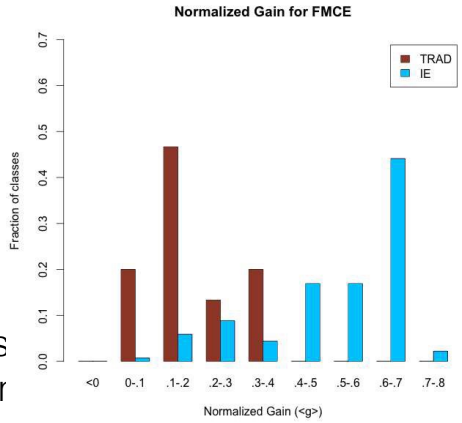
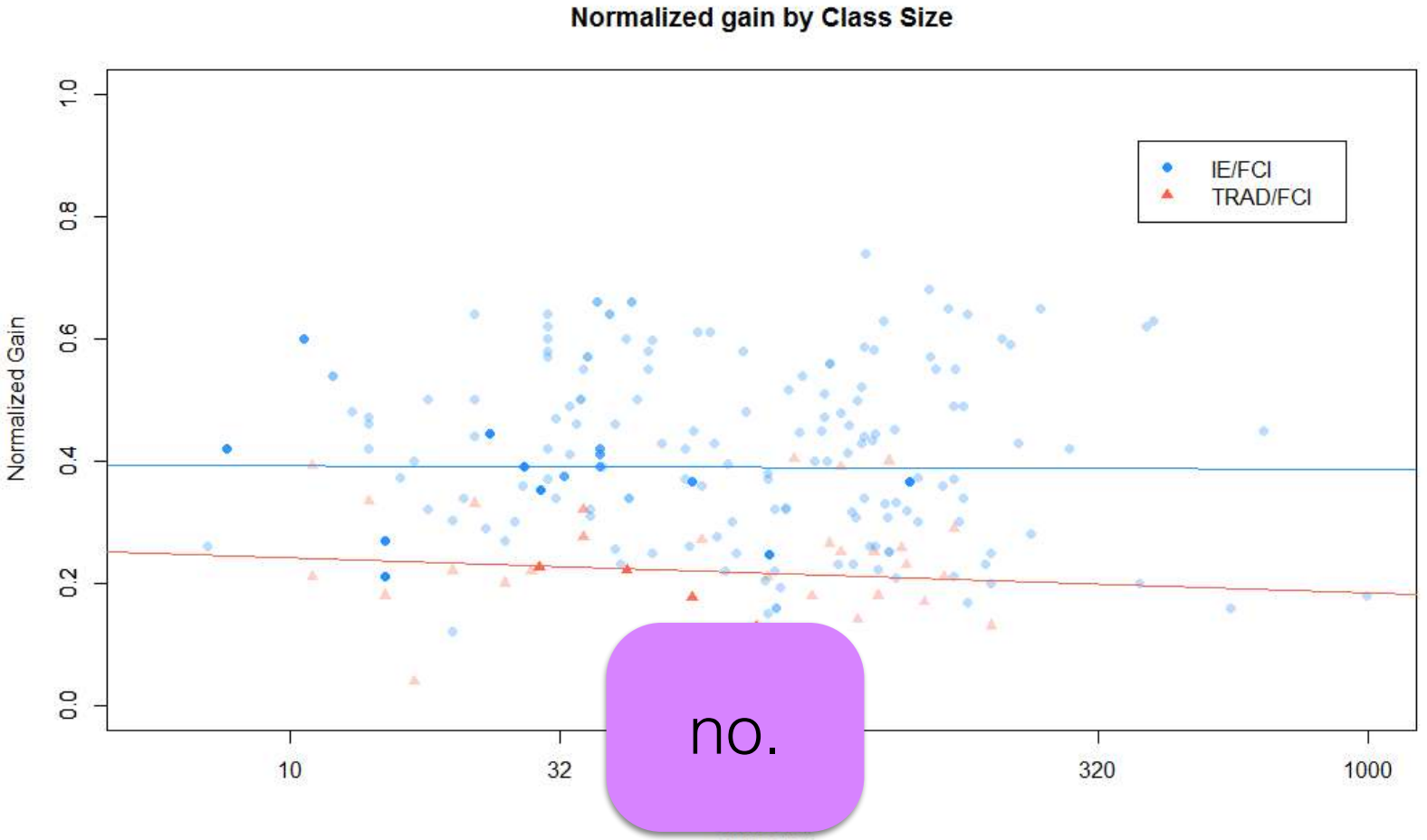




Von Korff, J., *et al* (in press). Secondary Analys
Introductory Physics : a 50k - Student Study. Ar

Does class size matter?



- Different sizes use different IE methods.
- Same trend for lecture and lab

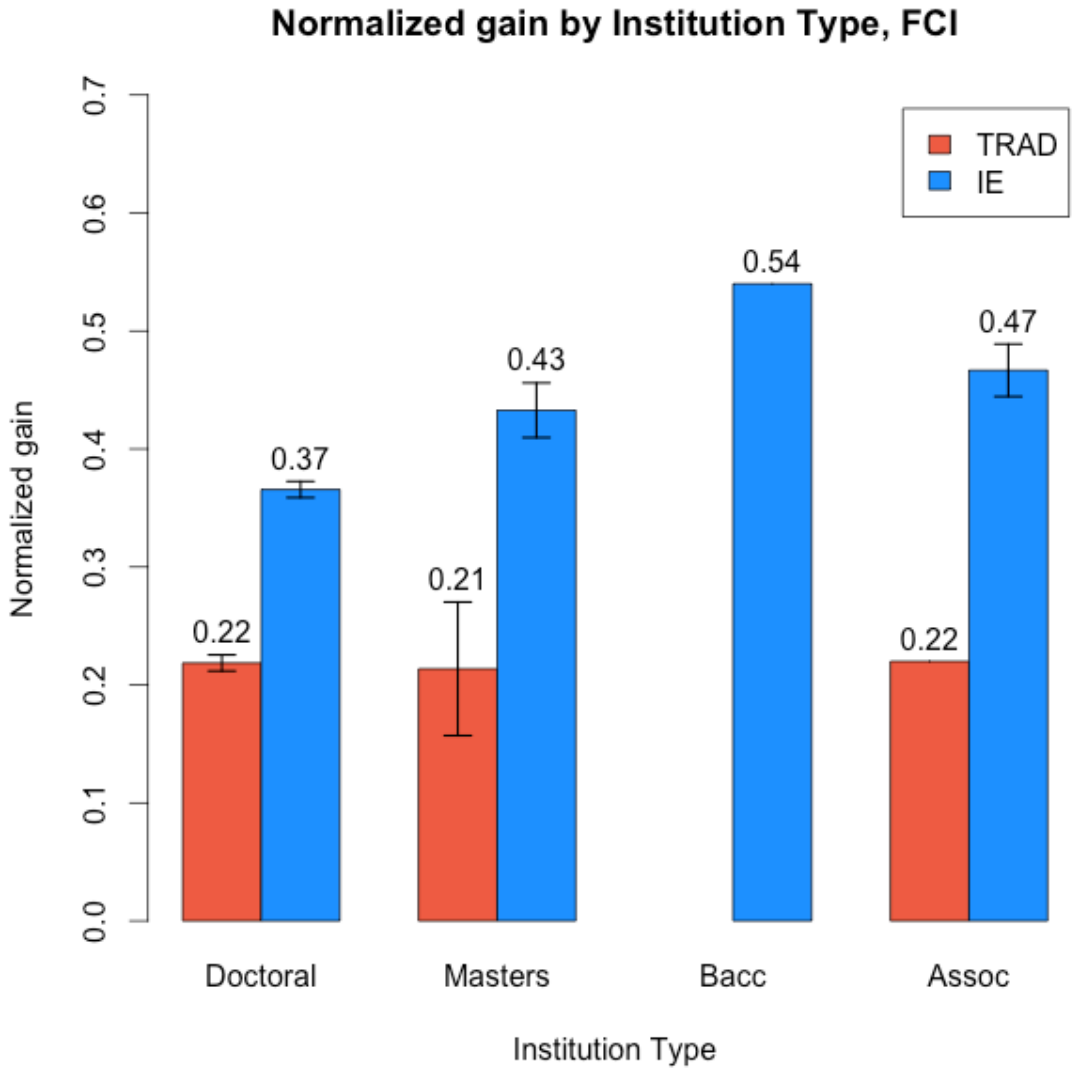
Von Korff, J., *et al* (in press). Secondary Analysis of Teaching Methods in Introductory Physics : a 50k - Student Study. American Journal of Physics

Does institution type matter?

- Reduced Carnegie classification
- No Canadian schools

no.

- Highly dependent on publishing effect
- Data are mostly Doc institutions.



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Student beliefs about physics

- How much do students' beliefs align with physicists?
- Measure **shifts** in physicist-like belief
- CLASS, MPEX

Survey

1. A significant problem in learning physics is being able to memorize all the information I need to know.

Strongly Disagree	1	2	3	4	5	Strongly Agree

2. When I am solving a physics problem, I try to decide what would be a reasonable value for the answer.

Strongly Disagree	1	2	3	4	5	Strongly Agree

3. I think about the physics I experience in everyday life.

Strongly Disagree	1	2	3	4	5	Strongly Agree

4. It is useful for me to do lots and lots of problems when learning physics.

Strongly Disagree	1	2	3	4	5	Strongly Agree

5. After I study a topic in physics and feel that I understand it, I have difficulty solving problems on the same topic.

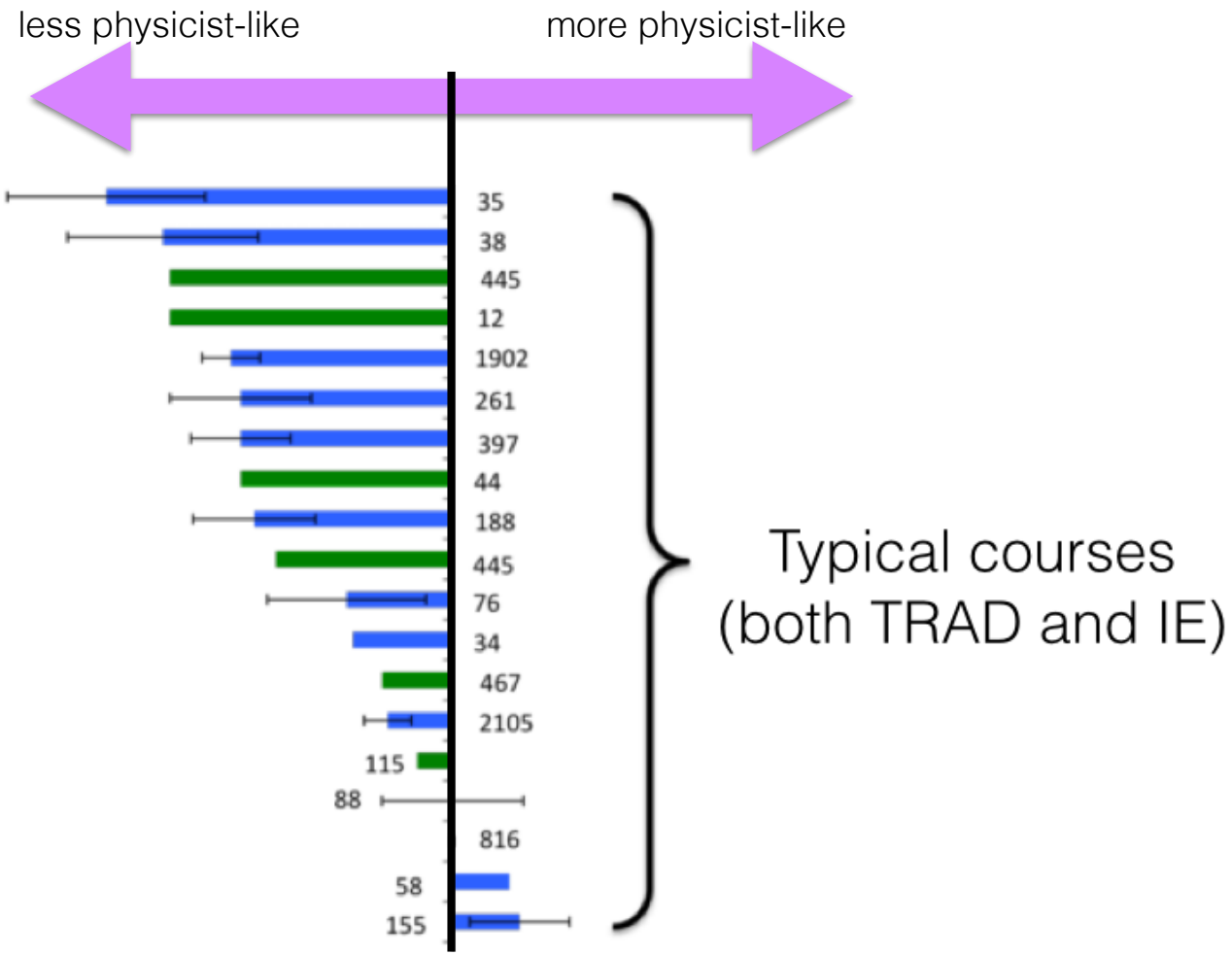
Strongly Disagree	1	2	3	4	5	Strongly Agree

Adams, W. K., et al (2006). New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. *Physical Review Special Topics - Physics Education Research*, 2(1), 010101.

Student Beliefs

- 24 studies
- Teaching method, class size, student population

"Ordinary" IE is not enough.



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Student Beliefs

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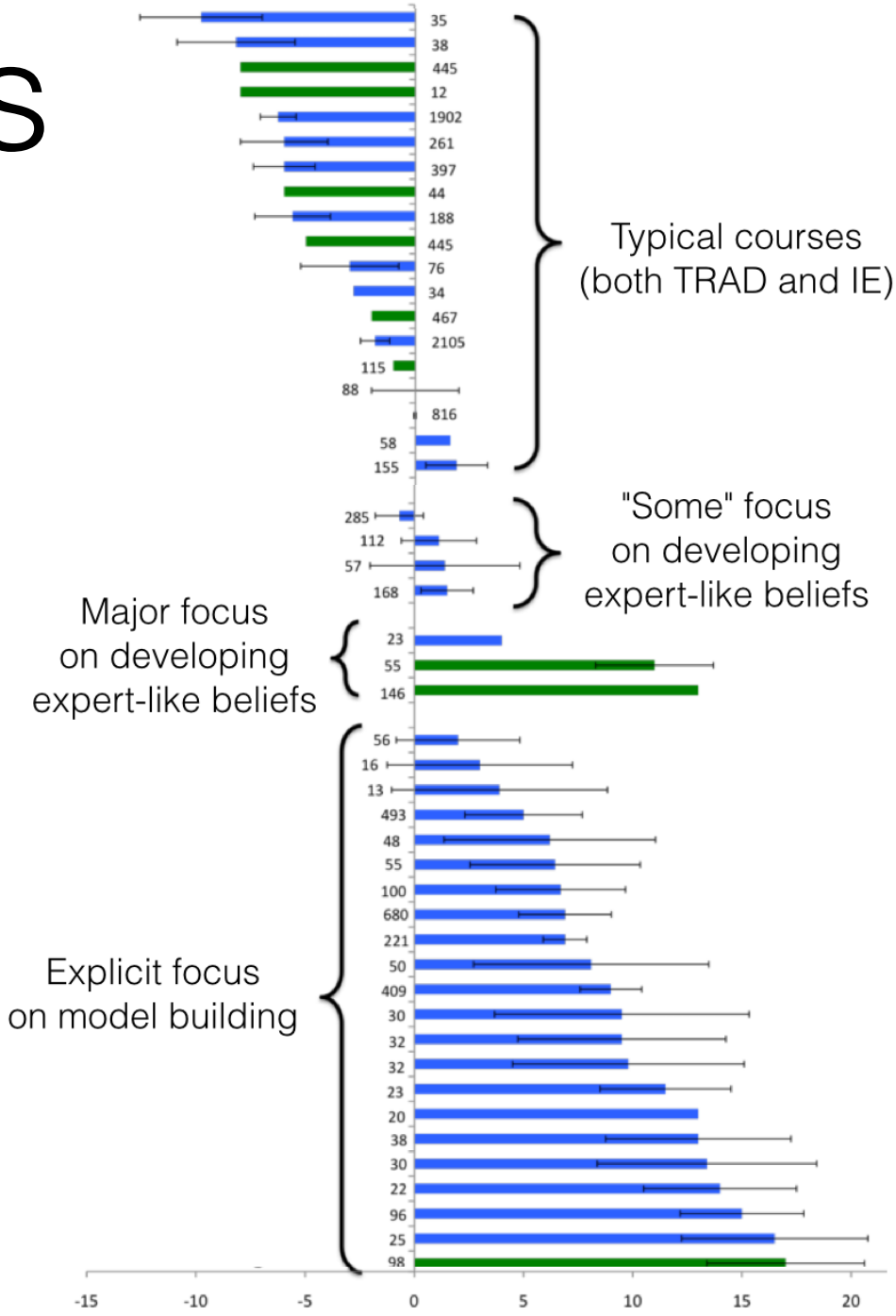
"Ordinary" IE is not enough.

Focus on connecting ideas and observations. ("model building")



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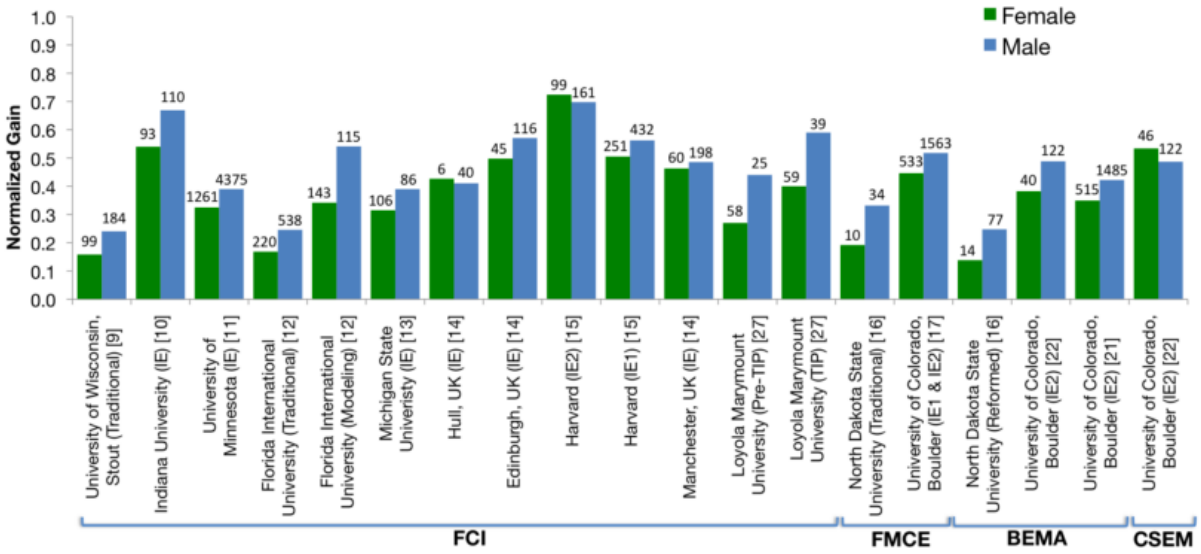
Gender gaps in learning physics

Men outperform women on RBAs

Mechanics: Men = .43; Women = .37
E&M: Men = .42; Women = .36

This is smaller than the Trad / IE gap.

There is no single factor which causes or maintains the gap.



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PhysPort.org Eleanor Sayre, esayre@ksu.edu

Questions so far?

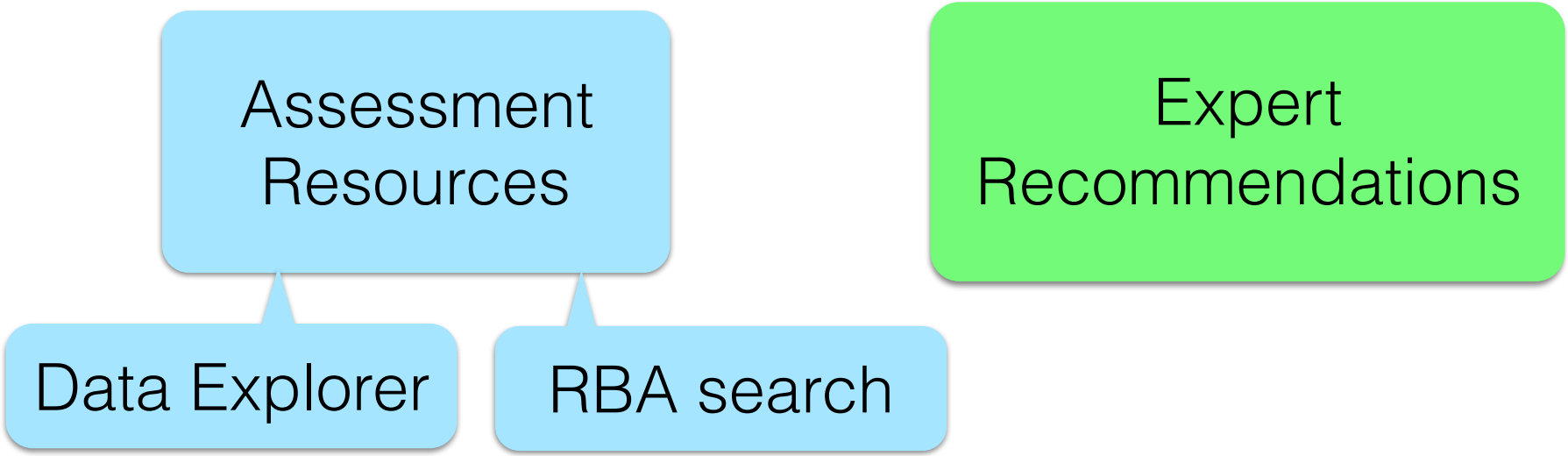
go here now!

Supporting physics teaching with research-based resources

Synthesis research

Faculty-centered online resources

Faculty-centered online resources



Research and development process

Interview & survey faculty and chairs

Synthesize faculty needs

Build resources to meet real users' needs

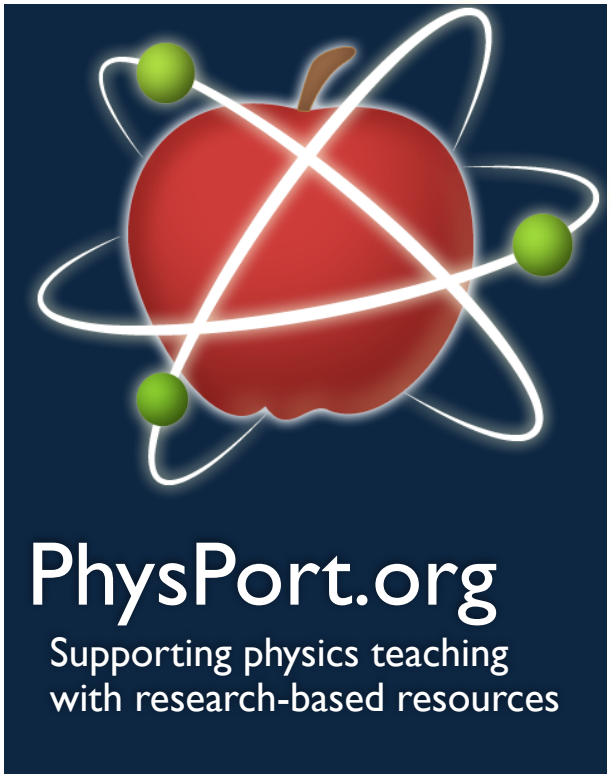
27 faculty & chairs

50 LA video project users

Faculty have practical needs.

Faculty want guidance.

Faculty consider broader contexts.



Start with the biggest needs of users.

PhysPort
Supporting physics teaching with research-based resources

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About Us | Contact Us

AAPT

Home | Expert Recommendations | Teaching Methods | Assessments | Workshops

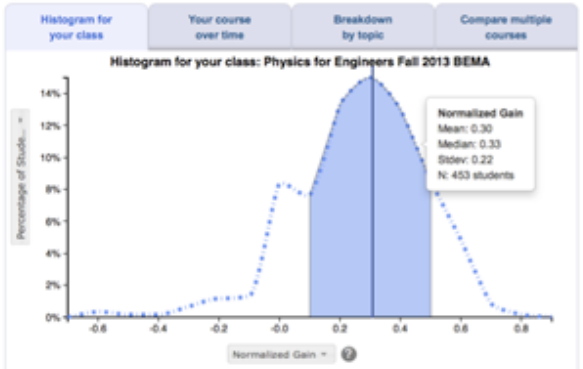
Welcome to PhysPort (formerly known as the PER User's Guide), the go-to place for physics faculty to find resources based on physics education research (PER) to support your teaching. Learn more...

Teaching
I want to...
- find a new teaching method
- get implementation help
- learn more about research-based teaching

Assessment
I want to...
- interpret assessment results
- assess the impact of reforms
- assess advanced physics content or skills

Troubleshooting
I need help with...
- covering enough material
- supporting group work
- arguments for skeptical colleagues

NEW - PhysPort Data Explorer



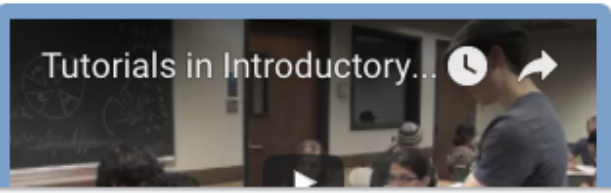
Explore assessment data

Where can I find good questions to use with clickers or Peer Instruction?

by Sam McKagan, PhysPort director — September 26, 2016

Many research-based teaching methods in physics, including Peer Instruction, CAE Think-Pair-Share, Technology Enhanced Formative Assessment, and teaching with clickers, involve having your students discuss and answer multiple-choice conceptual questions. A challenge of using these methods is finding and writing good questions. This recommendation helps you find and write questions for your class.

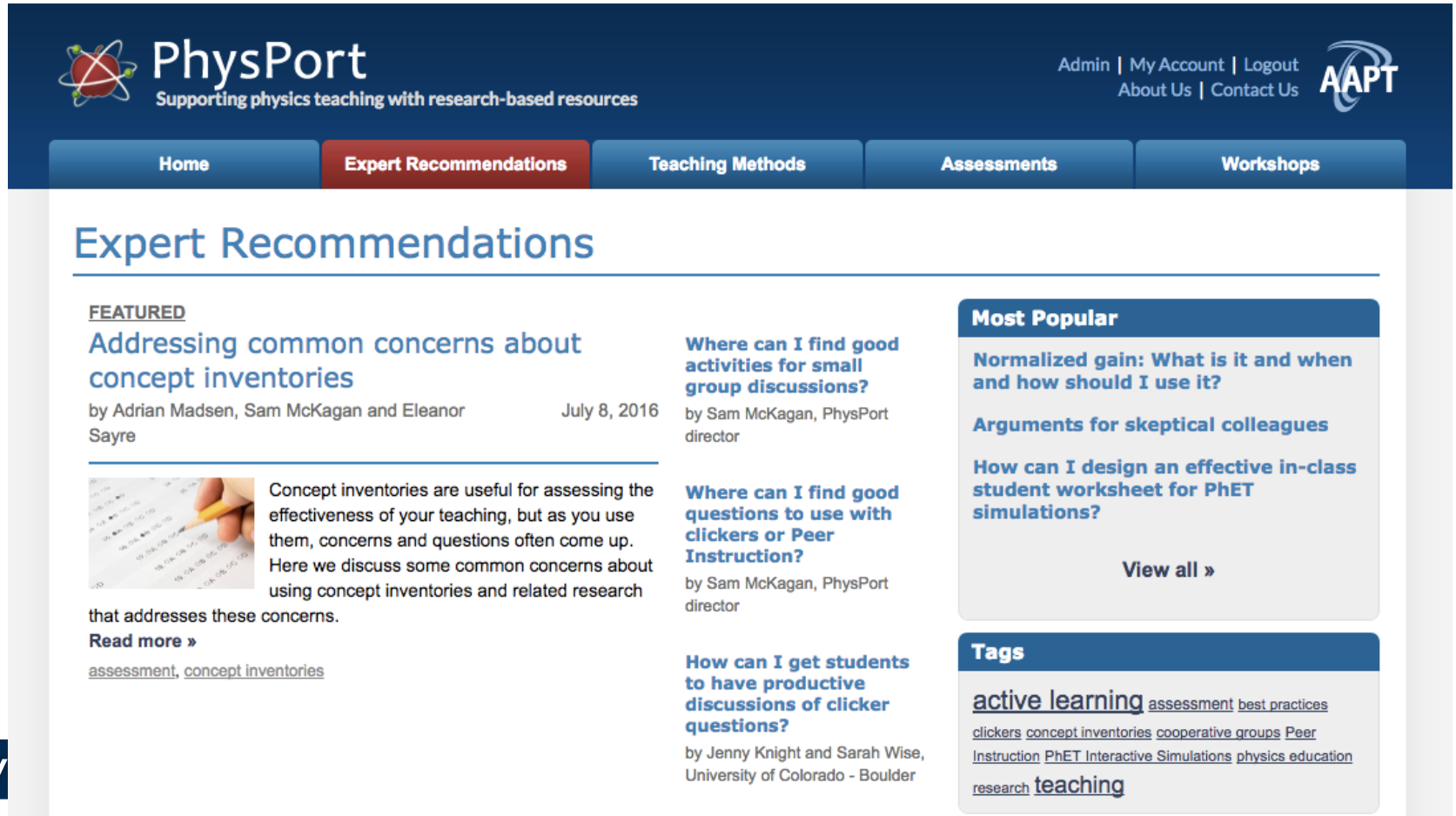
Peer Instruction, CAE Think-Pair-Share, clickers, Technology-Enhanced Formative Assessment — Read more »



Expert Recommendations

Friendly articles that interpret and synthesize PER results for physics faculty.

physport.org/recommendations



Expert Recommendations

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- Big Ideas
  - Ten results of physics education research that every physics instructor should know
  - Arguments for skeptical colleagues
  - What makes research-based teaching methods in physics work?
  - Recursos en Español / Research-based teaching resources in Spanish

Expert Recommendations

Friendly articles that interpret and synthesize PER results for physics faculty.

physport.org/recommendations

- Big Ideas
- Assessment issues
  - How do I get my students to take concept inventories seriously?
  - Guidelines for administering concept inventories online
  - How can I get my students' answers to concept inventories into electronic spreadsheets?
  - Effect size: What is it and when and how should I use it?
  - Normalized gain: What is it and when and how should I use it?

Expert Recommendations

Friendly articles that interpret and synthesize PER results for physics faculty.

physport.org/recommendations

- Big Ideas
- Assessment issues
- Teaching method help
  - Where can I learn more about research-based teaching in physics?
  - How can I get students to have productive discussions of clicker questions?
  - Which polling method should I use for Peer Instruction?
  - How do I facilitate Tutorials in Introductory Physics?

Expert Recommendations

Friendly articles that interpret and synthesize PER results for physics faculty.

physport.org/recommendations

- Big Ideas
- Assessment issues
- Teaching method help
- Teaching instructors
  - How can I train teaching assistants and/or learning assistants?
  - How do I facilitate a Periscope lesson for TA/LA training or faculty PD?
  - How can I teach a graduate class on the basics of physics education research?

Expert Recommendations

Friendly articles that interpret and synthesize PER results for physics faculty.

physport.org/recommendations

- Big Ideas
- Assessment issues
- Teaching method help
- Teaching instructors
- Broader issues
  - What racial, gender, and sexual orientation bias still exists in physics and what can I do about it?
  - How can I set up an effective mentoring program to support students in my department?

Have a suggestion?

Want to contribute?

esayre@ksu.edu

smckagan@aapt.org

Teaching Methods

Searchable, faculty-friendly guides
to research-based teaching practices

physport.org/methods/

- Type of method
- Level & Setting
- Coverage & Topics
- Instructor Effort
- Research validation
- Compatible methods
- Similar methods
- More information

Assessment Resources

physport.org/assessments

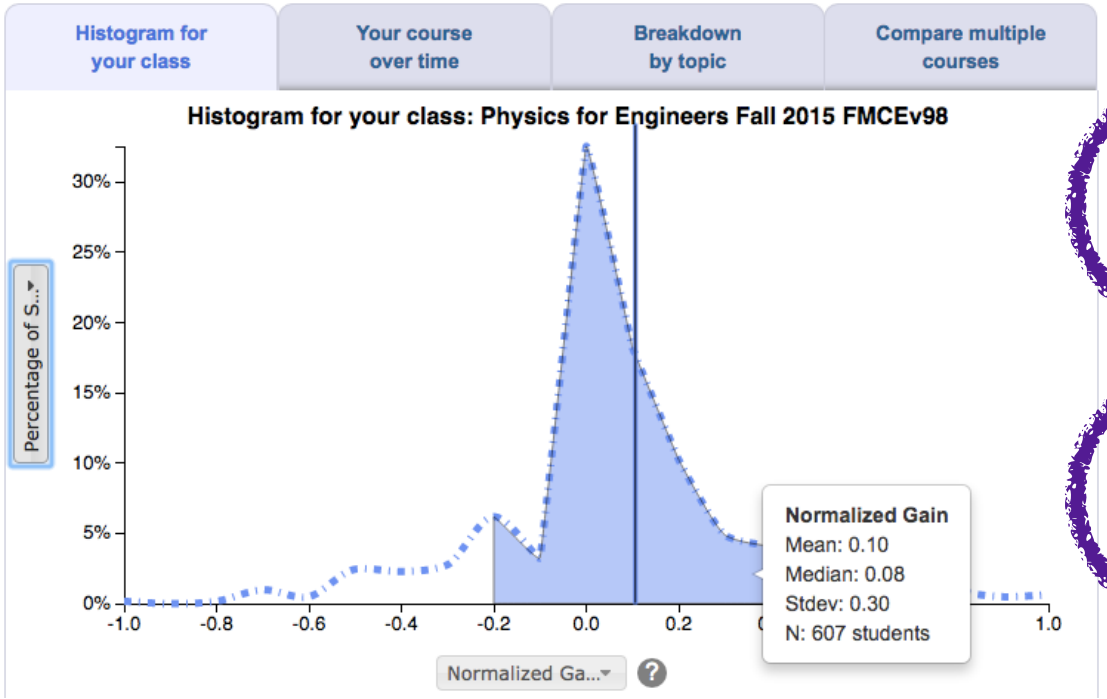
- Search for RBAs
- Get administration deta
- See sample questions
- See typical results
- Download RBAs
- Download usage guide

project info

Data Explorer

Visualize and compare your students' performance from 50+ research-based assessment instruments.

physport.org/DataExplorer



Upload your data

Explore your data

Download a report

Data Explorer

Secure

We use the same security measures used by banks and financial institutions so you can have the utmost confidence that your data is safe.

- Your identity is protected
- Your students' identities are protected
- We use one-way, cryptographically-secure transformations
- We report on aggregate data

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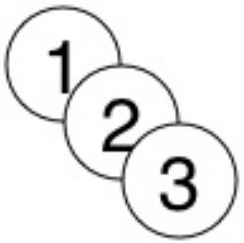

Easy

Our guided process makes it easy to upload your data, and our visualization engine is tailored to assessments, making charting a snap.

- We match pre- and post-data for you
- You can upload the files you already have*: no need to use a template

* .csv, xls, or .xlsx; one assessment per file; one row per student

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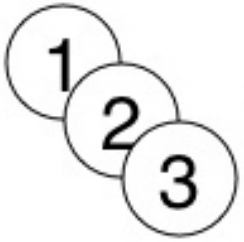

Easy

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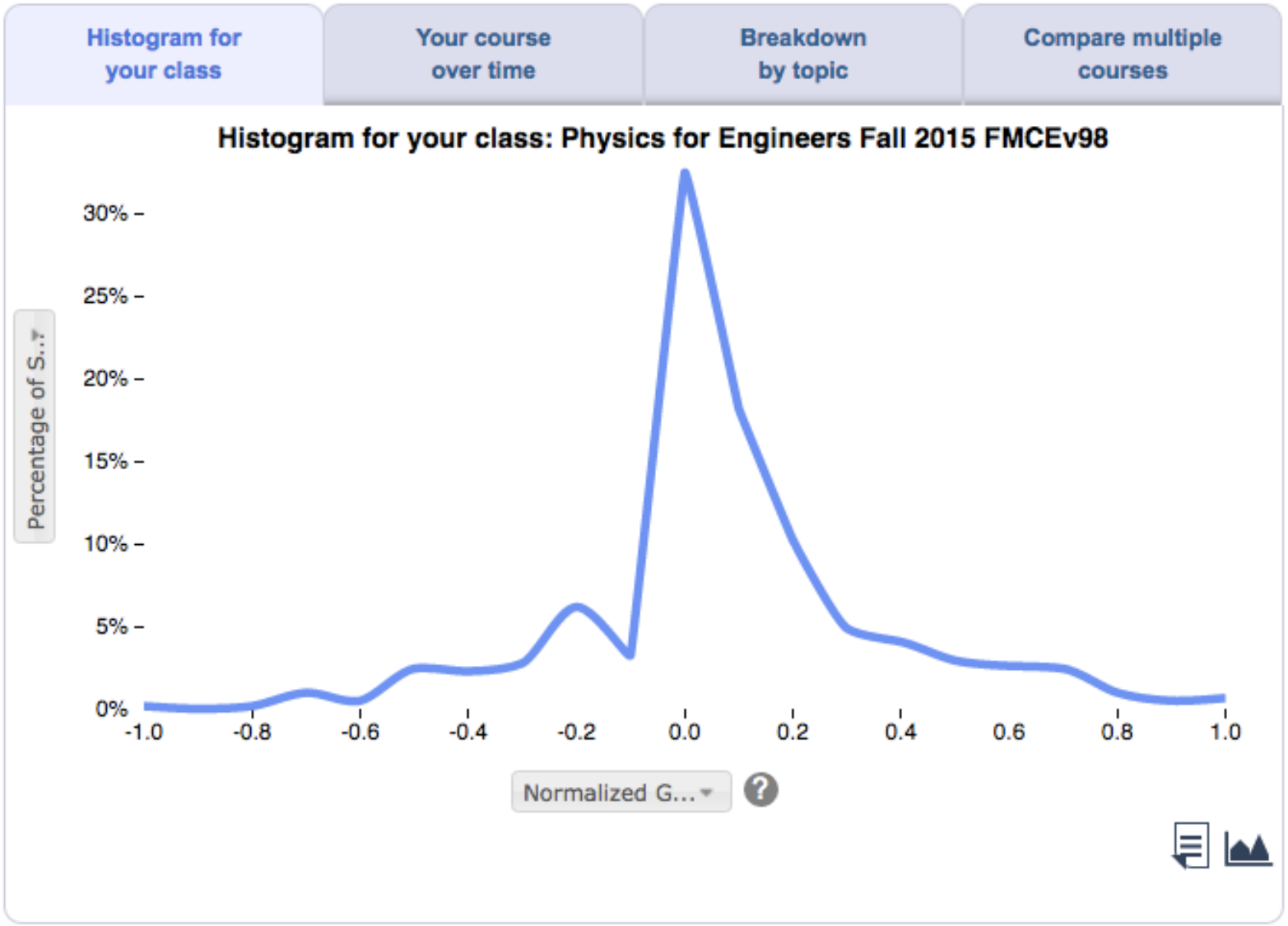
Powerful

With one click, you get a comprehensive analysis of your results, allowing you to compare your data with classes and teachers in similar institutions nationwide.

- Explore responses on by questions or clusters
- Track your classes over time
- Split data by demographics
- Rigorous statistics done for you in the background

physport.org/DataExplorer



physport.org/DataExplorer

Histogram for your class | Your course over time | Breakdown by topic | Compare multiple courses

Summary

Average Gain
0.10
± 0.01

Your students' average normalized gain of **0.10 ± 0.01** is near the bottom of the range for traditional lecture classes . See typical results.

Effect Size
0.61

The effect size of the change between pre and post for your class is **0.61**. This is a moderate effect size

Average Score
Pre 18%
± 1%
Post 30%
± 1%

Your students' average score increased from **18% ± 1%** on the pre-test to **30% ± 1%** on the post-test. See typical results.

N (matched)
607

You have 607 "matched" students (who took both the pre- and post-test) in your class. All calculations are based on matched students.

Recommendations

Courses that are taught using interactive engagement techniques tend to have higher normalized gains than those using traditional lecture. The key to these methods is getting students actively engaged in constructing their own understanding and not just passively listening.
This can be accomplished in many ways. Popular methods that you could try include: Peer Instruction, PhET Interactive Simulations, Interactive Lecture Demonstrations, and Just In Time Teaching.
As we collect more data on how teaching practices correlate with learning gains, we will eventually provide more customized recommendations.

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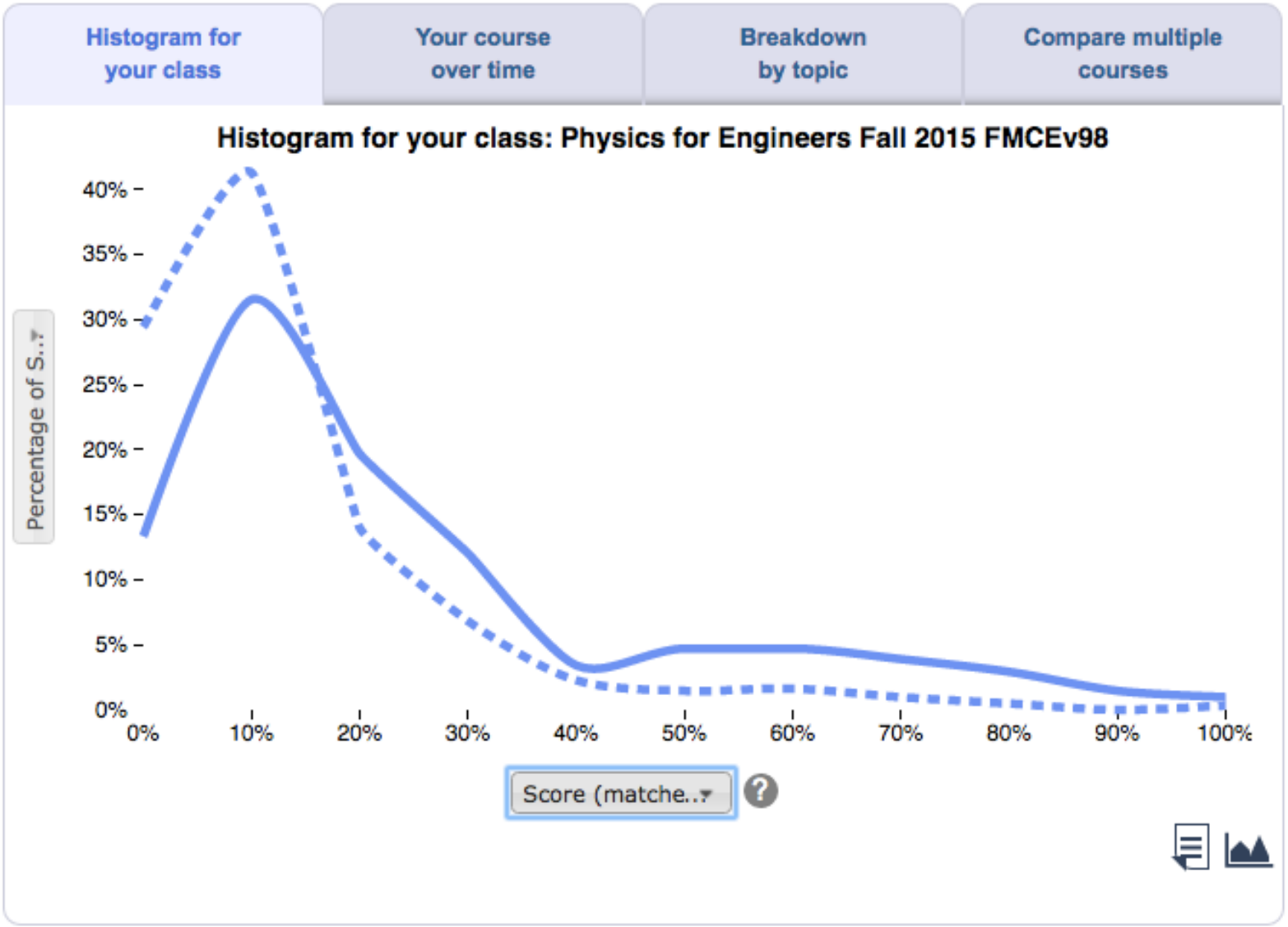

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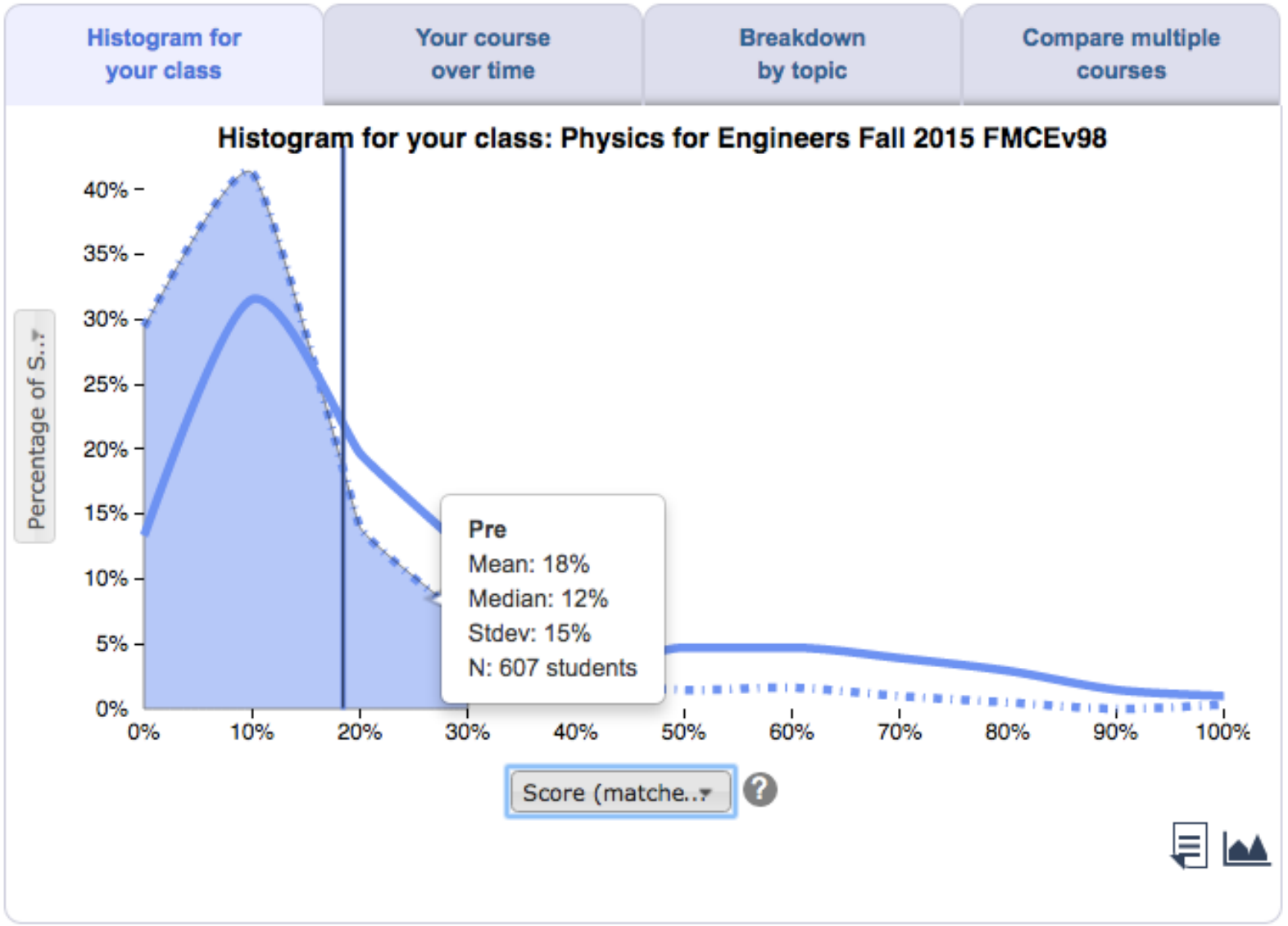

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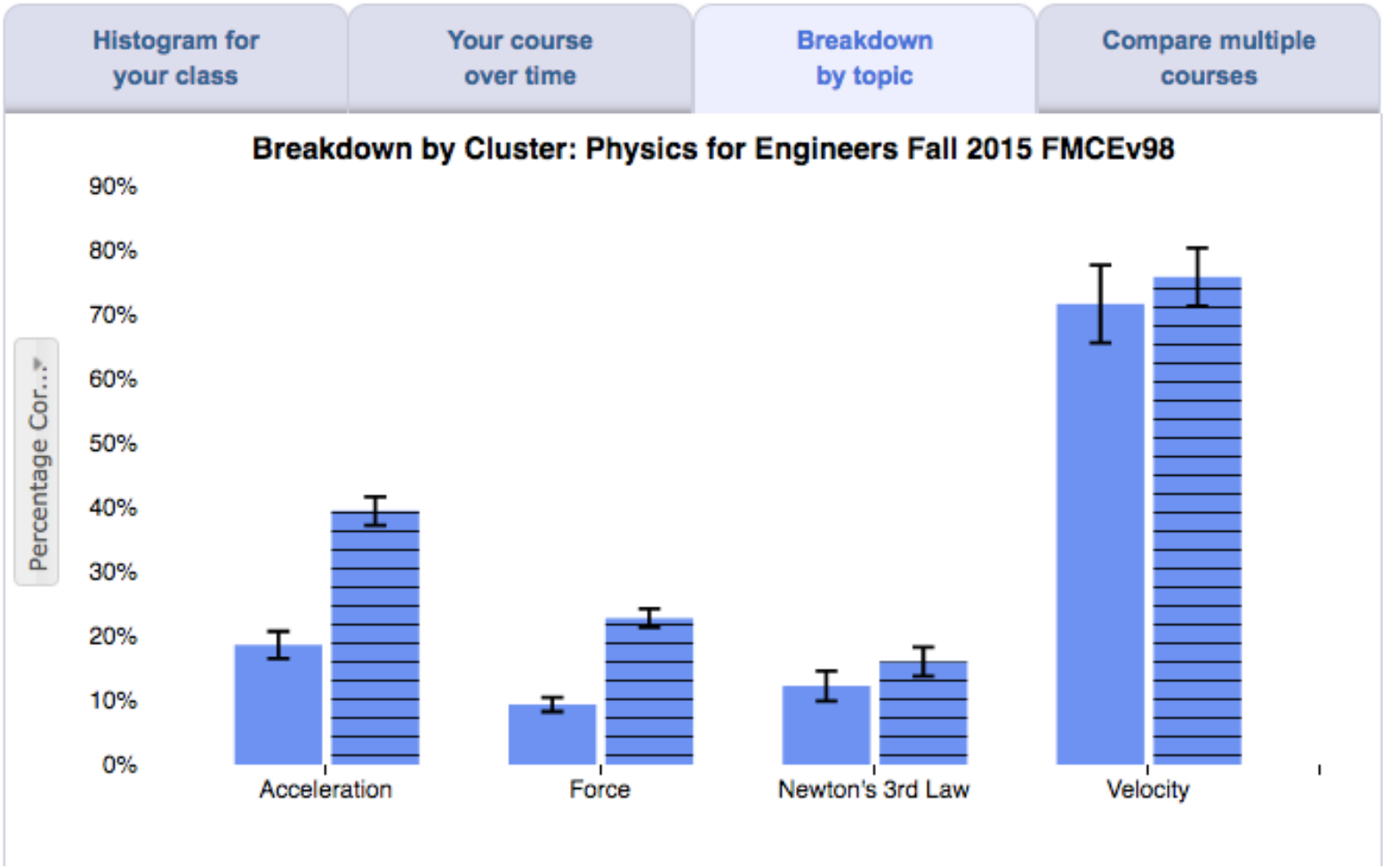

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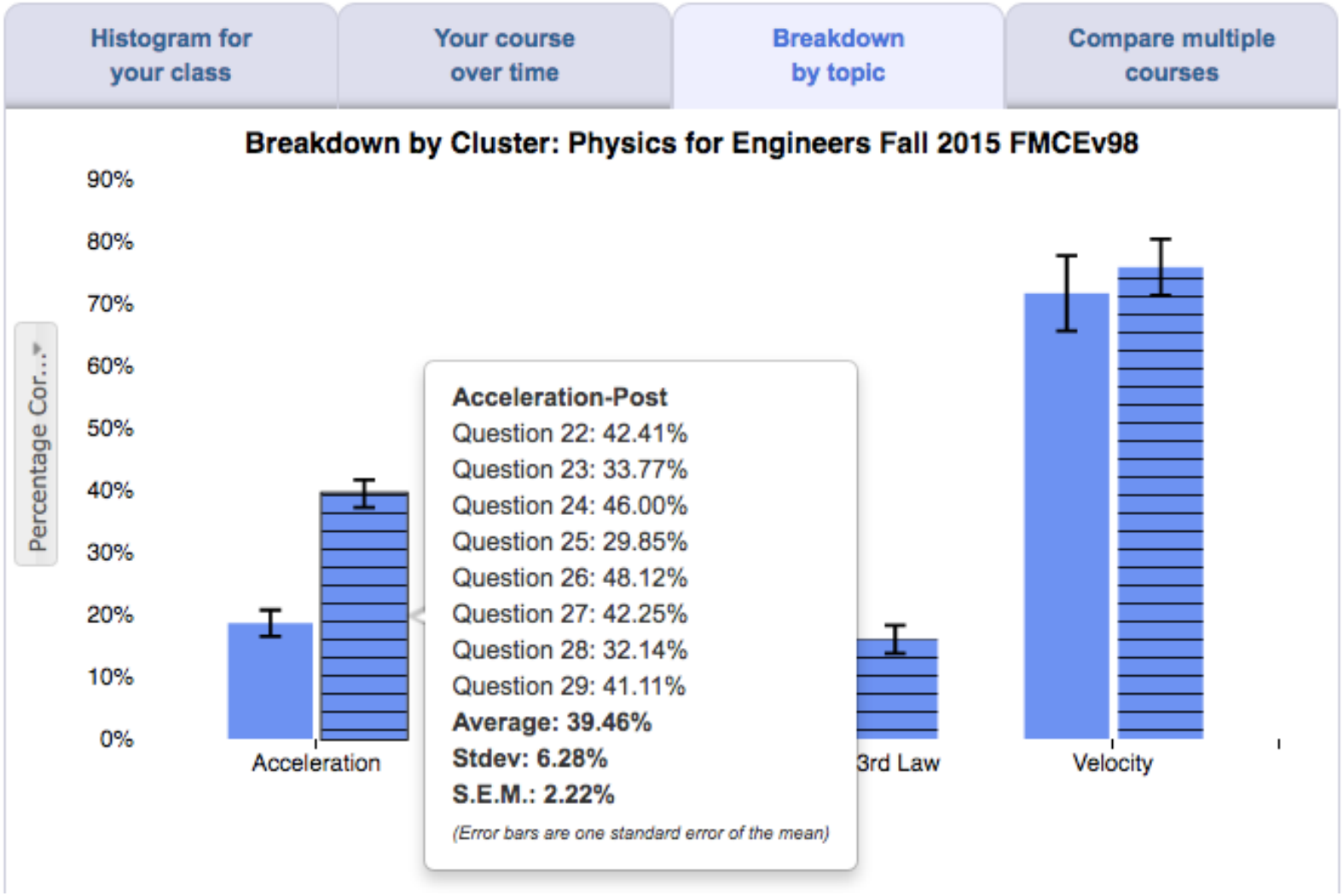

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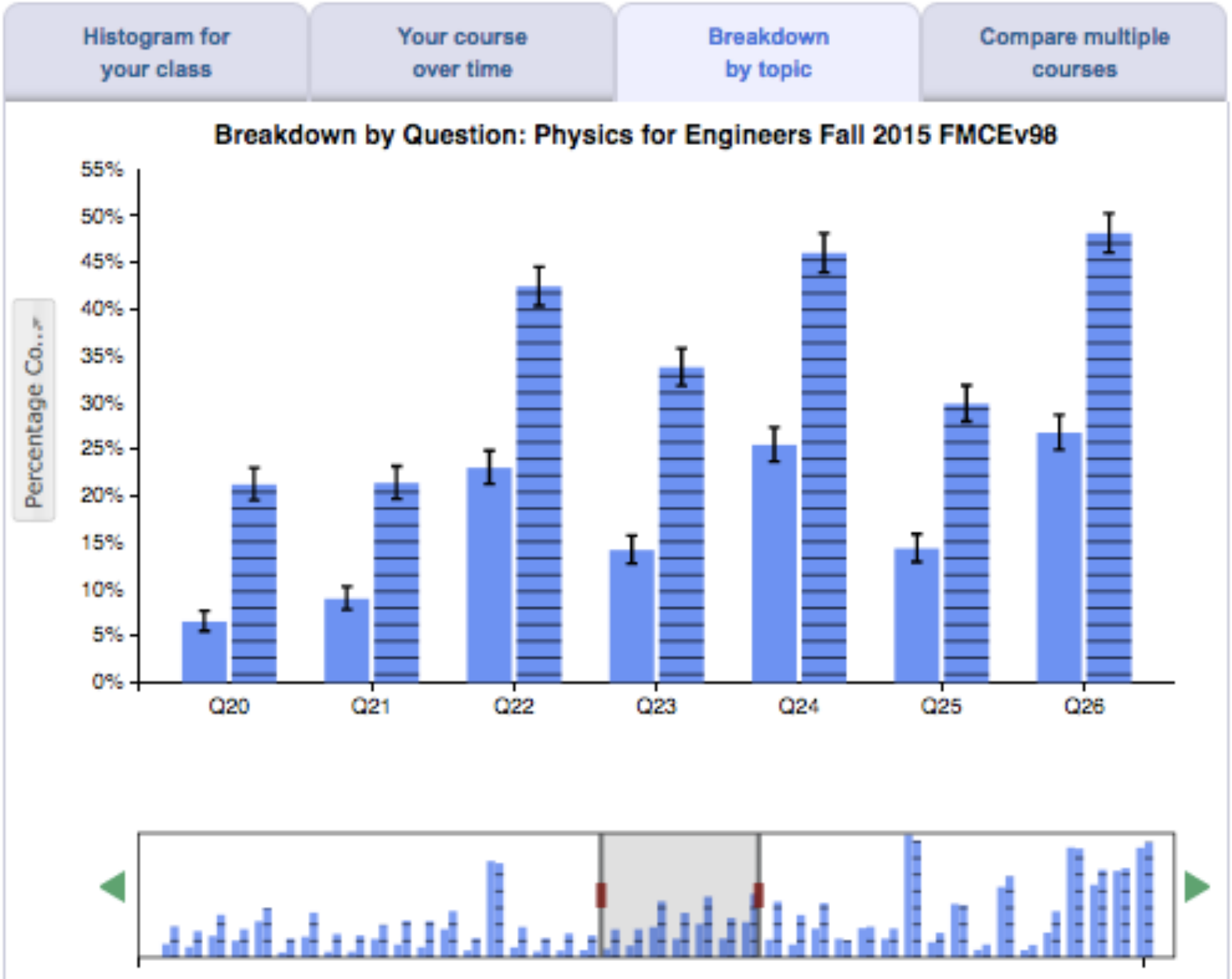

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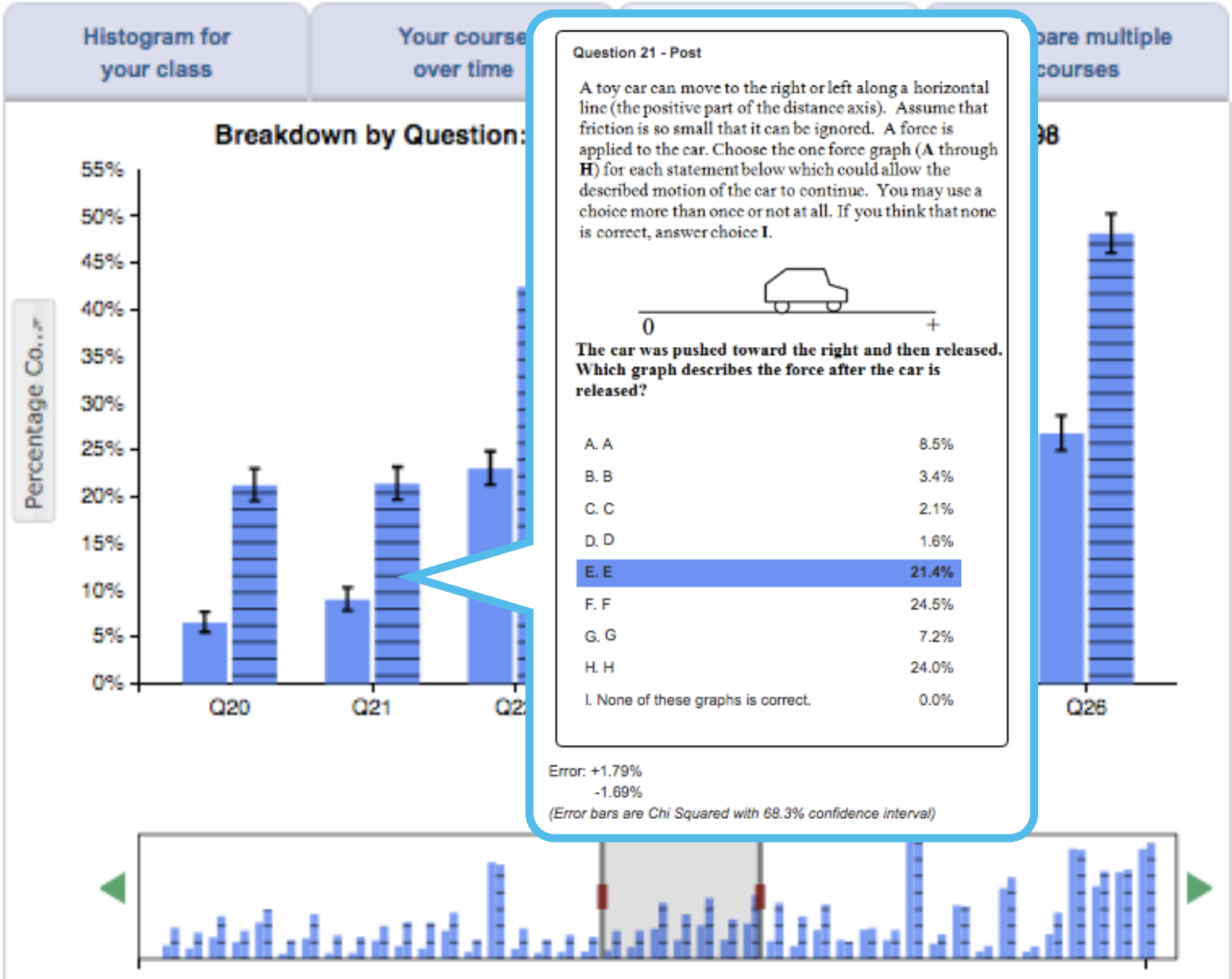


Data Explorer

Visualize and compare your students' performance from 60+ research-based assessment instruments.

physport.org/DataExplorer

- Compare multiple courses
- Track your courses over time
- Group and split by gender, major, section, instructor, etc
- Easy to upload
- Download reports for your tenure file
- Coming soon:
  - Compare to national averages
  - Add custom assessments

Available now!

FCI, FMCE
CSEM, BEMA
CLASS, MPEX

Available soon!

60+
research-based
assessments

Online workshops

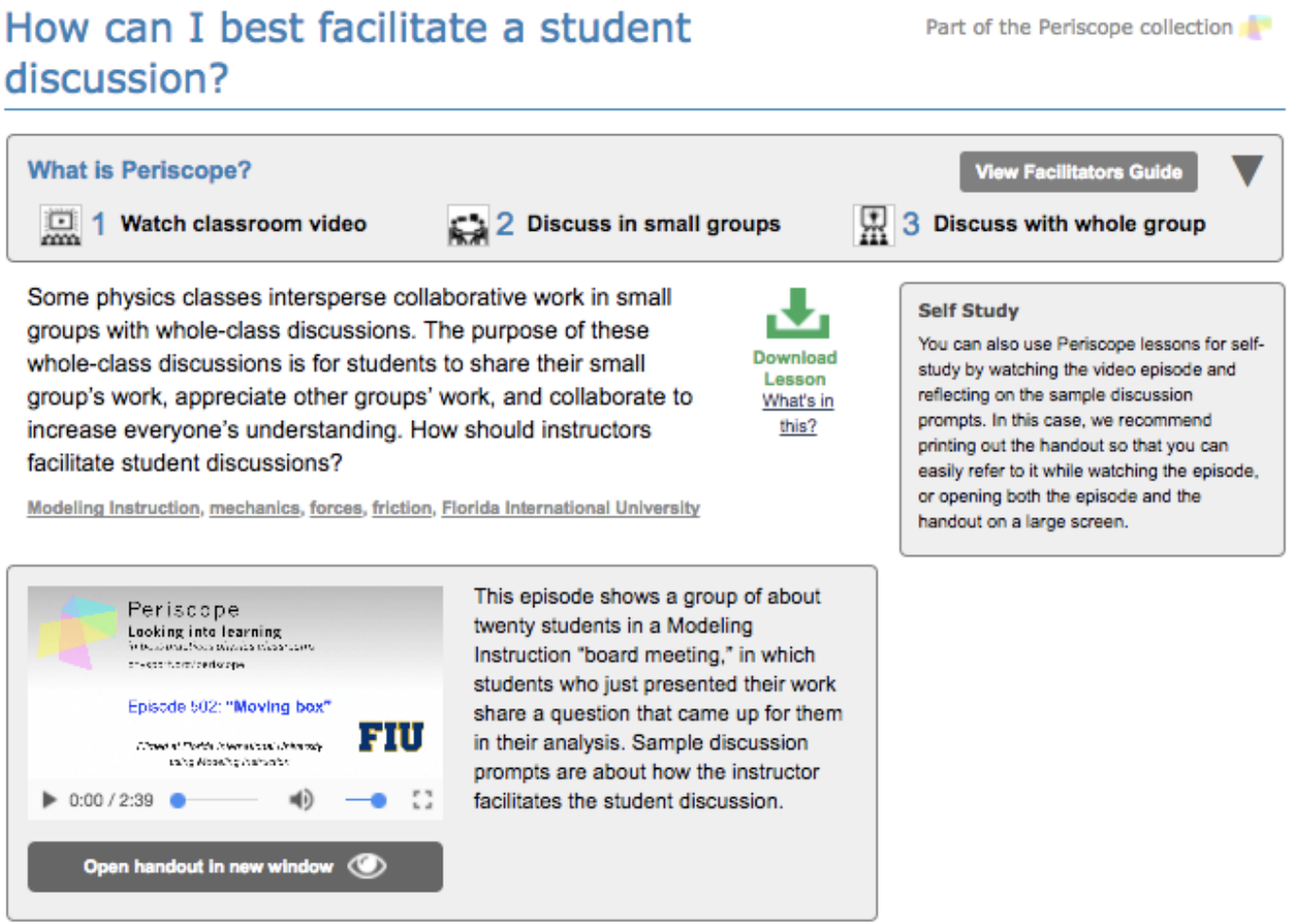
Video workshops for
training teaching assistants and
faculty professional development in best practices

physport.org/workshops

Periscope

physport.org/periscope

Videos of students working with handouts for training TAs and faculty in best-practices.



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physport.org/periscope

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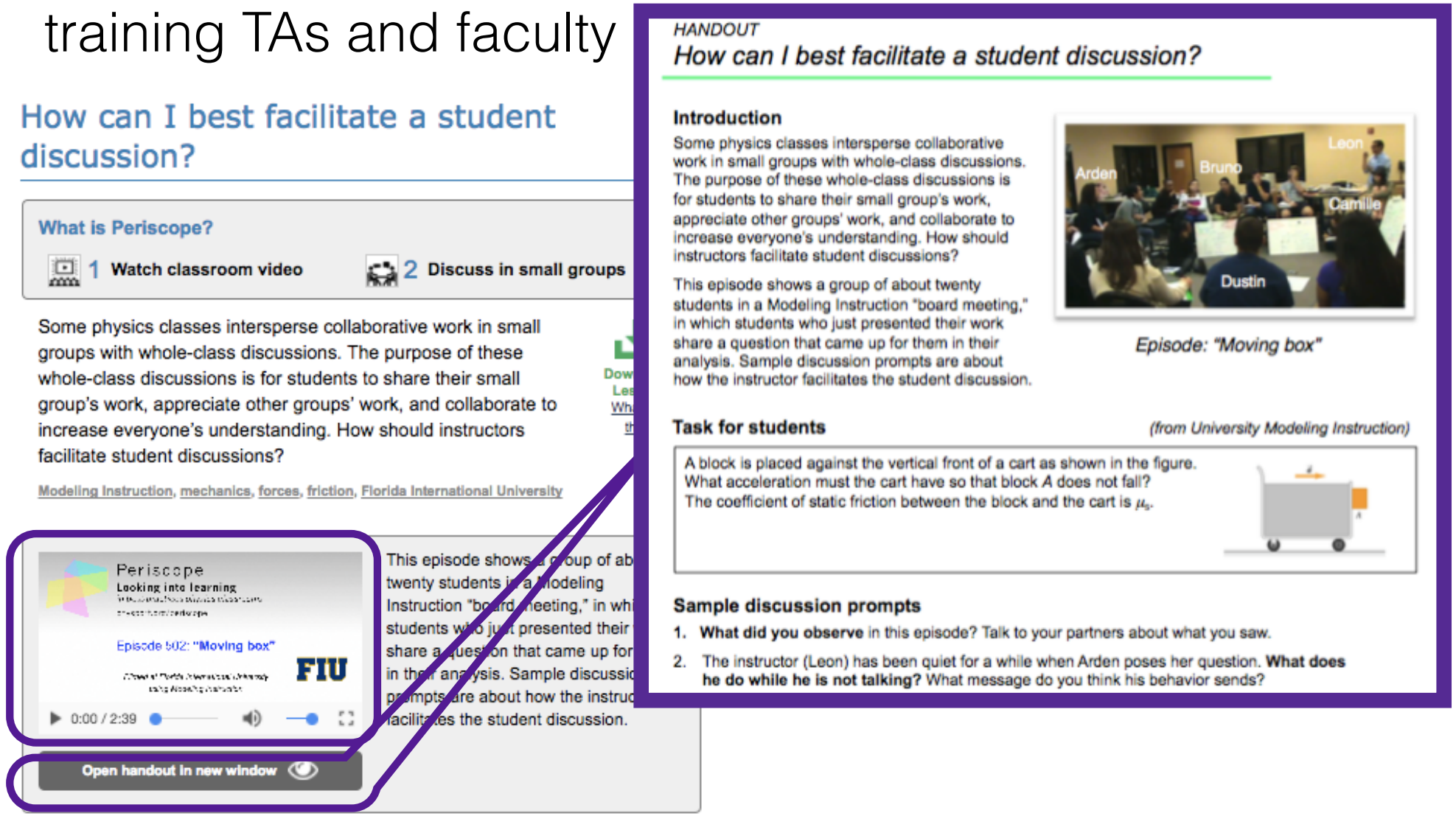

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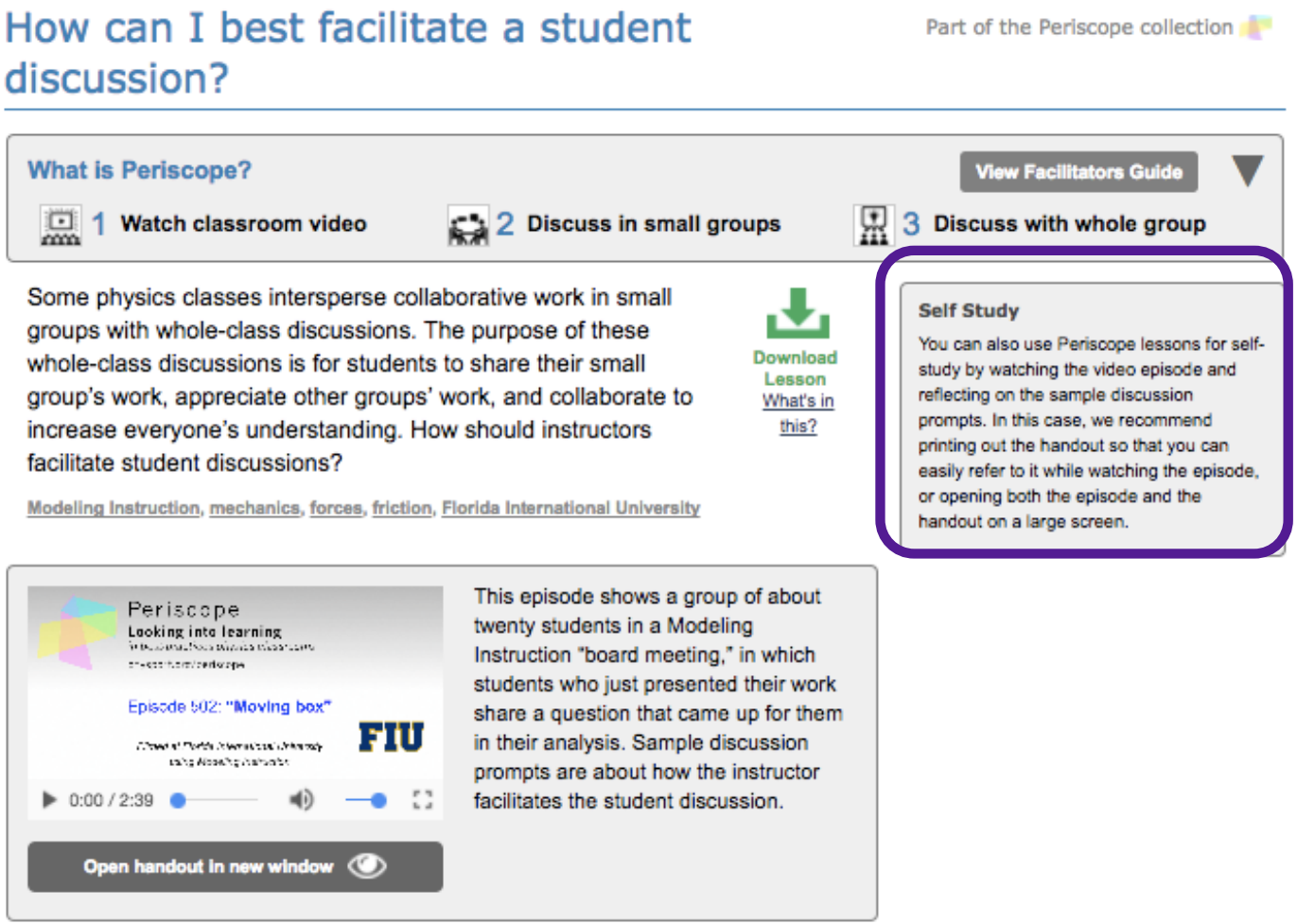

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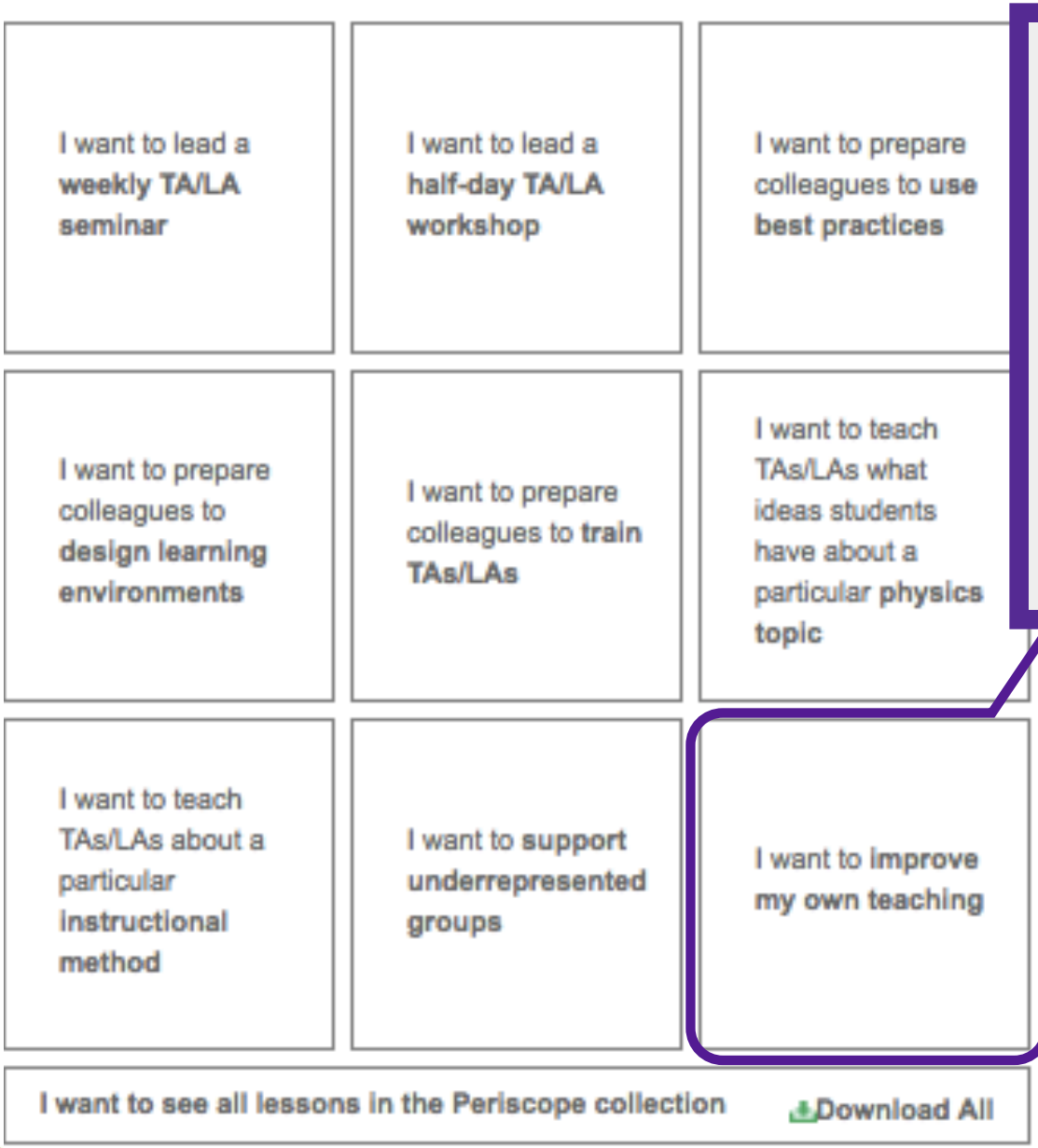

Available now!

54 lessons

Facilitators' Guide

PhysPort

Supporting physics teaching with research-based resources

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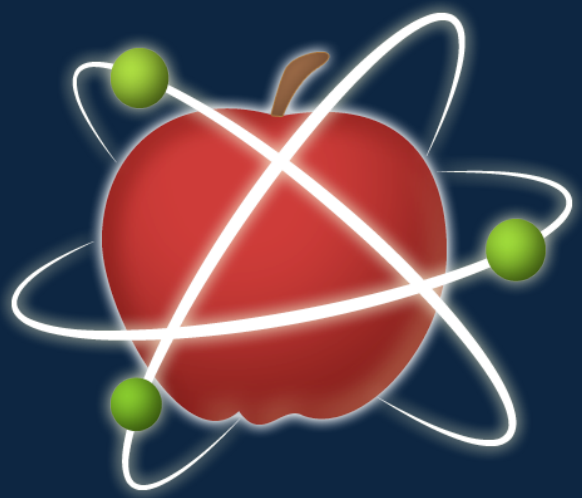
Resources

- Synthesis research
- Expert recommendations
- Teaching method search
- Assessment search
- Data explorer
- Online workshops



PhysPort

Supporting physics teaching with research-based resources

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KSUPER

perg.phys.ksu.edu

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