Assessment Tools & the PhysPort Data Explorer

Eleanor C Sayre,
Sam McKagan,
Adrian M Madsen

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esayre@ksu.edu

perg.phys.ksu.edu

www.physport.org

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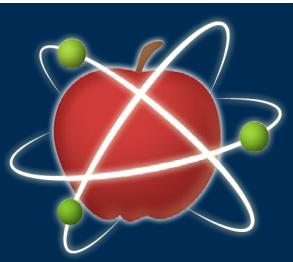
DUE-1347821,
DUE-1347728,
PHYS-1461251



PhysPort

Supporting physics teaching
with research-based resources

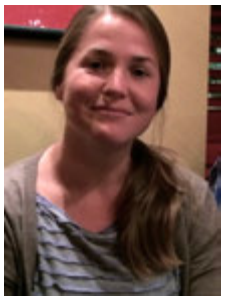
What is PhysPort?

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

www.physport.org

PhysPort Team

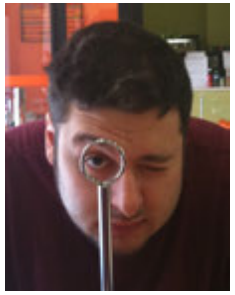
American Association of Physics Teachers

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

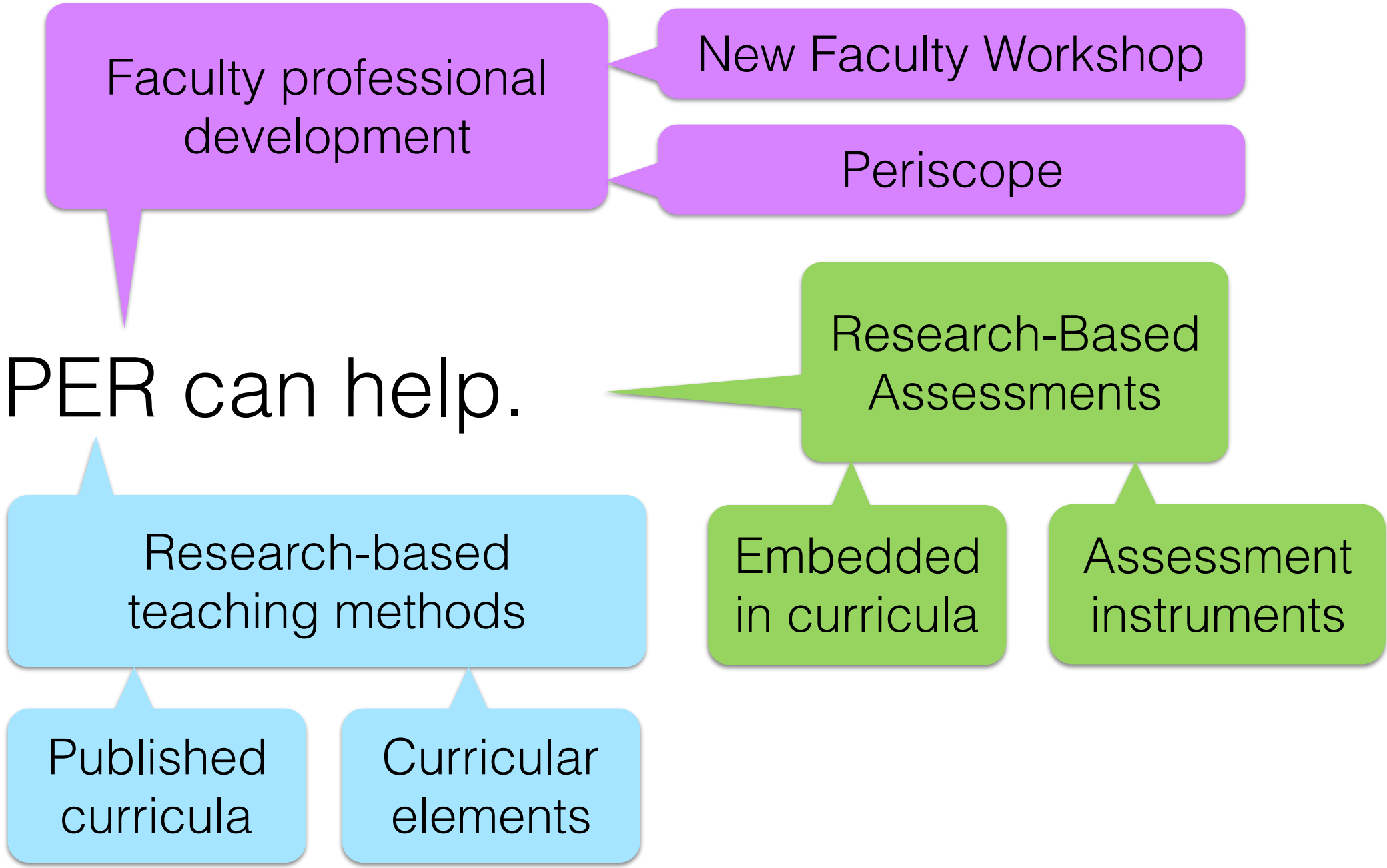
How do you know if students are learning?

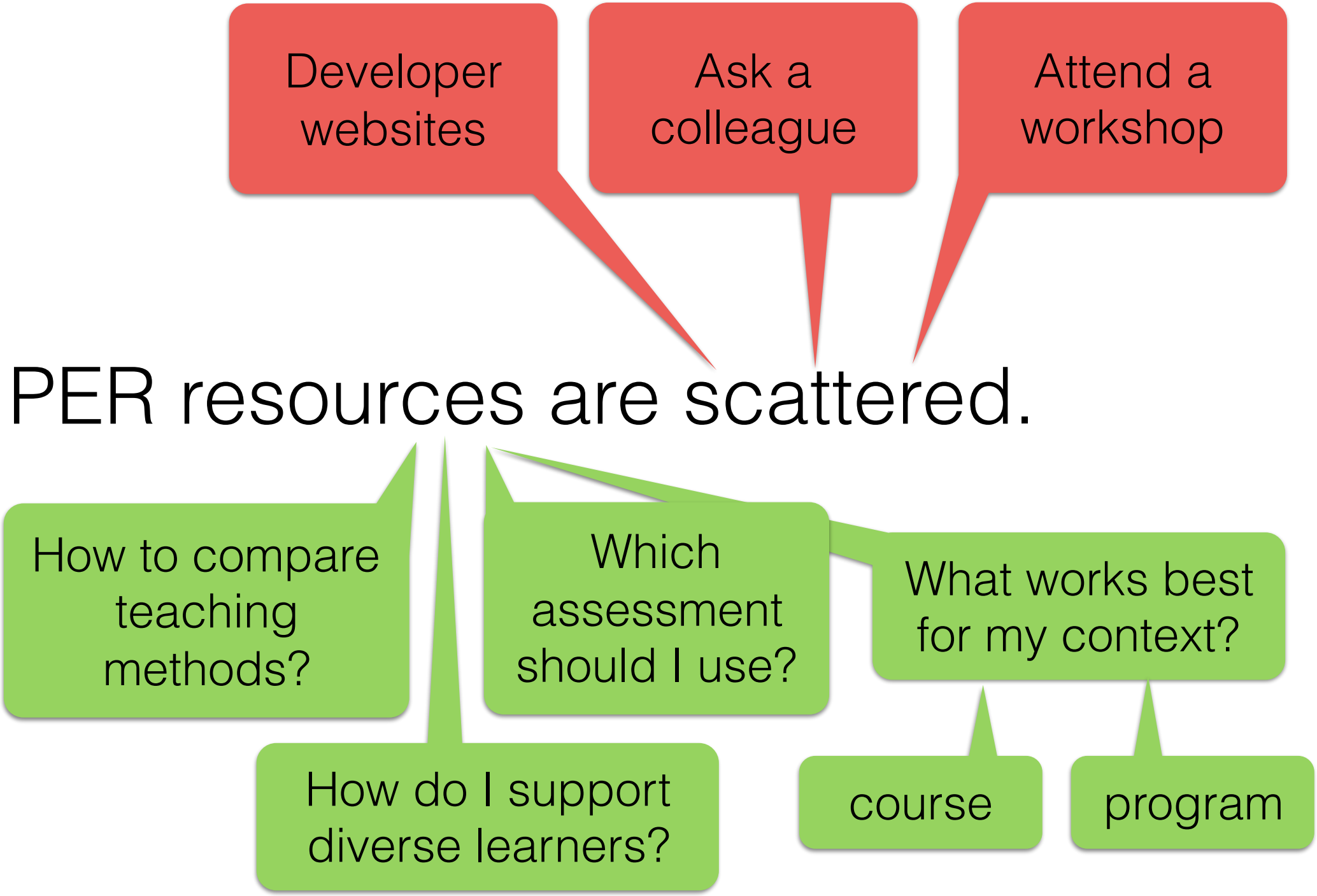
Assessment is a gateway drug

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.

Finding information and advice

Changing department practices

Supporting physics teaching with research-based resources

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* (accepted). 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 60+ more

These are:

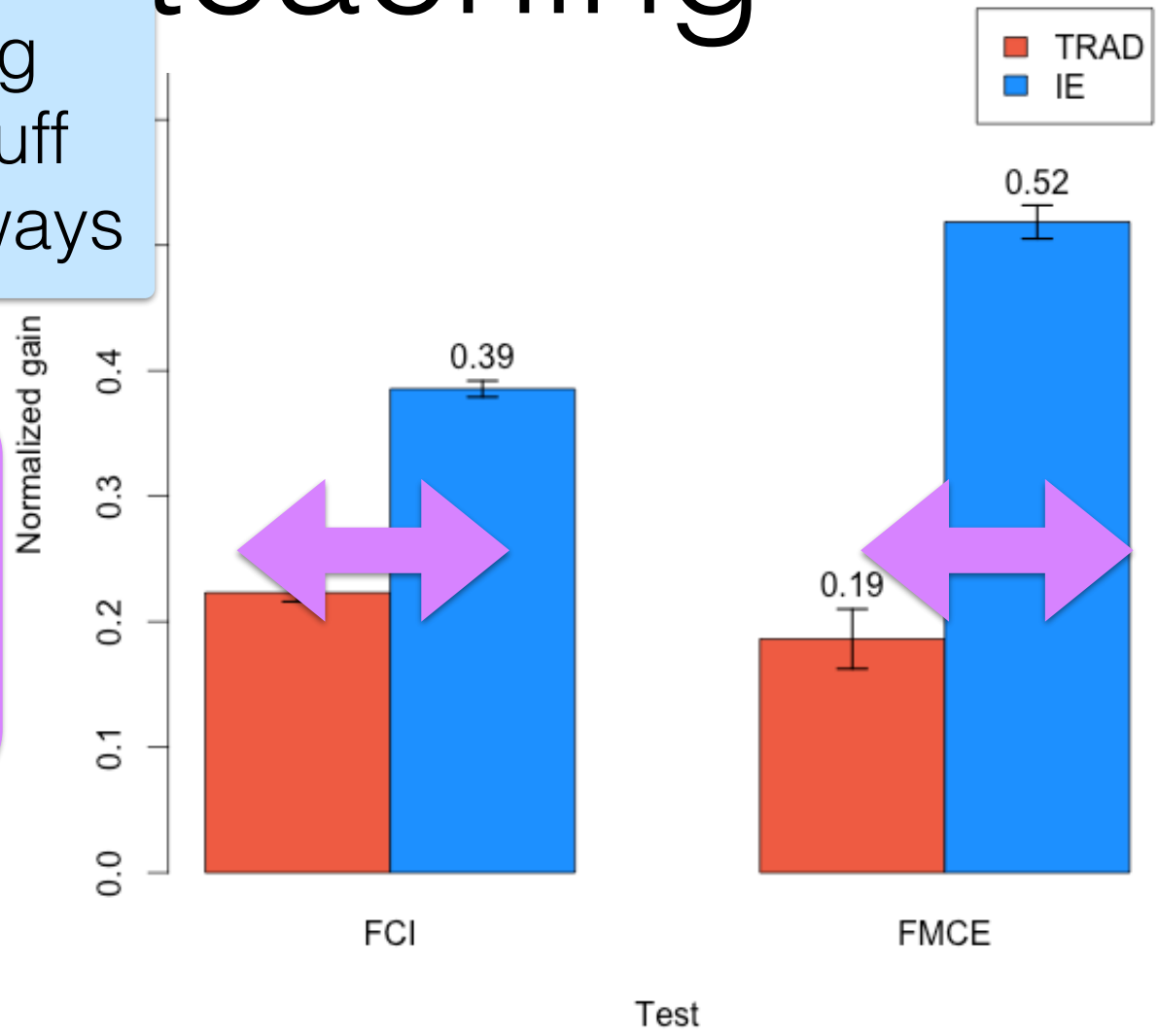
- Generally multiple-choice surveys
- Carefully crafted questions
- Conceptual topics across the physics curriculum
- Additionally: beliefs, problem-solving skills, affect

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



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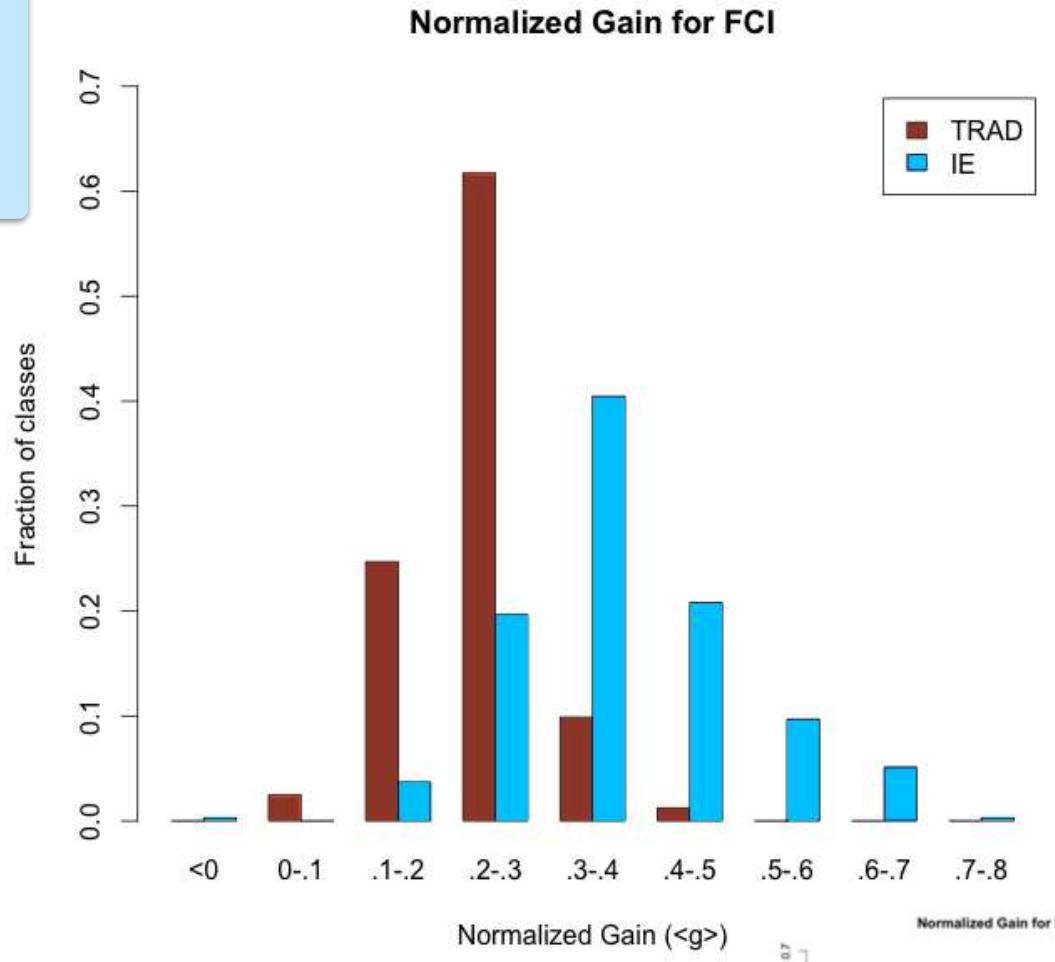
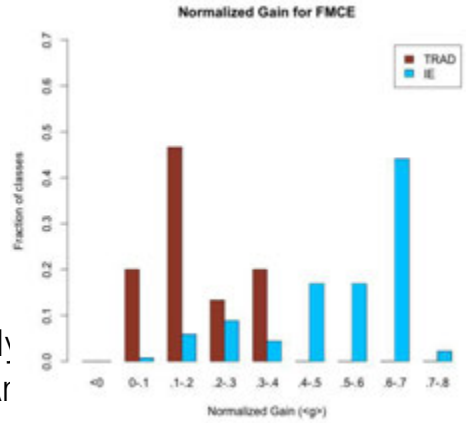
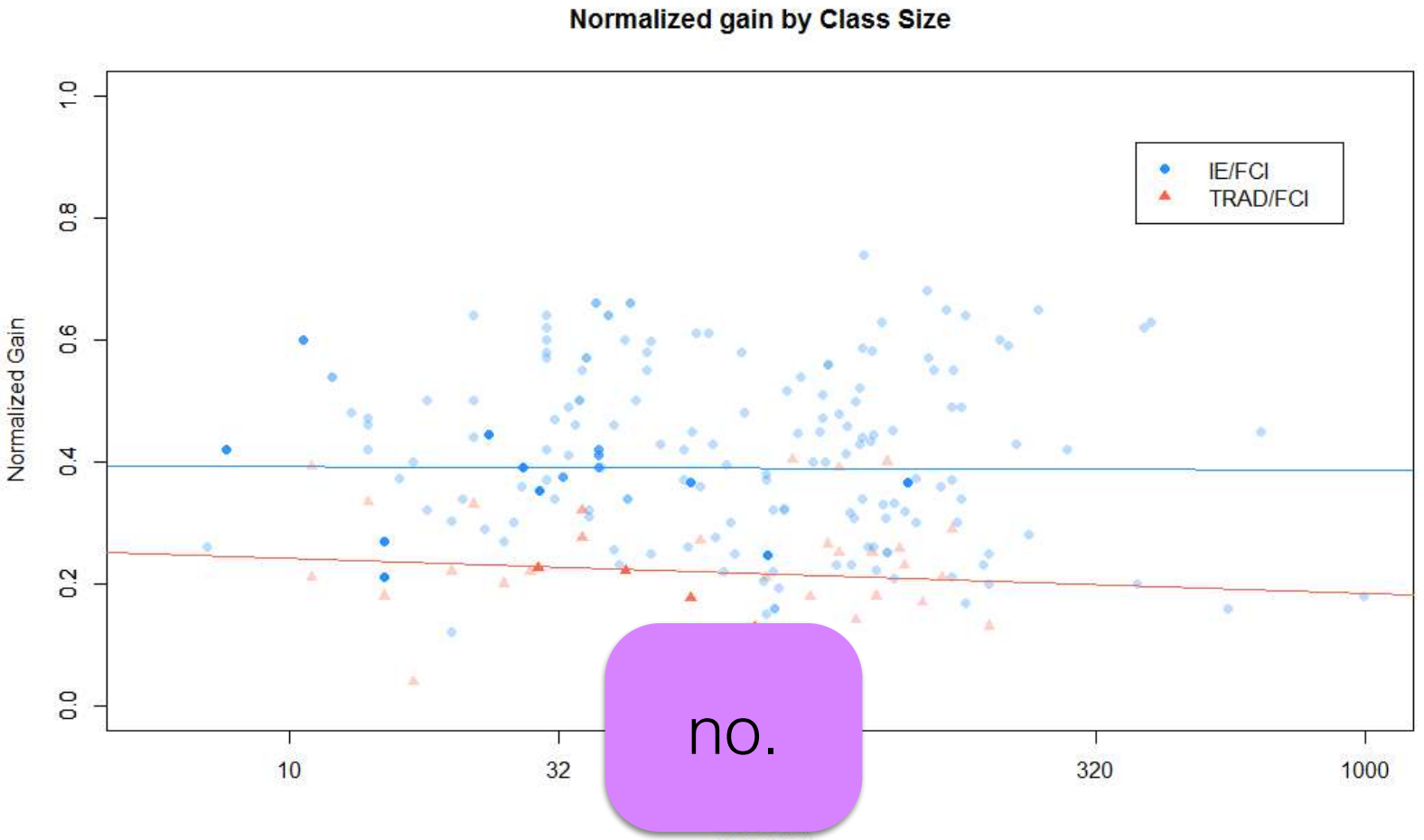




Von Korff, J., *et al* (accepted). Secondary Analy
Introductory Physics : a 50k - Student Study. Ar

Does class size matter?



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

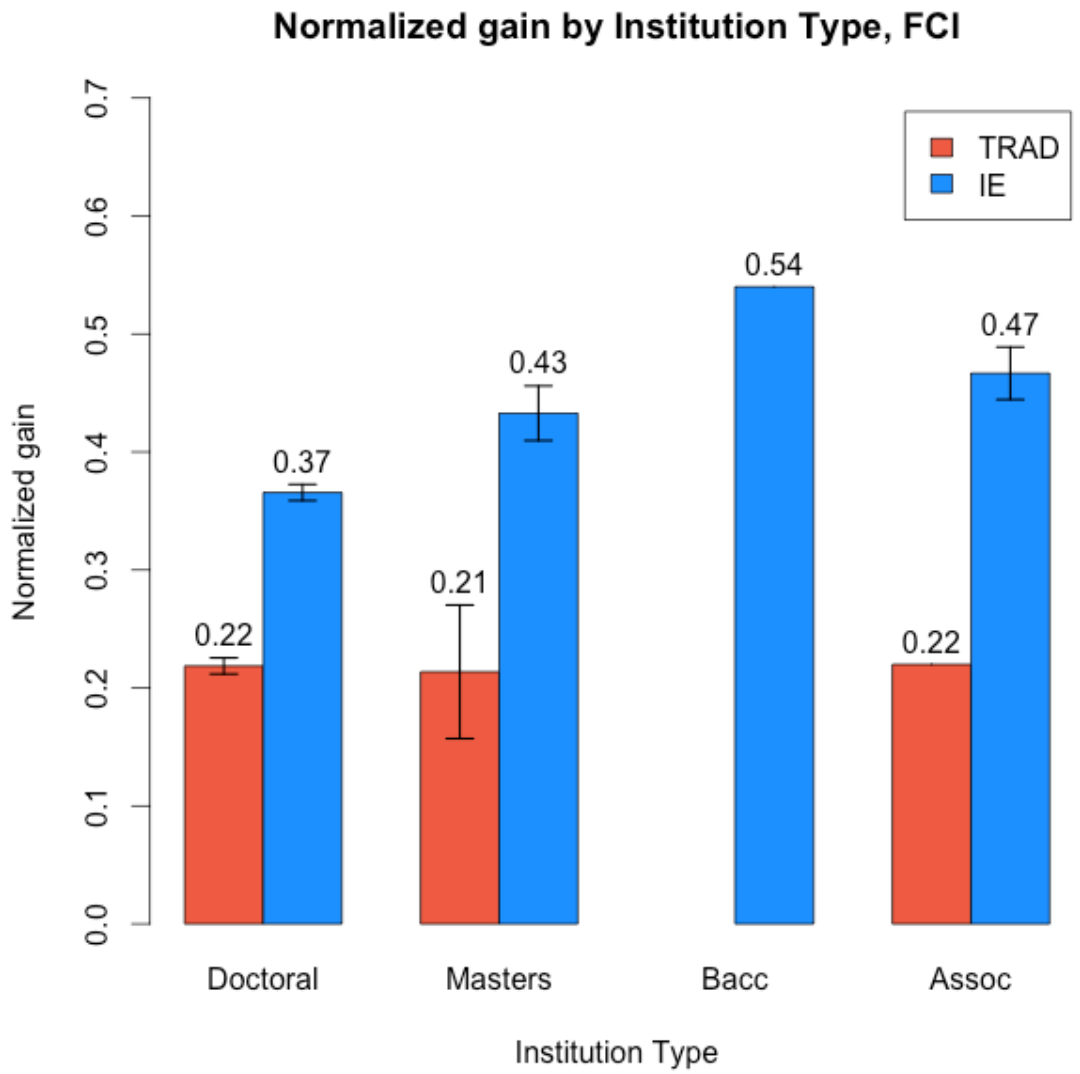
Von Korff, J., *et al* (accepted). Secondary Analysis of Teaching Methods in Introductory Physics : a 50k - Student Study. American Journal of Physics

Does institution type matter?

- Reduced Carnegie classification
- No Canadian schools

no.

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



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

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

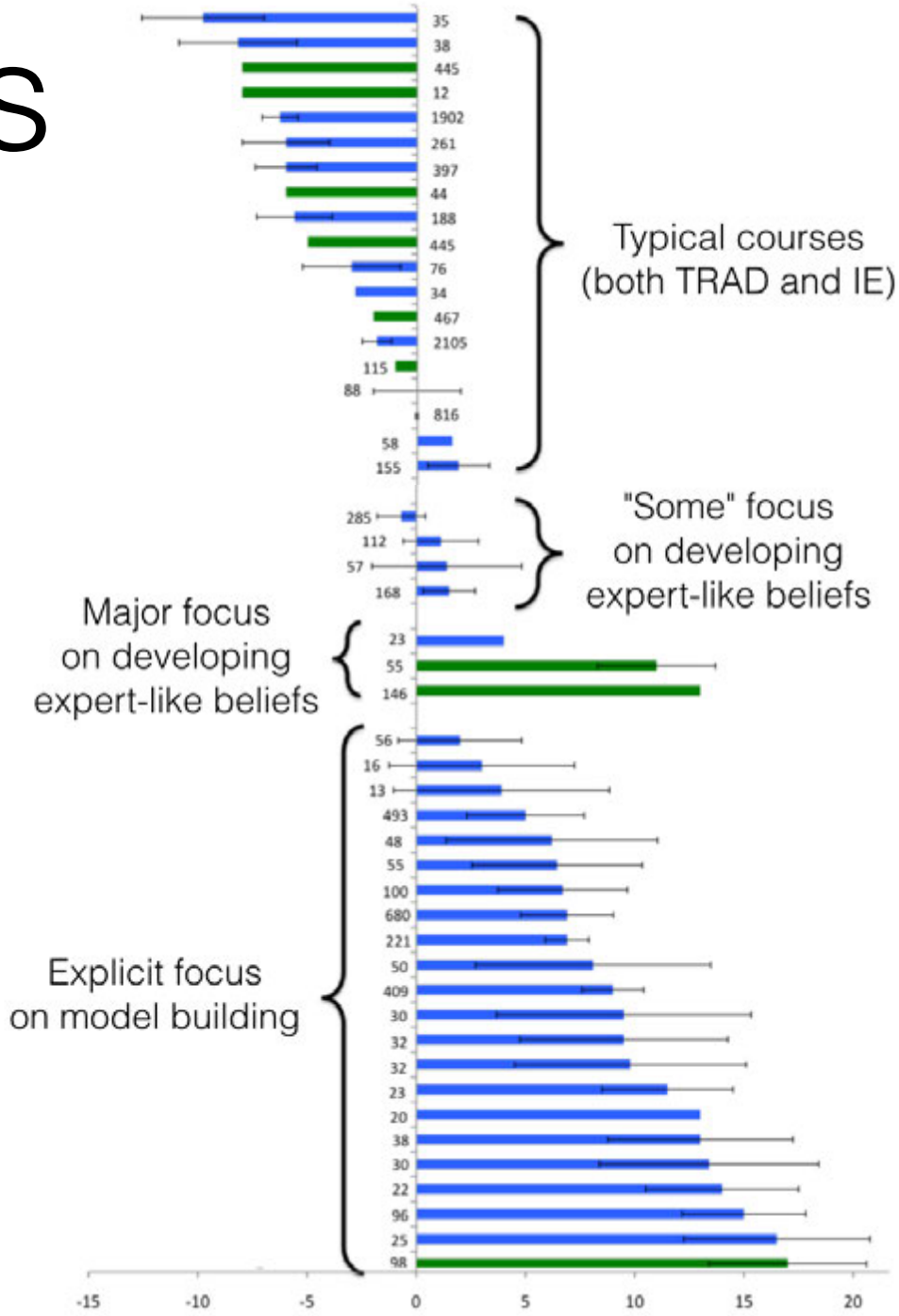
Adams, W. K., et al (2006). New instrument for measuring student beliefs about physics and learning physics: The Colorado Learning Attitudes about Science Survey. *Physical Review Special Topics - Physics Education Research*, 2(1), 010101.

Student Beliefs

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

"Ordinary" IE is not enough.

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



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Gender gaps in learning physics

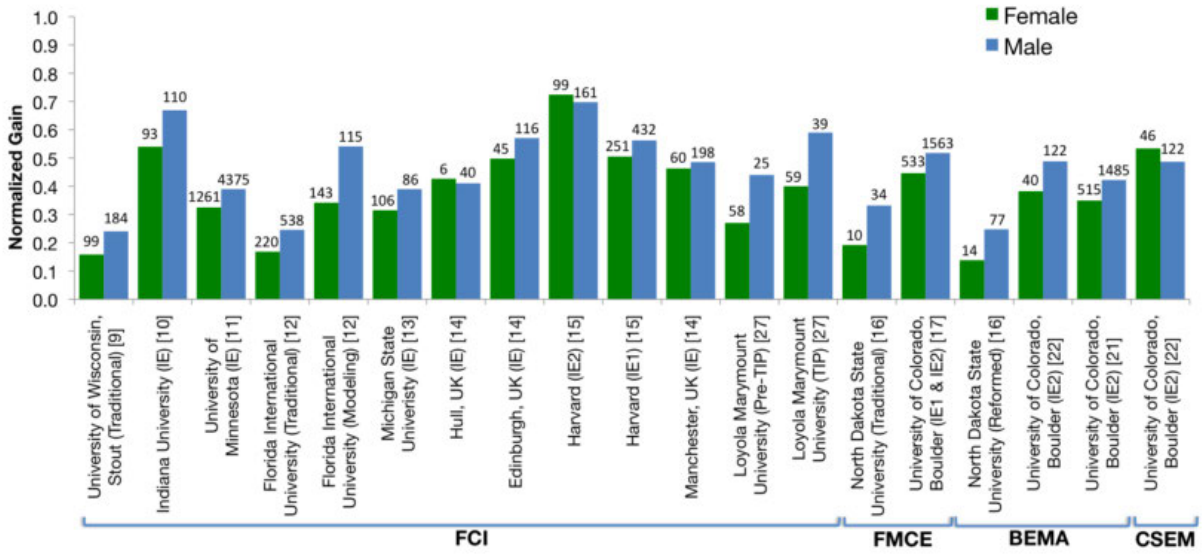
Men outperform women on RBAs

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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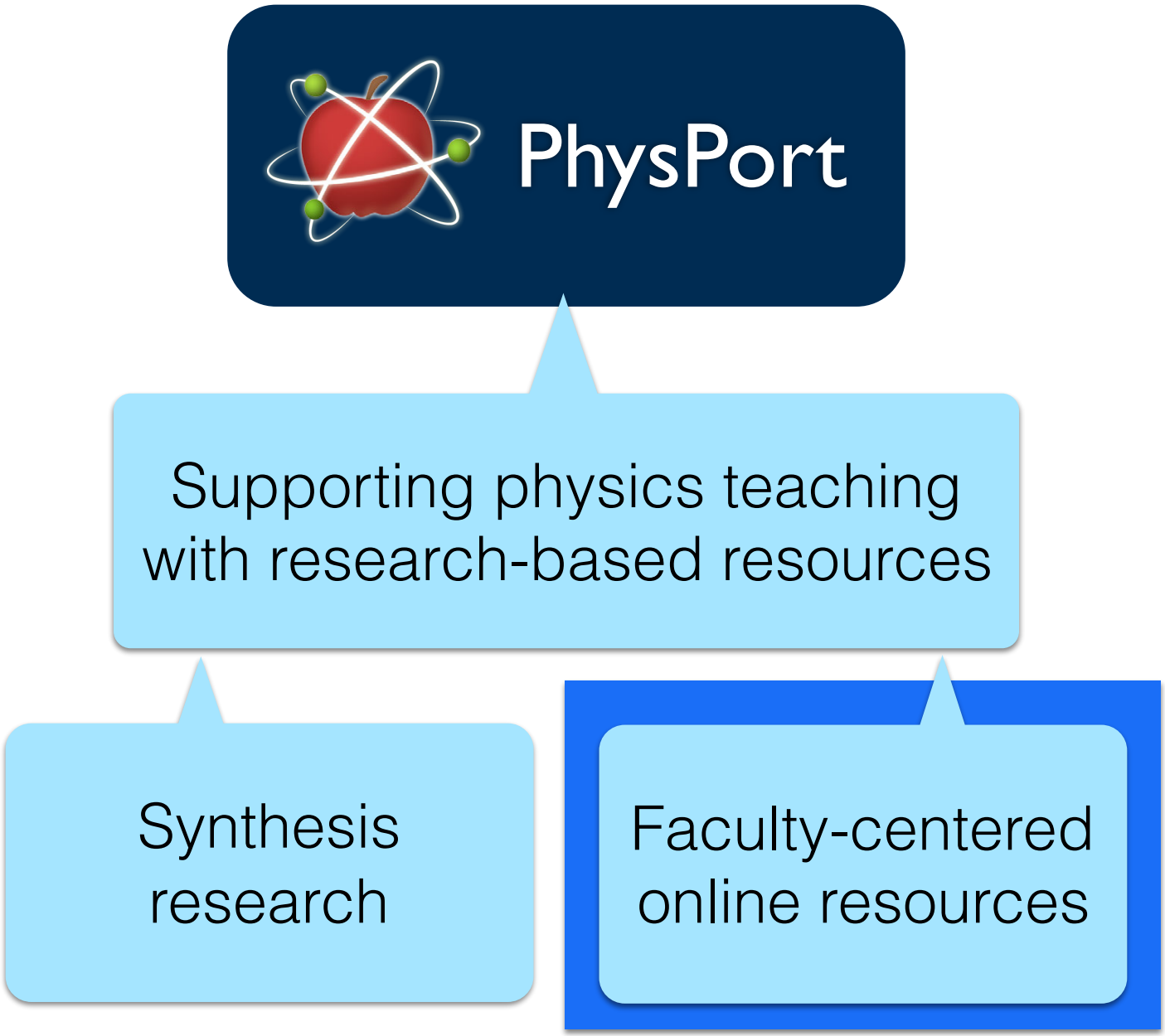
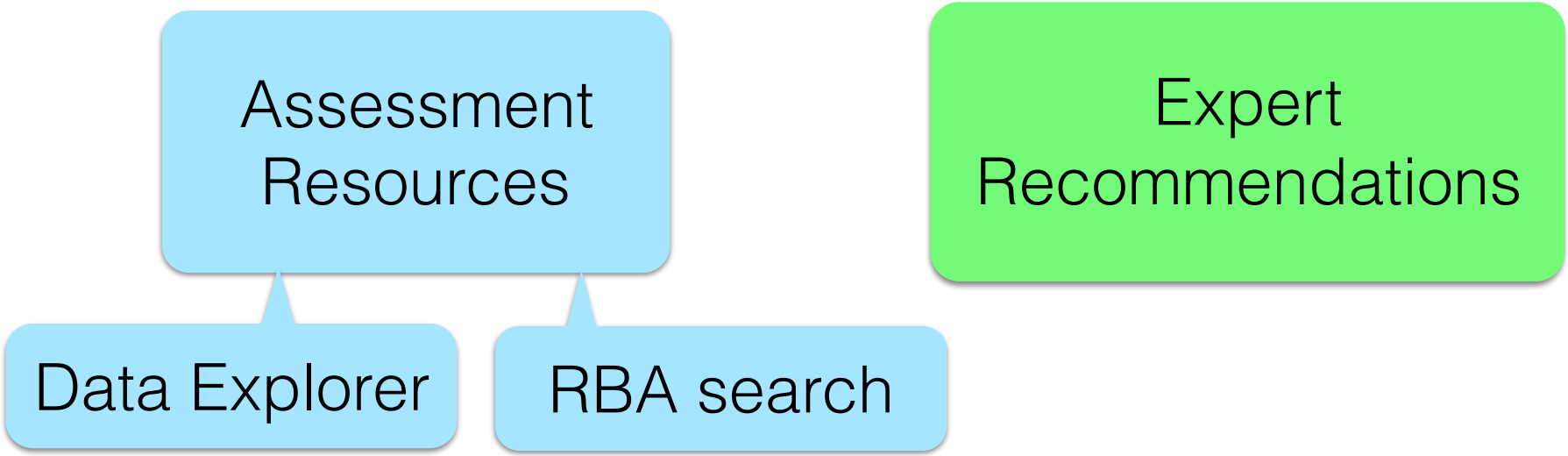
Questions so far?


PhysPort
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

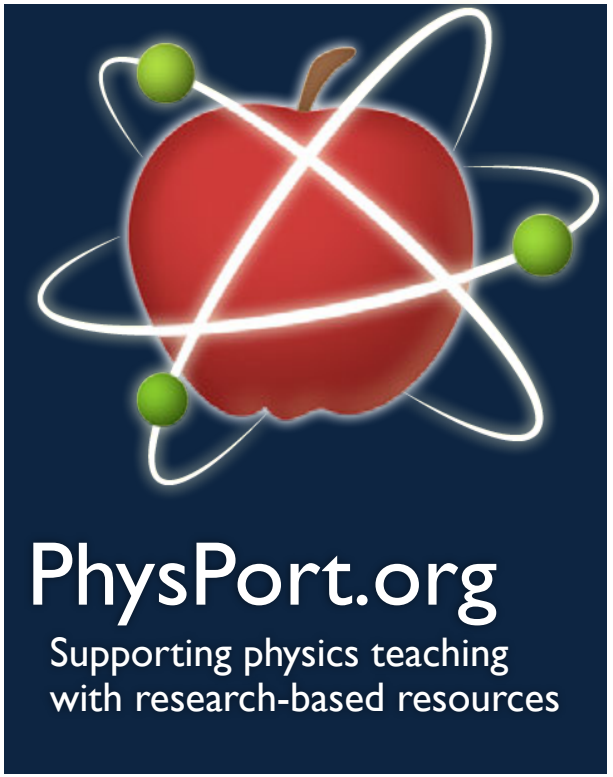
27 faculty & chairs

50 LA video project users

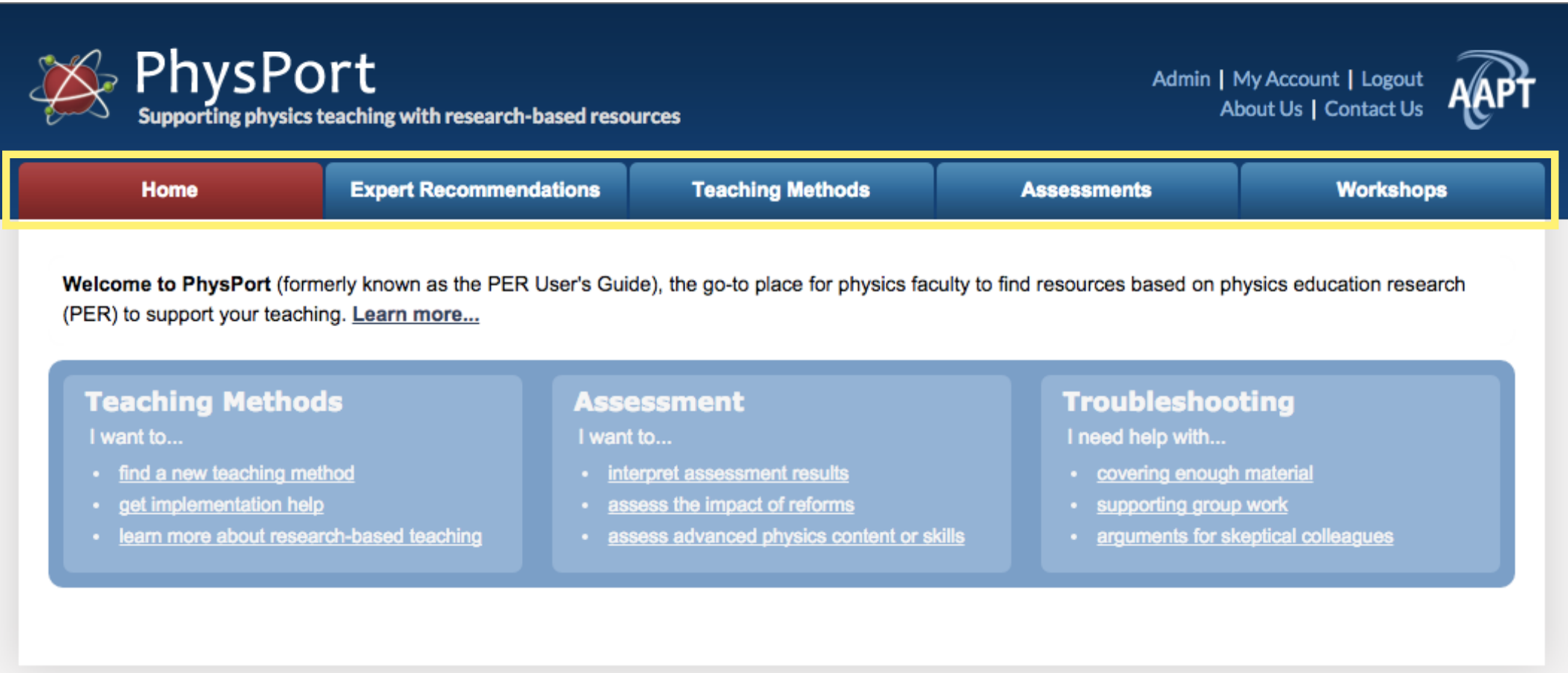
Faculty have practical needs.

Faculty want guidance.

Faculty consider broader contexts.



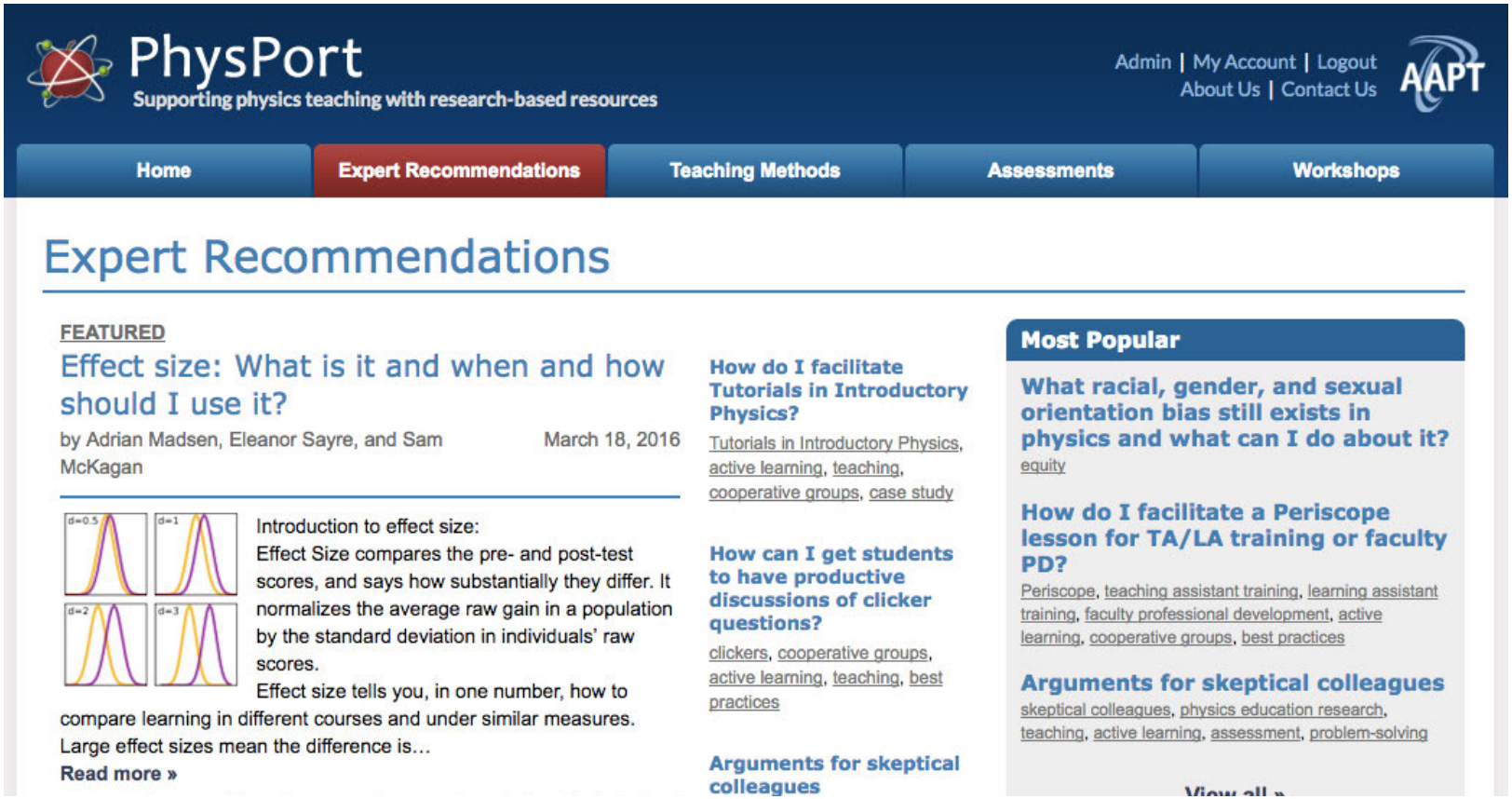
Start with the biggest needs of users.



Expert Recommendations

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

physport.org/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?

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- 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?

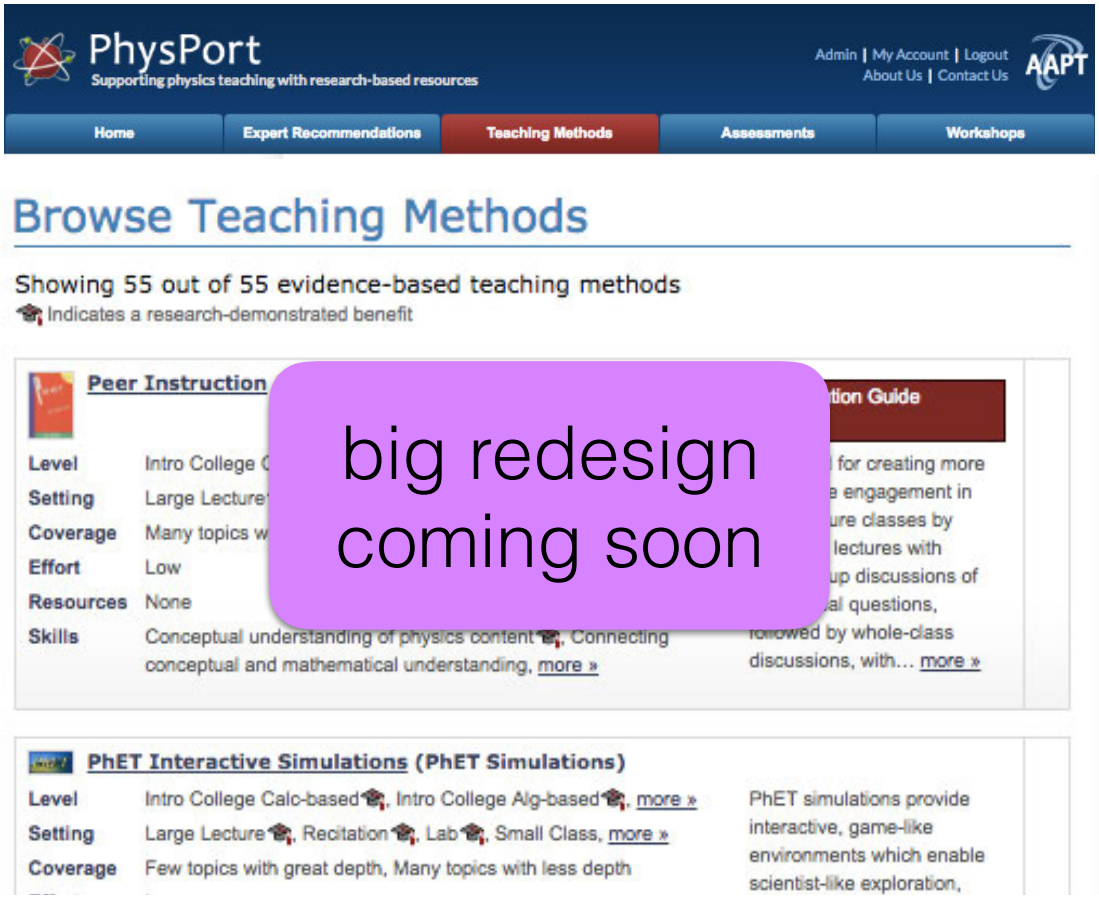
esayre@ksu.edu

smckagan@aapt.org

Teaching Methods

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

physport.org/guides/browse.cfm

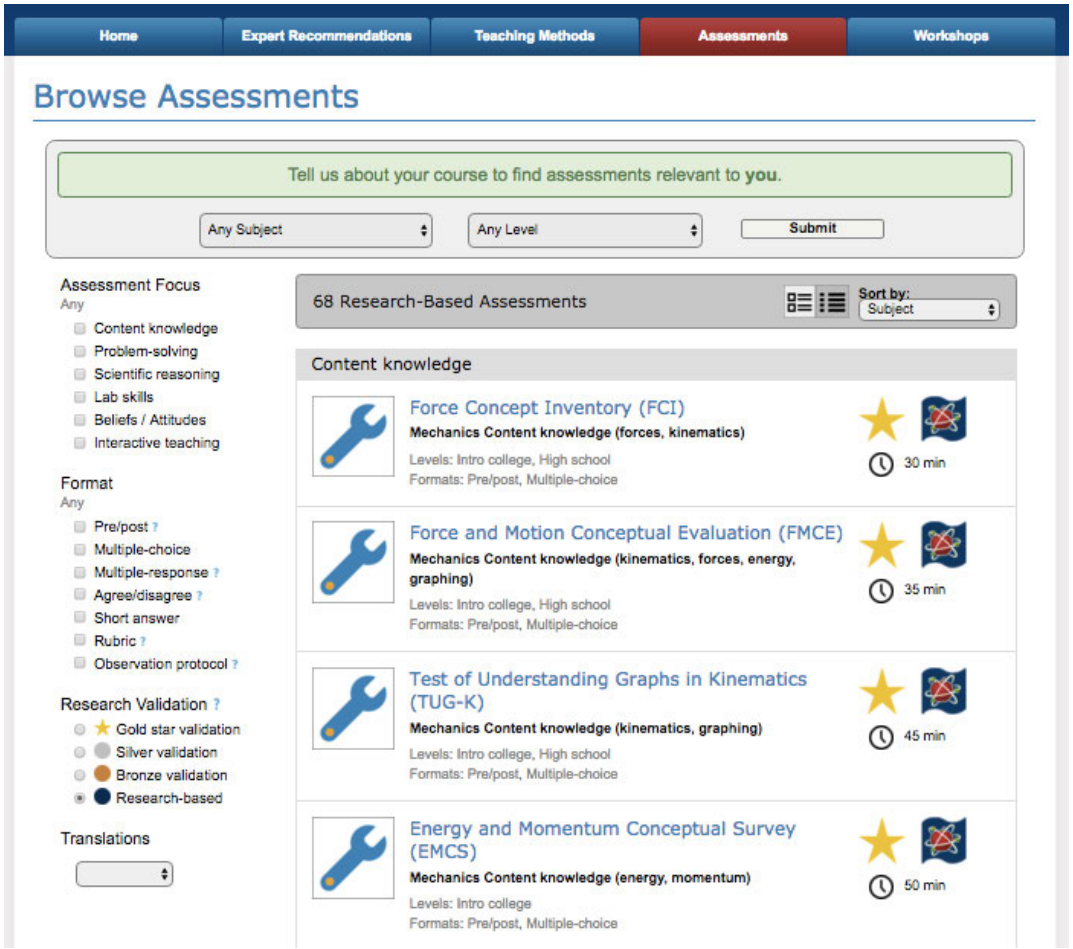


big redesign
coming soon

- 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 details
- See sample questions
- See typical results
- Download RBAs
- Download usage guides

project info

Browse Assessments

Tell us about your course to find assessments relevant to **you**.

Any Subject | Any Level | Any Setting | Save Course | reset

Assessment Focus

Any

- Content knowledge
- Problem-solving
- Scientific Reasoning
- Lab skills
- Beliefs / Attitudes
- Interactive Teaching

Format

Any

- ☐ Multiple-choice
- ☐ Multiple-response
- ☐ Short answer
- ☐ Pre / Post
- ☐ Agree / Disagree
- ☐ Observational Protocol

Research Validation

Any

- ★ Gold Star Validation
- ☒ Validated Level 2
- ☒ Validated Level 1
- ☒ Research-Based

Content

Force Concept Inventory (FCI)

Mechanics Content Knowledge (Kinematics, Forces)
Introductory College
Multiple-choice, Pre/post
30 minutes

Representational Variant of the Force Concept Inventory (R-FCI)

Mechanics Content Knowledge (Kinematics, Forces)
Introductory College
Multiple-choice, Pre/post
30 minutes

Test of Understanding Graphs in Kinematics (TUG-K)

Mechanics Content Knowledge (Kinematics, Graphing)
Introductory College
Multiple-choice, Pre/post
30 minutes

Beliefs / Attitudes

Colorado Learning Attitudes about Science Survey (CLASS)

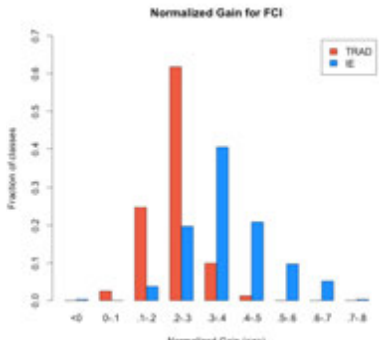
Beliefs / Attitudes

Force Concept Inventory (FCI)

developed by David Hestenes, Malcolm Wells, and Gregg Swackhamer
http://modelinginstruction.org/researchers/evaluation-instruments/

Format	Multiple-choice, Pre/post
Duration	30 minutes
Focus	Mechanics Content Knowledge (Kinematics, Forces)
Level	Introductory

Typical Results



Explore More Results

Examples | **Resources** | **Research** | **Translations** | **Variations**

Example Question 1

A book is at rest on a table top. Which of the following force(s) is(are) acting on the book?

1. A downward force due to gravity
2. The upward force by the table
3. A net downward force due to air pressure
4. A net upward force due to air pressure

(A) 1 only

(B) 1 and 2

(C) 1, 2, and 3

(D) 1, 2, and 4

(E) none of these, since the book is at rest there are no forces acting on it.

Verified educators can download.

Students cannot.

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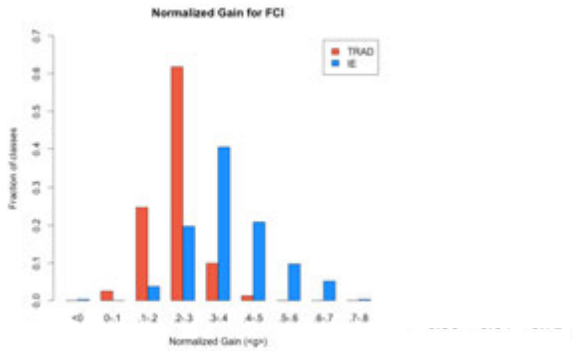
Format Multiple-choice, Pre/post

Duration 30 minutes

Focus Mechanics Content Knowledge (Kinematics, Forces)

Level Introductory

Typical Results



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Related Expert Recomendations

view all >

Best practices for administering concept inventories

Should I use the FCI or the FMCE?

Why use research-based assessment?

Related Assessments

Mechanics Baseline Test (MBT)

Force and Motion Conceptual Evaluation (FMCE

Related Teaching Methods

view all >

Modeling Instruction
Instruction organized around active student construction of conceptual and mathematical models in an interactive learning community

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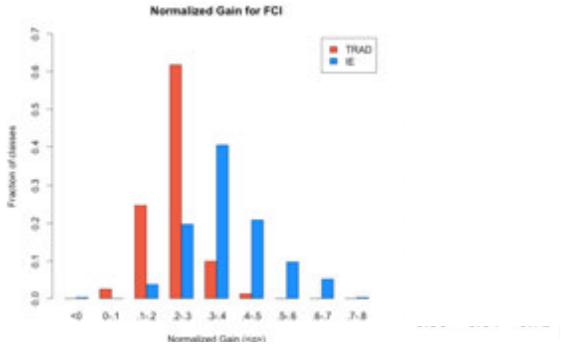

Explore More Results

Examples | Resources | Research | Translations | Variations

FCI Implementation and Troubleshooting Guide

This guide covers all the information teachers would need to **implement** this assessment in their course. It also includes **troubleshooting** information and links to **additional resources**.

Related Expert Recomendations

view all >

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PhysPort beta
Supporting physics teaching with research-based resources

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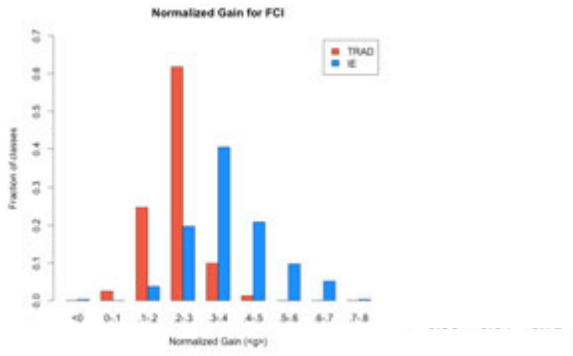


Explore More Results

Examples | Resources | Research | Translations | Variations

RESEARCH VALIDATION **Gold Star Validation**
This is the highest level of research validation.
This indicates that the assessment instrument has been thoroughly validated and researched.

RESEARCH VALIDATION SUMMARY

Based on Research Into:
- ☑ Student thinking

Studied Using:
- ☑ Student interviews
- ☑ Expert review
- Statistical analysis

Research Conducted
- ☑ At multiple institutions
- ☑ By multiple research groups

Related Expert Recomendations — view all >

Best practices for administering concept inventories

Should I use the FCI or the FMCE?

Why use research-based assessment?

Related Assessments

Mechanics Baseline Test (MBT)

Force and Motion Conceptual Evaluation (FMCE

Related Teaching Methods — view all >

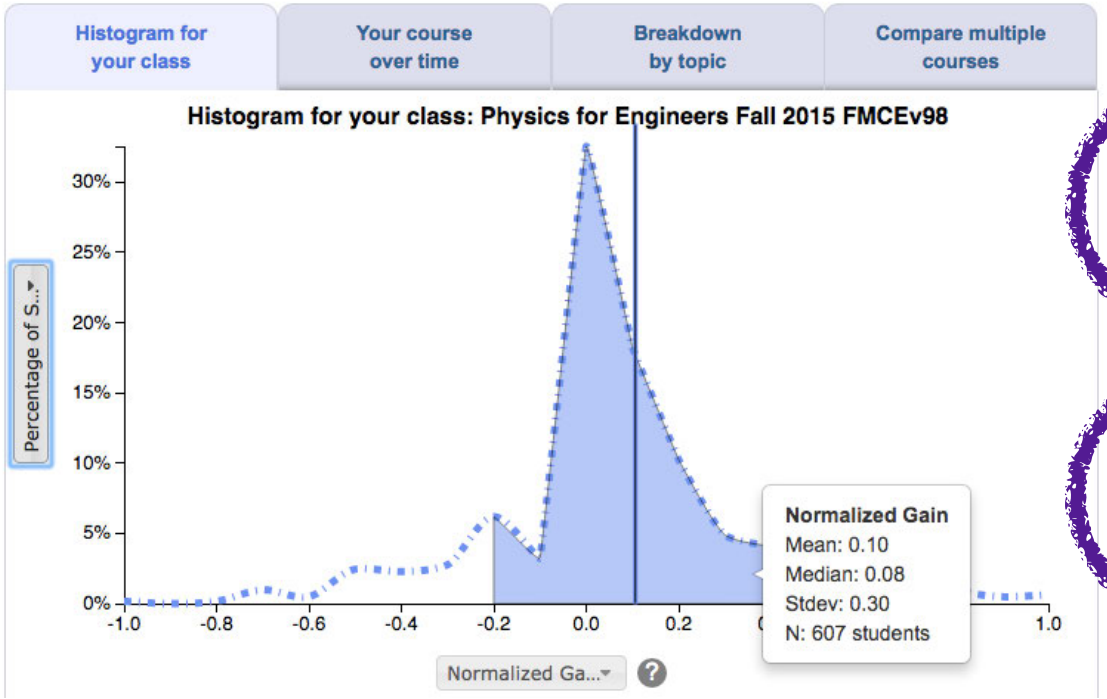
Modeling Instruction
Instruction organized around active student construction of conceptual and mathematical models in an interactive learning community

and even guides to running your own workshop

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

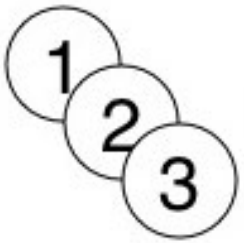
Data Explorer

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

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.



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

Data Explorer

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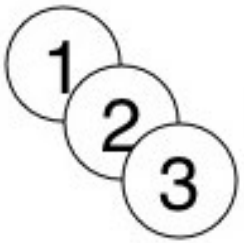

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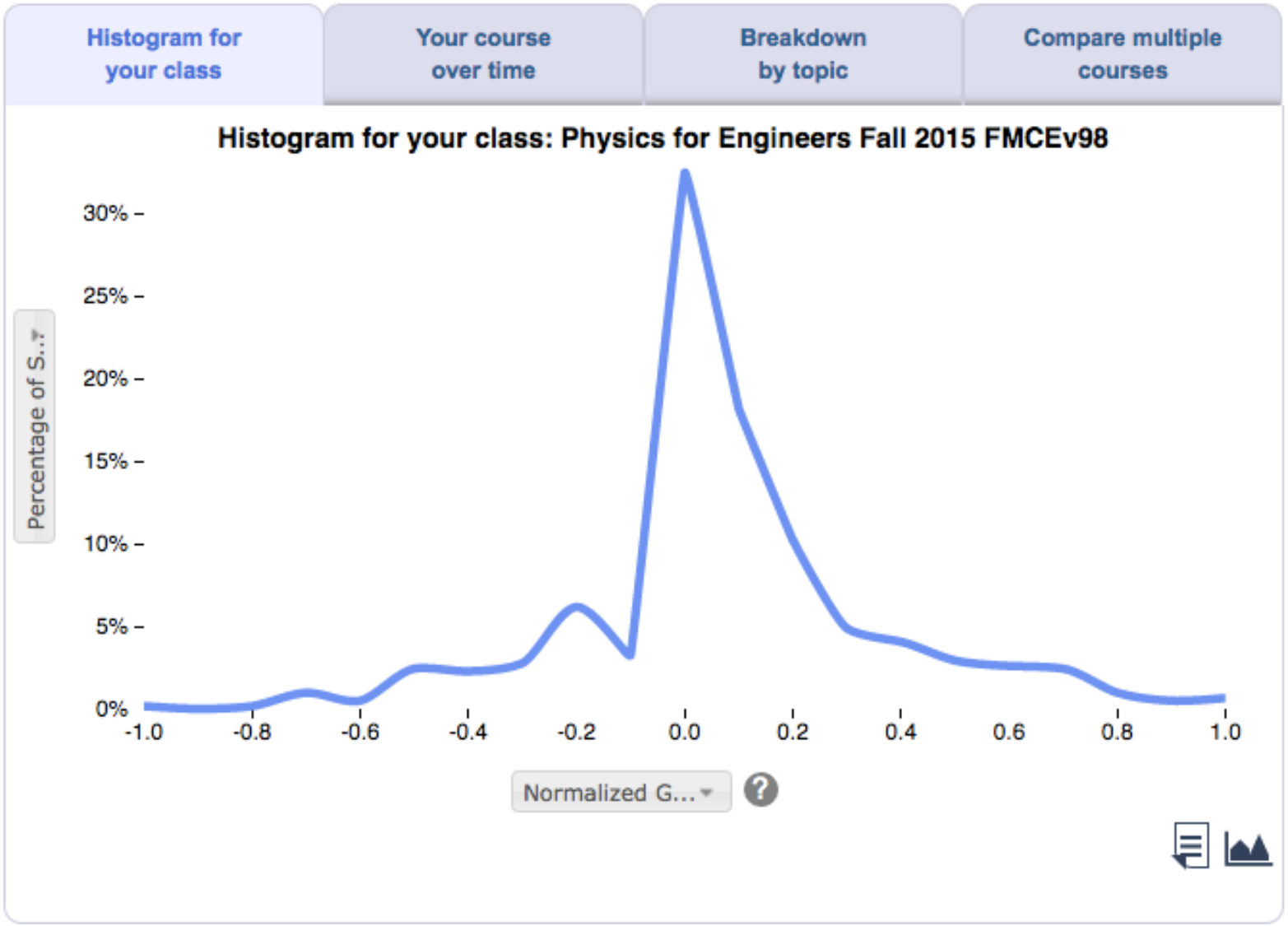
Powerful

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



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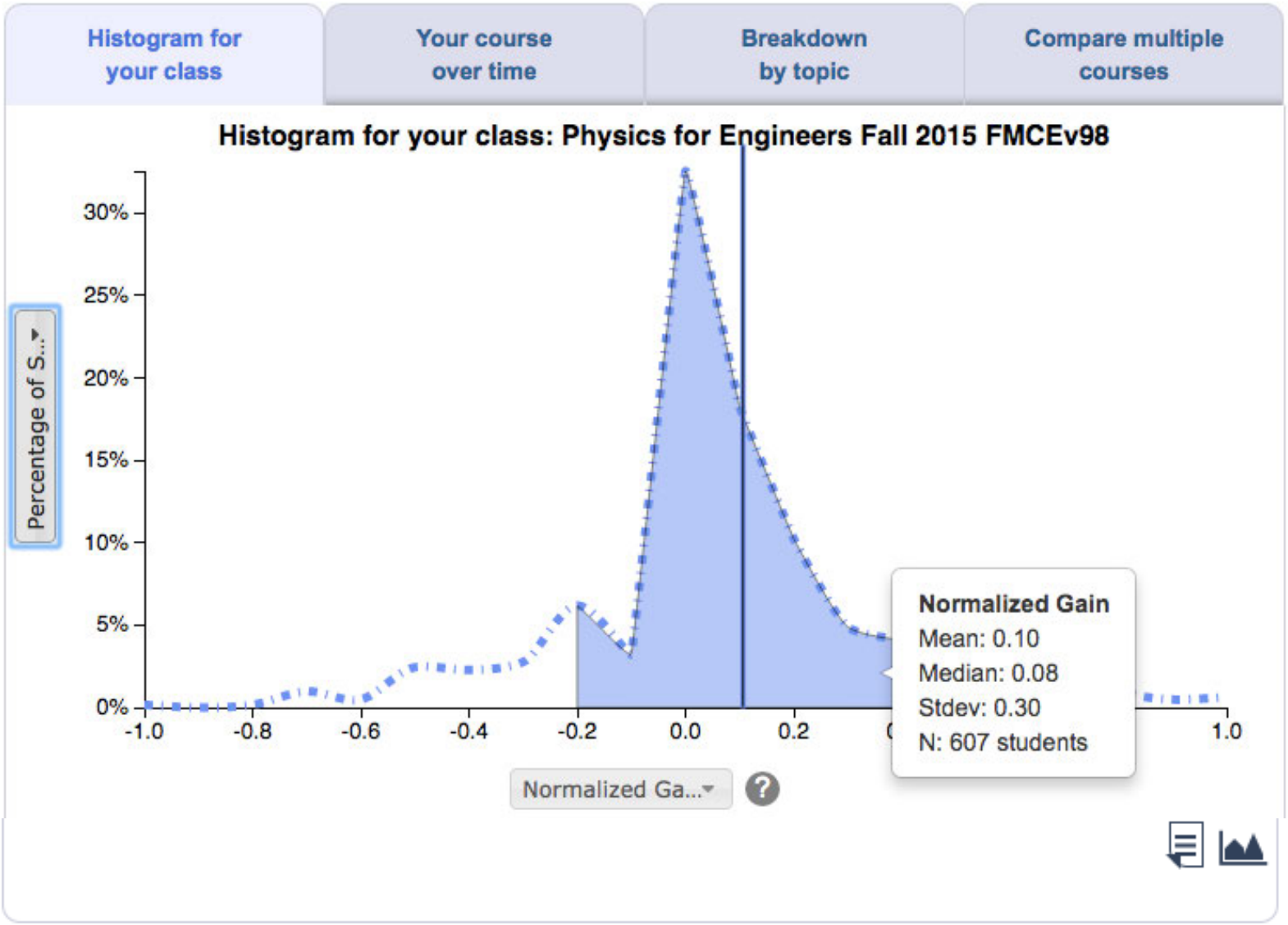

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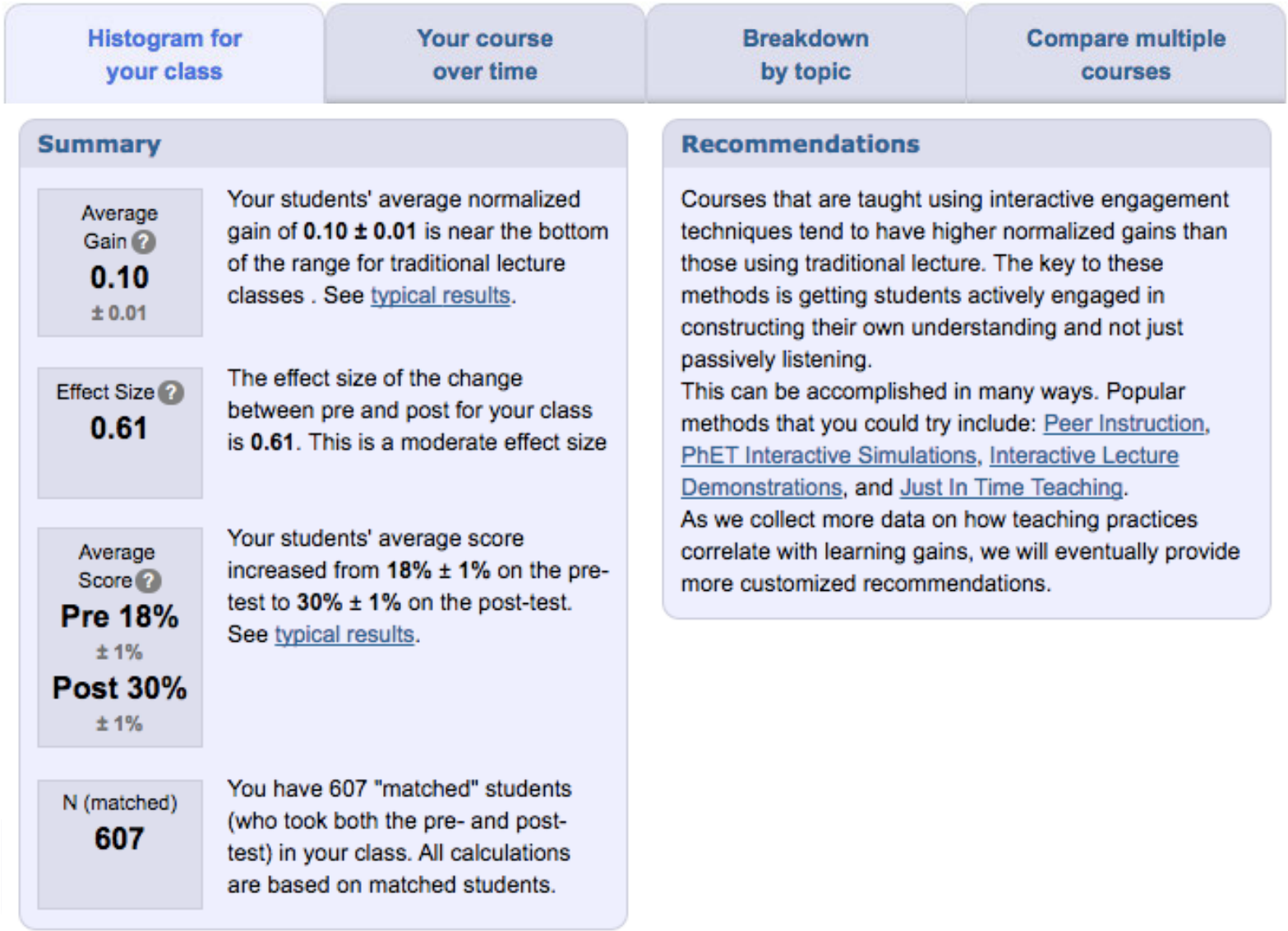

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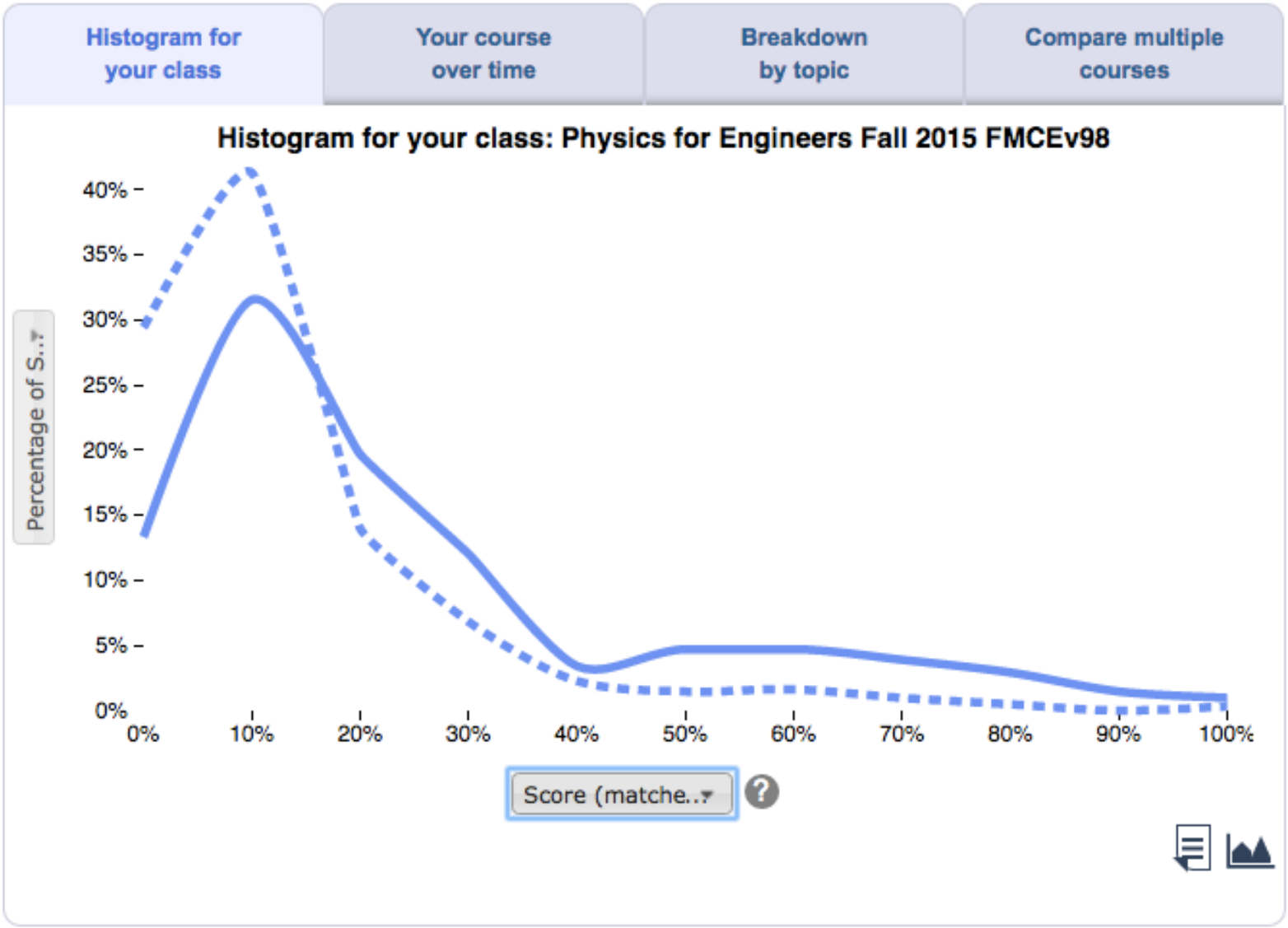

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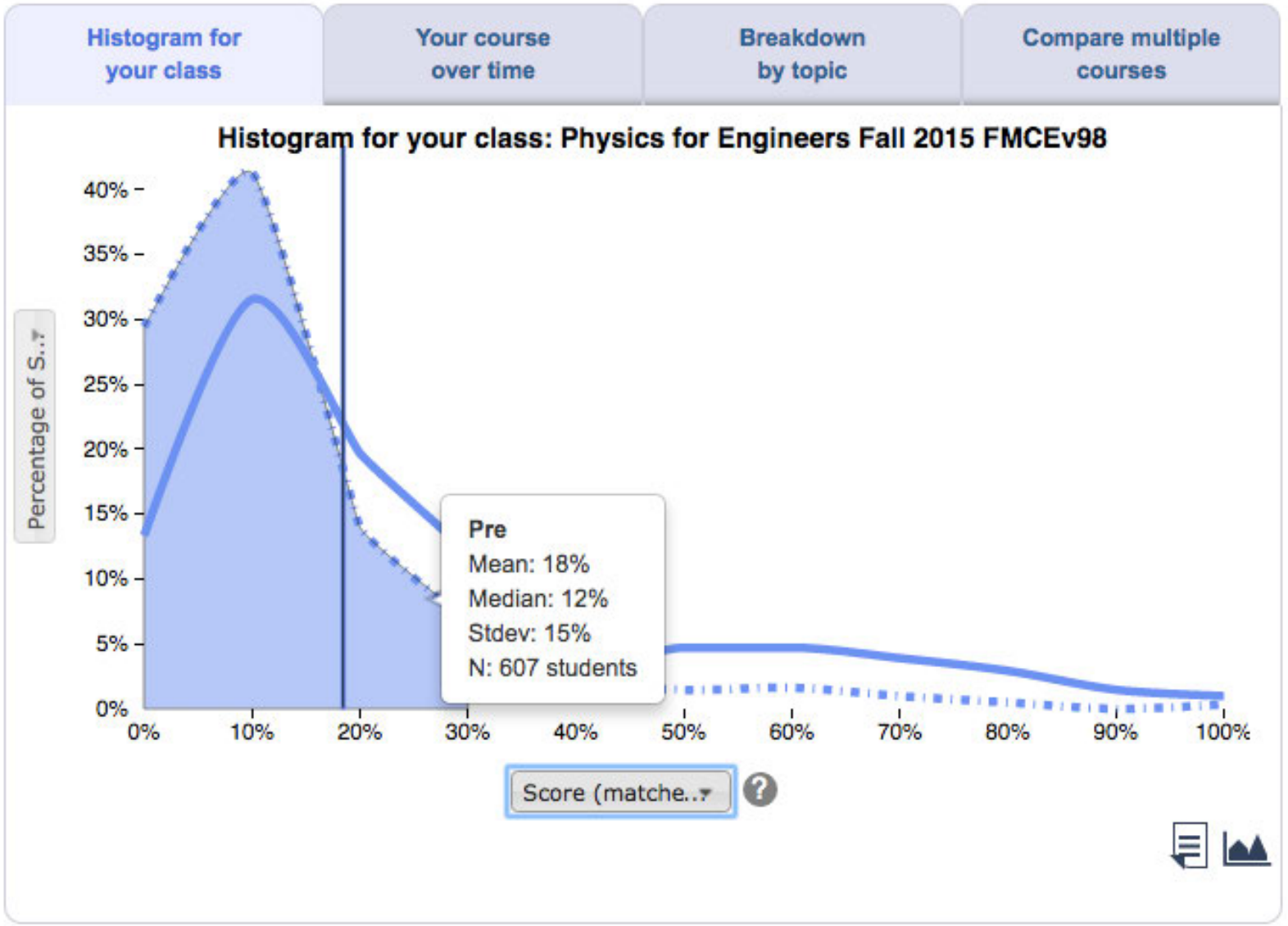

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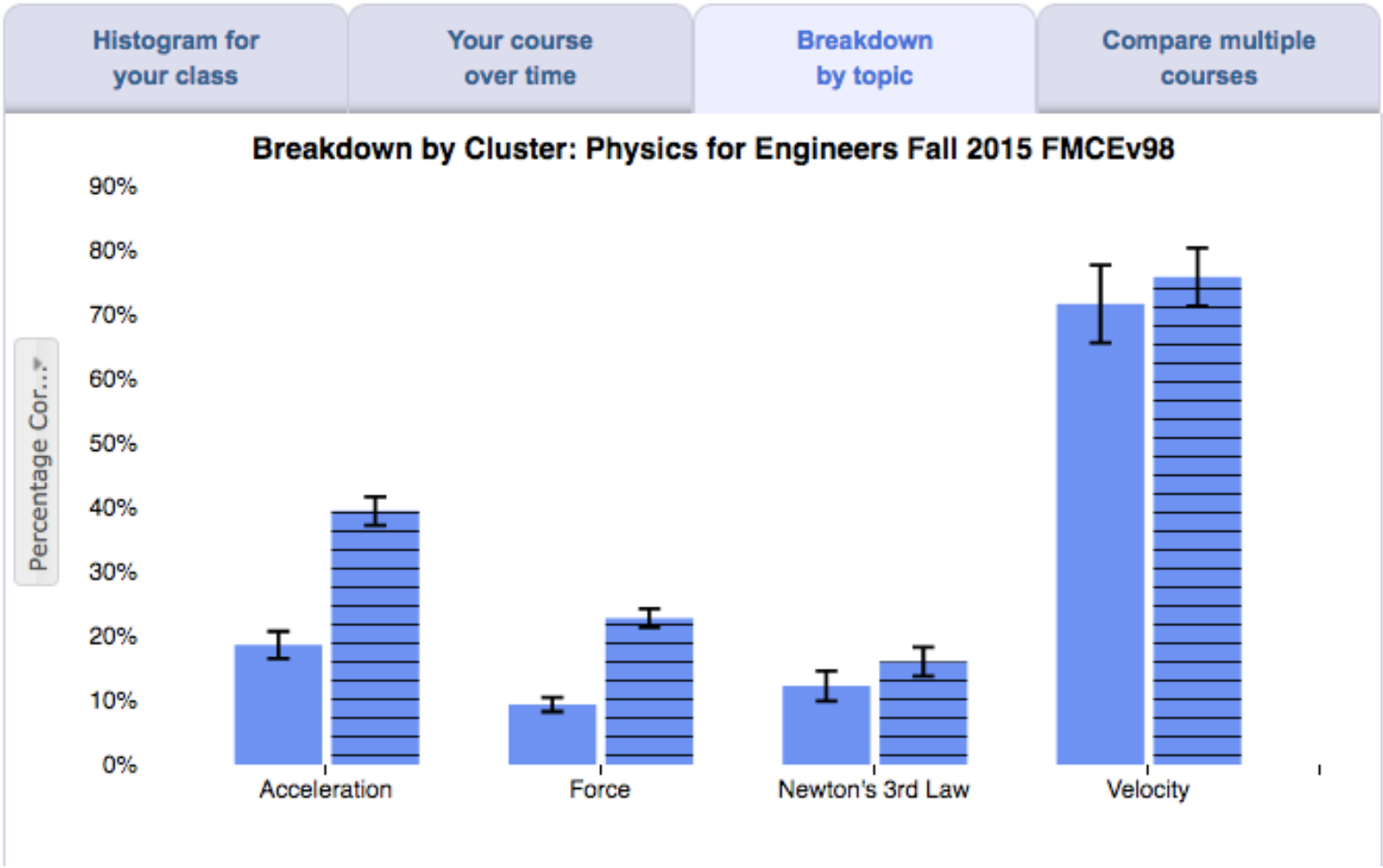

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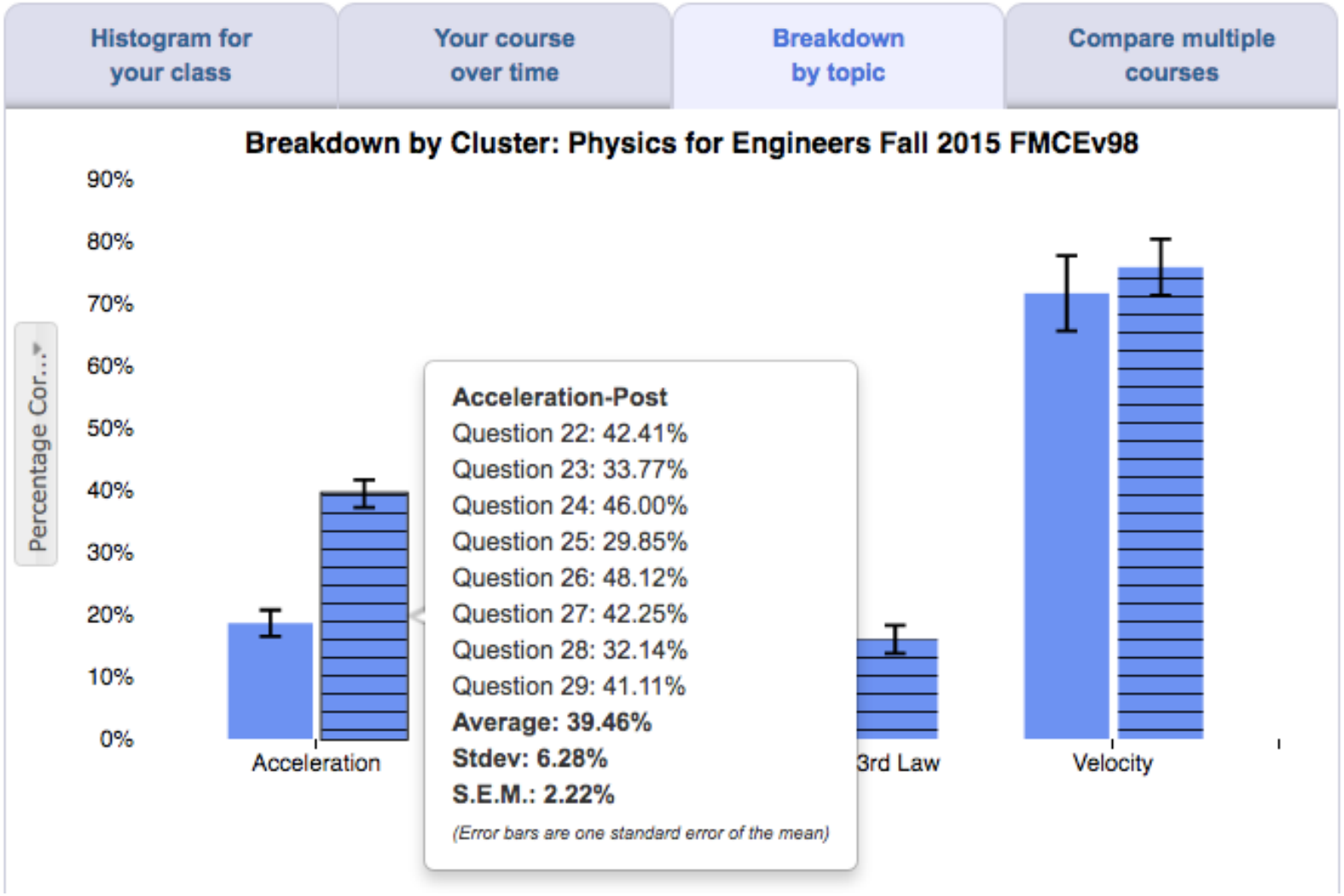

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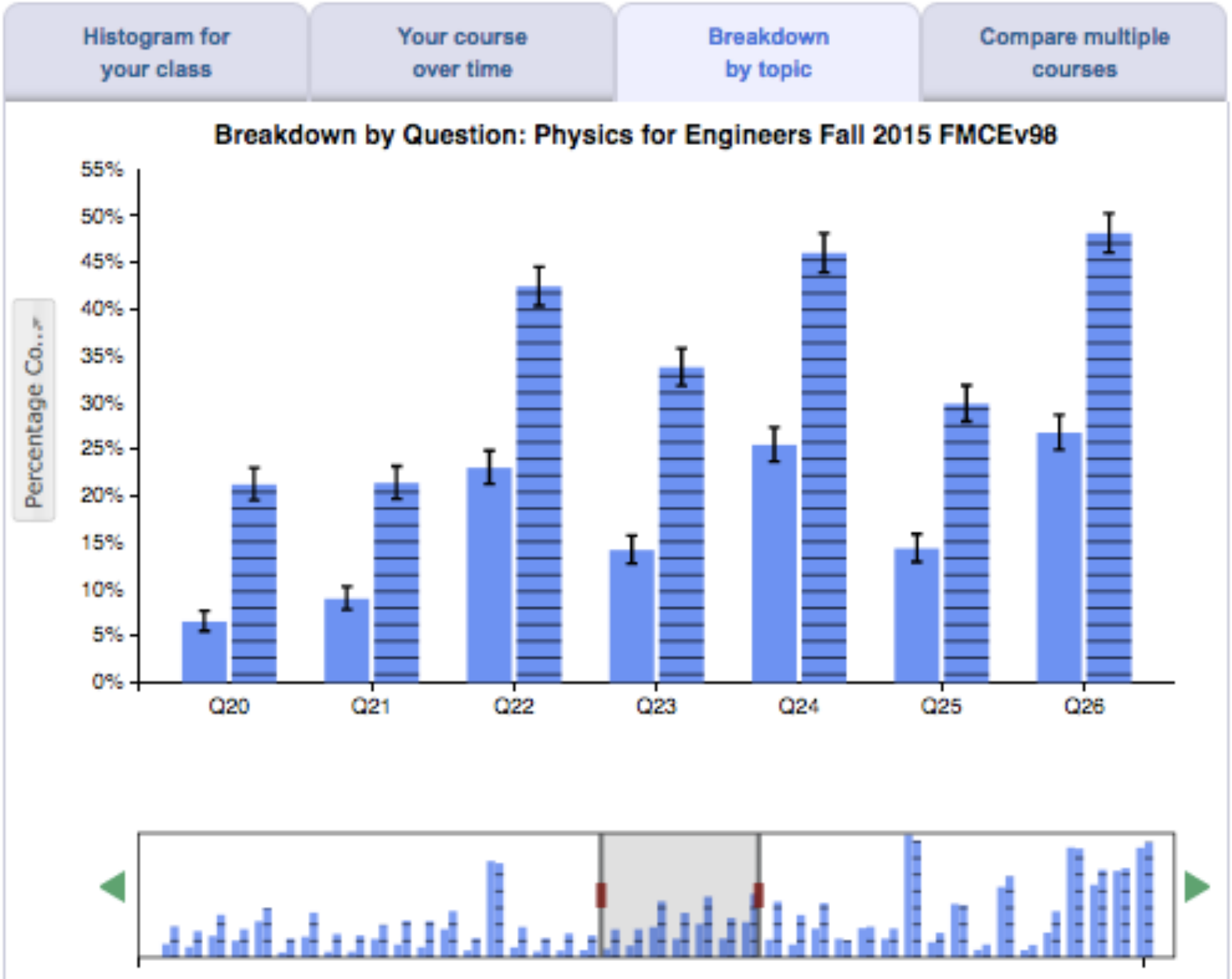

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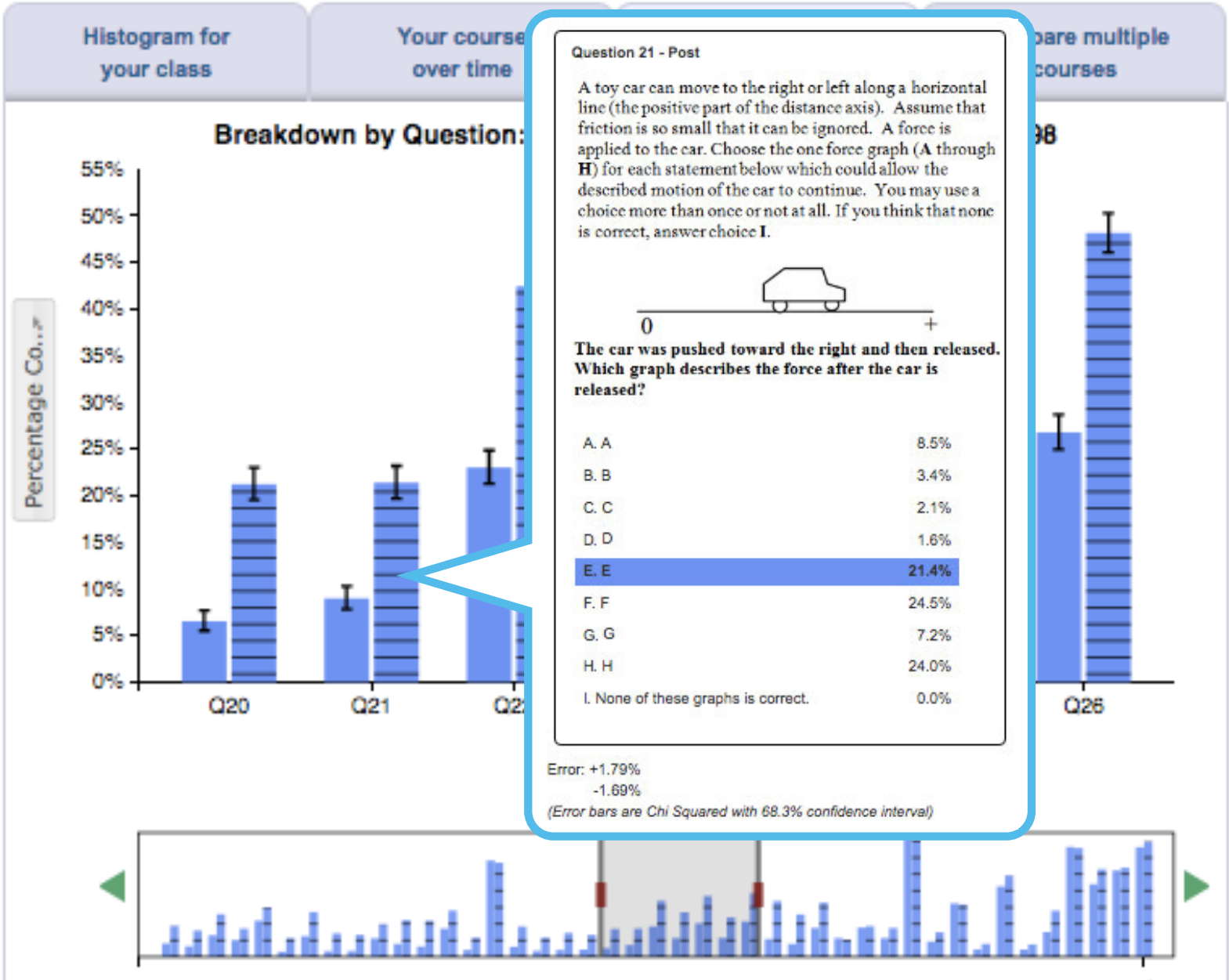

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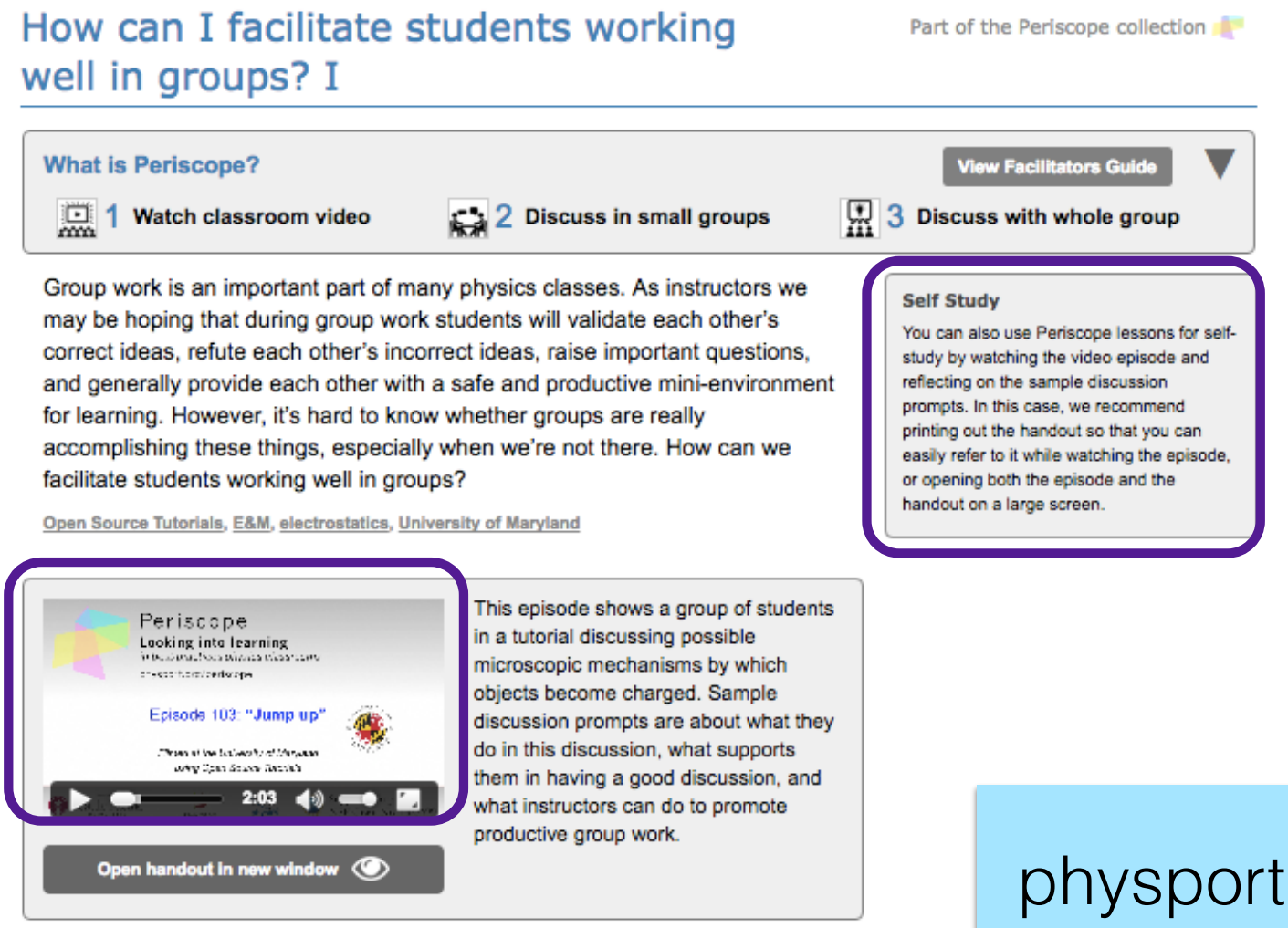
Videos of students working with handouts for training TAs and faculty in best-practices.



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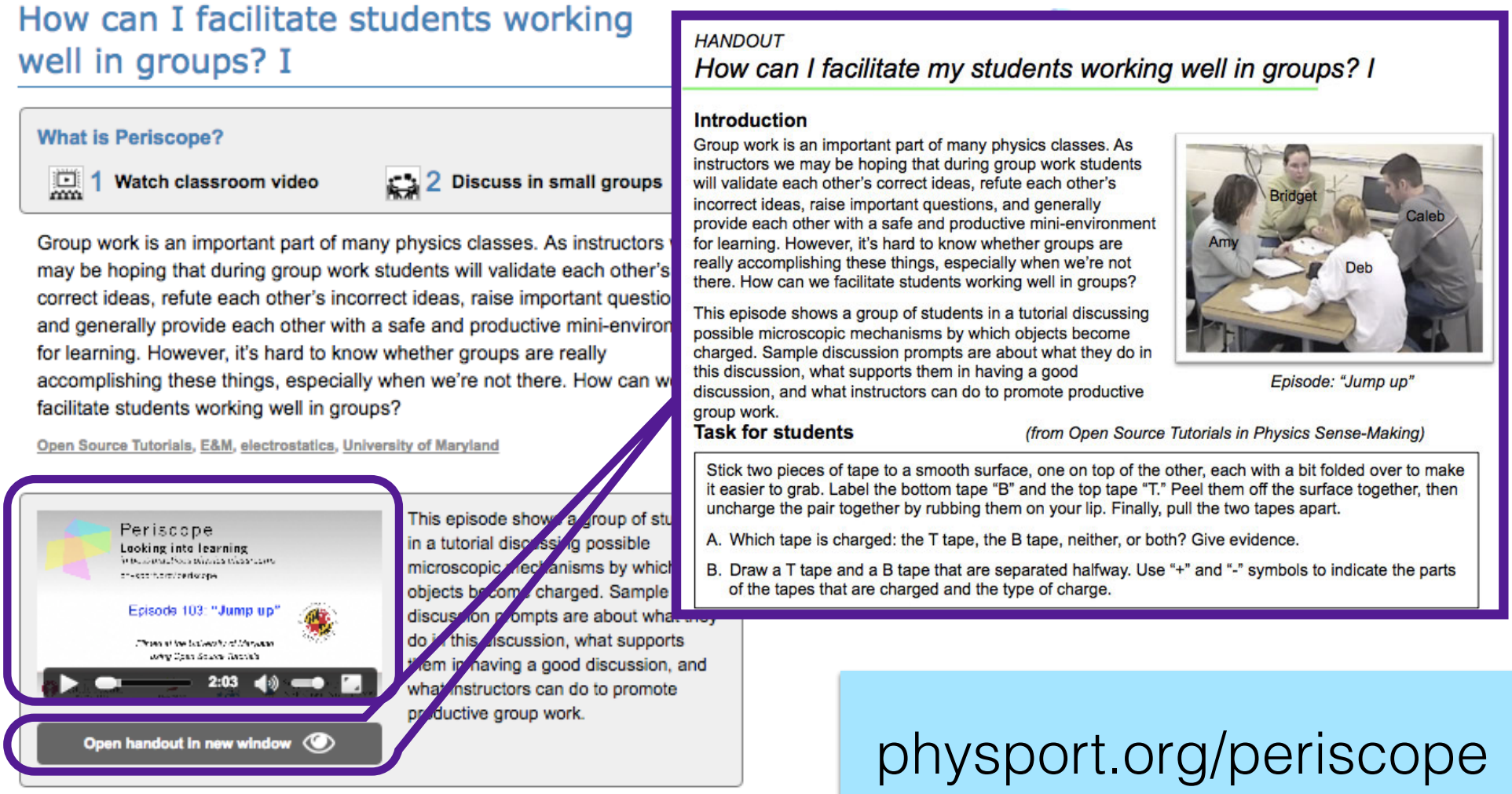
Periscope

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



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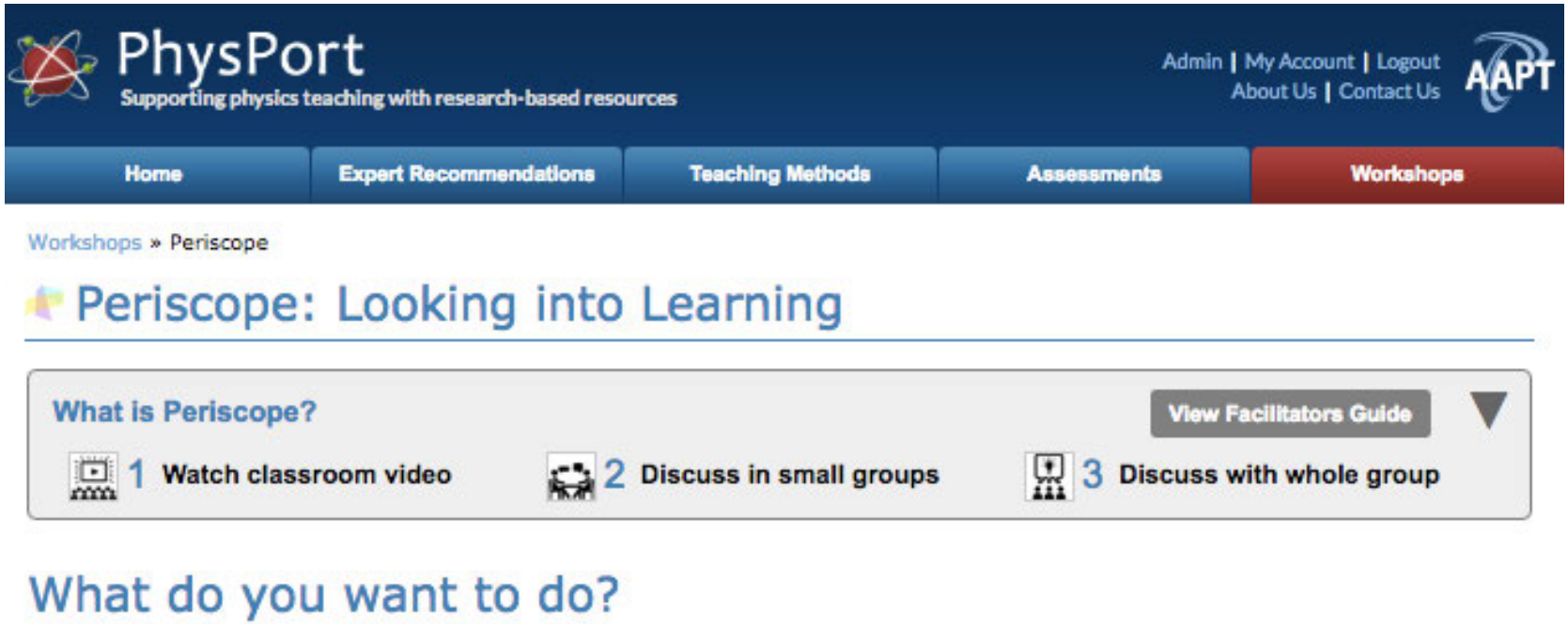
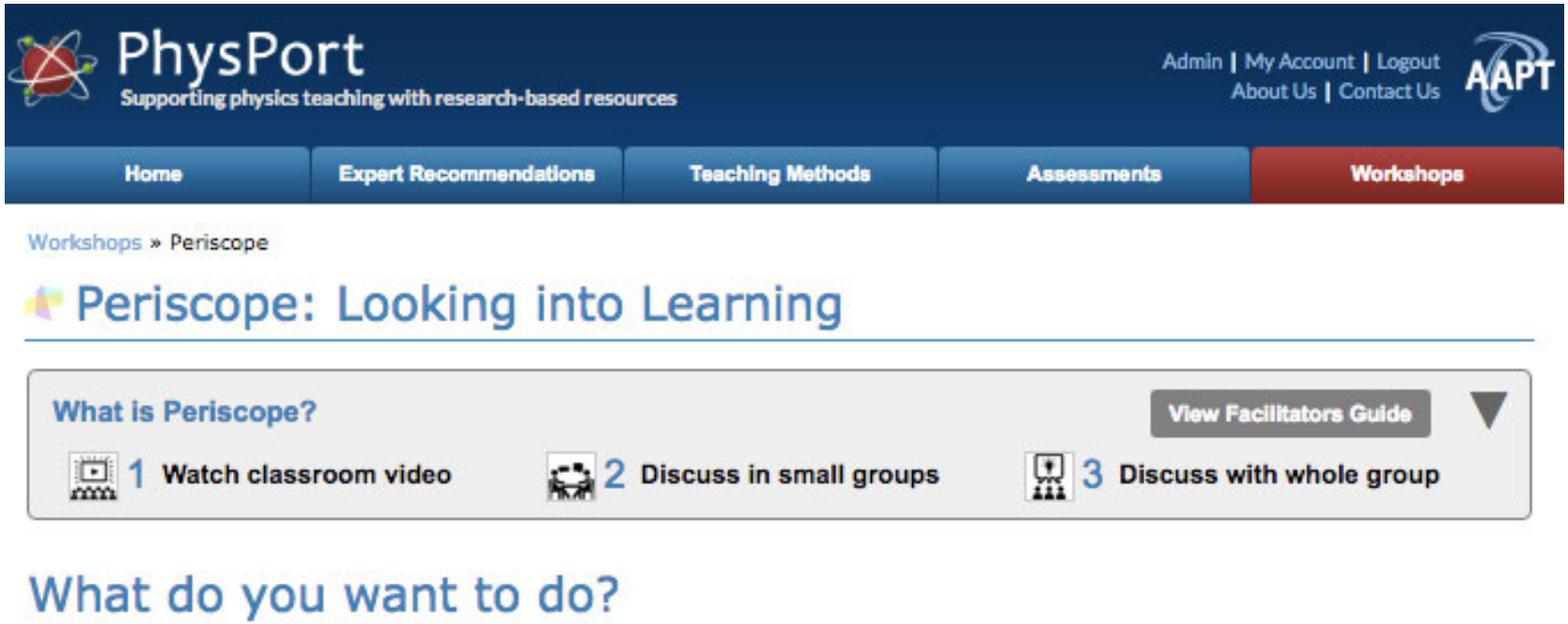


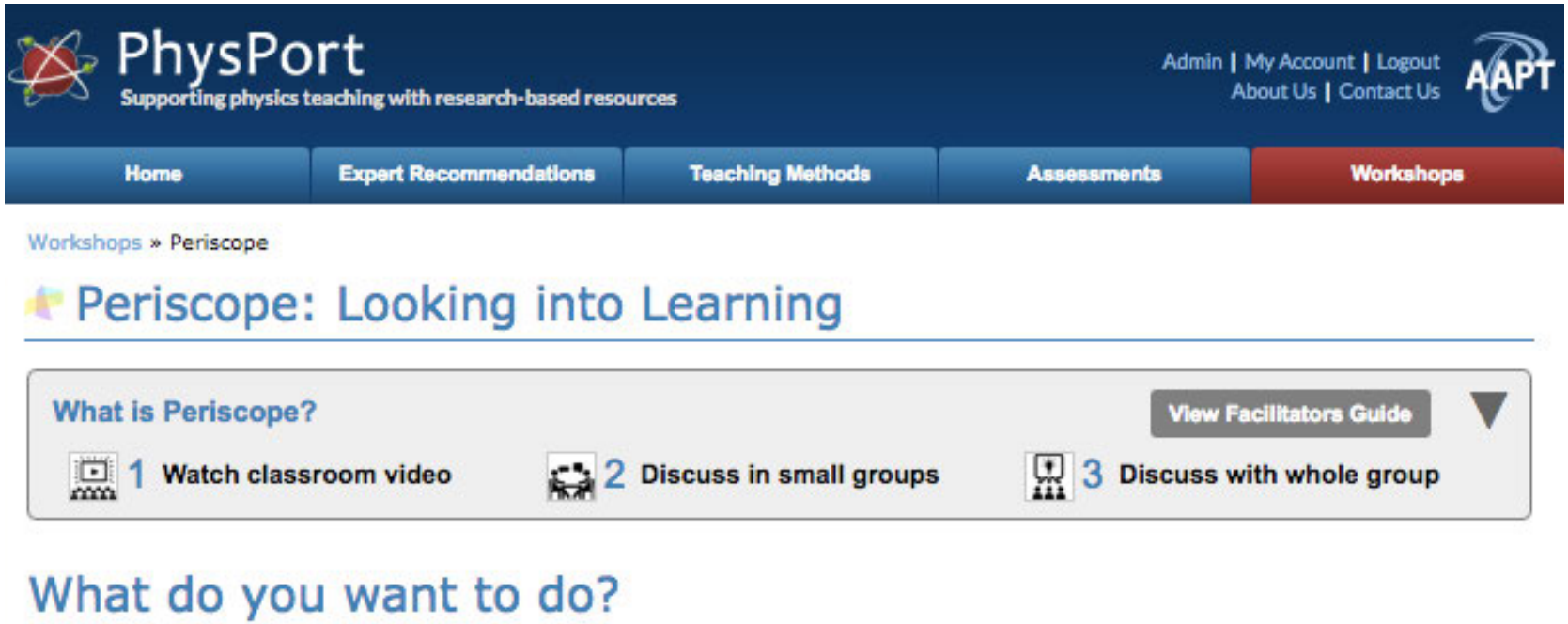
- I want to....
  - lead a weekly TA/LA seminar
  - lead a half-day TA/LA workshop
  - teach TAs/LAs what ideas students have about a particular physics topic
  - teach TAs/LAs about a particular instructional method

Periscope



- I want to....
- I want to....
  - prepare colleagues to use best practices
  - prepare colleagues to design learning environments
  - prepare colleagues to train TAs/LAs

Periscope



- I want to....
- I want to....
- I want to....
  - support underrepresented groups
  - improve my own teaching

Guided suites of lessons by topic

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Supporting physics teaching with research-based resources

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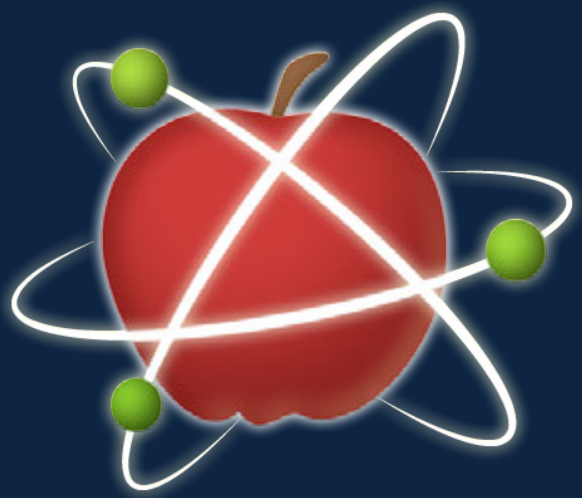
Resources

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



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