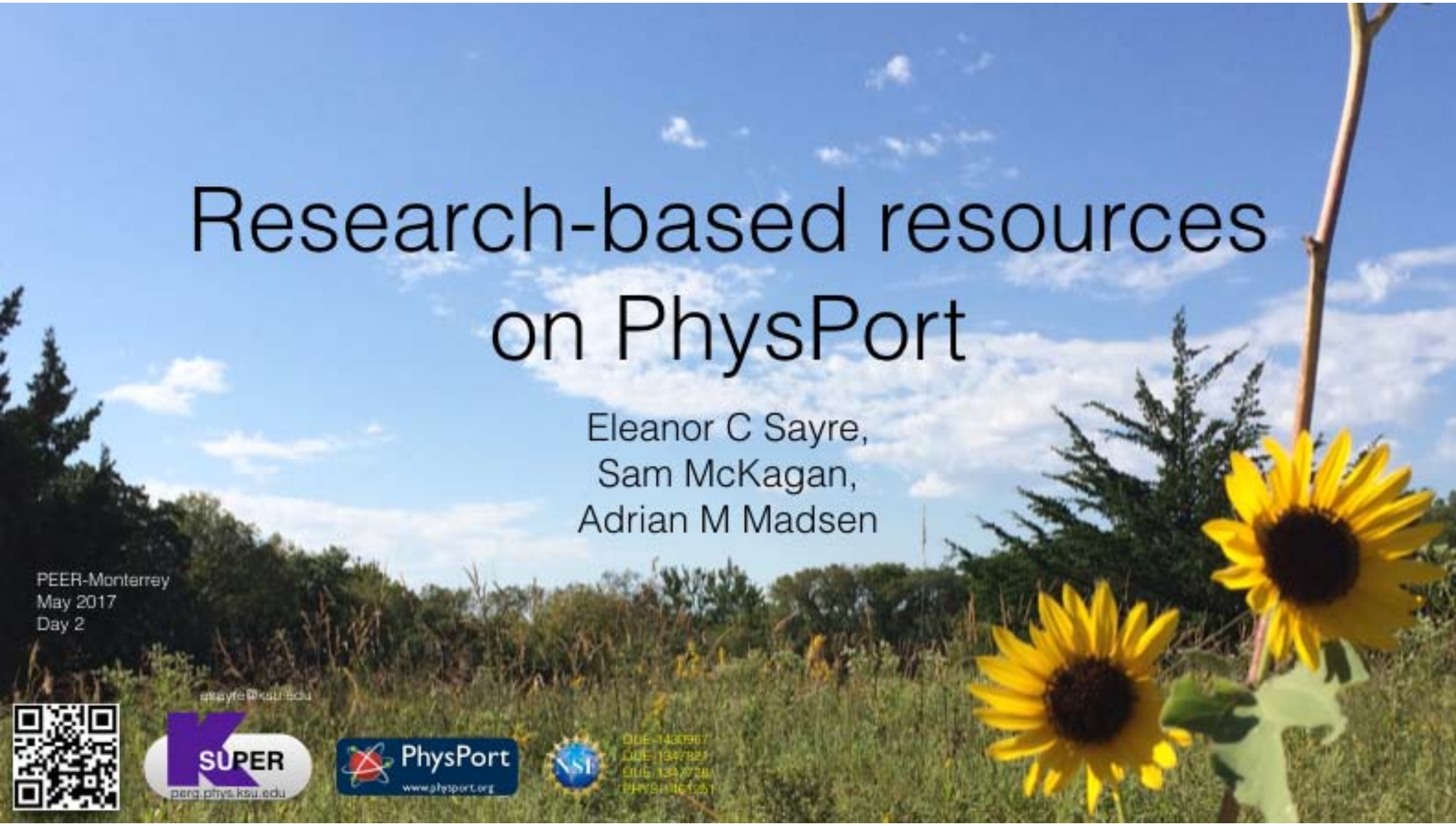

Research-based resources
on PhysPort
Eleanor C Sayre,
Sam McKagan,
Adrian M Madsen
PEER-Monterrey
May 2017
Day 2
esayre@ksu.edu
SUPER
perg.phys.ksu.edu
PhysPort
www.physport.org

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?

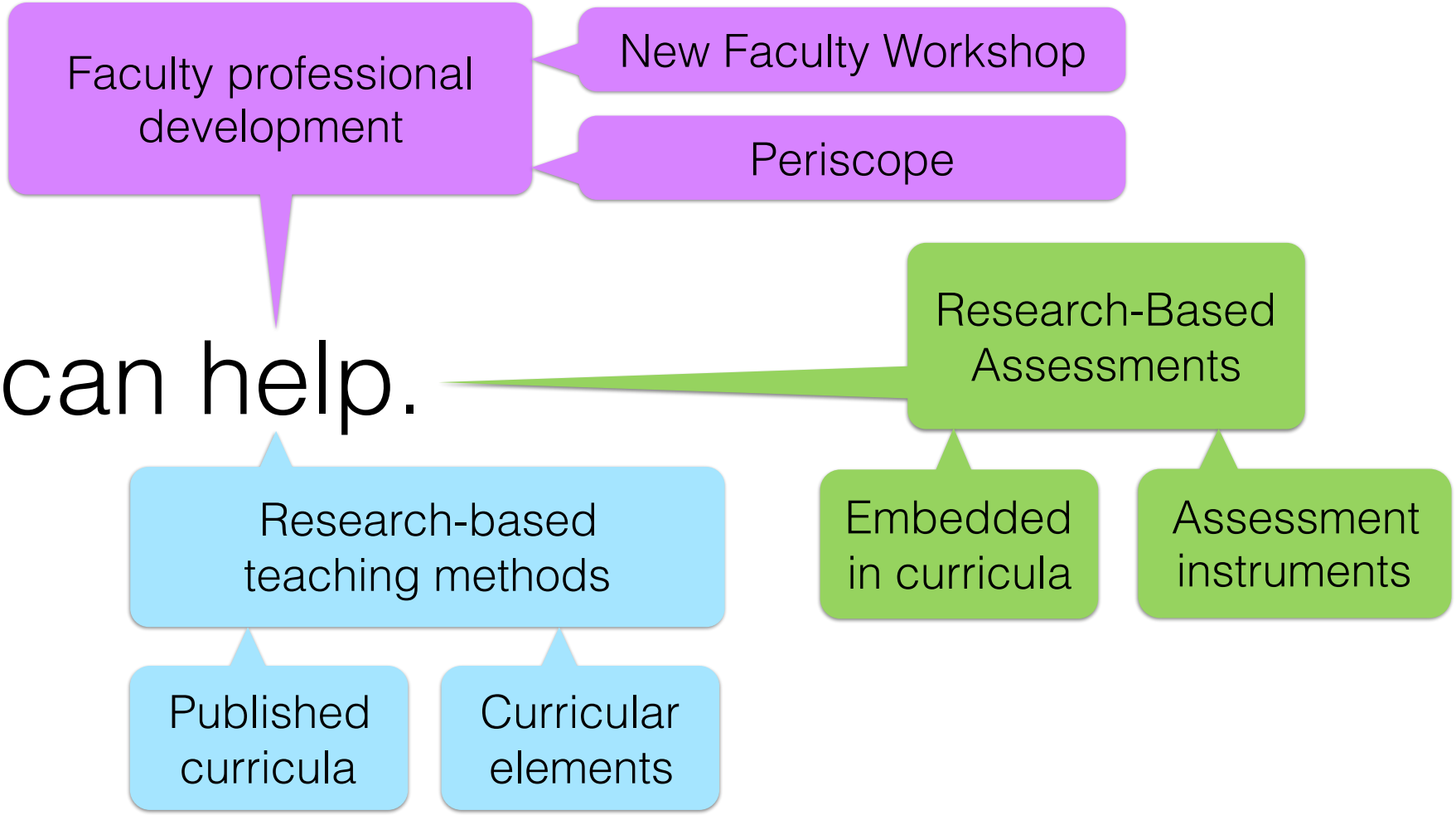
Assessment is a gateway drug

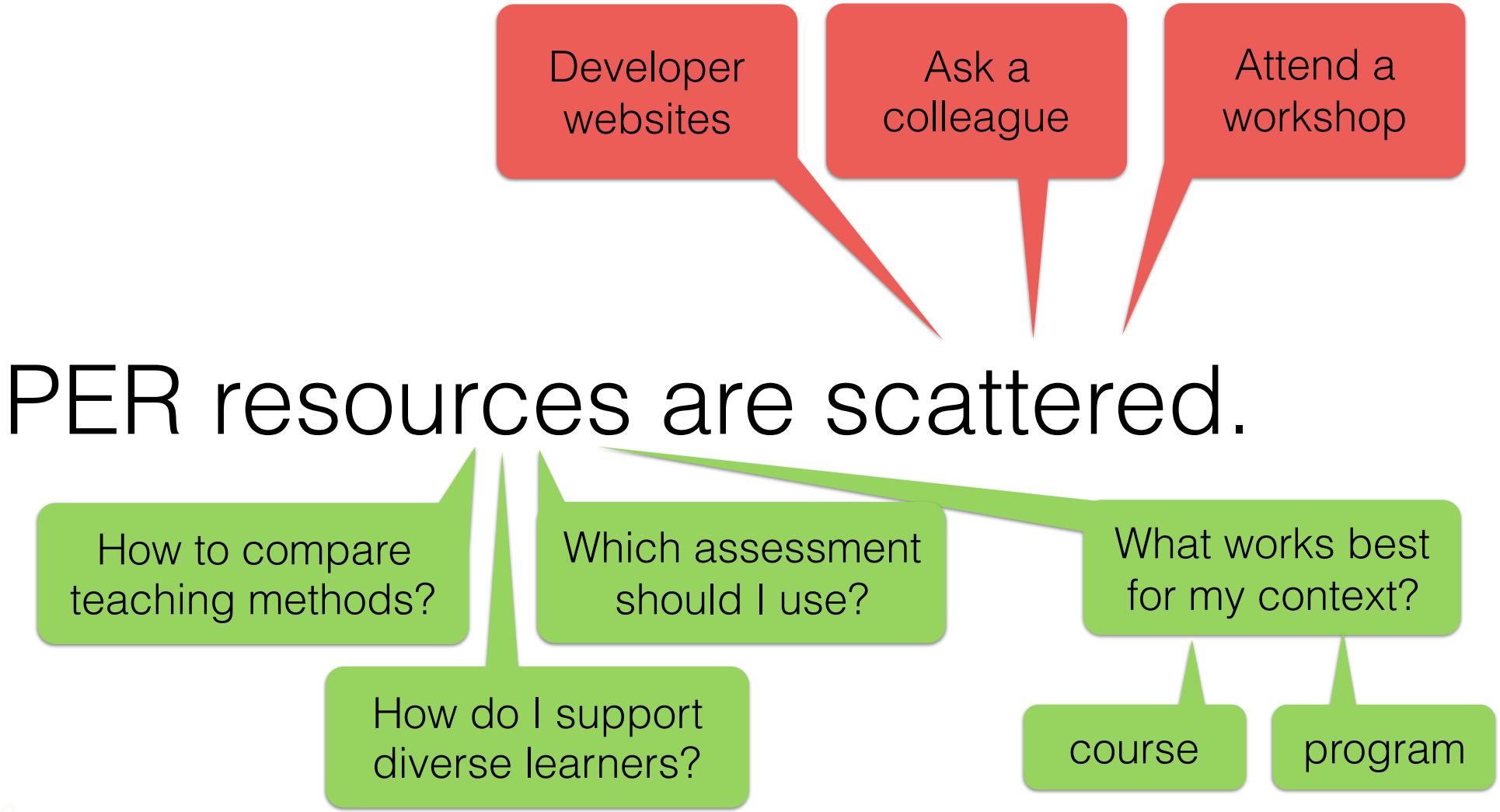
Good teaching and assessment are important.

How to teach better?

How to help students learn more?

PER can help.


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



PhysPort.org Eleanor Sayre, esayre@ksu.edu

PhysPort can help.

Supporting physics teaching with research-based resources

Finding information and advice

Changing teaching practices

Faculty-centered online resources

Synthesis research

Eleanor Sayre, esayre@ksu.edu

Interpret the results of diverse PER studies

Weighted combination of data from published studies

More robust than single study

Vulnerable to publishing bias

Synthesis research

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

Force Concept Inventory

30 Questions

A stone dropped from the roof of a single story building to the surface of the earth:

(A) reaches a maximum speed quite soon after release and then falls at a constant speed thereafter.

(B) speeds up as it falls because the gravitational attraction gets considerably stronger as the stone gets closer to the earth.

(C) speeds up because of an almost constant force of gravity acting upon it.

(D) falls because of the natural tendency of all objects to rest on the surface of the earth.

(E) falls because of the combined effects of the force of gravity pushing it downward and the force of the air pushing it downward.

Force Concept Inventory

RESEARCH VALIDATION SUMMARY

Based on Research Into:

- ☑ **Student thinking**

Studied Using:

- ☑ **Student interviews**
- ☑ **Expert review**
- ☑ **Appropriate statistical analysis**

Research Conducted:

- ☑ **At multiple institutions**
- ☑ **By multiple research groups**
- ☑ **Peer-reviewed publication**

About half of the questions on the FCI come from an earlier test called the Mechanics Diagnostic Test (MDT). Questions on the MDT were developed using students ideas from open-ended responses. These questions were then reviewed by experts, refined through student interviews and given to over 1000 students. Statistical analysis of the reliability of the MDT was conducted and the pre- and post-test were found to be highly reliable. For those FCI questions not taken directly from the MDT, open-ended responses and responses given by students in interviews were compared to ensure the questions were being interpreted correctly. Since its release, over 50 studies have been published using the FCI at both the high school and college level at over 70 institutions and including data on over 35,000 students. Most notable is the study by Hake (1998) comparing FCI scores based on instructional method for over 6500 students.

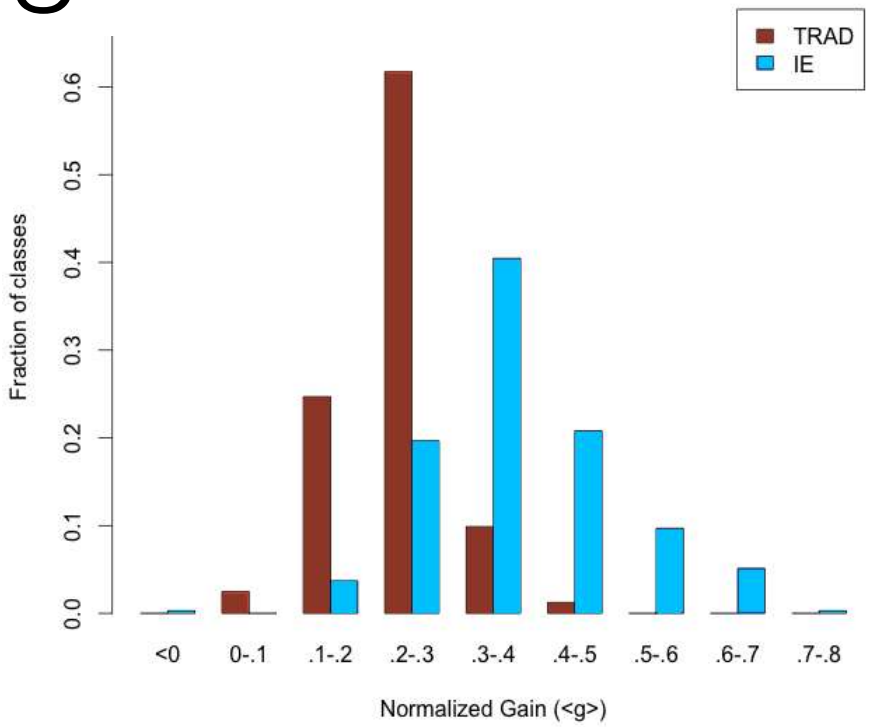
Available on PhysPort!

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

Von Korff, J., *et al* (2016). Secondary Analysis of Teaching Methods in Introductory Physics : a 50k - Student Study. American Journal of Physics

Mechanics teaching

active learning
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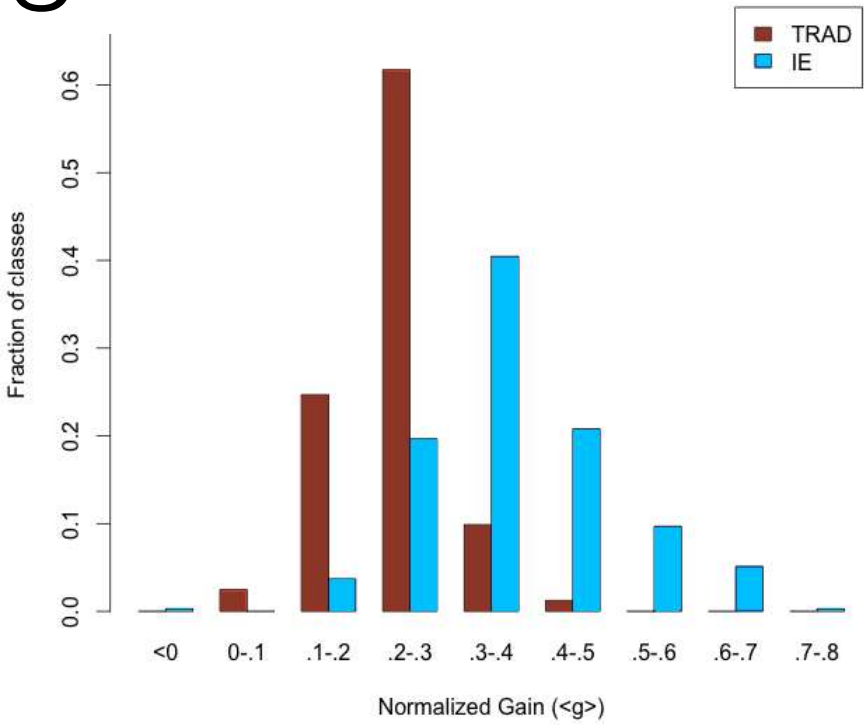
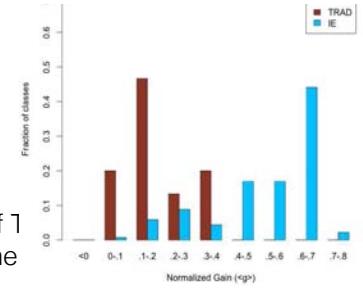
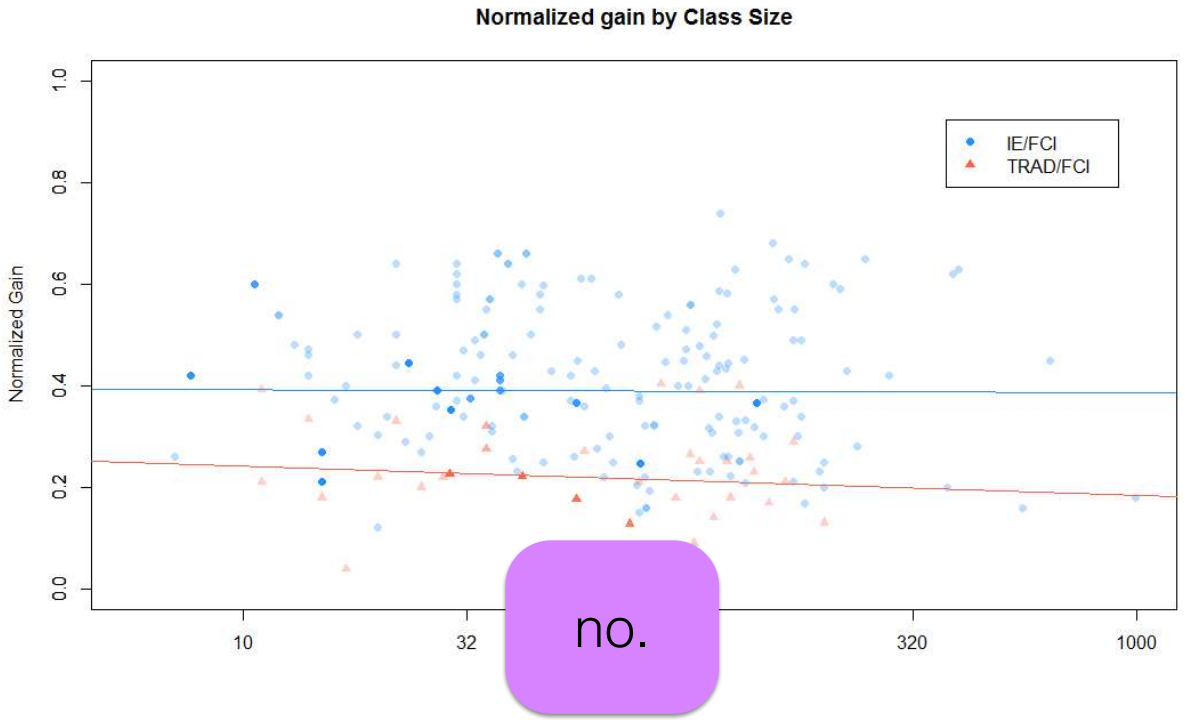




Von Korff, J., *et al* (2016). Secondary Analysis of T
Introductory Physics : a 50k - Student Study. Ame

Does class size matter?

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



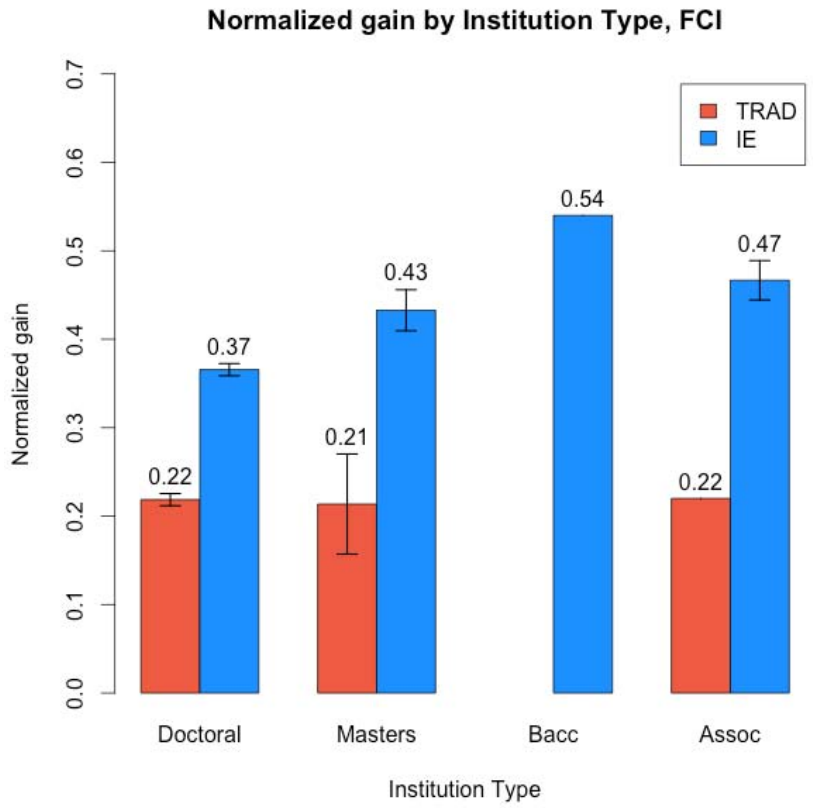
Von Korff, J., *et al* (2016). Secondary Analysis of Teaching Methods in Introductory Physics : a 50k - Student Study. American Journal of Physics

Does institution type matter?

- Reduced Carnegie classification
- Only US schools

no.

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



Von Korff, J., *et al* (2016). 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

12 beliefs and attitudes surveys available on PhysPort!

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.

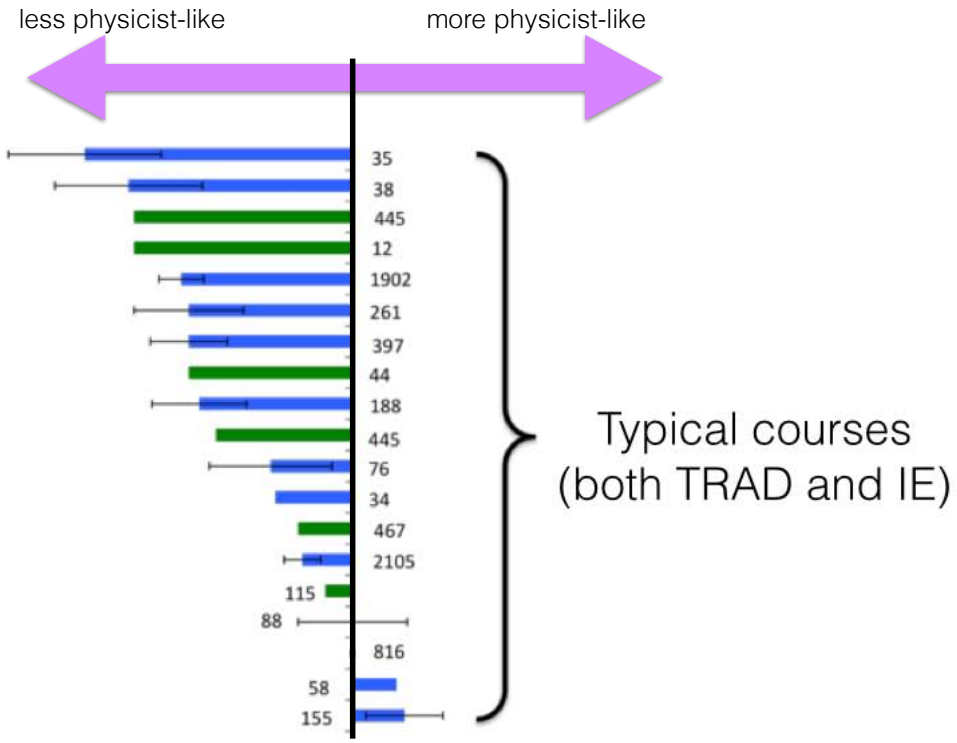
Strongly Disagree	1	2	3	4	5	Strongly Agree

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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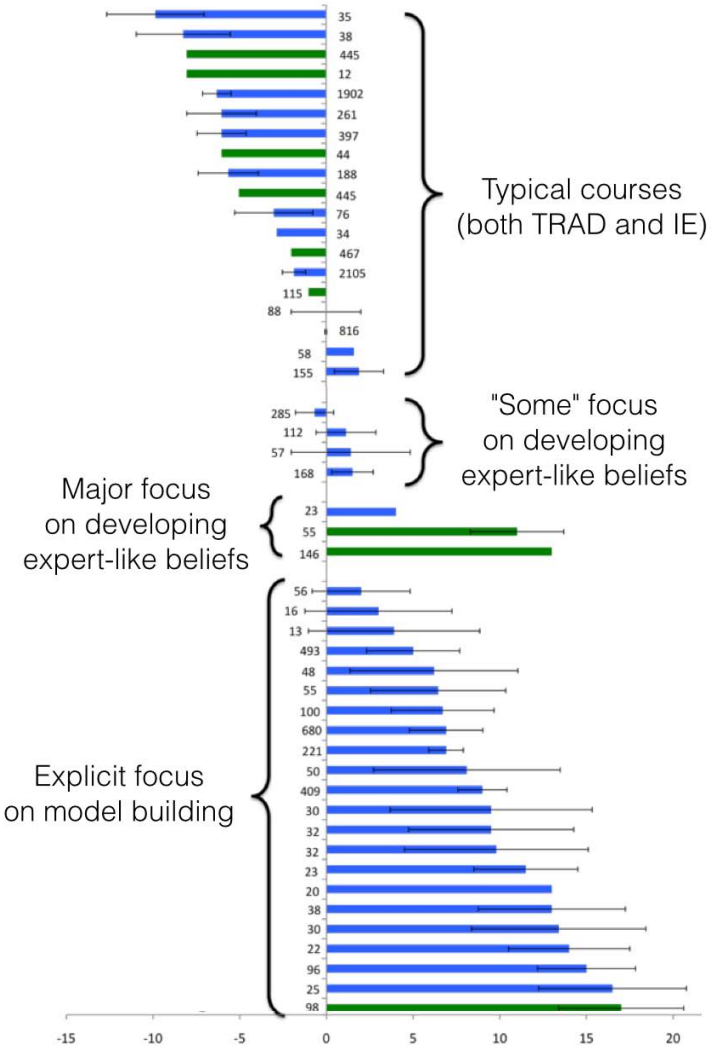
Student Beliefs

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

"Ordinary" IE is not enough.

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



Madsen, A. M., McKagan, S. B., & Sayre, E. C. (2015). How Physics Instruction impacts students' beliefs about learning physics. *Physical Review Special Topics — Physics Education Research*.

Gender gaps in learning physics

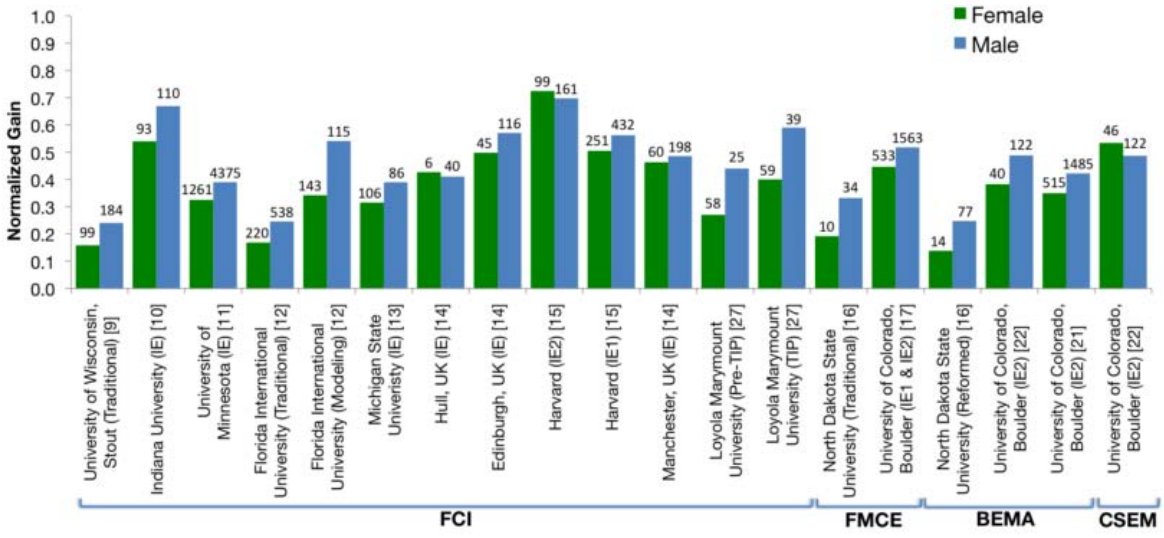
Men outperform women on RBAs

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.

Bias can be subtle. Need process measures.



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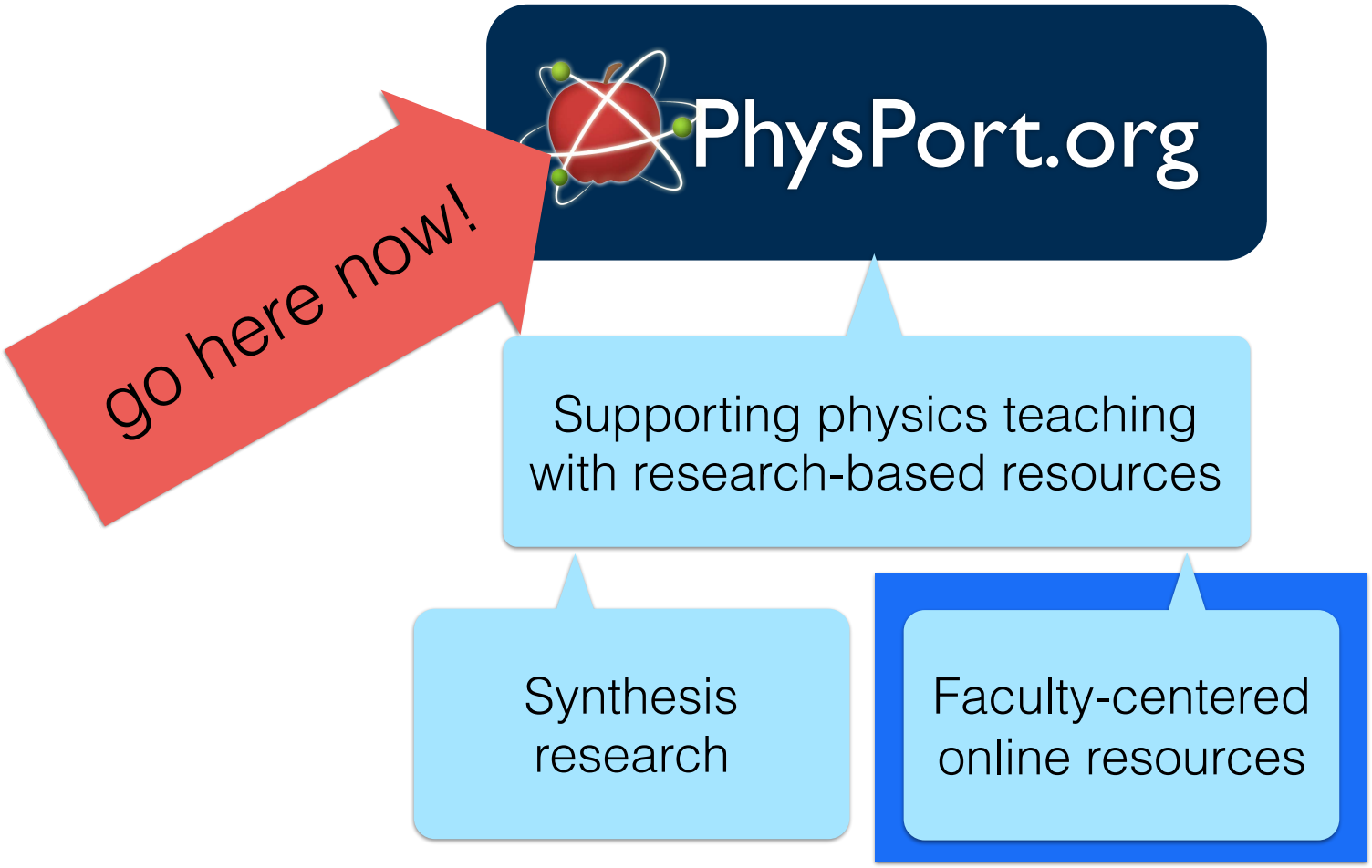
PhysPort.org Eleanor Sayre, esayre@ksu.edu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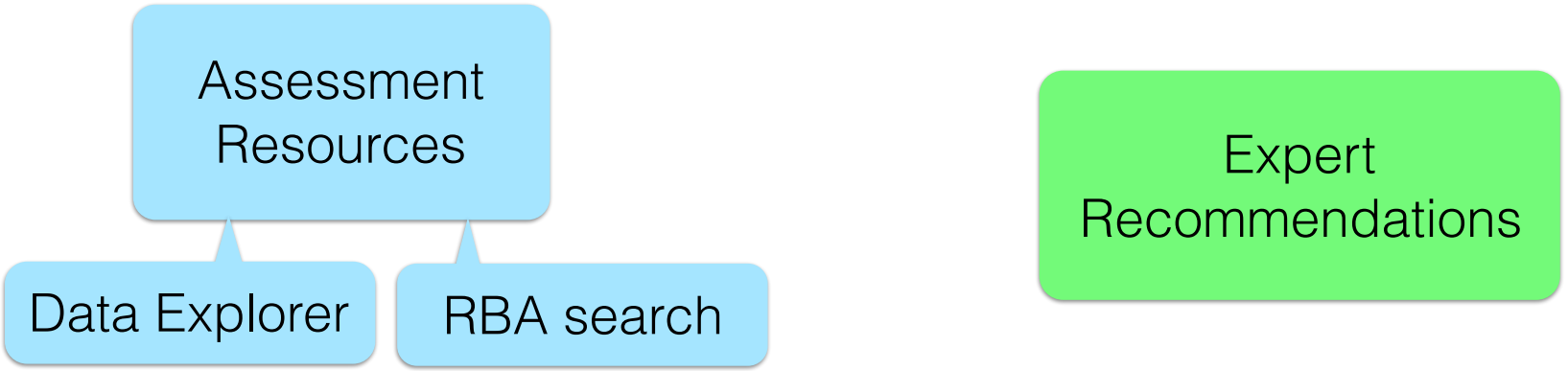
Supporting physics teaching with research-based resources
Synthesis research
Faculty-centered online resources

Faculty-centered online resources



Research and development process

27 faculty & chairs

50 LA video project users

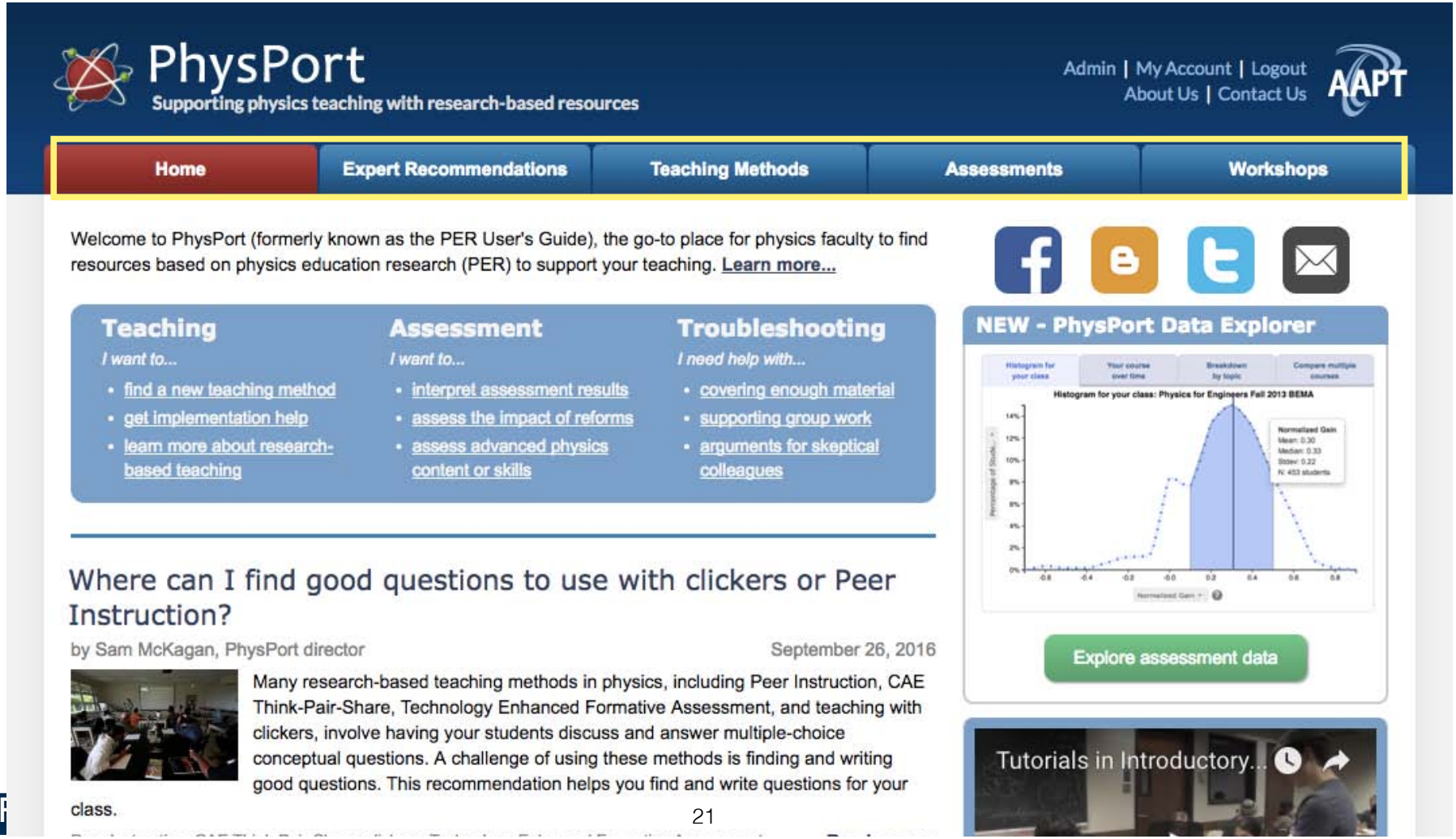
Faculty have practical needs.

Faculty want guidance.

Faculty consider broader contexts.

PhysPort.org
Supporting physics teaching with research-based resources

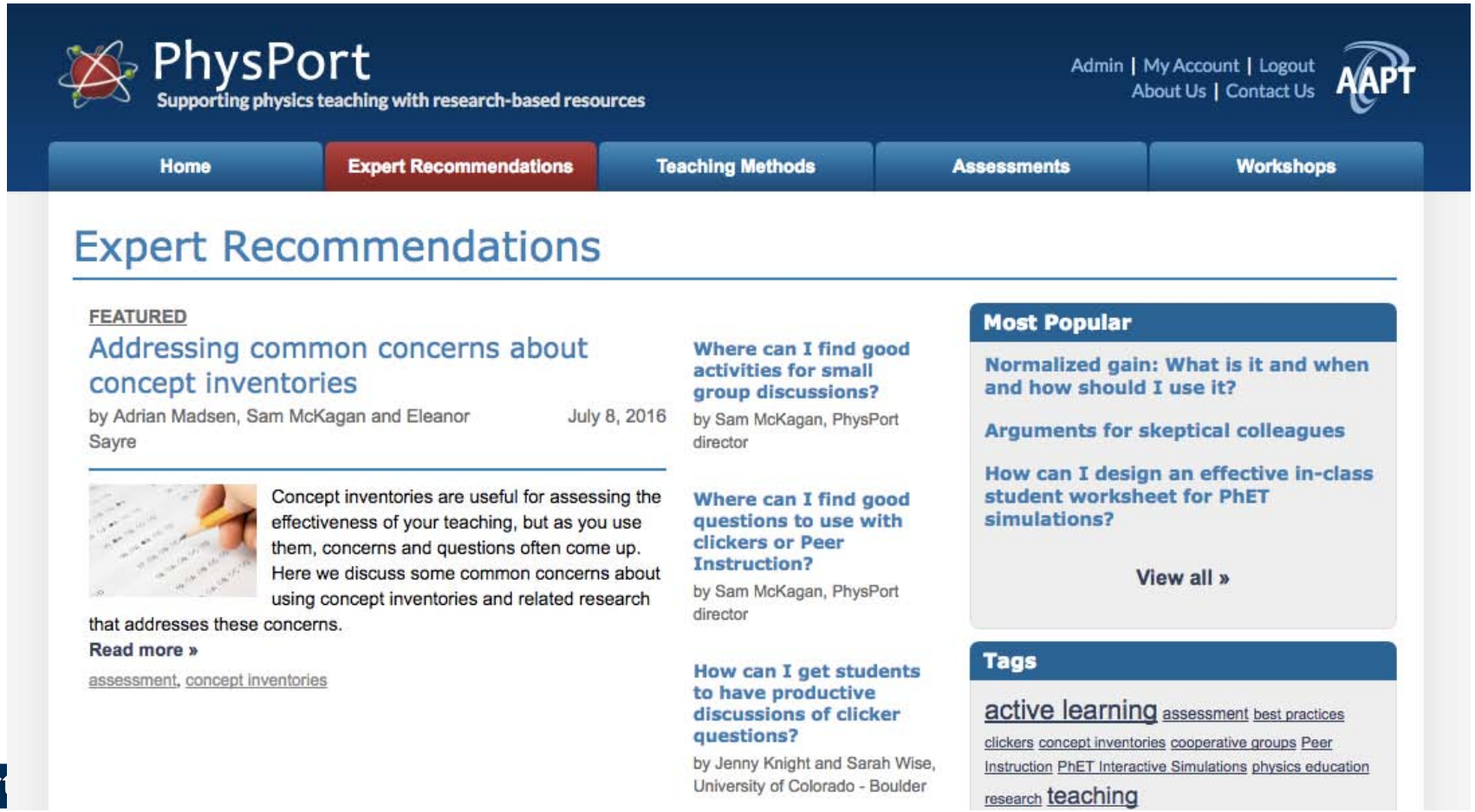
Start with the biggest needs of users.



Expert Recommendations

physport.org/recommendations

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



Expert Recommendations

physport.org/recommendations

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

- 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

physport.org/recommendations

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

- 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

physport.org/recommendations

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

- 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

physport.org/recommendations

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

- 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

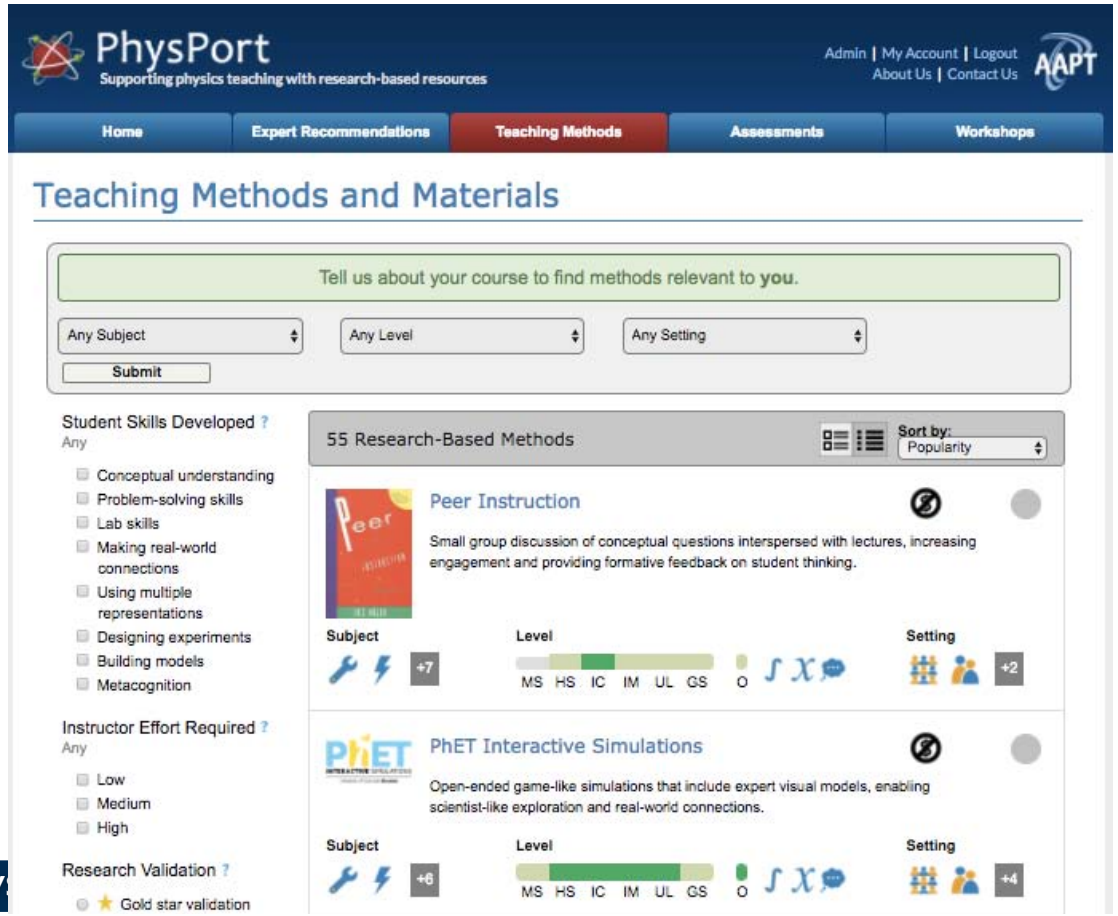
smckagan@aapt.org

PhysPo

Teaching Methods

physport.org/methods/

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



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

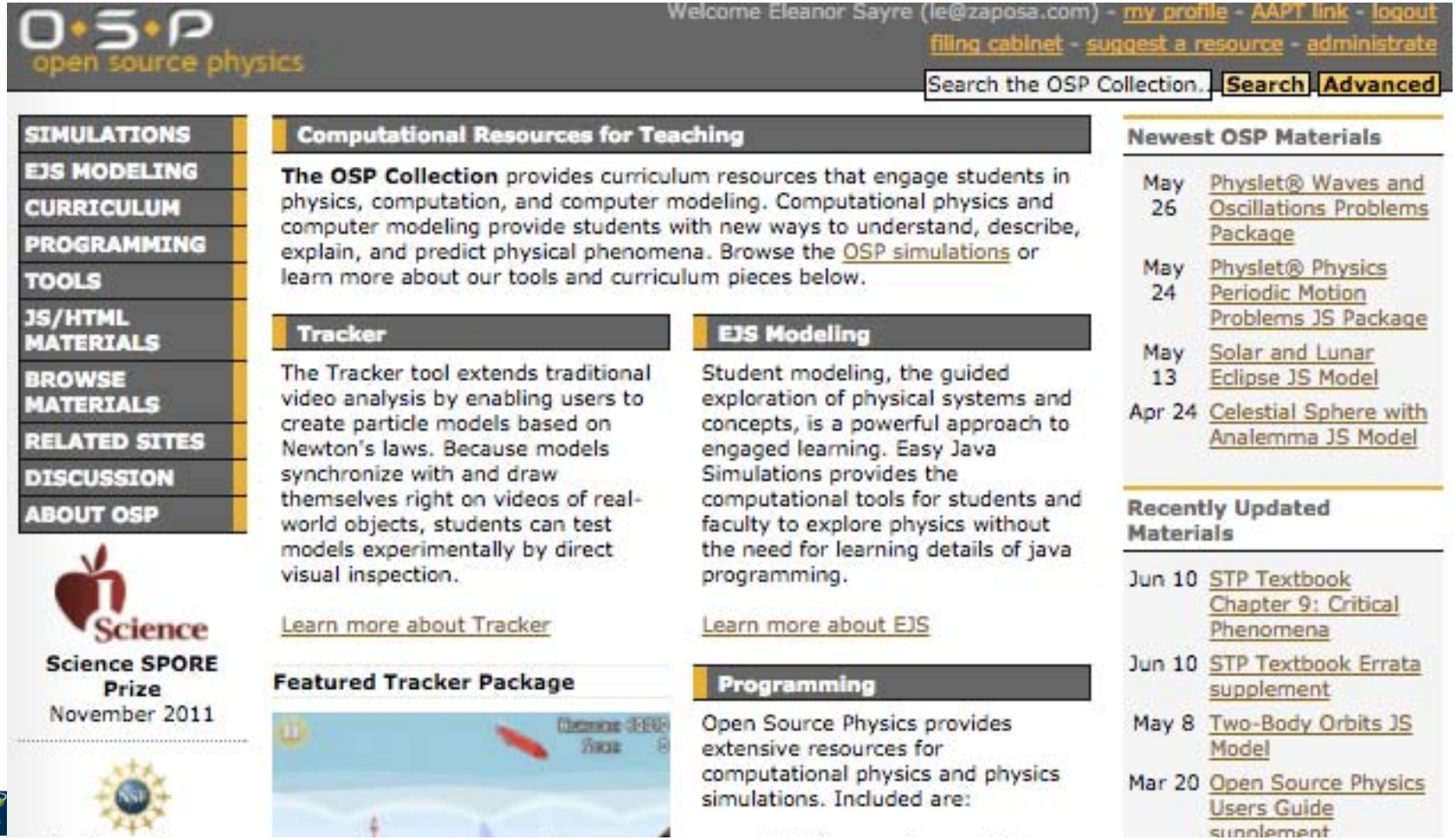
Curricular elements: ComPADRE

- Collections of teaching materials
- Free.
- Intro, upper division, astro, IPLS.... etc
- Simulations, tutorials, clicker questions, ebooks.... etc

ComPADRE is PhysPort's parent.

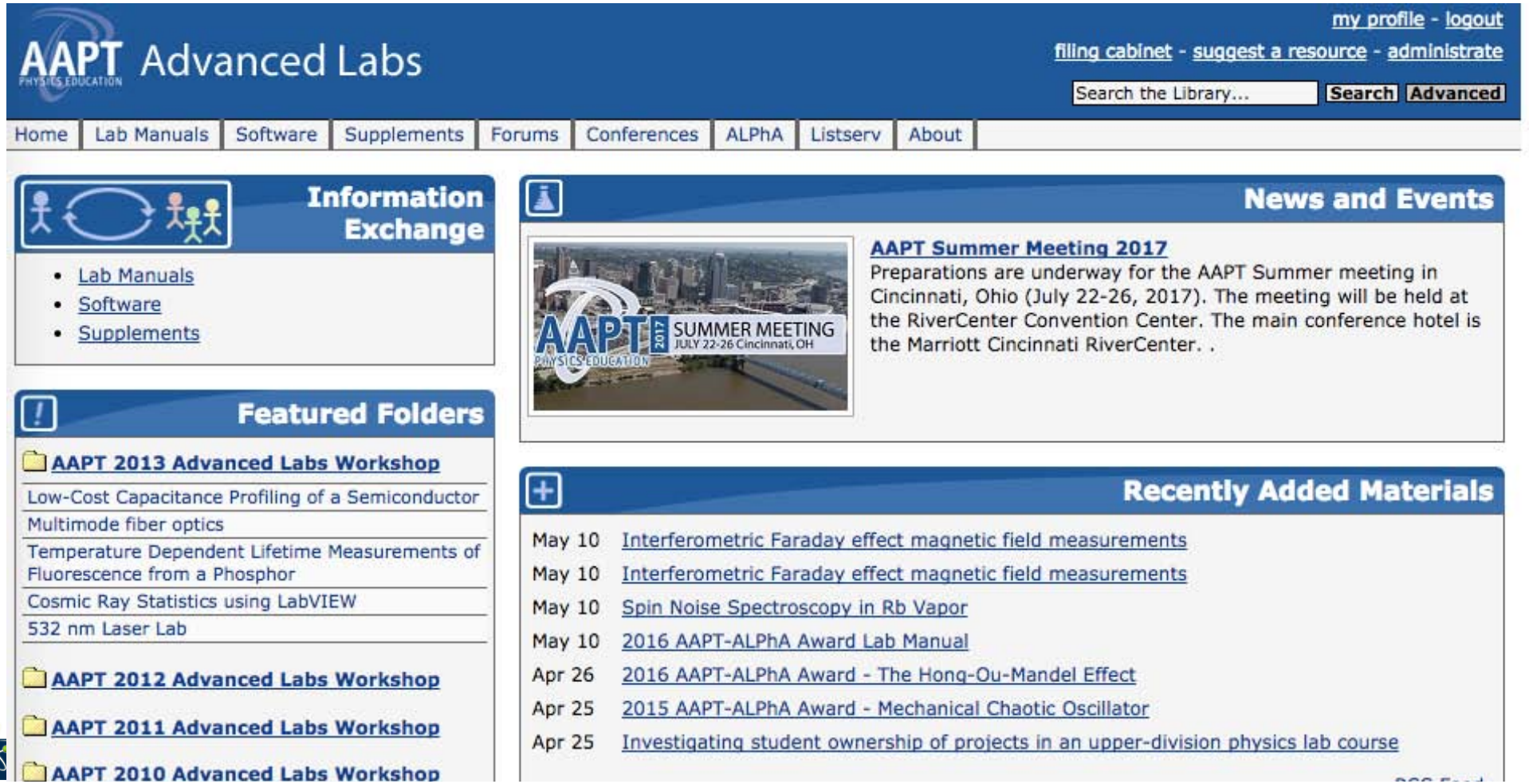
Open Source Physics

www.compadre.org/osp/



Advanced Labs

www.compadre.org/advlabs/



Interactive eBooks

www.compadre.org/books/SoundBook

www.compadre.org/books/?ID=15

Filing cabinet

bit.ly/compadre-nfw

- NFW collection
- Make your own collections!

Assessment Resources

physport.org/assessments

- Search for RBAs
- Get administration details
- See sample questions
- See typical results
- Download RBAs
- Download usage guides

Verified educators!

For faculty and teaching staff

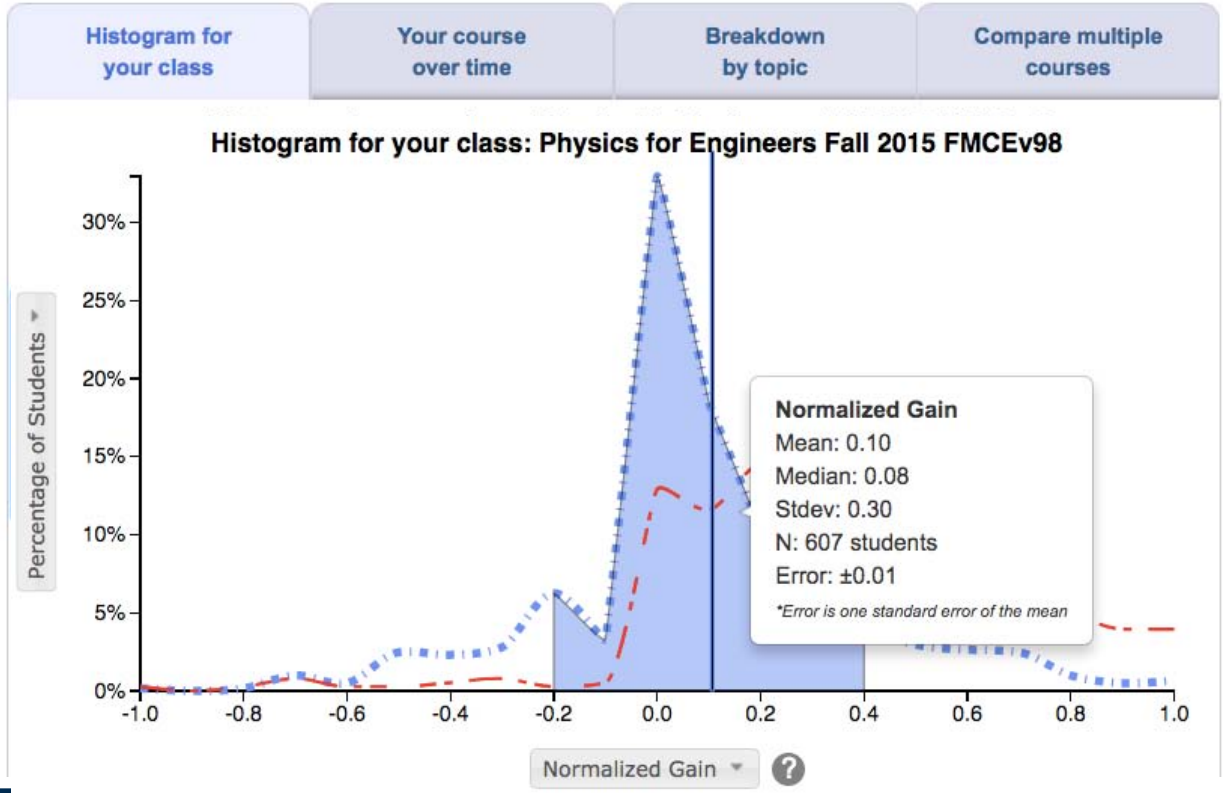
free, easy

project info

Data Explorer

physport.org/DataExplorer

Visualize and compare your students' performance on research-based assessment instruments.



Upload your data

Explore your data

Download a report

Data Explorer

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

Data Explorer

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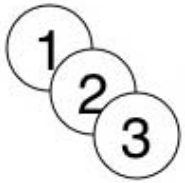
Secure

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

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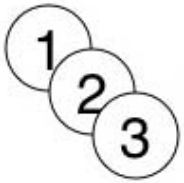
We use the same security measures used by banks and financial institutions so you can have the utmost confidence that your data is safe.



Easy

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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

Data Explorer

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

physport.org/DataExplorer

Available now!

FCI, FMCE
CSEM, BEMA
CLASS, MPEX

Available soon!

80+
research-based
assessments

Custom assessments
for researchers and
departments

Online workshops

physport.org/workshops

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

Online workshops

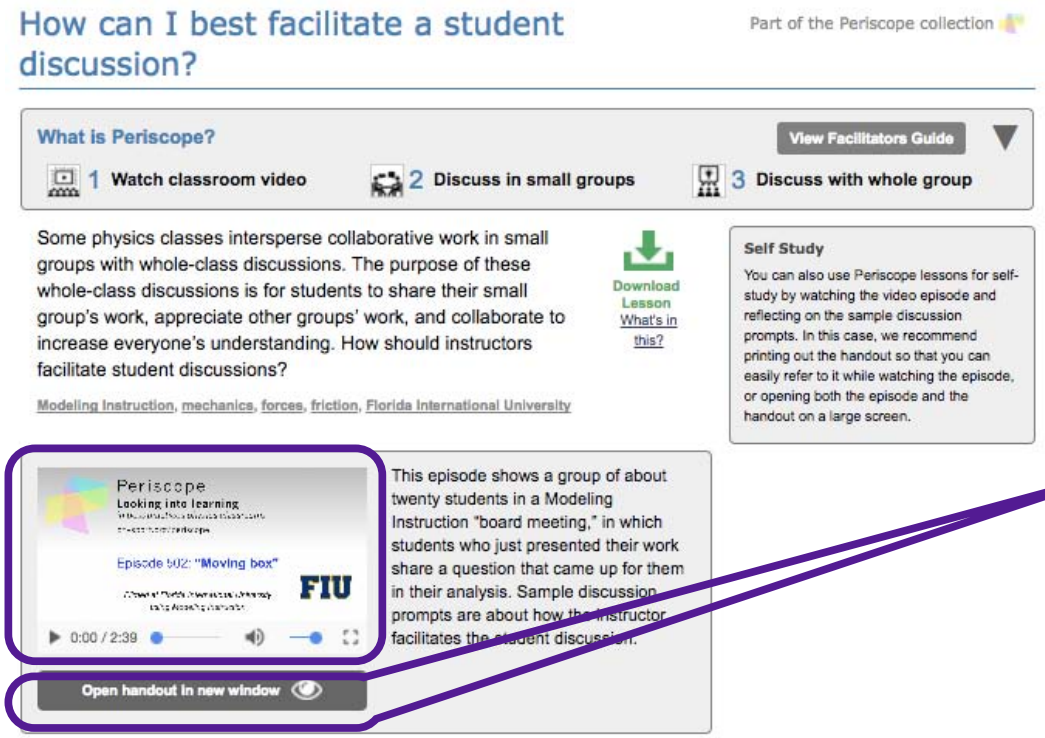
physport.org/workshops

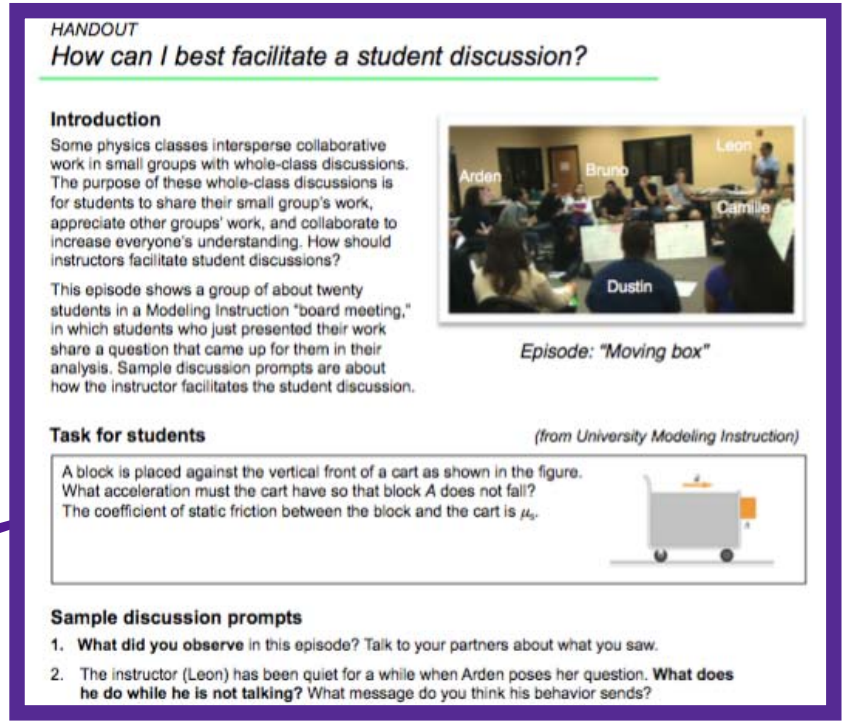
Video workshops for training teaching assistants and faculty professional development in best practices

Periscope

physport.org/periscope

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





Periscope

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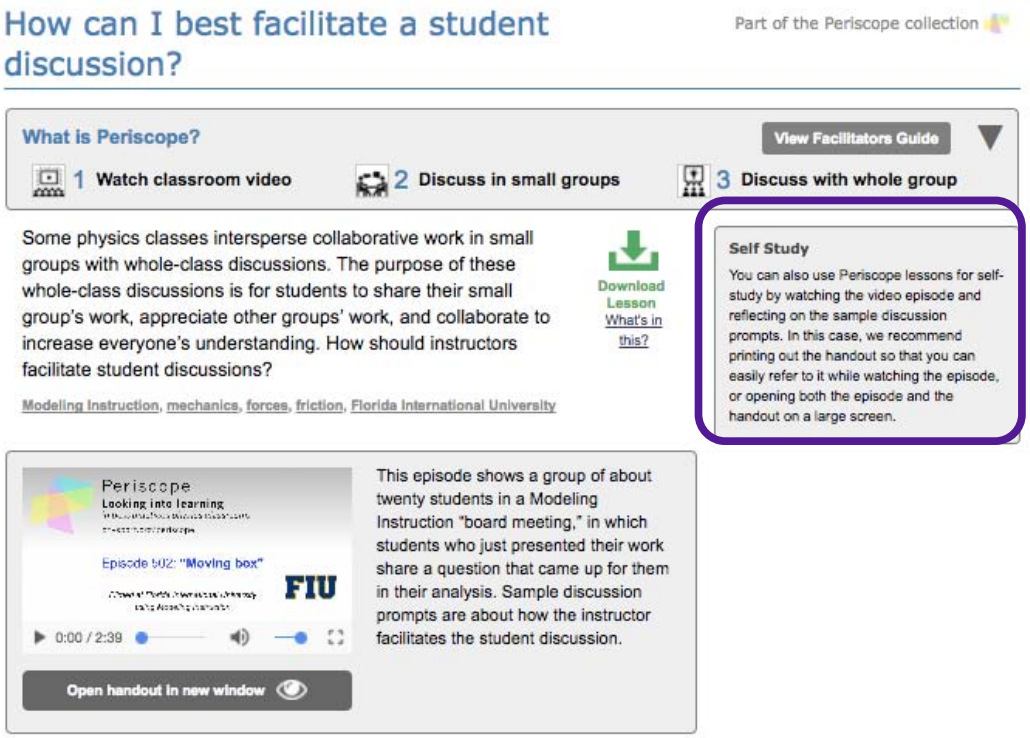
Videos of students working with handouts for training TAs and faculty in best-practices.

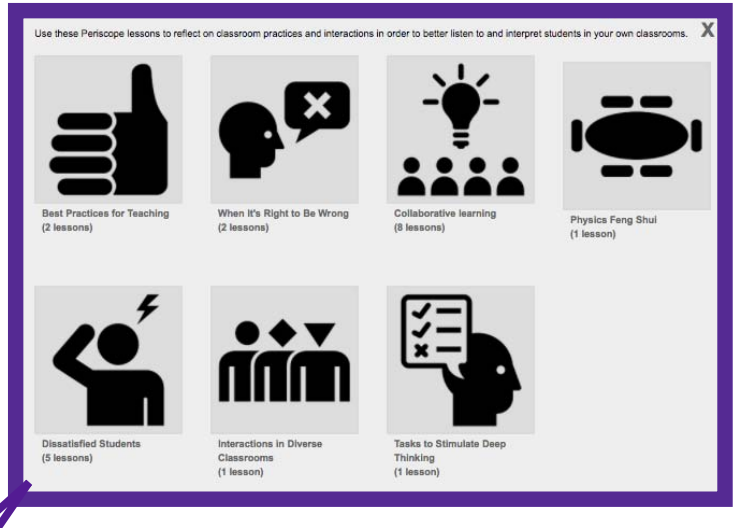


Periscope

physport.org/periscope

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

I want to lead a **weekly TA/LA seminar**	I want to lead a **half-day TA/LA workshop**	I want to prepare colleagues to **use best practices**
I want to prepare colleagues to **design learning environments**	I want to prepare colleagues to **train TAs/LAs**	I want to teach TAs/LAs what ideas students have about a particular **physics topic**
I want to teach TAs/LAs about a particular **instructional method**	I want to **support underrepresented groups**	I want to **improve my own teaching**

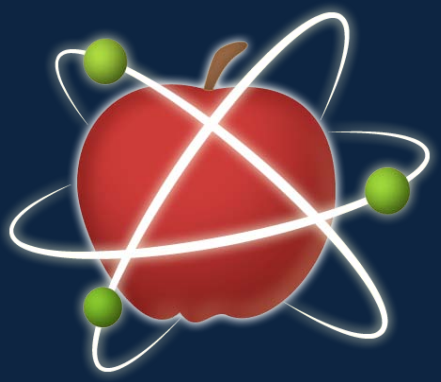


Available now!

54 lessons

Facilitators' Guide

PhysPort.org



PhysPort

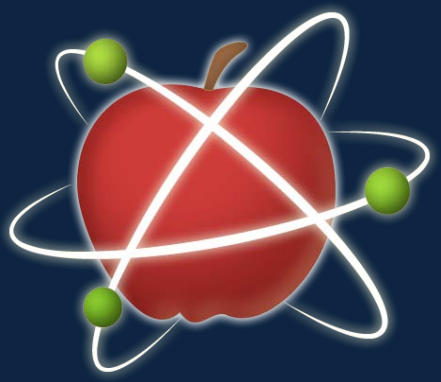
Supporting physics teaching
with research-based resources

physport.org

Resources

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

PhysPort can help.



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KSUPER

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Learn about better teaching!
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Build better pedagogy
Write part of your CAREER proposal

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