

The Status of High School Physics Teaching

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ITS TIME FORA



POP QUIZ !!!!!

Pop Quiz

- Take a minute and jot down your answers.
- Turn to a neighbor and discuss your predictions.

A green rectangular sign with rounded corners and a white border is mounted on two wooden posts. The sign features the text "Answers Just Ahead" in a white, sans-serif font. The background of the image is a bright blue sky filled with numerous white, fluffy clouds.

Answers
Just Ahead

About the Study

- Two-stage sample that targeted:
 - 2,000 schools (public and private)
 - Over 10,000 K-12 teachers
 - Purposefully oversampled teachers of advanced mathematics, chemistry, and physics
- We got a really good response rate:
 - 1,504 schools agreed to participate
 - Over 80 percent of program representatives
 - Over 75 percent of sampled teachers

- Data presented today are based on:
 - 647 high schools
 - 472 physics teachers
 - 326 physics classes
- Sampling and analysis techniques used allow for nationally representative estimates

Who Teaches High School Physics?



2012 National Survey of Science and Mathematics Education

Quiz Question 1

1. Over the past decade, how has the physics teaching force changed in respect to gender and race/ethnicity?
 - a. It is less diverse now.
 - b. It hasn't changed much.
 - c. It is more diverse now.

Demographics of Physics Teachers

	2000			
Sex				
% Female	40	(6.6)		
% Male	60	(6.6)		
Race/Ethnicity				
% White	89	(1.3)		
% Non-White	11	(1.3)		
Average Age	43	(1.3)		
Average Years Teaching Experience	13	(1.3)		

Demographics of Physics Teachers

	2000		2012	
Sex				
% Female	40	(6.6)	34	(3.6)
% Male	60	(6.6)	66	(3.6)
Race/Ethnicity				
% White	89	(1.3)	96	(0.9)
% Other	11	(1.3)	4	(0.9)
Average Age	43	(1.3)	44	(0.9)
Average Years Teaching Experience	13	(1.3)	14	(0.9)

Quiz Question 2

2. About what percentage of physics teachers has a degree in physics?
- a. 10
 - b. 20
 - c. 30
 - d. 40

College Coursework

	Percent of Teachers							
	Degree in Field		No Degree in Field, but 3+ Advanced Courses		No Degree in Field, but 1-2 Advanced Courses		No Degree in Field, No Advanced Courses	
Life science/ biology	53	(2.4)	37	(2.3)	4	(1.0)	6	(1.2)
Chemistry	25	(1.8)	43	(2.2)	21	(2.3)	11	(2.4)
Physics	20	(2.4)	36	(3.1)	16	(2.5)	29	(3.7)

Perceptions of Preparedness

	Percent of Physics Teachers	
Forces and motion	80	(3.5)
Energy transfers, transformations, and conservation	74	(4.2)
Properties and behaviors of waves	63	(4.0)
Electricity and magnetism	54	(3.7)
Modern physics (e.g., special relativity)	24	(2.9)
Engineering	17	(2.3)

Quiz Question 3

3. About what percentage of physics teachers think instruction on an idea should begin with providing definitions for new vocabulary?
- a. 35
 - b. 50
 - c. 65
 - d. 80

Beliefs about Teaching and Learning

- Some are in line with current recommendations:

	Percent of Physics Teachers	
Most class periods should provide opportunities for students to share their thinking and reasoning	92	(1.7)
Inadequacies in students' science background can be overcome by effective teaching	84	(2.7)
It is better for science instruction to focus on ideas in depth, even if that means covering fewer topics	74	(3.1)

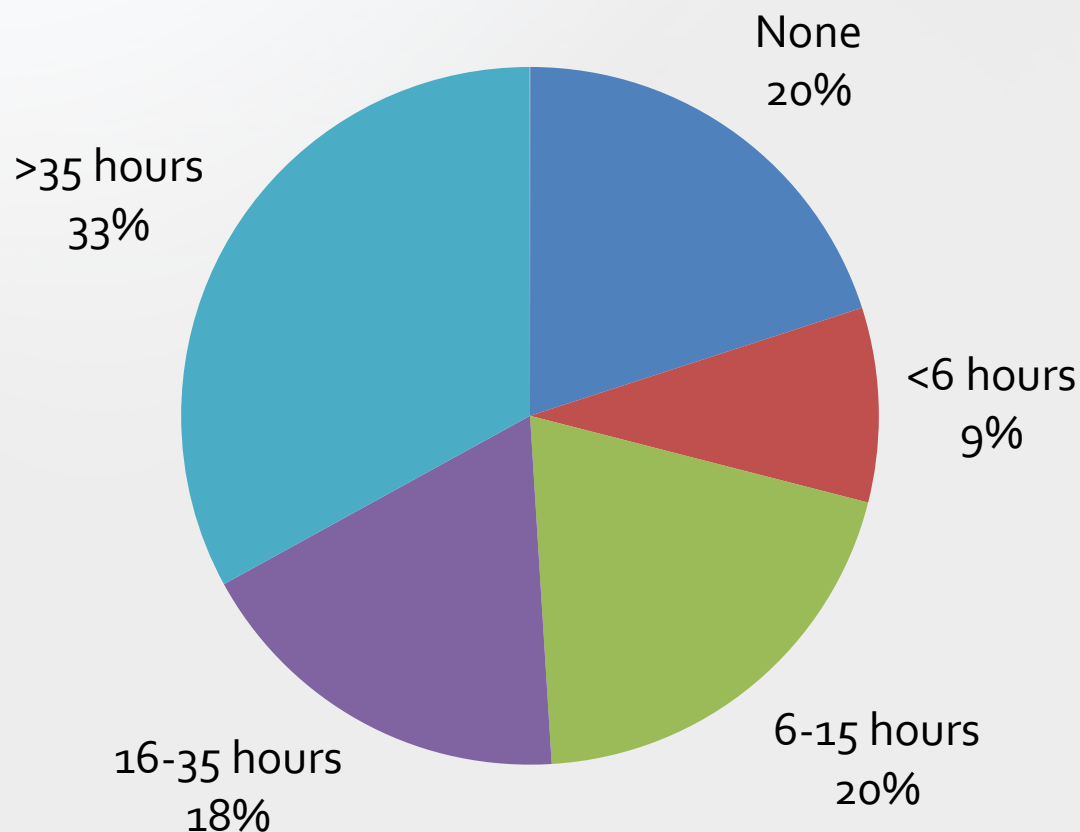
Beliefs about Teaching and Learning

- Some are not:

	Percent of Physics Teachers	
Students learn science best in classes with students of similar abilities	68	(3.3)
At the beginning of instruction on a science idea, students should be provided with definitions for new scientific vocabulary that will be used	64	(3.8)
Hands-on/laboratory activities should be used primarily to reinforce a science idea that the students have already learned	45	(3.9)

Professional Development in Last 3 Years

Percent of Physics Teachers



Emphasis of Professional Development

	Percent
• Monitoring student understanding	54
• Assessing students after instruction	51
• Planning differentiated instruction	49
• Deepening own content knowledge	47
• Learning about student difficulties	46
• Eliciting student ideas pre-instruction	39

Quiz Question 4

4. About what percentage of high schools offer one or more physics courses?

Physics Course Offerings

- 85 percent of high schools offer physics
 - 37 percent offer a non-college prep course
 - 77 percent offer a 1st year college prep course
- 34 percent offer a 2nd year/advanced course
 - 22 percent offer AP Physics B
 - 12 percent offer AP Physics C

Quiz Questions 5 & 6

5. Compared to 1st year high school biology, students in 1st year high school physics are:
 - a. Less likely to be female.
 - b. Just as likely to be female.
 - c. More likely to be female.

6. In terms of race/ethnicity, compared to 1st year high school biology, students in 1st year high school physics are:
 - a. Less diverse.
 - b. Just as diverse.
 - c. More diverse.

Who Takes 1st Year Physics?

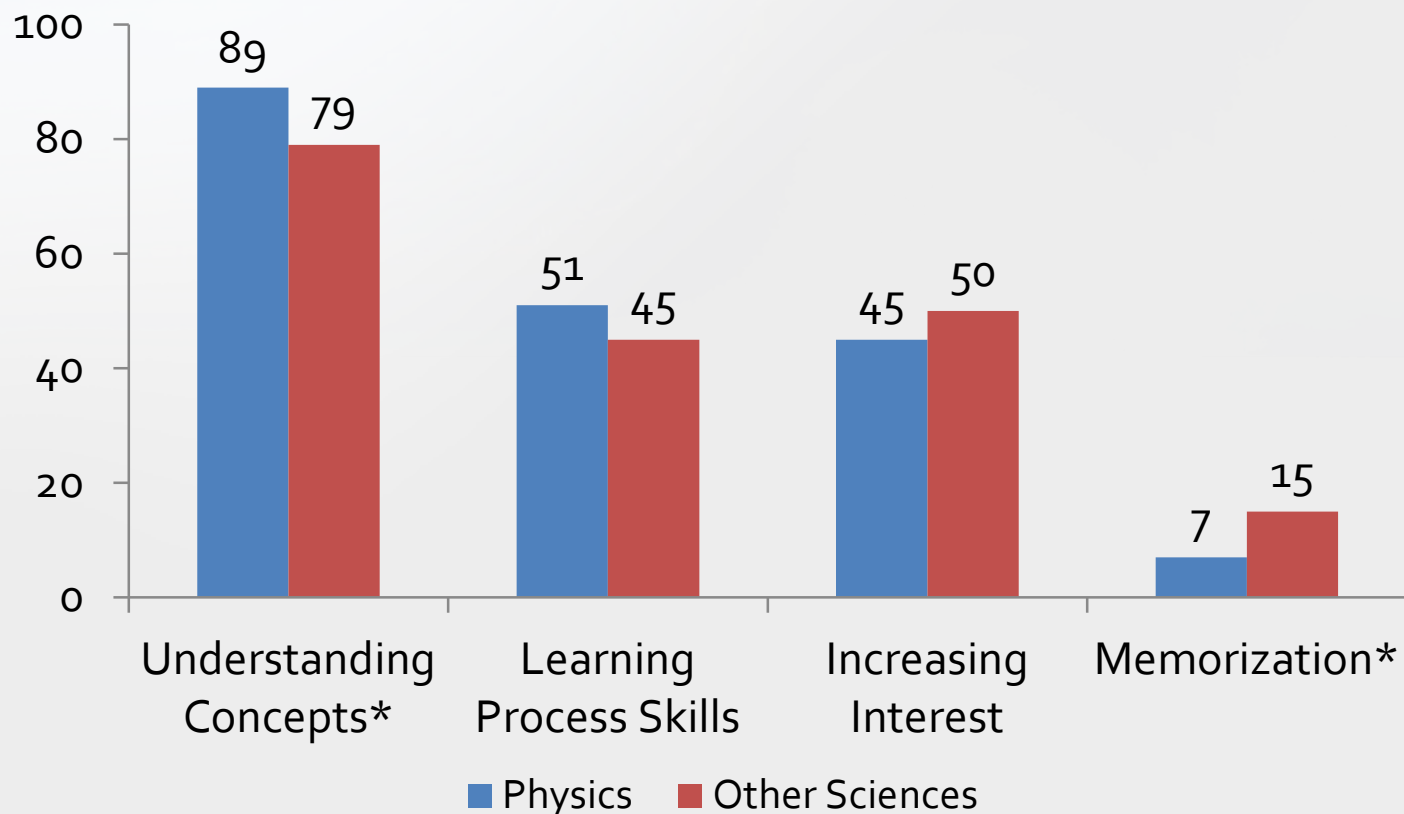
	Percent of Students			
	Female		Non-Asian	
2000				
1 st Year Biology	52	(1.0)	25	(2.1)
1 st Year Chemistry	56	(1.3)	21	(2.4)
1 st Year Physics	46	(1.9)	19	(3.5)

Who Takes 1st Year Physics?

	Percent of Students			
	Female		Non-Asian	
2000				
1 st Year Biology	52	(1.0)	25	(2.1)
1 st Year Chemistry	56	(1.3)	21	(2.4)
1 st Year Physics	46	(1.9)	19	(3.5)
2012				
1 st Year Biology	49	(1.6)	33	(2.7)
1 st Year Chemistry	51	(1.4)	30	(1.8)
1 st Year Physics	49	(1.8)	23	(2.7)

What Does Instruction Look Like in Physics Classes?

Instructional Objectives



* Significant difference between physics and other sciences, $p < 0.05$

Quiz Question 7

7. What percentage of physics classes include:
 - I. Lecture at least once per week?
 - II. Hands-on activities at least once per week?

Instructional Practices: At Least Once per Week

	Percent of Classes			
	Other Sciences		Physics	
Explain science ideas to the whole class	95	(0.8)	95	(2.1)
Have students work in small groups*	83	(1.4)	89	(2.2)
Engage the whole class in discussions	82	(1.3)	85	(2.1)
Do hands-on/laboratory activities	70	(1.7)	74	(3.2)
Require students to supply evidence for claims *	58	(1.8)	74	(3.4)
Have students write their reflections*	21	(1.5)	15	(2.5)

* Significant difference between physics and other sciences, $p < 0.05$

Most Recent Unit

- The survey asked about how student understanding was assessed
- For physics classes
 - 97 percent: the teacher used informal questioning
 - 92 percent: the teacher administered quizzes/tests to assign grades
 - 49 percent: the teacher administered an assessment, task, or probe at the beginning of the unit to find out what students thought or already knew

Instructional Technology Available

	Percent
• Probeware	85
• Internet access	83
• Computers/laptops	82
• Graphing calculators	64
• Classroom response systems/clickers	44
• Hand-held computers	27

Instructional Technology Use

- Probeware:
 - 20 percent use it at least once a week
 - 44 percent use it monthly
 - 21 percent use it only a few times a year
- Although 44 percent of physics classes have access to clickers, only 7 percent use it at least once a week

For More Information

<http://www.horizon-research.com/2012nssme/>

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