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High School Physics Teacher Preparation

Results from the 2012–13 Nationwide Survey of High School Physics Teachers

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REPORTS ON HIGH SCHOOL PHYSICS

Who Teaches High School Physics? (11/2014)

High School Physics Teacher Breakdown (11/2014)

Underrepresented Minorities in High School Physics (6/2015)

High School Physics Teacher Preparation (9/2015)

THE 2012–13 NATIONWIDE SURVEY OF HIGH SCHOOL PHYSICS TEACHERS

During the 2012–13 academic year, we collected data from a representative national sample* of over 3,500 public and private high schools across the United States to inquire about physics availabilities and offerings. This and future reports describe our findings.

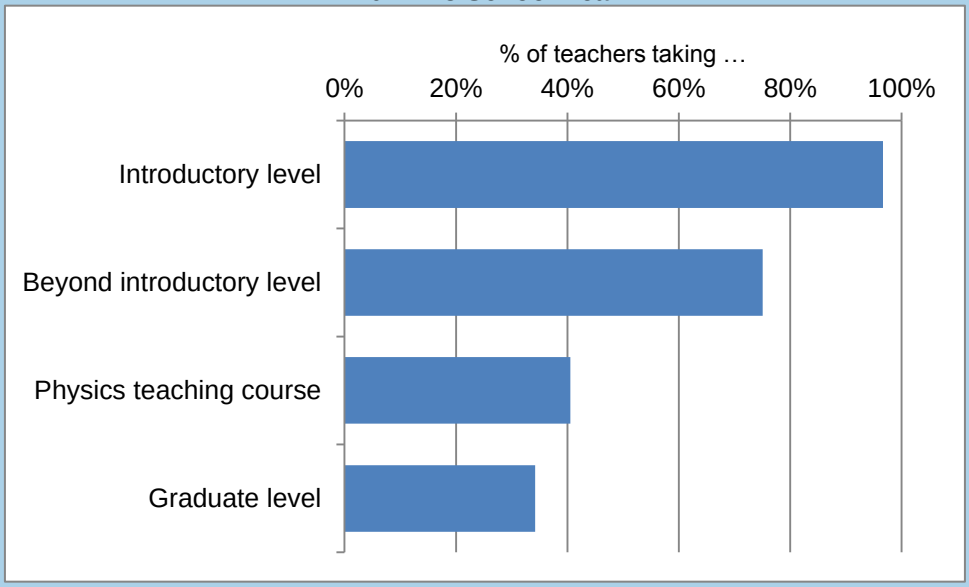
*Excluding Hawaii.

Physics Background

In an earlier report, we examined the formal academic preparation of high school physics teachers. (See *focus on Who Teaches High School Physics?*) We now turn to teachers' self-assessed preparedness to teach physics, their membership in professional associations, and where they turn for help when they have questions. We define a "high school physics teacher" to be any teacher who is listed as the teacher of record for at least one high school physics class. About 40% of these teachers teach a majority of their classes in a subject other than physics, so it is not surprising that some have a degree in a discipline other than physics. In addition to asking about academic major, we asked respondents how much physics they had taken as part of their post-secondary education.

Figure 1

Post-secondary Physics Courses Taken by US High School Physics Teachers 2012–13 School Year



The overwhelming majority of those who indicated they had not taken any physics classes were STEM majors in other fields. Only 0.6% of the teachers were non-STEM majors.

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In **Figure 1** (previous page), we can see that the majority of our high school physics teachers have taken physics courses beyond the introductory level as part of their degree programs. However, only about four in ten have taken a physics teaching course, and slightly fewer have taken any graduate-level physics courses.

Self-Assessed Levels of Preparedness

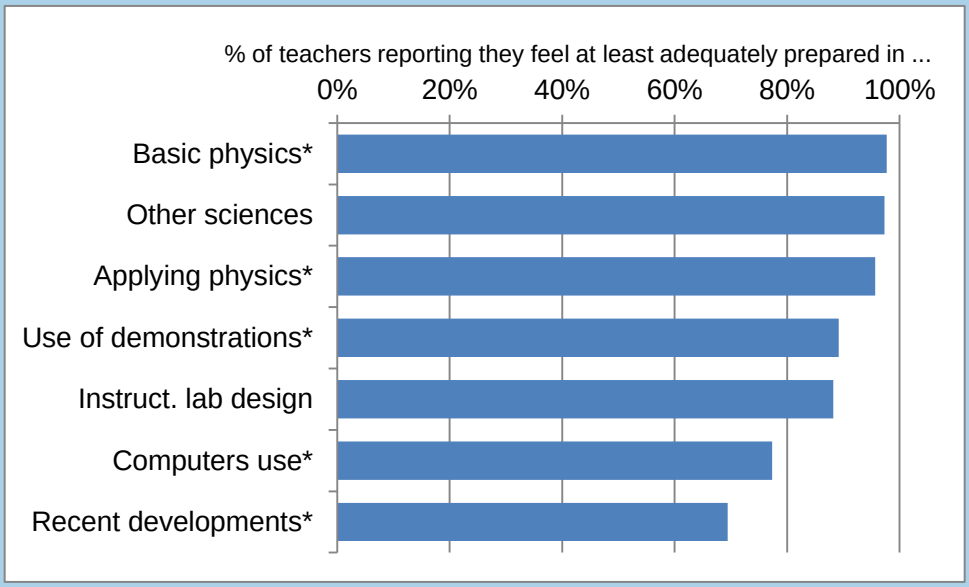
We asked our teachers to rate how well prepared they felt in various aspects of teaching. The response choices were "not adequately prepared," "adequately prepared," or "very well prepared." We asked about the following aspects:

- basic physics knowledge,
- other science knowledge,
- application of physics to everyday experience,
- use of demonstrations,
- instructional laboratory design,
- use of computers in physics instruction and labs, and
- recent developments in physics.

Almost every physics teacher felt at least adequately prepared in basic physics and other sciences.

Figure 2

High School Physics Teachers' Self-Assessed Levels of Preparation
US High Schools, 2012–13 School Year



*We detected statistically significant differences between men and women in this item.

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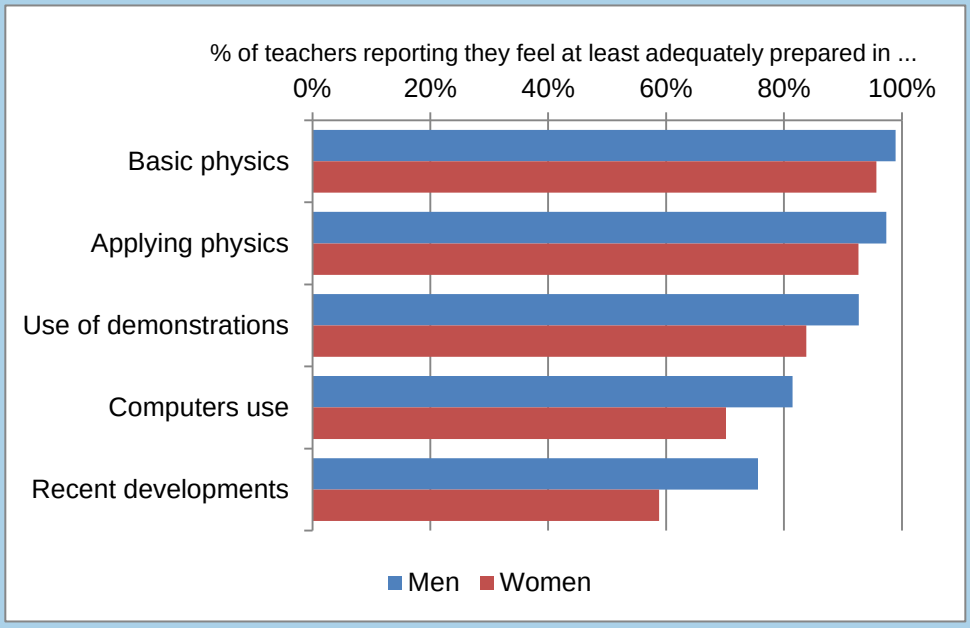
We combined the proportion of teachers indicating they felt very well prepared and those who indicated feeling adequately prepared into a single category. More than 60% of the teachers in our sample believed themselves to be at least adequately prepared in every category. (See **Figure 2** on previous page.) Almost every teacher reported feeling adequately or very well prepared with respect to their basic physics knowledge; about seven in ten indicated feeling at least adequately prepared in terms of recent developments in physics.

We found statistically significant differences between the responses of men and women on several of the questions. We expand upon these in **Figure 3** (below).

Figure 3

Male and Female High School Physics Teachers' Self-Assessed Levels of Preparation[1]
US High Schools, 2012–13 School Year



[1] All differences shown above are statistically significant at the 1% level (p-value < 0.01).

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Men are more likely to report feeling at least adequately prepared to teach in many aspects.

In each area, a higher proportion of men indicated they felt at least adequately prepared than women. We looked to see if academic background, teaching experience, self-identification as a physics specialist, or other factors could explain these differences. Even when accounting for these factors in a multivariate model, men are still more likely to report feeling at least adequately prepared than women. It is important to note that these are the teachers' self-assessed levels of preparedness; we do not measure teacher or student performance. It is

entirely possible that women are objectively just as well prepared as men but that the difference lies in their subjective experience. The largest gap between the responses of men and those of women is seen in how prepared they felt to teach recent developments in physics.

Self-Identified Physics Specialists

In an earlier report, we grouped our teachers into categories based on their academic backgrounds and teaching experience. The categories were physics specialists, career teachers, occasional teachers, apprentice teachers, and newcomers. (See *focus on What High School Physics Teachers Teach*.) Historically, we have defined a physics specialist as an individual teacher who

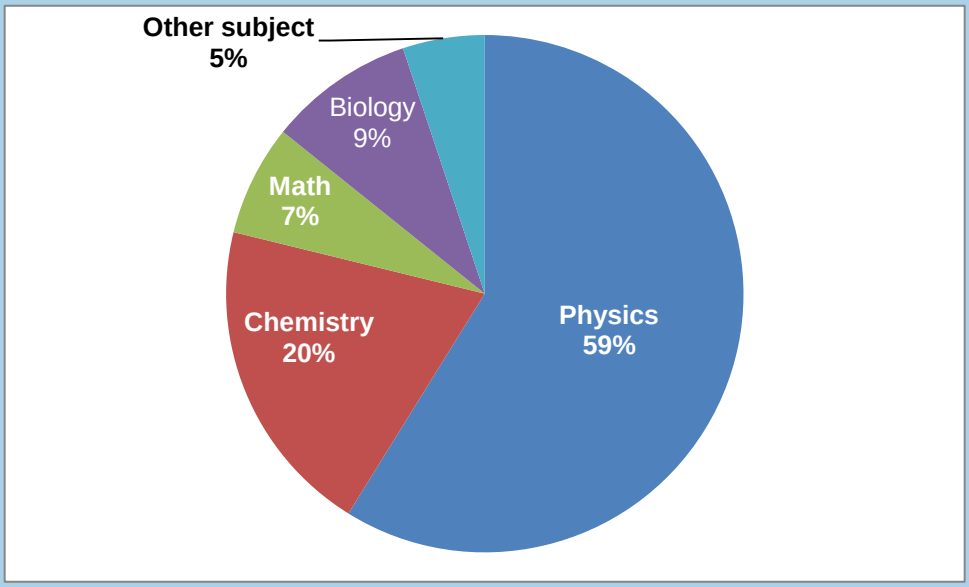
- holds a degree in physics or physics education,
- has taught at the high school level for at least 5 years,
- has taught physics in at least half of their total years teaching, and
- is currently teaching physics.

In our most recent survey (2012–13), about a quarter of teachers met this definition. In addition to categorizing the teachers based on their academic background and teaching experience, we asked our teachers to identify an area in which they considered themselves to specialize. Below, in **Figure 4**, we display the results of this question.

About 60% of the teachers teaching at least one physics class in US high schools consider themselves to be physics specialists.

Figure 4

Self-Identified Area of Specialty
US High School Physics Teachers, 2012–13



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Recall that about 40% of our "physics teachers" teach most of their classes in other subjects. Therefore, it is not surprising that about 40% of our respondents indicated that they considered their area of specialization to be something other than physics.

Where do teachers turn for help?

The overwhelming majority of high school physics teachers are the only person teaching physics at their high school; therefore, they do not necessarily have a colleague nearby who can answer questions about physics for them. We asked about where they turn for such answers. In **Table 1** (below), we detail the resources most often used by teachers and their reported best resource.

Table 1

Resources Used to Answer Questions About Physics
US High School Physics Teachers, 2012–13

Resource	% Using*	% Naming as best resource
Internet	88	42
Another physics textbook	68	—
Class textbook	65	14
Other high school physics teachers	44	18
Internet group	22	—
College or university teachers	22	—
Research scientists	11	—

* Teachers could indicate using more than one resource, so this column will not sum to 100%.

— Indicates this was not a "Top 3" best resource.

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The most widely used avenue for answers to physics teachers' questions was the Internet.

Almost nine out of ten teachers reported using the Internet to get answers. We also asked teachers to identify what they believed to be their best resource. The teachers selected the Internet as the best resource 42% of the time. The next two closest items to the Internet were other high school physics teachers and the teacher's current class textbooks; these three resources were the "best" choice for about two-thirds of our respondents.

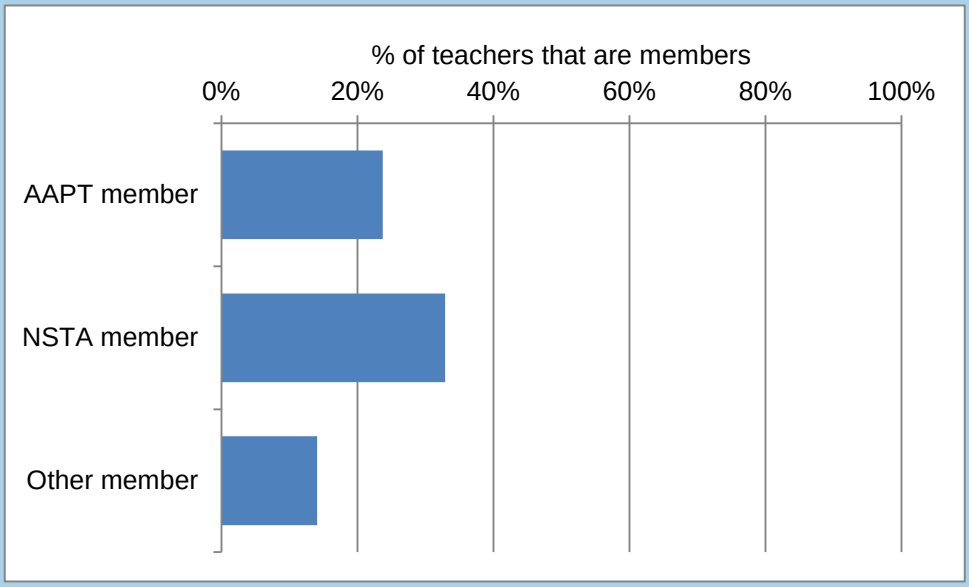
Professional Associations

We asked respondents to tell us about membership in the National Science Teachers Association (NSTA), the American Association of Physics Teachers (AAPT), or other professional teaching organizations. We included membership at any level — national, state, or local.

About one-third of physics teachers are members of the National Science Teachers Association (NSTA).

Figure 5

Membership in Professional Organizations
US High School Physics Teachers, 2012–13



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In Figure 5, we see that about one-third of the teachers were members of NSTA, and one-fourth were members of AAPT. About 15% of the physics teachers were members of another organization; these organizations include state science teacher associations, classroom teacher associations, and other professional associations.

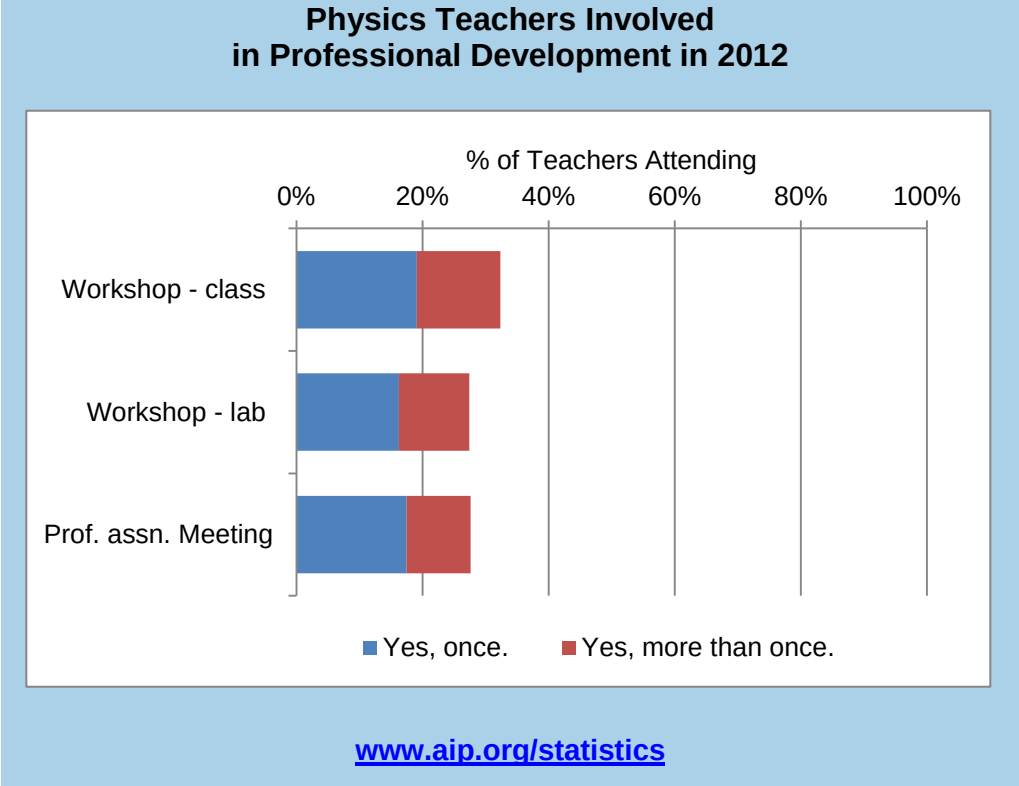
Workshops and Professional Meetings

We asked our respondents about their attendance at physics teaching workshops or professional association meetings. We indicated that respondents should include only meetings or workshops that lasted at least one-half of one day. Specifically, we asked about attendance at or participation in

- workshops on physics classroom techniques,
- workshops on physics lab design or delivery, and
- professional association local or national meetings.

In **Figure 6** we detail the responses.

Figure 6



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Teachers were most likely to have attended workshops on physics classroom techniques.

Almost 35% of our respondents attended at least one workshop on physics classroom techniques. More than one-quarter attended at least one workshop on lab design or delivery, or a professional association meeting.

What does this mean?

These questions give us some insight into high school physics teachers' thoughts about their preparedness to teach. Almost all of our respondents consider themselves to be at least adequately prepared to teach basic physics, other sciences, and applications of physics; about seven in ten reported feeling adequately or very well prepared to teach recent developments in physics. Perhaps some teachers would appreciate more in-service training about recent developments in physics.

While only a quarter of physics teachers met our imposed definition of a physics specialist, almost 60% believed themselves to be specialists. This is about the same proportion of teachers who teach at least half of their classes in physics. Furthermore, not every teacher who had a degree in physics or physics education considered themselves to be a

physics specialist. This suggests that teaching experience plays a role in identifying as a specialist.

Almost all who teach high school physics report having taken at least introductory physics as part of their post-secondary education. When physics teachers encounter questions about physics, they use a wide array of resources, most notably the Internet, to find answers.

References

focus on Who Teaches High School Physics?, Susan White and John Tyler, December 2014, http://www.aip.org/sites/default/files/statistics/highschool/hs-whoteaches-13.pdf

focus on What High School Physics Teachers Teach, John Tyler and Susan White, December 2014, https://www.aip.org/sites/default/files/statistics/highschool/hs-whattheyteach-13.pdf

Physics in Hawaiian High Schools

For the first time in the history of our study, the superintendent of schools for the state of Hawaii refused to allow us to contact schools in Hawaii. Thus, the data in this report covers all high schools — both public and private — in every state in the United States except Hawaii. Hawaii public schools account for less than one-half of one percent (<0.5%) of graduates from US public schools; likewise, schools in Hawaii account for less than one percent (<1%) of graduates from private schools. The exclusion of these schools should not significantly affect the national results.

Survey Methodology

This study is based on a sample of one-sixth of the public and private high schools in the United States. Data collection for this round began in the fall of 2012. Although in past years we began the study by surveying all of the schools in our sample, we changed our methodology this round in order to lower the burden on high schools in our sample, many of which are already heavily surveyed. We began with web searches for each of the 3,858 schools in our sample. If we could identify a physics teacher at the school, we collected the contact information for that teacher. If not, we collected contact information for the principal or science chair. We then contacted each of the schools where we had not identified a physics teacher by phone and e-mail to determine whether or not physics was offered at the school and, if so, who taught it. We collected data on whether or not physics was offered from 3,553 of our 3,858 sampled schools (92%). We compared demographics for the non-responding schools with those of the responding schools and found no evidence to suggest that the two

groups differ significantly. Thus, we believe we have a representative sample of schools.

During the spring of 2013, we contacted each of the 3,702 teachers we had identified in the fall to learn more about physics in each of the high schools. We heard back from 56% of the teachers.

Without the help of the principals, teachers, and staff at our sampled schools, we could not provide this information. We offer a sincere thank you to each of you.

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