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Who Teaches High School Physics?

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

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REPORTS ON HIGH SCHOOL PHYSICS

High School Physics Availability (4/2014)

High School Physics Courses & Enrollments (6/2014)

Textbooks, Resources and Teacher Resourcefulness (7/2014)

Who Teaches High School Physics? (12/2014)

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 U.S. to inquire about physics availabilities and offerings. This and future reports describe our findings.

*Hawaii opted out.

Number of Teachers Unchanged

We estimate that 27,000 teachers in US high schools taught at least one physics class during the 2012-13 school year; this is unchanged from our estimate for 2008-09. The number of students taking physics increased slightly over the four-year period, but high school enrollments are decreasing. So, it is not surprising that the number of teachers teaching physics did not change. **Table 1** provides a snapshot of teacher demographics; except for an increase in the proportion of women, they have changed little since 2005.

Table 1

High School Physics Teacher* Demographics

	2013	2005	1997	1987
Estimated Number of Teachers	27,000	23,000	19,000	17,900
Median age (years)	46	46	44	41
AAPT membership (%)	24	23	25	24
Highest Degree Earned				
% with Bachelor's as highest	31	34	42	37
% with Master's as highest	63	60	54	59
% with Doctorate as highest	6	6	4	4
Physics or Physics Ed Major (%)	32	33	33	26
… in Physics(%)	24	23	22	—
… in Physics Education (but not Physics (%)	8	10	11	—
Self-described physics specialist (%)	56	57	48	—
% Women	37	30	25	23

* We call anyone teaching at least one physics class a physics teacher; for many teachers, a majority of their classes are in other subjects.

— These data were not collected in the 1987 survey.

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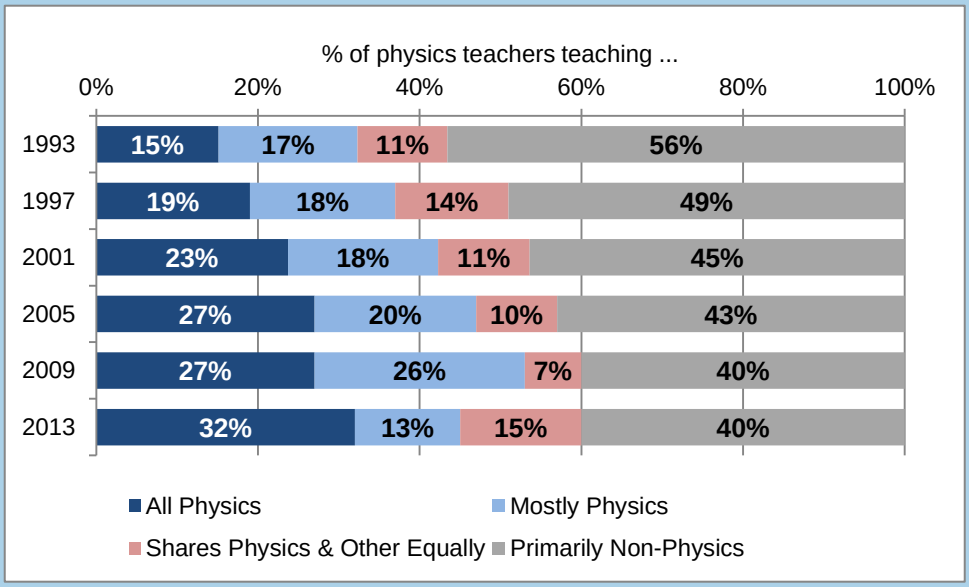
Teaching Loads

We call a teacher who teaches at least one physics class a physics teacher. Data from the National Center for Education Statistics show that 96% of high school graduates in 2009 had completed a biology course, 70% had completed a chemistry course, and 36% had completed a physics course[1]. Since fewer students take physics than chemistry or biology, it follows that there are fewer physics classes taught than chemistry or biology classes. Therefore, most teachers who teach physics teach classes in other subjects, too. **Figure 1** presents the data for teaching loads. About one-third of the physics teachers teach only physics; four in ten teach a majority of their classes in other subjects.

One-third of the 27,000 teachers teach only physics.

Figure 1

Place of Physics in Current Teaching Assignment 1987 – 2013



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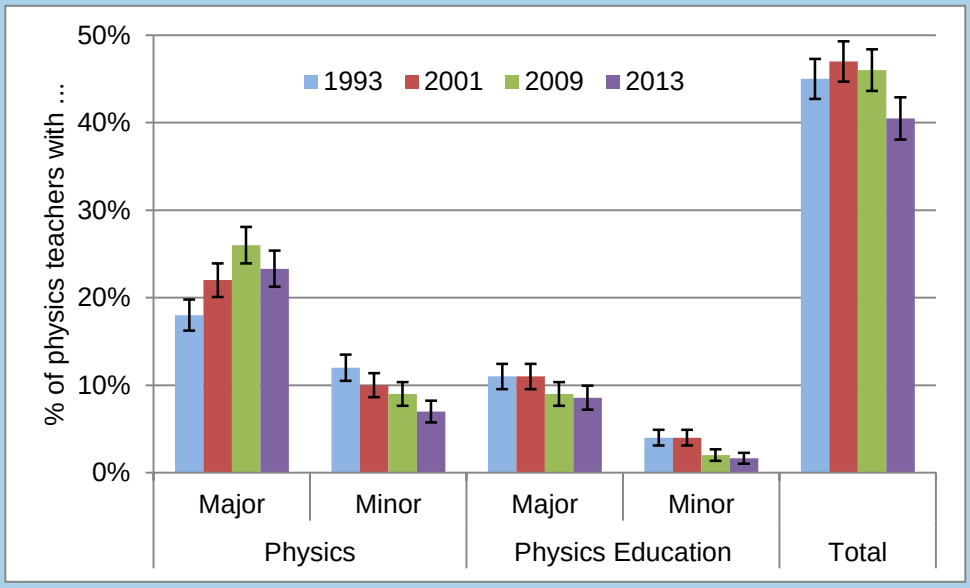
The increase in the proportion of teachers teaching only physics is offset by a reduction in the proportion of teachers teaching mostly physics and an increase in the proportion of teachers sharing physics and other courses evenly. Given this shift, a larger proportion of physics students are taking physics from a teacher who teaches only physics. This shift also helps explain why more students can take physics while

[1] See http://nces.ed.gov/fastfacts/display.asp?id=97, accessed November 13, 2014. Also note that the 36% figure for physics taking in 2009 is not statistically significantly different from the 37% figure we estimated for the same year.

the number of teachers is unchanged. Since the proportion who are sharing physics with other courses equally has increased, it is possible that the number of physics classes could increase without an increase in the number of teachers simply by adding another physics class or two to some of these teachers' teaching assignments, rather than hiring another teacher.

Figure 2

Percent of Physics Teachers with a Physics Degree*



*** Teachers are counted only once, so a teacher with both a physics major and a physics education minor counts here only as a physics major. The hierarchy for counting is physics major, physics education major, physics minor, and physics education minor.**

The error bars represent a 95% confidence interval for the proportion.

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While none of the changes in a specific major or minor is statistically significant, the cumulative proportion of physics teachers with a major or minor in physics or physics education appears to have declined slightly.

Educational Background of Physics Teachers

Historically we have used two different approaches to examine the educational background of high school physics teachers in the US. One approach considers only degrees the teachers have earned. This approach is, in some sense, a "pre-service" education view. We also combine a teacher's education with a measure of the frequency of teaching physics relative to other classes to get an idea of the level of physics teaching experience.

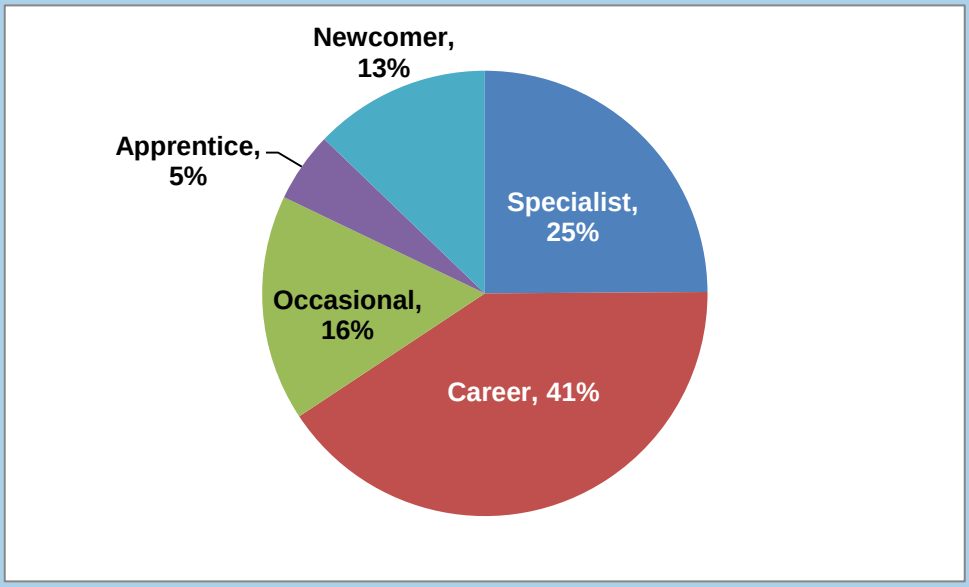
Our estimates for the proportion of high school physics teachers with a major or minor in physics or physics education have not changed much

since 2001. As seen in **Figure 2** (above), there has been a statistically significant decline in the total proportion of teachers with a major or minor in physics or physics education. The error bars (which indicate a 95% confidence interval for the true proporiton of teachers in each group) suggest the the slight variations within each specific major and minor are within the margin of error; however, the cumulative effect is negative overall. The decline appears to stem from a decrease in the proportion of "new" teachers – those in their first four years of teaching at the high school level – with a major or minor in physics or physics education. There is some good news along with the bad; our data seem to indicate that a "new" teacher with a degree in physics is more likely to be assigned to teach more physics than in the past. (See the discussion of Figure 4 on pages 5 and 6.)

Specialists and Apprentice Teachers have degrees in physics or physics education. Some experienced high school teachers with physics degrees fall into the Occasional Teacher category because they have not taught physics in at least half of their years of teaching in high school.

Figure 3

Type of Teacher Teaching High School Physics, 2013



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Our "in-service" look at the composition of physics teachers considers how long a teacher has been teaching in a high school, how often he or she has taught physics relative to other courses, and the academic disciplines in which the teacher holds a degree. For teachers who have been teaching high school at least five years, we classify them into three groups:

- **Specialists** have taught at the high school level for at least five years, have taught physics in at least half of that time, and have a major in physics or physics education.
- **Career Teachers** have taught at the high school level for at least five years and have taught physics in at least half of that time.

Some of these teachers have a minor in physics or physics education.

- **Occasional Teachers** have taught at the high school level for at least five years and have taught physics less than half of that time. Some of these teachers have a major or minor in physics or physics education.

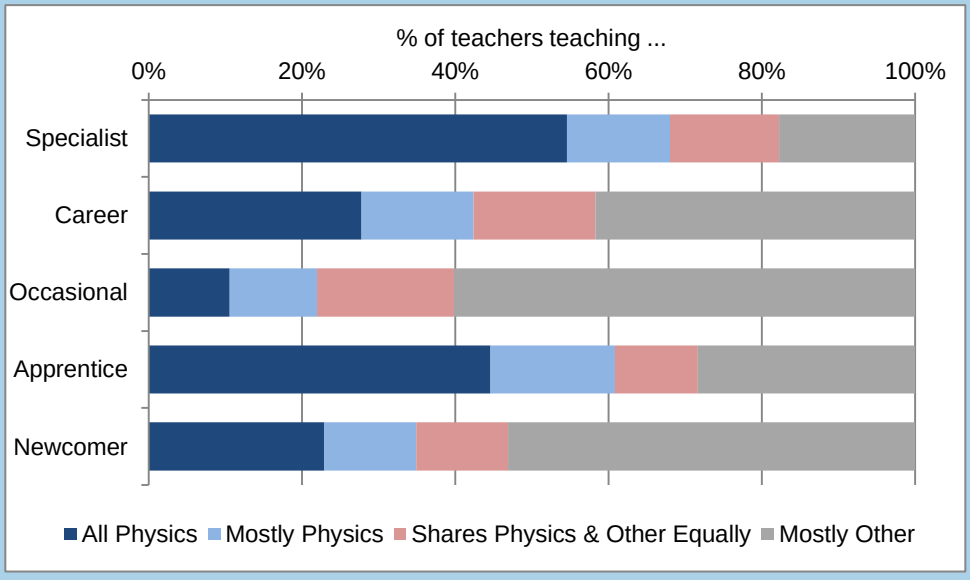
We divide the teachers with less than five years of high school teaching experience into two groups by major:

- **Apprentice Teachers** have taught at the high school level less than five years and have a major in physics or physics education.
- **Newcomers** have taught at the high school level less than five years and do not hold a degree in physics or physics education. Some may have a minor in physics or physics education.

Figure 3 (previous page) shows that Career Teachers comprise the largest fraction of the high school physics teaching corps.

Figure 4

Place of Physics in Current Teaching Assignment by Type of Teacher, 2013



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Teachers with a degree in physics or physics education – Specialists and Apprentice Teachers – are more likely to teach all or mostly physics than teachers without a degree in physics.

Both Specialists and Apprentice Teachers hold degrees in physics or physics education, but Apprentice Teachers have not taught at the high school level for as long as Specialists. As seen in **Figure 4** (above) almost 70% of the Specialists and slightly more than 60% of the Apprentice Teachers teach all or mostly physics. At least 40% of the teachers in every other group – Career Teachers, Occasional Teachers, and Newcomers – teach most of their courses in other subjects.

Some have suggested that new teachers with a degree in physics are less likely to be assigned to teach physics than experienced teachers with no physics degree. For example, Ingersoll, using data from 1993-94, found that out-of-field teaching is a "common" practice where "teachers are assigned by school principals to teach classes in subjects that do not match their training."[2] However, the contrast between what Ingersoll found happening twenty years ago and these results appears to be good news: the data suggest that teachers with a degree in physics are more likely to be assigned to teach physics than those without a degree – whether they are experienced or new teachers.

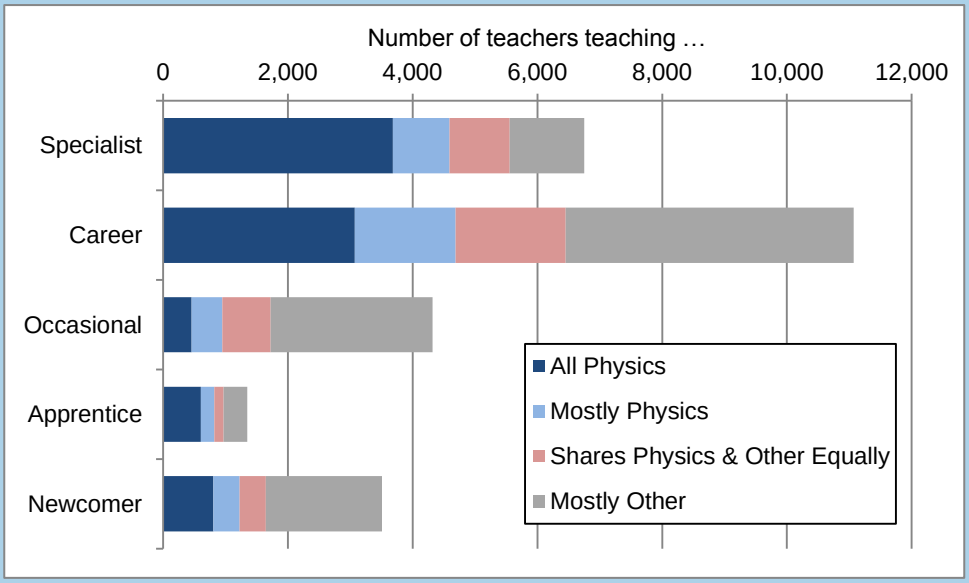
In a forthcoming report, we take a closer look at the specific classes taught by teachers in each of these groups – both the types of physics classes and the other subjects taught in addition to physics. See *focus on What High School Physics Teachers Teach*.

In addition to considering the *proportion* of teachers in each category, it is sometimes useful to consider the *number* of teachers that comprise those groups. **Figure 5** shows the numbers of teachers in each group and the place of physics in their teaching assignments. This view helps put the data into a different perspective. Among the total number of teachers teaching all or mostly physics, the overwhelming majority are either Specialists or Career Teachers.

[2] Ingersoll, R.M. "Why some schools have more underqualified teachers than others," (2004) http://www.gse.upenn.edu/pdf/rmi/BPEP-RMI-2004.pdf, accessed November 24, 2014.

Figure 5

Place of Physics in Current Teaching Assignment by Number of Teachers of Different Types, 2013



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Among the total number of teachers teaching all or mostly physics, the overwhelming majority are either Specialists or Career Teachers.

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 US 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 is unfortunate, but 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 US. 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. Again, we compared demographics of the schools with responding teachers to those with no responding teachers. There is no evidence to suggest the teachers who responded differ significantly from those who did not.

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

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