

Who Teaches High School Physics?

Results from the 2008-09 Nationwide Survey of High School Physics Teachers

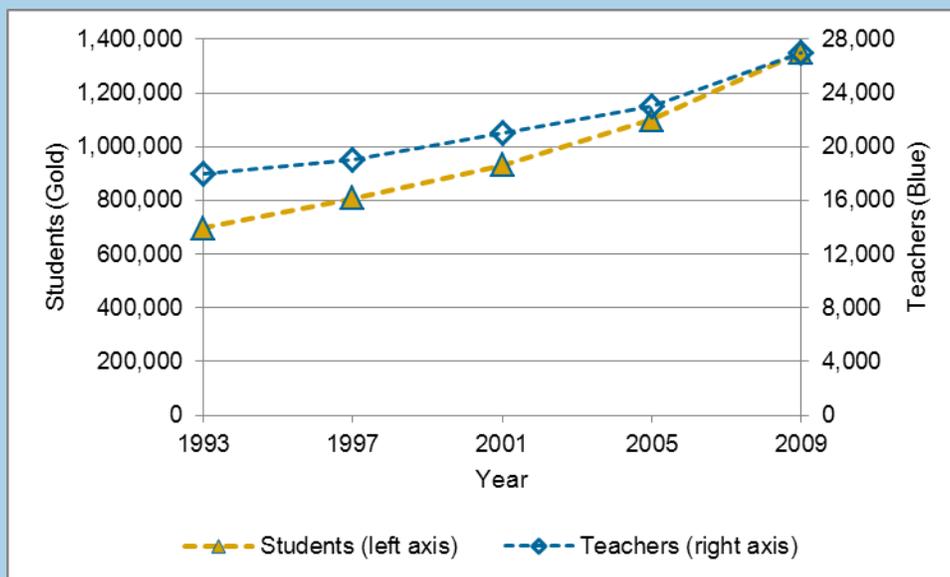
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27,000 Teachers Teach Physics

During the 2008-09 school year, approximately 27,000 teachers in U.S. high schools taught at least one physics course. While this represents considerable growth from the 23,000 teachers teaching physics in 2004-05, the annual growth rate is still below that of students taking physics courses. Figure 1 depicts the growth both in the number of teachers teaching physics and in the number of students taking physics in U.S. high schools since 1993; the growth rate for the number of students exceeds that for the number of teachers in every period. So, physics teachers are teaching more physics students, on average. Typically, physics teachers had fewer than 39 physics students in 1993; by 2009, this had grown to 50. The average class size has been fairly stable, so the number of classes per teacher has also grown.

Figure 1

Number of Students and Teachers in High School Physics
All U.S. High Schools



<http://www.aip.org/statistics>

REPORTS ON HIGH SCHOOL PHYSICS

High School Physics
Availability (April 2010)

High School Physics
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**Who Teaches High
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Under-Represented
Minorities in High School
Physics (March 2011)

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THE 2008-09 NATIONWIDE SURVEY OF HIGH SCHOOL PHYSICS TEACHERS

During the 2008-09 academic year, we contacted a representative national sample of about 3,600 public and private high schools across the U.S. to inquire about physics availability and offerings. These reports describe our findings.

Teacher Demographics

The number of teachers teaching physics has grown by more than 25% since 2001; yet, the demographic profile of these teachers has remained relatively stable during that period. The median age remains unchanged, as does the proportion of teachers holding a degree with a major in physics or physics education.

Table 1

| Teacher Demographics | | | | |
|--|--------|--------|--------|--------|
| | 2009 | 2001 | 1993 | 1987 |
| Number of teachers | 27,000 | 21,000 | 18,000 | 17,900 |
| Median age (years) | 46 | 46 | 43 | 41 |
| AAPT Membership (%) | 27 | 24 | 29 | 24 |
| <u>Degree Level</u> | | | | |
| Bachelor's (%) | 30 | 35 | 38 | 37 |
| Master's (%) | 63 | 60 | 58 | 59 |
| Doctorate (%) | 7 | 5 | 4 | 4 |
| Any Physics Major (%) | 34 | 33 | 29 | 26 |
| ... in Physics (%) | 25 | 22 | 18 | — |
| ... in Physics Education (but not Physics) (%) | 9 | 11 | 11 | — |
| Self-described physics specialist (%) | 57 | 56 | 40 | — |

<http://www.aip.org/statistics>

The demographics of physics teachers have changed little since 2001.

Table 1 presents demographics for physics teachers. Data from the National Center for Education Statistics (NCES, U.S. Department of Education) show that 52% of all teachers had earned a graduate degree in 1986; this proportion changed little over twenty years and was 53% in 2007. The years for which the NCES data is available do not correspond exactly to those shown above; however, it is still notable that the proportion of physics teachers with a graduate degree rose from 63% to 70% during roughly the same period.

We ask teachers responding to our survey to tell us their primary area of specialization. In 1993, fewer than half of the teachers who were teaching high school physics identified physics as their area of specialization. Perhaps this was because most teachers taught a majority of their classes in something other than physics. (See Figure 2.) By 2001, over half identified themselves as physics specialists.

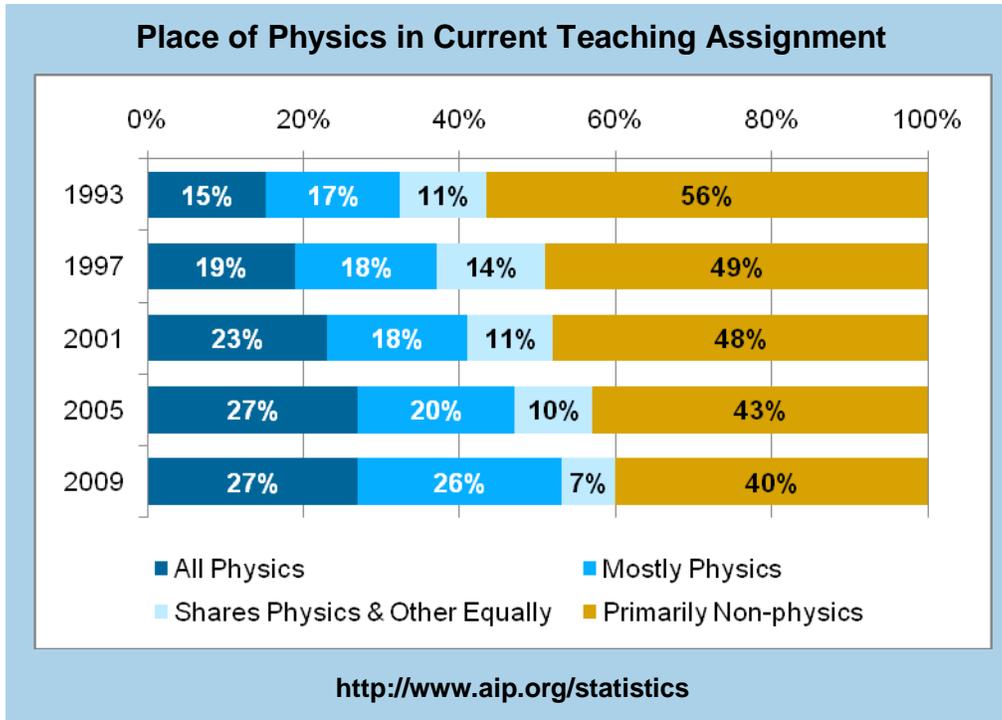
Physics Teachers Teaching More Physics

In 2009, over half of the high school physics teachers taught all or mostly physics classes. This represents a dramatic increase from 1993. Although the proportion teaching physics classes exclusively did not change from 2005, those teaching most of their classes in physics did grow significantly. This could be further evidence of a shrinking “hidden” capacity to teach more physics classes. (See Figure 2.)

This “hidden” capacity refers to the additional physics classes that a physics teacher who does not teach physics exclusively could teach. The growth rate in the number of students taking physics has been able to exceed that for the number of teachers teaching physics, in part, because of this “hidden” capacity.

The average physics class size has remained fairly stable at around 18 students; the number of physics classes being taught has grown along with the number of students taking physics. This growth in the number of classes, then, results from one of two possibilities: (a) the teachers who were already teaching physics taught additional physics classes or (b) teachers who had not already been teaching physics began to do so.

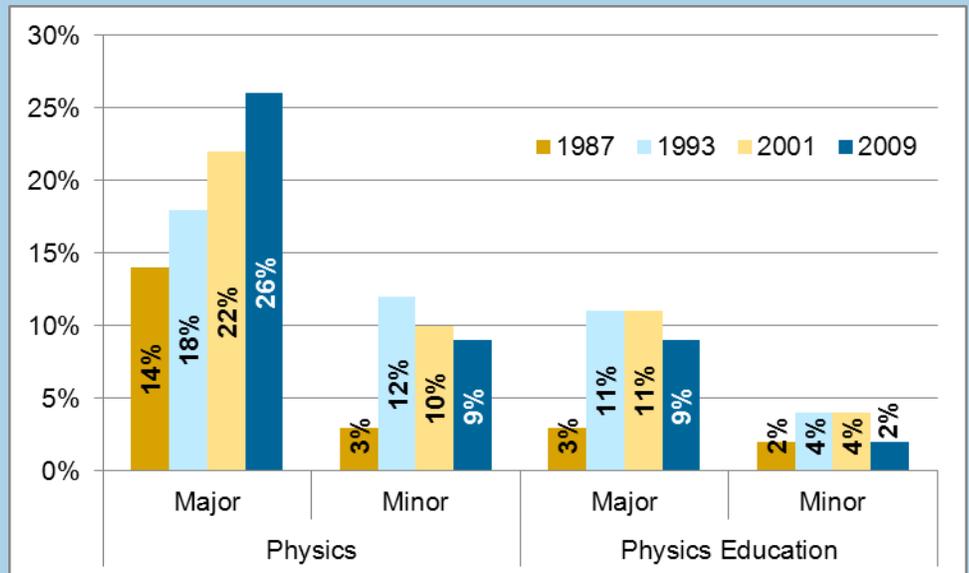
Figure 2



Over half of the teachers teaching physics in 2009 taught all or most of their classes in physics. This is up from one-third in 1993.

Figure 3

Percent of Physics Teachers with a Physics Degree*



* Teachers are counted only once, so a teacher with both a physics major and 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.

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46% of the teachers who taught physics courses in U.S. high schools in 2008-09 had a degree with a major or minor in physics or physics education.

As more and more physics teachers teach a majority of their classes in physics, this could increase the teachers' enthusiasm for physics. The increased enthusiasm could spill over to students and spur even more interest in physics among high school students. This could, then, lead to even faster growth in physics taking in high school. Many physics majors tell us that a high school teacher first piqued their interest in the subject. So, increased excitement about physics in high schools could lead to increases in the number of students choosing to major in physics in college. Of course, only time will tell if this growth really does occur.

Figure 3 depicts the changes in the proportion of physics teachers with a major or minor in physics or physics education. While the proportion of teachers with a major in physics has increased, the total proportion of teachers with a major or minor in physics or physics education has been fairly stable around 46% for some time. In 1993, there was a large increase in both physics minors and physics education majors. Since then, the total has changed little.

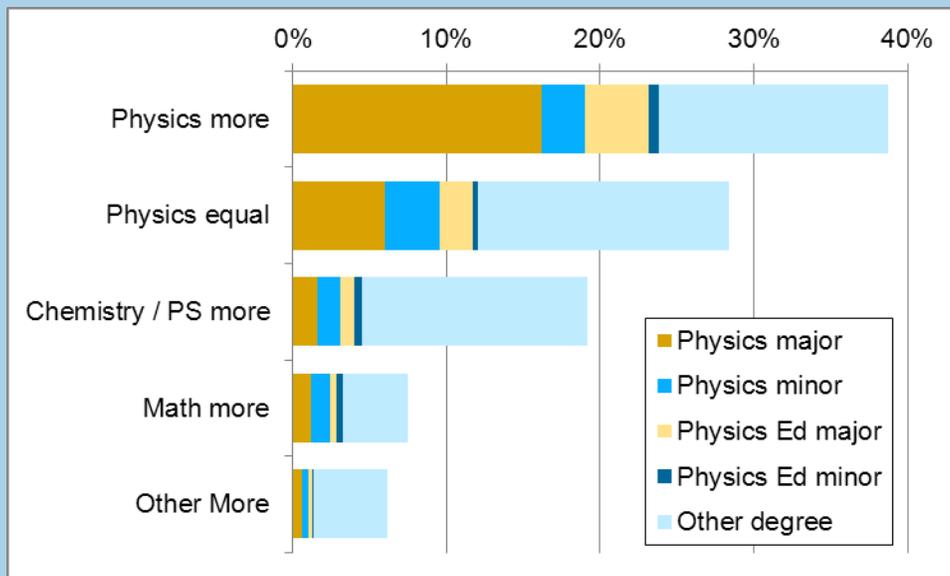
Physics Teaching Experience

Less than half of the teachers who teach high school physics have a degree in physics or physics education. However, this does not necessarily imply that the teachers are not qualified to teach physics. It is likely some of the non-degreed physics teachers began teaching physics at the request of a principal or science department leader and liked it enough to seek additional professional development that did not lead to a formal degree. For example, some teachers told us about NSF-funded summer programs that they attended that dramatically affected the way they teach physics. Since 2001, about 57% of physics teachers have described themselves as physics specialists when asked to indicate a primary area of specialization.

In addition to this self-identification, about two-thirds of physics teachers have taught physics for as many or more years than they have taught any other subject, and over half of these experienced teachers have a physics or physics education degree. Figure 4 shows the relationship between a teacher's physics teaching experience and type of physics degree.

Figure 4

Years of Physics Teaching Experience versus Other Subjects



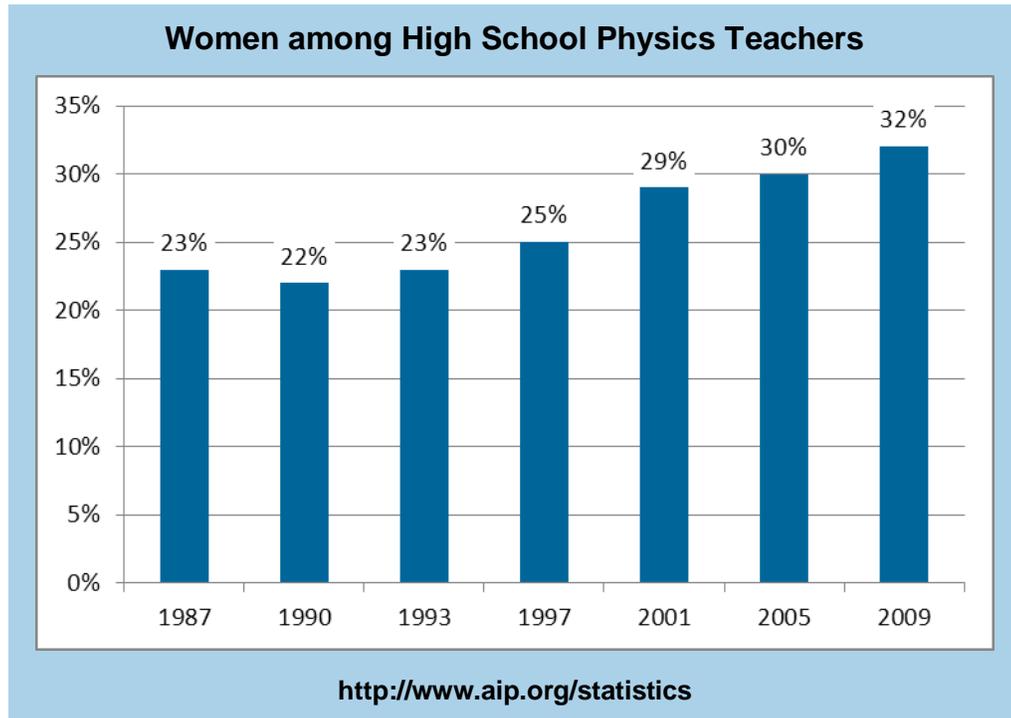
Two-thirds of high school physics teachers have taught physics as much as or more than any other subject.

Teachers are counted only once, so a teacher with both a physics major and 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 variable here is years of teaching experience. So, teachers who teach “Physics more” have more years of experience teaching physics than any other subject.

<http://www.aip.org/statistics>

Figure 5



The proportion of high school physics teachers who are women has risen steadily over the last twenty years.

Rising Proportion of Women

Overall, about sixty percent of high school teachers in the U.S. are women. Yet, the representation of women among physics teachers is much lower. The good news is that the proportion of women among high school physics teachers has steadily increased over the last twenty years. It is also important to note that high school teaching is not the only area in which women are underrepresented in physics. Over half of graduates earning bachelor's degree in the U.S. are women; yet, only 20% of the bachelor's degrees in physics are awarded to women.

In our forthcoming report, *focus on Females in High School Physics* (July 2011), we will examine the representation of women in the various types of physics courses from conceptual physics through AP Physics B and C.

In 1993, even though 43% of all high school physics students were female, female representation differed dramatically by type of course. In physics for non-science students, 46% of the students were female. For AP Physics C, the proportion was only 27%. It will be interesting to see whether or not the increased presence of women physics teachers will be mirrored by an increase in female students in the upper-level courses.

Survey Methodology

In the fall of 2008, we contacted a representative sample of over 3,600 high schools in the U.S., both public and private, to determine whether or not physics was taught there. We received responses from over 99% of the schools. For the schools which indicated they were offering physics, we obtained contact information for the teachers. In the spring of 2009, we contacted each of the teachers who were thought to be teaching physics. We received responses from over 2,500 teachers (a 62% response rate). Our findings are based on their responses.

For a copy of the principal survey or the teacher survey, please contact Susan White at swhite@aip.org.

We are able to conduct this research only with the gracious help of the more than 6,000 people who provided responses, including an administrator at each school and each of the teachers who responded. We are deeply grateful for their assistance and their time.

This marks the seventh time we have conducted a survey examining physics in U.S. high schools. The first six studies were directed by Michael Neuschatz, who retired from AIP in 2008. We hope to continue the tradition of excellent work in this area that he began.