AIP American Institute of Physics

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A publication of the AIP Statistical Research Center
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March 2011

Under-Represented Minorities in High School Physics

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

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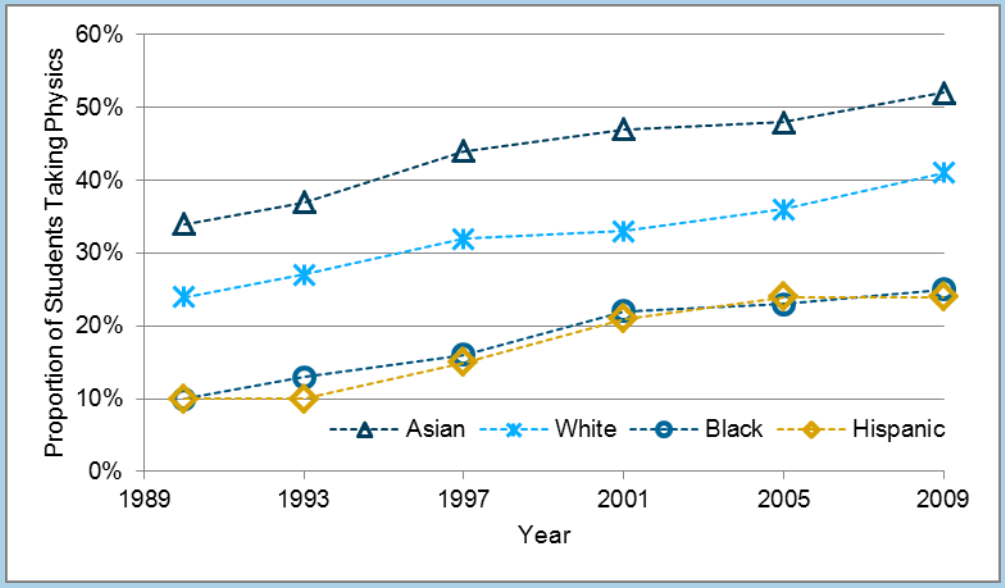
Black and Hispanic Participation Low: Why?

In 2009, about 25% of Black and Hispanic high school students in the U.S. took at least one physics course prior to graduation. This is up from the 10% we saw in 1990. However, the physics-taking rate for Blacks and Hispanics is still well below the 41% of White students and 52% of Asian students who will take at least one physics course in high school. (See Figure 1.)

A closer examination of the data reveals that these differences are likely driven more by socioeconomic factors than by race.

Figure 1

Proportion of Students in Each Racial or Ethnic Group Taking Physics*
All U.S. High Schools



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Reports on High School Physics

High School Physics Availability (April 2010)

High School Physics Courses & Enrollments (August 2010)

High School Physics Textbooks (September 2010)

Who Teaches High School Physics? (November 2010)

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

Females in High School Physics (July 2011)

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.

Factors Affecting Educational Outcomes

Research suggests that many factors affect course selection for high school students; these same factors also impact matriculation to and success in higher education and other educational outcomes. These factors include race, but race alone explains only part of the difference in educational attainment. In many research models, the race variables alone are statistically insignificant when parental education, family income, and school composition are included. This suggests that these other factors explain more of the variation in educational outcomes than race. Table 1 provides more information about a few of these studies.

Socioeconomic status and institutional characteristics affect educational outcomes.

Table 1

Selected Studies Addressing Educational Outcomes by Race & Ethnicity

Study	Highlights
A. P. Carnevale and J. Strohl, "How Increasing College Access is Increasing Inequality, and What to Do about it," in *Rewarding Strivers*, ed. Richard D. Kahlenberg (New York: The Century Foundation, 2010)	Socioeconomic status accounts for much more of the variation in SAT scores than race.
L Griffith, "Persistence of Women and Minorities in STEM field majors: Is it the school that matters?," *Economics of Education Review*, 29 (2010): 911 - 922 (2007)	Institutional characteristics play a key role in the persistence of women and minorities in STEM majors.
C. Riegle-Crumb and E. Grodsky, "Racial-Ethnic Differences at the Intersection of Math Course-taking and Achievement," *Sociology of Education*, 83 (2010): 248-270	Family socioeconomic status and school composition are important predictors.
W. Tyson, R. Lee, K. M. Borman, and M. A. Hanson, "Science, Technology, Engineering, and Mathematics (STEM) Pathways: High School Science and Math Coursework and Postsecondary Degree Attainment," *Journal of Education for Students Placed at Risk*, 12 (2007): 243 – 270	Factors beyond race, class, and gender influence course-taking in high school.

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We collect data from high school physics teachers, and we do not ask the teachers to provide information about their students' parents' incomes or education levels. We do, however, ask teachers and principals at public high schools to tell us about the socioeconomic status of their students in their school relative to other students in the area. We do this in order to get a sense of the socioeconomic profile of each school in our sample. (We consider public high schools only since private schools can be selective in enrollments.)

When we first examined the potential connection between socioeconomic status and high school physics, we used a fairly standard

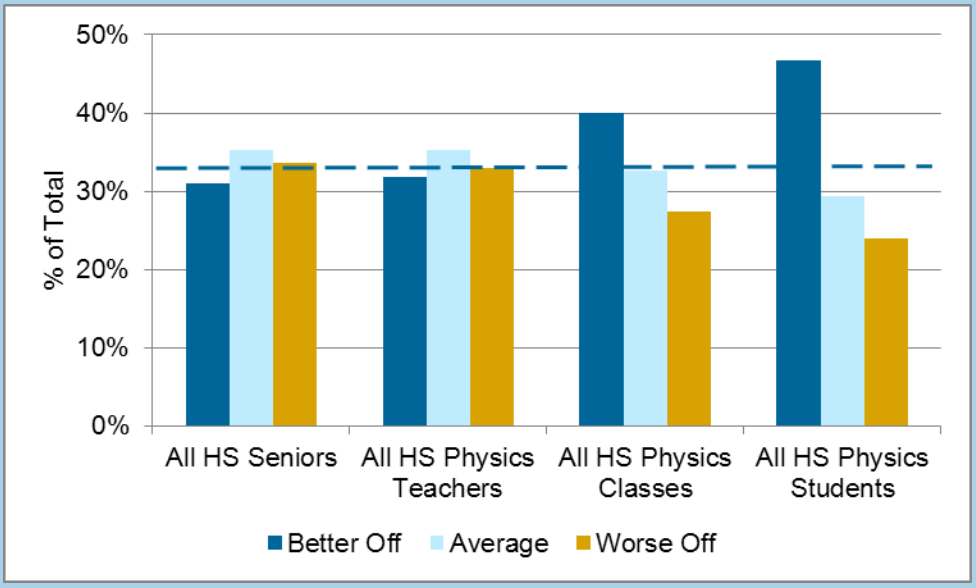
measure: the proportion of students receiving free or reduced-price lunches. However, we found that this measure did not distinguish very well between average and well off schools. We began asking our principals to assess the economic situation of their students in 1997, and we have found this measure to be consistent with the free and reduced-price lunches on the lower end of the spectrum (worse off) while further allowing us to distinguish between average and better off.

We do not find dramatic differences in the total number of seniors enrolled at schools by socioeconomic profile. About one-third of seniors are enrolled at each type of school. Furthermore, the number of physics teachers is fairly consistent with about one-third of the physics teachers at each type of school. However, we do see differences in the physics classes and physics students by socioeconomic profile of the school. This is depicted in Figure 2.

We define a "physics teacher" to be a teacher who teaches at least one physics class. We know that 40% of the teachers who teach at least one physics class teach primarily non-physics courses. (See ***focus on Who Teaches High School Physics***.) In Figure 2, we see that the number of physics teachers is fairly constant across schools

Figure 2

Percent of Seniors, Physics Teachers, Classes, and Enrollments by Socioeconomic Profile of the School‡
U.S. Public High Schools Only, 2008-09



‡ Teacher/principal assessment of student economic circumstances relative to those of students at other schools in the local area.

-- The dashed line is at 33.3%. If there were no differences by socioeconomic profile of the school, then each bar would be this tall. Small variations are not statistically significant.

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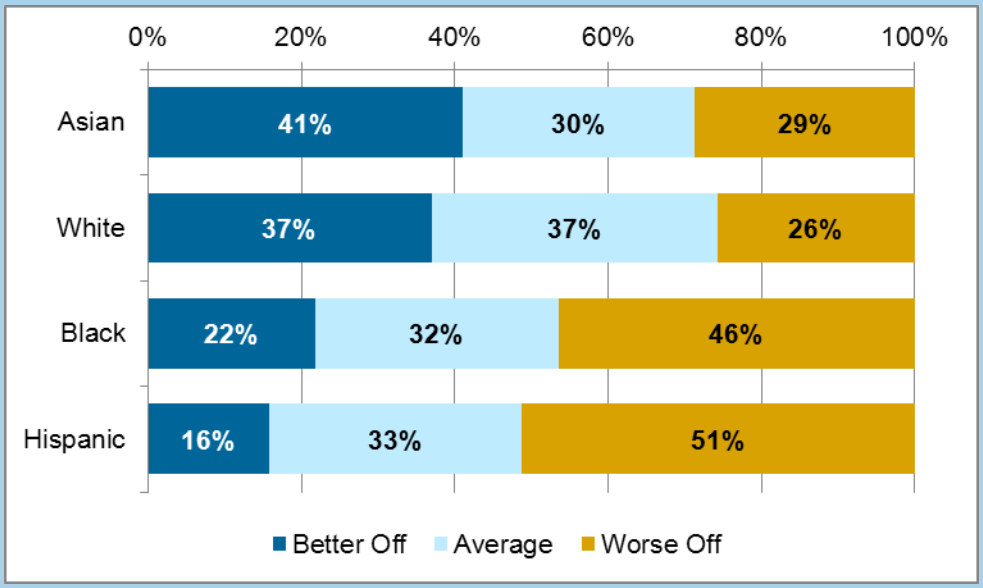
Even though the number of students is fairly consistent by socioeconomic status, the number of students enrolled in physics courses differs dramatically.

with different socioeconomic profiles. Since there are more physics classes and students at "better off" schools, physics teachers at these schools are teaching more physics classes and more physics students per teacher than physics teachers at other schools. These higher enrollments allow teachers to focus more on physics.

Figure 3

Percent of Students by Race or Ethnicity and Socioeconomic Profile of the School‡
U. S. Public Schools Only, 2008-09



‡ Teacher/principal assessment of student economic circumstances relative to those of students at other schools in the local area.

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There is a marked difference in the percent of Asians and Whites attending "better off" and "worse off" schools as compared to Blacks and Hispanics.

Race and Socioeconomic Profile

We combined race and ethnicity data from the National Center for Education Statistics with data from our principals to examine the percent of each race and ethnicity attending schools by our socioeconomic profile of the school. This is depicted in Figure 3. Less than one-third of White and Asian public high school students attend a school that our principals classify as "worse off." Less than one-fourth of Black and Hispanic public high school students attend a school that our principals classify as "better off." This difference is stark. When combined with the percent of physics classes and physics students at each type of school, we have some insight into explaining the variation in physics taking by race and ethnicity.

In addition to the differences in the total number of teachers and students, a higher percentage of students at "better off" schools attend

a school where two or more teachers teach physics: 56% of the seniors attending a "better off" school attend a school with at least two physics teachers. This compares to the less than one-third of seniors attending an "average" or "worse off" school who attend a school with more than one physics teacher.

Physics Offerings by Socioeconomic Profile

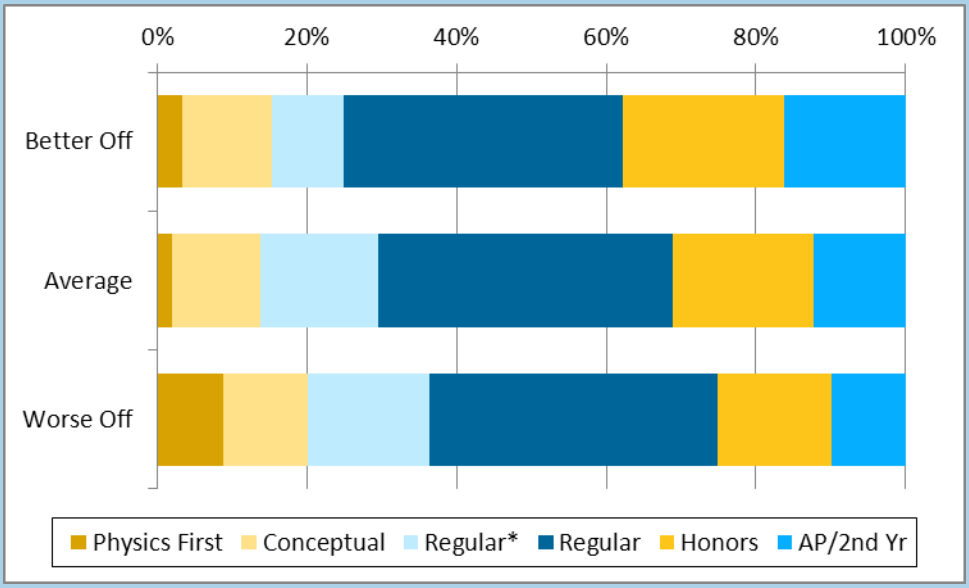
Not only do fewer students take physics at the "worse off" schools, but the types of physics courses students take also differs by socio-economic profile. As seen in Figure 4, about 10% of the students taking physics at "worse off" schools take AP and second-year physics; almost 20% of the students at "better off" schools take these courses.

From our data, we do not know why these differences exist – we only know that they *do* exist.

The data presented in this report suggests that the differences are driven, in part, by underlying socioeconomic factors. Other factors, such as the availability of additional seats in physics classes and the ability of teachers to attract students to physics, also impact physics taking. It is unlikely that the racial and ethnic differences in physics taking in high school will decrease unless the underlying factors are addressed.

Figure 4

High School Physics Enrollment Distribution by Socioeconomic Profile‡
U. S. Public Schools Only, 2008-09



‡ **Teacher/principal assessment of student economic circumstances relative to those of students at other schools in the local area.**

* **Regular course taught using conceptual textbook.**

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A higher proportion of students is enrolled in AP and second-year physics at "better off" schools as compared to "worse off" schools.

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.

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