



Taking Mathematics in High School: Is Opportunity Equal?

by

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Educators have long realized that course taking opens doors to learning and that mathematics courses in particular are the key to higher level postsecondary schooling and improved employment opportunities. Using data from the 1994 High School Transcript Study (HSTS), we investigated policies and practices of high schools that encourage or discourage students' enrollment in advanced mathematics courses. Also examined were the effects of schools' graduation requirements, course offerings, and tracking practices on the patterns of mathematics courses taken by high school students. Special attention was given to minority and low-income students.

The primary objective of the study was to identify a set of alterable school practices that can be implemented to increase access to learning opportunities. The investigation found that, with the exception of a significant shortage of mathematics course offerings in rural schools, school demographics are less important than school practices in determining the courses a student takes. The disproportionate tracking of minority and low-income students into lower level mathematics sequences rather than lowered graduation requirements or lack of advanced course options accounts for their lower level of mathematics

achievement in high school. Future research needs to investigate the antecedents of course-taking decisions and the role that parents, teachers, and counselors play in formulating students' plans for postsecondary education.

Methods

The primary source of data used in the study was the 1994 HSTS, containing school characteristics, student demographics, course offerings, and grade information for 25,000 high schools students from 305 public schools nationwide. A secondary data source, the 1994 National Assessment of Educational Progress (NAEP), included student background questionnaires.

Each of 79 distinct mathematics courses available to students was assigned to one of five levels, from basic mathematics to calculus and analytic geometry. This information was used to derive a series of course-taking measures such as the number of years of mathematics taken, the highest level of course taken, the ratio of basic-to-advanced (level 3 and above) courses taken, and the student's GPA. On the basis of course-taking patterns, students were placed in one of four categories: remedial (17.3%), slow starter (15.3%), modal (55%), or advanced (12.4%).

Findings

Patterns of Mathematics Courses Taken by High-School Graduates. About 81% of high school graduates completed at least six semesters of mathematics as recommended by the Carnegie Commission; however, approximately 60% of students stopped their mathematics course work at level 3 or below. The highest level of mathematics taken by the majority of students is a second-level algebra course or introductory geometry, and only 7.5% of high school graduates have taken AP calculus.

High school girls took as much mathematics in total and a slightly greater proportion of advanced mathematics courses than did boys. The girls also maintained a slightly higher mathematics GPA than did boys; nevertheless, a higher percentage of boys took AP calculus.

Among the four racial/ethnic groups studied, Asian students took the most mathematics, had the highest ratio of advanced- to beginning-level mathematics (1.8), and had the highest percentage of students taking AP calculus (21%). The figures for White students were somewhat lower, followed by non-Hispanic whites. The course-taking profile of African American students was below that of the other racial/ethnic groups in all measures: one fourth of all African

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American high school graduates took a remedial curriculum, while only 5.8% took an advanced curriculum.

Differences between high and low socioeconomic status (SES) were even more pronounced. Lower-SES students accrued fewer mathematics units, did not reach as high a level, took substantially more level-1 courses, and had a substantially lower advanced- to beginning-level ratio of mathematics courses compared with higher-SES students. Almost half of these students took a curriculum classified as “remedial” or “slow starter.” Low-SES students were more likely to be assigned to vocational tracks than high-SES students.

Student and family characteristics also affect course-taking patterns. Students who took more and higher level mathematics courses obtained higher grades than did lower level students. There is also a clear association of mathematics course taking with students’ postsecondary plans; students planning to attend 4-year colleges had a ratio of advanced- to beginning-level course work of 2.1, and approximately 13.5% of these students completed an AP calculus course. Parents’ educational attainment is related positively to every index of course taking. Student mobility was found to be particularly detrimental to mathematics achievement. Mobile students accrued fewer units of mathematics, did not attain as high a level of course work, and took a substantially higher proportion of their classes at level 1 than did more stable students.

School Characteristics Related to Practices that Affect Course Taking. Lower SES schools and larger schools tended to offer fewer advanced mathematics courses in general and fewer semesters of calculus in particular than did higher SES schools. Interestingly, high-poverty schools tended to require slightly more mathematics courses for graduation than did low-poverty schools.

Course offerings were related to school urbanicity, but the most

significant finding was the dearth of mathematics offerings in rural schools. They offered fewer advanced areas of mathematics, fewer calculus courses, and had a lower proportion of advanced courses than did urban or suburban schools. Also, the percentage of students in vocational tracks was greater in rural schools than elsewhere.

School enrollment is significantly related to three school practices: the number of advanced areas offered, the number of semesters of calculus offered, and the percentage of students assigned to a vocational track. Larger schools offered, on average, close to one additional advanced area of study and almost one-half additional semester of calculus. And contrary to previous research, when enrollment and urbanicity were controlled statistically, the poverty status of high schools was not significantly related to any of the school practices with the exception of semesters of calculus offered.

School Practices and Policies and the Courses Students Take. Differences among academic tracks produced the strongest results of any effect studied in the investigation. Students in vocational tracks took substantially fewer and less challenging mathematics courses than did students in general tracks. More African American students were assigned to vocational tracks, whereas greater percentages of White and Asian students were assigned to academic tracks. Interestingly, Asian students in general tracks took more years of mathematics than other general-track students, but Asian students in vocational tracks displayed about the same course-taking patterns as did other racial/ethnic groups. There is little evidence that participation in a vocational track was more harmful to one group than another. The tracking effect on African American students is similar to that for White students; however, those African Americans assigned to academic tracks generally did not take as advanced course work as did

White students in academic tracks. One interesting finding is that African American students who attended schools with high course offerings took substantially fewer level-1 courses than did their counterparts in moderate-offerings schools.

Students of all racial/ethnic groups tend to accrue more credits of mathematics when schools require more for graduation, but the requirements do not affect the extent of advanced work for any racial/ethnic group in particular. Graduation requirements have the biggest impact on vocational students. Vocational students in high requirement schools tended to have increased years of mathematics course work and a somewhat higher ratio of advanced-to-basic courses taken.

Conclusions

To the extent that students take different amounts of mathematics course work, the differences are attributable largely to practices that determine who will take particular courses. Students in vocational tracks accomplished less than students in general tracks, who, in turn, accomplished less than students in academic tracks. The utility of tracking is controversial; however, research and policy should make every attempt to channel motivated students into advanced course work and to provide pathways for students to change from one track to another. In particular, research should focus on the roles of teachers and counselors in assigning students to maximally challenging but realistic programs of study as well as the role of students themselves in making course decisions.

Rural schools in both high- and low-poverty areas fared worse than schools in all other settings in every measure of mathematics achievement. Given the close relationship between the availability of advanced mathematics course offerings and students’ opportunities for post-secondary accomplishments, this problem needs more attention.