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ABSTRACT

"The Condition of Education" summarizes important developments and trends in U.S. education using the latest available data. The 2001 edition had a special focus essay on the access, persistence, and success of first-generation students (students whose parents did not attend college). To make the essay available to audiences interested in how academic preparation in high school can increase postsecondary education opportunities, the essay is reprinted in this document. The essay summarizes findings of a recent series of National Center for Education Statistics studies about the experiences of high school graduates and postsecondary students whose parents did not attend college. Data are from the National Education Longitudinal Study, the beginning Postsecondary Students Longitudinal Study, and the Baccalaureate and Beyond Longitudinal Study. These studies show that such students are at a distinct disadvantaged when it comes to accessing postsecondary education, and those who overcome barriers and enroll in postsecondary education remain at a disadvantage with respect to staying enrolled and attaining degrees, even when there is control for other factors. Rigorous high school course-taking mitigates, but does not completely close, the gaps in access and persistence. For students who do earn a degree, labor market outcomes in the short term are similar regardless of their parents' education. (Contains 11 figures, 8 tables, and 14 references.) (SLD)

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Students Whose Parents Did Not Go To College

Postsecondary Access, Persistence, and Attainment

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Preface

The Condition of Education summarizes important developments and trends in education using the latest available data. The report, which is required by law, is an indicator report intended for a general audience of readers who are interested in education. The indicators represent a consensus of professional judgment on the most significant national measures of the condition and progress of education for which accurate data are available. The 2001 print edition includes 59 indicators in six main areas: (1) enrollment trends and student characteristics at all levels of the education system from preprimary education to adult learning; (2) student achievement and the longer-term, enduring effects of education; (3) student effort and rates of progress through the educational system among different population groups; (4) the quality of elementary and secondary education in terms of courses taken, teacher characteristics, and other factors; (5) the context of postsecondary education; and (6) societal support for learning, including parental and community support for learning, and public and private financial support of education at all levels.

The 2001 edition also includes a special focus essay on the access, persistence, and success of first-generation students (i.e., students whose parents did not attend college) in postsecondary education. To make the essay available to audiences interested in how academic preparation in high school can increase postsecondary education opportunities, the essay is reprinted here as a separate volume.

Students Whose Parents Did Not Go to College: Postsecondary Access, Persistence, and Attainment

Susan P. Choy, MPR Associates, Inc.

Participation in postsecondary education has positive benefits for individuals and society. Although researchers struggle to define and measure these benefits and policymakers debate who should be targeted and how much to spend, programs and practices designed to broaden access to postsecondary education typically receive strong support (Hossler, Schmit, and Vesper 1999; Tinto 1993).

Reflecting the value placed on postsecondary education, nearly all 1992 high school graduates (97 percent) reported in 12th grade that they expected to continue their education at some point, and 79 percent planned to enroll immediately after finishing high school (Berkner and Chavez 1997). Sixty-five percent of this cohort had carried out these plans by October 1992. Over the last decade, the percentage of high school completers who were enrolled in college the October after finishing high school has ranged between 60 and 67 percent, up from 49 percent in 1972 (*Indicator 26, The Condition of Education 2001*).

College enrollment rates vary considerably with parents' educational attainment. In 1999, 82 percent of students whose parents held a bachelor's degree or higher enrolled in college immediately after finishing high school. The rates were much lower for those whose parents had completed high school but not college (54 percent) and even lower for those whose parents had less than a high school diploma (36 percent) (*Indicator 26, The Condition of Education 2001*). Because of the difference in enrollment rates, students whose parents did not go to college are one of the most frequently targeted groups (along with minorities and low-income students) for outreach programs designed to raise the level of student preparation and readiness for postsecondary work (Swail and Perna 2000).

This essay summarizes the findings of a series of recent NCES studies about the experiences of high school graduates and postsecondary students whose parents did not attend college. These studies show that such students are at a distinct disadvantage when it comes to postsecondary access—a disadvantage that persists even after controlling for other important factors such as educational expectations, academic preparation, support from parents and schools in planning and preparing for college, and family income. Also according to these studies, among those who overcome the barriers to access and enroll in postsecondary education, students whose parents did not attend college remain at a disadvantage with respect to staying enrolled and attaining a degree (referred to as persistence and attainment throughout this essay), again controlling for other related factors. Rigorous high school coursetaking mitigates, but does not completely close, the gaps in access and persistence. For those who earn a bachelor's degree, labor market outcomes in the short term (but not enrollment in graduate school) are similar regardless of parents' education.

Data and Terminology

The data presented here come from three nationally representative longitudinal studies conducted by NCES:

- The National Education Longitudinal Study (NELS), which studied a cohort of 1988 8th-graders every 2 years until 1994, 2 years after most of them finished high school, and then again in 2000.[1]
- The Beginning Postsecondary Students Longitudinal Study (BPS), which included students (of all ages) who enrolled in postsecondary education for the first time in either 1989–90 or 1995–96.[2] The first group was surveyed again in 1992 and 1994, and the second group in 1998.
- The Baccalaureate and Beyond Longitudinal Study (B&B), which conducted follow-ups on 1992–93 bachelor's degree recipients in 1994 and 1997.

In the tables and figures that follow, "parents' highest education" refers to the highest level of education attained by either parent. "High school diploma or less" means that neither parent had any postsecondary education. "Some college, including vocational/technical" means that at least one parent attended

college or a vocational/technical program, but neither earned a bachelor's or advanced degree. "Bachelor's degree or higher" means that at least one parent earned a bachelor's or advanced degree. An advanced degree is a master's, doctoral, or first-professional degree.[3]

A number of complex measures of college qualification, mathematics proficiency and coursetaking, and high school curriculum were used in the NCES studies. The technical note at the end of the essay provides complete descriptions of these variables.

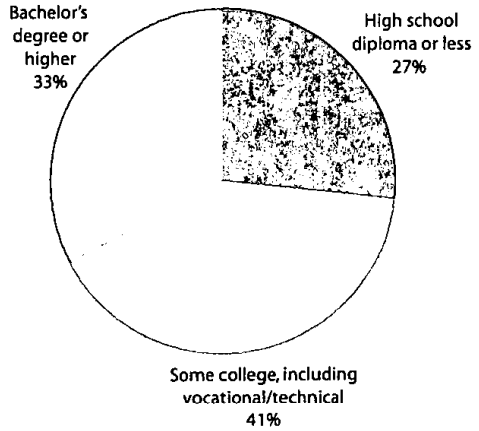
Access

NELS:1988/1994 followed students through high school and 2 years afterward. This survey thus provides a rich source of information on how student and family background characteristics and students' high school experiences are related to their access to postsecondary education immediately after high school.

Characteristics of students whose parents did not go to college

Among 1992 high school graduates, 27 percent were from families in which neither parent had any postsecondary education (figure 1). Compared with their peers whose parents held bachelor's or advanced degrees, these graduates were

Figure 1.—Percentage distribution of 1992 high school graduates according to parents' highest level of education

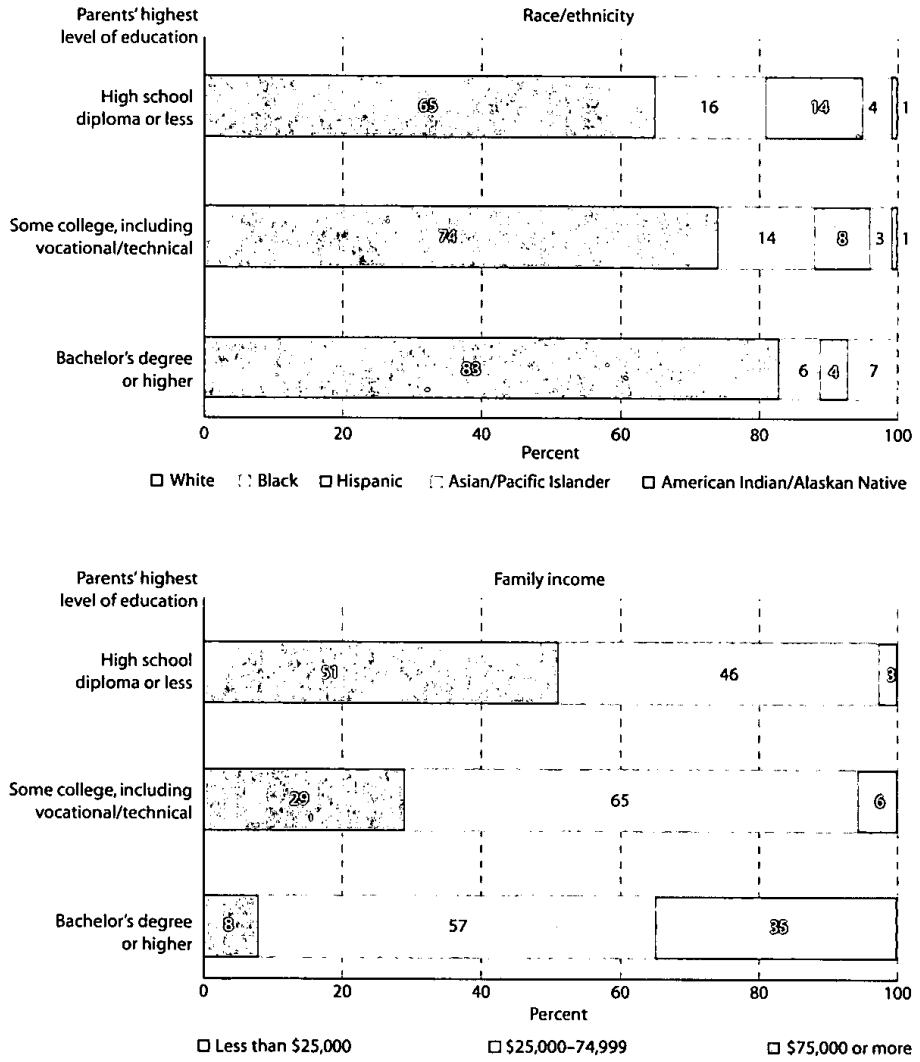


NOTE: Percentages may not add to 100 due to rounding.

SOURCE: Horn and Nuñez (2000), figure 1. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

more likely to be black or Hispanic and to be from families in the lowest income quartile (figure 2). Thus, policies or programs that increase access for students whose parents did not go to college may also do the same for low-income and minority students.

Figure 2.—Percentage distribution of 1992 high school graduates according to race/ethnicity and family income, by parents' highest level of education



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SOURCE: Horn and Nuñez (2000), table 1. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

Enrollment rates

Enrollment in postsecondary education represents the culmination of a process that typically begins years earlier. How students move through this process varies greatly (Hossler et al. 1999). Some students grow up expecting to go to college, take appropriate courses in high school, and concentrate on choosing a specific institution, often soon after they begin high school. Others plan to attend college as they progress through high school but then change their goals or even decide not to enroll. Others decide late in their high school careers that they want to go to college and then find their options limited because they have not taken appropriate courses or met other admission requirements.

- *The likelihood of enrolling in postsecondary education is strongly related to parents' education even when other factors are taken into account.*

As parents' education increases, so does students' likelihood of enrolling in postsecondary education. Among 1992 high school graduates whose parents did not go to college, 59 percent had enrolled in some form of postsecondary education by 1994 (table 1). The enrollment rate increased to 75 percent among those whose parents had some college experience, and to 93 percent among those whose parents had at least a bachelor's degree.

Table 1.—Percentage of all 1992 high school graduates who had enrolled in postsecondary education by 1994, and percentage of those who planned to attend a 4-year institution immediately after high school who had enrolled in postsecondary education by 1994, by institution type and parents' highest level of education

Parents' highest level of education	All high school graduates			Planned to attend a 4-year institution immediately after high school		
	Total*	4-year	Public 2-year	Total*	4-year	Public 2-year
Total	75.2	45.9	25.7	94.0	77.8	15.1
High school diploma or less	59.0	26.9	27.3	86.7	65.3	19.8
Some college, including vocational/technical	74.7	41.6	29.5	93.4	73.7	18.5
Bachelor's degree or higher	92.5	70.8	18.0	97.5	87.3	9.4

*Includes other types of institutions not shown here: private, for-profit; private, not-for-profit less-than-4-year; and public less-than-2-year-institutions.

SOURCE: Horn and Nuñez (2000), table 9 and Berkner and Chavez (1997), table 10. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

Parents' education mattered even for graduates who as seniors had *planned* to enroll in a 4-year institution immediately after high school. Among these college-bound seniors, 65 percent of those whose parents did not attend college had enrolled in a 4-year institution by 1994, compared with 87 percent of those whose parents had bachelor's degrees or higher. In addition, rather than pursuing their plans to attend a 4-year institution, graduates whose parents did not attend college were about twice as likely as their peers whose parents had attained bachelor's or advanced degrees to attend public 2-year institutions instead (20 versus 9 percent).

Parents' education is only one of many factors linked to postsecondary enrollment. In fact, multivariate analyses have shown that family income, educational expectations, academic preparation, parental involvement, and peer influence also independently affected graduates' likelihood of enrolling in a 4-year institution by 1994 (Horn and Nuñez 2000). Nonetheless, parents' education—specifically, having a parent with a bachelor's degree—remained significant even after controlling for these other factors. Students whose parents had some college experience, but not a bachelor's degree, did not appear to have an advantage over those whose parents had no postsecondary education.

Among 1992 high school graduates who had not enrolled in a 4-year institution by 1994, the likelihood of enrolling in any other postsecondary education increased with parents' education—starting with 43 percent of those whose parents had no postsecondary education, increasing to 59 percent of those whose parents had some college experience, and to 74 percent of those whose parents had bachelor's degrees or higher (Horn and Nuñez 2000). This relationship held after controlling for the factors mentioned above that were associated with 4-year enrollment, although family income and high school coursetaking did not independently affect the likelihood of enrolling in less-than-4-year institutions.

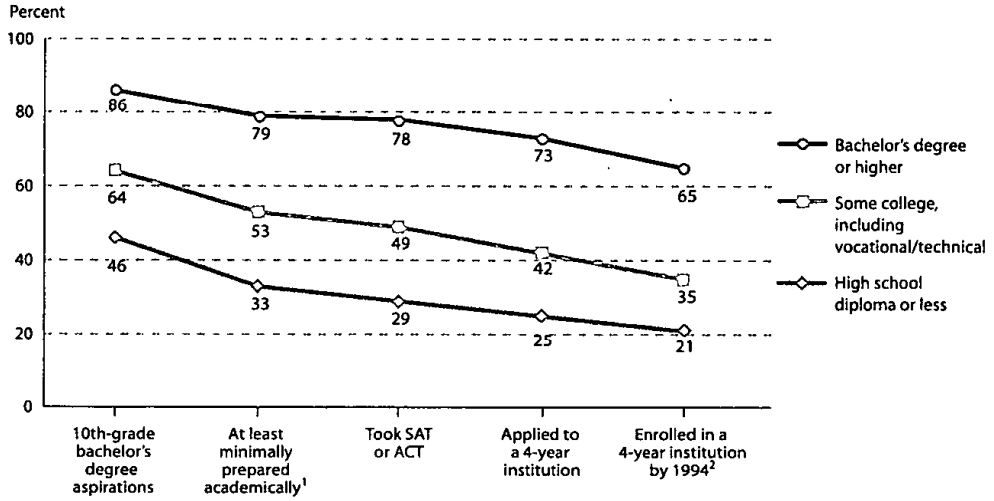
While the data indicate that postsecondary enrollment is linked to parents' education, increasing access to postsecondary education for these students by changing their parents' education is not feasible. Therefore, examining parents' education in relation to students' behaviors and academic experiences as they plan and prepare for college during high school may produce insights into how the influence of parents' education might be reduced.

The path to college

The path to college enrollment consists of five somewhat sequential steps (Berkner and Chavez 1997), although students do not always think of the process in these terms (Hossler et al. 1999). First, students must decide that they want to pursue postsecondary education and what type. Second, they must prepare academically for college-level work. Third, if they want to attend a 4-year institution, they must usually take the SAT or ACT entrance examinations. Fourth, they must choose one or more institutions and file applications. Finally, they must gain acceptance and make the financial and other arrangements necessary to enroll.

Figure 3 displays the percentage of 1992 high school graduates who completed each step (and all previous steps) toward enrollment in a 4-year institution. Graduates whose parents did not go to college were much less likely than their peers with more educated parents to complete each step. Compared with graduates whose parents had earned bachelor's degrees, they were about half as likely to aspire to a bachelor's degree in 10th grade (46 versus 86 percent), and, having completed all the other steps in the pipeline, about a third as likely to enroll in a 4-year institution (21 versus 65 percent).

Figure 3.—Percentage of 1992 high school graduates who progressed through each step to enrollment in a 4-year institution, by parents' highest level of education



[1]See the technical note at the end of this essay for the definition of "at least minimally prepared."

[2]Percentages differ from those shown in table 1 because the graduates who enrolled in a 4-year institution but did not have a bachelor's degree goal in 10th grade or skipped other steps (5 percent) are not included here.

NOTE: To be included in each of the second through fifth steps, students must have been included in all previous steps.

SOURCE: U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

As will be described, the findings from the NELS survey indicate that high school graduates whose parents did not go to college tended to report lower educational expectations, be less prepared academically, and receive less support from their families in planning and preparing for college than their peers whose parents attended college. The following discussion addresses each step to college enrollment in more detail.

Educational expectations

Most high school students formalize their educational plans between 8th and 10th grades, suggesting that interventions to influence students' educational aspirations are most likely to succeed if they take place by 8th or 9th grade (Hossler et al. 1999). Among 1992 high school graduates, educational expectations in both 8th and 12th grades varied considerably with parents' education.

- *High school graduates whose parents did not go to college tend to report lower educational expectations than their peers as early as 8th grade.*

Lower educational expectations figure prominently in the lower postsecondary enrollment rates of students whose parents did not go to college. In the NELS survey, students were asked the following question in both 8th and 12th grades: "As things stand now, how far in school do you think you will get?" Overall, expectations were high, with all but 7 percent of 1992 high school graduates reporting in 8th grade that they expected to continue their education beyond high school (table 2). Seventy-three percent reported that they expected to earn at least a bachelor's degree, and another 20 percent expected to complete some college or vocational training. Students' expectations of earning a bachelor's degree or higher increased sharply as their parents' education rose—from 55 percent for those whose parents had no postsecondary education, to 71 percent for those whose parents had some college experience, to 91 percent for those whose parents had bachelor's degrees or higher.

Regardless of parental education level, the percentage of students expecting to earn a bachelor's or advanced degree did not change much between 8th and 12th grades (although it was not necessarily the same individuals reporting this expectation in both years). Among students whose parents had less than a bachelor's degree, the percentage who expected to complete some postsecondary education (but less than a bachelor's degree) increased between 8th and 12th grades. The percentage of these students who did not expect to continue their education beyond high school decreased.

Table 2.—Percentage distribution of 1992 high school graduates according to their educational expectations in 1988 and 1992, by parents' highest level of education

Parents' highest level of education	Expectations in 1988			Expectations in 1992		
	No post-secondary education	Some post-secondary education	Bachelor's or advanced degree	No post-secondary education	Some post-secondary education	Bachelor's or advanced degree
Total	7.3	19.9	72.8	4.5	24.8	70.8
High school diploma or less	15.6	29.6	54.9	8.3	38.4	53.3
Some college, including vocational/technical	6.2	23.1	70.7	4.5	27.2	68.3
Bachelor's degree or higher	1.4	7.6	91.0	1.0	9.5	89.5

NOTE: Percentages may not add to 100.0 due to rounding.

SOURCE: Berkner and Chavez (1997), table 8. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

Academic preparation

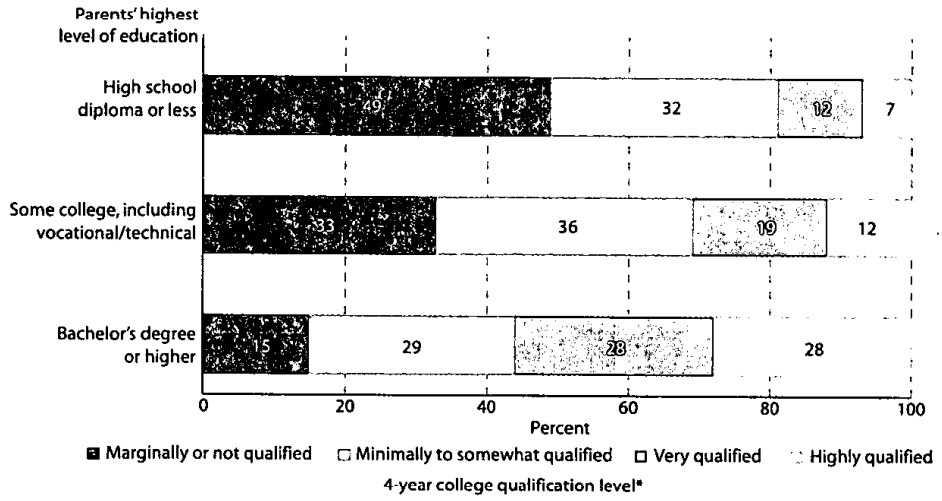
Taking appropriate courses in high school is an important step in preparing for college. In discussing academic preparation, this essay emphasizes preparation for 4-year colleges or universities. Lack of academic preparation is not necessarily a barrier to entry into a less-than-4-year institution, but it may be associated with students' success once there.

- *High school graduates whose parents did not go to college are less likely than those whose parents earned bachelor's or advanced degrees to be academically prepared for admission to a 4-year college.*

Low academic qualifications as well as lower expectations contributed to the lower enrollment rates of 1992 high school graduates whose parents had no postsecondary education. About half (49 percent) of this group were only "marginally or not qualified" for admission to a 4-year college (figure 4).[4] Considerably smaller proportions of those with more educated parents lacked qualifications (33 percent of those whose parents had some college experience and 15 percent of those whose parents had at least bachelor's degrees). At the other end of the preparation scale, those whose parents had no postsecondary education were less likely than others to be in the "highly qualified" category.

Academic qualifications alone do not fully explain the observed variation in enrollment rates. Parents' education made a difference even among the most highly qualified graduates. Of this group, 92 percent of those whose parents

Figure 4.—Percentage distribution of 1992 high school graduates according to their 4-year college qualification index level, by parents' highest level of education



*See the technical note at the end of this essay for a description of the college qualification index.

NOTE: Percentages may not add to 100 due to rounding.

SOURCE: Horn and Nuñez (2000), table 7. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

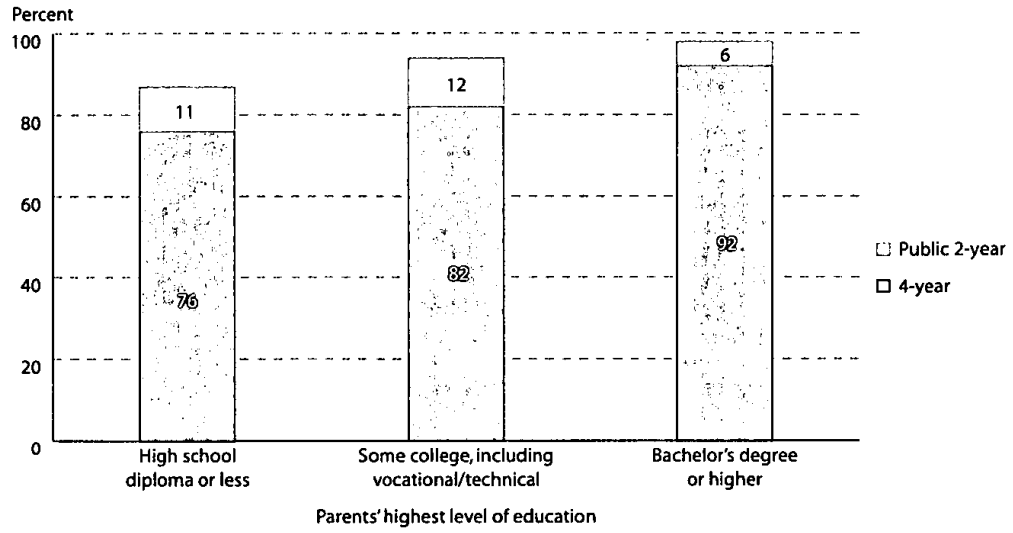
had bachelor's degrees or higher had enrolled in a 4-year institution by 1994, but just 76 percent of those whose parents had no postsecondary education had done so (figure 5).

- *High school mathematics coursetaking is strongly associated with eventual enrollment in a 4-year institution, and mathematics coursetaking is related to parents' education.*

The relationship between mathematics coursetaking and enrollment in a 4-year institution is striking. Seventy-six percent of 1992 high school graduates who took advanced academic mathematics[5] in high school had enrolled in a 4-year institution by 1994 (figure 6). The enrollment rate declined to 44 percent for those at the Middle Academic II level (did not go beyond algebra II), to 16 percent for those at the Middle Academic I level (only algebra and geometry), and to 6 percent for those with no mathematics or low-level or nonacademic mathematics.

Mathematics coursetaking is strongly related to parents' education, even when considering only students with comparatively high mathematics skills. Among high

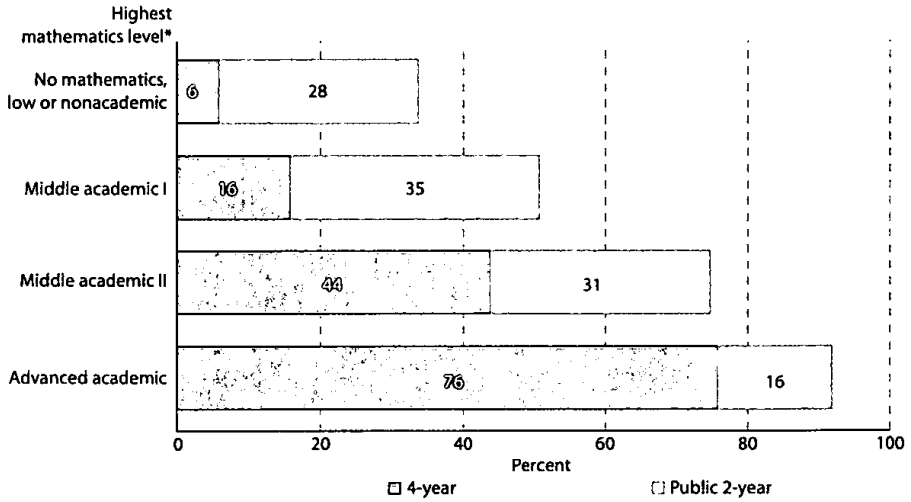
Figure 5.—Percentage of "highly qualified" 1992 high school graduates who had enrolled in 4-year and public 2-year institutions by 1994, by parents' highest level of education



NOTE: See the technical note at the end of this essay for a description of the college qualification index.

SOURCE: Horn and Nuñez (2000), table 9. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

Figure 6.—Percentage of 1992 high school graduates who had enrolled in 4-year and public 2-year institutions by 1994, by highest mathematics level completed in high school



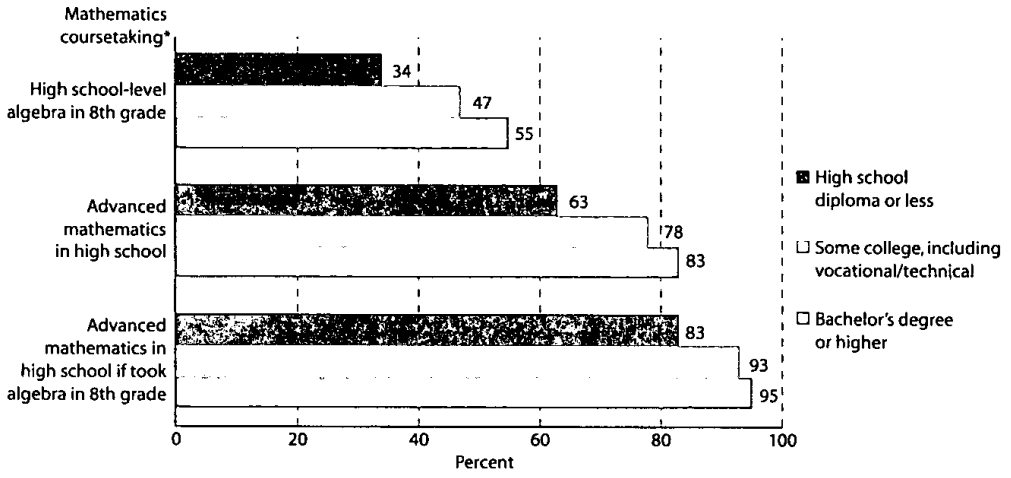
*See the technical note at the end of this essay for a description of mathematics levels.

SOURCE: Horn and Nuñez (2000), table 8. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994,

school graduates who had achieved the highest level of mathematics proficiency tested in the 8th grade,[6] those whose parents did not attend college were much less likely than those whose parents had bachelor's degrees or higher to take algebra in 8th grade (34 versus 55 percent) (figure 7). They were also much less likely to complete any advanced mathematics in high school (63 versus 83 percent). However, if they took algebra in 8th grade, the percentage taking advanced mathematics in high school rose to 83 percent, narrowing the gap with those students whose parents had bachelor's degrees.

Taking advanced mathematics in high school, in turn, is associated with a higher rate of enrollment in a 4-year institution. Among graduates whose parents had no postsecondary education, the enrollment rate of those who took advanced mathematics (64 percent) greatly exceeded the enrollment rates of their peers who did not take advanced mathematics (4 to 34 percent, depending on the level completed; figure 8). First-generation status still mattered, however, because even if they took advanced mathematics in high school, graduates whose parents had no postsecondary education were considerably less likely than those whose parents had at least bachelor's degrees to enroll in 4-year institutions (64 versus 85 percent).

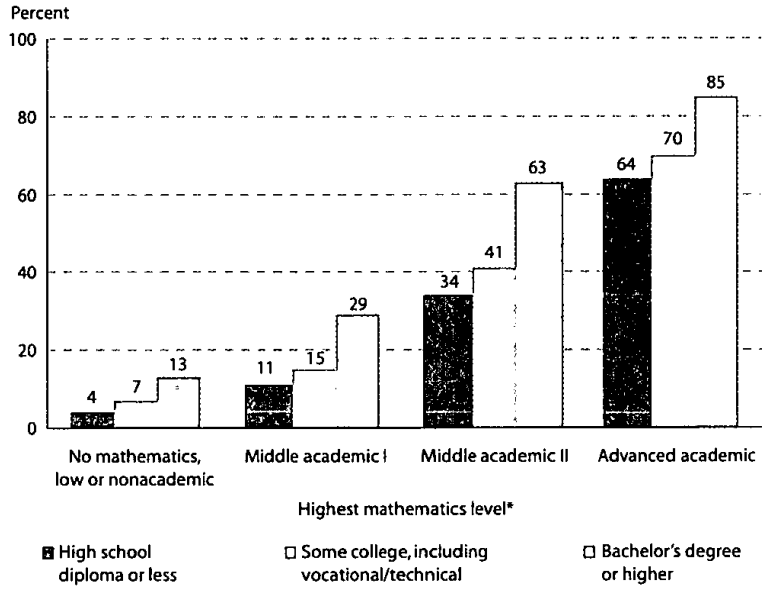
Figure 7.—Percentage of 1992 high school graduates with the highest mathematics proficiency in 8th grade who took algebra in 8th grade and advanced mathematics in high school, by parents' highest level of education



*See the technical note at the end of this essay for a description of the levels of mathematics proficiency tested and mathematics coursetaking.

SOURCE: Horn and Nuñez (2000), tables 4–6. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

Figure 8.—Percentage of 1992 high school graduates who had enrolled in a 4-year institution by 1994, by parents' level of education and highest mathematics level completed in high school



*See the technical note at the end of this essay for a description of mathematics levels.

SOURCE: Horn and Nuñez (2000), figure 7. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

In sum, students whose parents did not go to college remained at a disadvantage in terms of access to postsecondary education, even when taking into account academic ability and mathematics coursetaking. However, if they took advanced mathematics in high school, and particularly if they started with algebra in 8th grade, they greatly increased their chances of enrolling in a 4-year institution. These findings are consistent with those of Adelman (1999), who, using more sophisticated measures and statistical tools than those used for the studies summarized here, found that students' high school curriculum was the most influential determinant of their attainment of a bachelor's degree. He also found that of all precollege curricula, the highest level of mathematics that students took had the strongest continuing influence on their completing a bachelor's degree.

- *Parents' involvement in their children's curricular choices increases with their education.*

Considering only students with comparatively high mathematics skills in 8th grade (those who scored at the highest level tested), the frequency with which students reported that their parents had encouraged them to take algebra in 8th grade increased with parents' education—from 52 percent of those whose parents had no postsecondary education, to 59 percent of those whose parents had some college experience, to 70 percent of those whose parents had bachelor's degrees or higher (Horn and Nuñez 2000).

Whether students received help in choosing a high school program was also related to their parents' education. High school graduates whose parents had no postsecondary education were less likely than those whose parents had bachelor's degrees or higher to report in 12th grade that they chose their high school program with their parents' help (34 versus 48 percent), and more likely to report that they chose it by themselves (28 versus 22 percent) (Horn and Nuñez 2000). Teachers and counselors do not appear to serve as surrogates for parents who are not involved in their students' curricular choices. At each level of parental education, 43 percent of students reported that they chose their high school program with the help of teachers or counselors.

Taking tests and preparing applications

The final steps in applying to a 4-year college include taking admissions tests (SAT or ACT) if required, selecting specific colleges, and preparing applications for admission. If financial aid is needed, relevant information must be gathered and the appropriate applications completed. Students sometimes receive help from parents, teachers, counselors, or others as they go through these steps.

- *Students whose parents did not go to college receive less assistance from their parents in applying to colleges.*

Among 1992 high school graduates who were "college qualified," the likelihood of receiving assistance in applying to college increased with their parents' education. When the graduates were seniors, those whose parents did not attend college were considerably less likely than their peers whose parents had bachelor's degrees or higher to report that they often discussed SAT or ACT preparation (16 versus 27 percent) or postsecondary plans (42 versus 61 percent) with their parents (table 3). Furthermore, the percentage of students whose parents reported that they had participated in various planning activities—such as attending programs on educational opportunities, seeking information on financial aid, and accompanying their child on a school visit to decide about

Table 3.—Percentage of "college-qualified" 1992 high school graduates who planned for college with their parents, by parents' highest level of education

Parents' highest level of education	Students and parents discussed often in 12th grade: SAT or ACT preparation	Students and parents discussed often in 12th grade: Postsecondary plans	Parents reported that they: Attended programs on educational opportunities	Parents reported that they: Sought financial aid information	Parents reported that they: Visited a postsecondary institution at least once
Total	22.1	50.7	41.9	80.7	74.2
High school diploma or less	16.2	42.0	28.9	71.6	61.0
Some college, including vocational/technical	20.4	47.1	38.6	82.6	70.9
Bachelor's degree or higher	27.1	60.6	50.7	82.8	82.0

NOTE: See the technical note at the end of this essay for a description of the college qualification index.

SOURCE: Horn and Nuñez (2000), tables 14–17. Data from U.S. Department of Education, NCES. National Education Longitudinal Study of 1988 Eighth Graders, "Third Follow-up" (NELS:1988/1994).

application or enrollment—was notably higher if the parents had bachelor's or advanced degrees than when they had no postsecondary education.

- *Students whose parents did not go to college are not more likely to receive help from their schools in applying to colleges.*

Some students receive help with the college application process from their schools. Among college-qualified 1992 high school graduates, 52 percent reported receiving help with completing their college applications, 33 percent with preparing an admissions essay, and 46 percent with arranging days off to visit colleges (Horn and Nuñez 2000). Although one might expect students whose parents had no postsecondary education to receive help more often in these areas, there were no significant differences by parents' education. Students whose parents had no postsecondary education or some college were more likely to report that they received help with a financial aid application (51 and 47 percent, respectively) than were those whose parents had bachelor's degrees (34 percent); however, they were probably also more likely to be applying for aid.

Multivariate analysis confirms the importance of parental involvement and school support in preparing for college. Parental involvement in curricular decisions and college planning activities was associated with higher enrollment rates even after controlling for parents' income and education and for students' mathematics curriculum and level of college qualification (Horn and Nuñez 2000).

- *In families with the lowest incomes and least educated parents, students and parents know the least about the price of attending college.*

Although all students must make decisions about how to finance their postsecondary education and many need financial aid, students and their parents are not well informed about the price of attending. Among students approaching college age (i.e., 11th- and 12th-graders) and planning to attend some form of postsecondary education, 37 percent of students and 28 percent of their parents could not estimate what the price of tuition and fees might be (*Indicator 25, The Condition of Education 2001*). For both students and their parents, the likelihood of such uncertainty declined as family income and parents' education increased.

Deciding to enroll

Although most high school graduates who complete the college application process and are accepted at a 4-year institution enroll, not all do. Some delay enrollment or decide not to enroll.

- *Among students who are accepted at a 4-year institution, the enrollment rate does not vary with parents' education.*

If students took all the necessary steps leading to college enrollment, including preparing academically, taking college entrance examinations (SAT or ACT), applying to a 4-year institution, and being accepted for admission to at least one college, parents' education ceased to be important in enrollment. Among 1992 high school graduates who made it to this point, 89 percent had enrolled in a 4-year college by 1994, with no measurable differences by parental education (Berkner and Chavez 1997). This suggests that students who get this far somehow find the necessary financial resources (including financial aid, if necessary) and other support they need to enroll; however, the analysis could not take into account the extent to which students were deterred along the way by the price of college, availability of financial aid, or other factors.

Persistence and Attainment

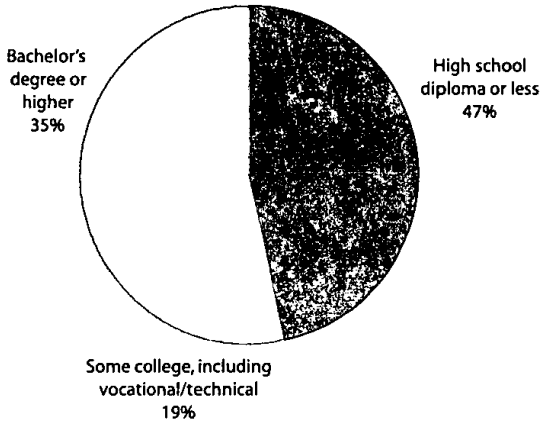
To reap the full benefits of postsecondary education, students must attain a degree. Enrolling and then leaving without a degree has negative monetary, occupational,

and other consequences for individuals (Tinto 1993). If leavers have borrowed to finance their education, they may be burdened with substantial loans to repay without the benefit of the higher salaries that often come with a degree.

The NELS 1988 8th-grade cohort was surveyed again in 2000 (8 years after most had finished high school). When the data from this survey are available for analysis, it will be possible to study this cohort's postsecondary persistence and attainment. For now, the most useful sources of data on persistence and attainment are the BPS longitudinal studies, which include postsecondary students of all ages rather than a single high school cohort as in NELS. About two-thirds of those in BPS, however, were 19 years or younger (Kojaku and Nuñez 1998) so findings from future analyses of the NELS data may be similar to those from analysis of the BPS data.

In 1995–96, 47 percent of all beginning postsecondary students were first generation—that is, neither of their parents had more than a high school education (figure 9). The proportion of students who were first generation declined as institution level increased—from 73 percent at less-than-2-year institutions, to 53 percent at 2-year institutions, to 34 percent at 4-year institutions (Kojaku and Nuñez 1998).

Figure 9.—Percentage distribution of beginning postsecondary students according to parents' highest level of education: 1995–96



NOTE: Percentages may not add to 100 due to rounding.

SOURCE: Kojaku and Nuñez (1998), table 3.5. Data from U.S. Department of Education, NCES. National Postsecondary Student Aid Study (NPSAS:1996).

Characteristics of first-generation students

- *First-generation students differ from other students in terms of age and enrollment characteristics.*

Among students who began their postsecondary education in 1995–96, first-generation students were more likely than others to be 24 years or older (table 4). If they were younger than 24 and financially dependent on their parents (as most students that age are), they were more likely than others to be in the lowest family income quartile. They were less likely than other students to have taken the SAT or ACT tests (which reflects the fact that they were also less likely to enroll in 4-year institutions; see table 5). If they did take one of these tests, they were more likely than those whose parents had bachelor's degrees or higher to have scored in the lowest quartile (table 4).

Table 4.—Percentage distribution of 1995–96 beginning postsecondary students according to selected student characteristics, by parents' highest level of education

		Parents' highest level of education			
Student characteristics	Total	High school diploma or less	Some college, including vocational/ technical	Bachelor's degree	Advanced degree
Total	100.0	100.0	100.0	100.0	100.0
Age as of 12/31/95					
18 and under	44.5	35.6	49.3	55.4	59.1
19	22.8	18.7	26.4	28.1	27.7
20–23	12.4	14.5	11.5	11.7	8.0
24 and above	20.3	31.2	12.9	4.8	5.2
Family income quartile (Dependent students only)					
Lowest (less than $25,000)	26.1	41.5	21.5	18.4	7.9
Second ($25,000–44,999)	24.5	27.0	28.4	23.5	16.8
Third ($45,000–69,999)	24.8	21.7	29.5	28.1	24.7
Highest ($70,000 or more)	24.6	9.8	20.7	30.0	50.6
Took SAT or ACT					
Yes	55.9	41.9	61.0	74.2	85.3
No	44.1	58.1	39.0	25.8	14.7
SAT percentile rank					
Lowest quartile	25.7	34.7	32.6	17.7	13.0
Middle quartiles	49.4	50.8	51.3	53.5	41.5
Highest quartile	24.9	14.5	16.1	28.8	45.5

NOTE: Percentages may not add to 100.0 due to rounding.

SOURCE: Kojaku and Nuñez (1998), tables 3.2, 3.3, and 4.3. Data from U.S. Department of Education, NCES. National Postsecondary Student Aid Study (NPSAS:1996).

Table 5.—Percentage distribution of 1995–96 beginning postsecondary students according to selected enrollment characteristics, by parents' highest level of education

Enrollment characteristics	Total	Parents' highest level of education: High school diploma or less	Some college, including vocational/ technical	Bachelor's degree	Advanced degree
Total	100.0	100.0	100.0	100.0	100.0
Level of institution					
Less-than-2-year	9.6	14.0	7.0	4.4	1.8
2-year	50.1	56.1	56.1	44.4	27.8
4-year	40.3	29.9	36.9	51.2	70.4
Attendance status					
Full-time, full-year	51.8	43.5	51.8	61.8	73.0
Full-time, part-year	17.7	20.2	17.3	14.1	11.2
Part-time, full-year	14.5	17.4	15.6	13.9	6.3
Part-time, part-year	15.9	18.9	15.3	10.2	9.6
Primary role if working					
Student working to meet expenses	71.1	61.7	75.1	82.4	84.7
Employee enrolled in school	28.9	38.3	24.9	17.6	15.3

NOTE: Percentages may not add to 100.0 due to rounding.

SOURCE: Kojaku and Nuñez (1998), tables 1.1, 1.3, and 5.6. Data from U.S. Department of Education, NCES. National Postsecondary Student Aid Study (NPSAS:1996).

Compared with other students, first-generation students were less likely to enroll in 4-year institutions, and to attend full time over a full year (table 5). In addition, first-generation students who worked while enrolled (as 70 percent did) were more likely than others to consider themselves to be primarily employees who were enrolled in school (as opposed to being primarily students) (Kojaku and Nuñez 1998).

- *As a group, first-generation students at 4-year institutions appear to begin college less academically prepared than other students.*

Based on what is known about their high school experiences, there is some evidence that first-generation students who began at 4-year institutions in 1995–96 were less well prepared academically than their peers whose parents had bachelor's or advanced degrees. In high school, they were less likely to follow a rigorous curriculum, take calculus, SAT or ACT examinations, or take an advanced placement test (table 6).

Table 6.—Percentage of 1995–96 beginning postsecondary students at 4-year institutions who took various steps to prepare academically for college, by parents' highest level of education

Parents' highest level of education	Took a rigorous high school curriculum*	Took calculus in high school	Took SAT or ACT	Took advanced placement test
Total	18.6	28.2	90.5	16.1
High school diploma or less	9.2	19.8	82.9	8.2
Some college, including vocational/technical	12.9	24.0	93.0	14.3
Bachelor's degree or higher	25.0	33.8	96.4	22.0

* See the technical note at the end of this essay for a description of curriculum levels.

SOURCE: Warburton, Bugarin, and Nuñez (2001), figure 1 and tables 4 and 5. Data from U.S. Department of Education, NCES. Beginning Postsecondary Students Longitudinal Study, "First Follow-up" (BPS:1996/1998).

Persistence and performance in the first year

Completing the first year in postsecondary education is related to timely attainment of a degree. Whereas about half of all students who entered postsecondary education in 1989–90 completed a certificate or degree within 5 years, about two-thirds of students who completed their first year attained within 5 years (Horn 1998).

- *First-generation status is associated with leaving a 4-year institution (but not a 2-year institution) before the second year.*

Overall, 16 percent of those who began their postsecondary education in a 4-year institution in 1989–90 left before their second year—that is, they either dropped out for at least 4 months during their first year or failed to return for their second year (Horn 1998). First-generation students were about twice as likely as those whose parents had bachelor's degrees to do so (23 versus 10 percent). Other characteristics associated with higher rates of leaving were having low grades (GPA under 2.0), delaying enrollment after high school, working 35 or more hours per week, and having low or moderate participation in campus activities.[7] After adjusting for these factors and also taking into account others—such as financial aid, attendance status when first enrolled (full- or part-time), race/ethnicity, sex, socioeconomic status, institutional control, and satisfaction with campus life—first-generation status was still a significant indi-

cator of leaving before the second year. In addition, first-generation students were less likely than others to return to a 4-year institution once they left. They represented a larger proportion of those who had left and not returned to a 4-year institution as of 1994 (55 percent) than of those who had left and returned (35 percent) (Horn 1998).

The situation was somewhat different for those who began at public 2-year institutions in 1989–90. Although first-generation students left during or after their first year at a higher rate than those whose parents had bachelor's degrees or higher (48 versus 33 percent), this difference disappeared when other factors were considered. Only low GPAs, low academic integration index scores,[8] and having no degree objective were significantly related to leaving before the second year.

- *A rigorous high school curriculum helps mitigate the disadvantage of first-generation status.*

Among 1995–96 beginning postsecondary students, academic performance in the first year varied with parents' education under some, but not all circumstances. Specifically, students' high school curriculum was an intervening factor.[9]

Among 1995–96 beginning postsecondary students at 4-year institutions whose high school curriculum did not exceed the core New Basics, first-generation students earned a lower average GPA in their first year (2.4) than their peers whose parents had bachelor's or advanced degrees (2.7) (Warburton, Bugarin, and Nuñez 2001). A similar relationship held if the high school curriculum was Beyond Core New Basics I—first-generation students had an average GPA of 2.5, and students whose parents had bachelor's or advanced degrees had an average GPA of 2.8. This difference did not extend to those who had taken more challenging curricula. Regardless of parents' education, students earned an average GPA of about 2.7 when their high school curriculum was Beyond Core New Basics II and an average of about 3.1 when it was in the Rigorous category.

Persistence and attainment after 3 years

To make meaningful comparisons between first-generation and other students, it is important to separate them by degree goal. After 3 years, it is reasonable to expect some of those seeking certificates or associate's degrees to have com-

pleted them. Although few will have earned bachelor's degrees during this time frame, it is useful to determine if the rest are still on track toward this goal.

- *After 3 years, first-generation students are as likely as others with certificate or associate's degree goals to persist and attain.*

Among 1995–96 beginning postsecondary students with certificate or associate's degree goals, there were no meaningful differences between first-generation and other students in either the percentage who had attained degrees or certificates by 1998 or the percentage who had left without attaining (table 7). Apparent differences were not statistically significant.

Table 7.—Percentage distribution of 1995–96 beginning postsecondary students according to degree attainment by 1998, by initial goal and parents' highest level of education

Parents' highest level of education	Highest degree attained by 1998			No degree		
				Still enrolled		
	Certificate	Associate's	Bachelor's	Less-than 4-year	4-year	Not enrolled
			Certificate goal			
High school diploma or less	51.3	2.0	(*)	8.2	1.1	37.3
Some college, including vocational/technical	50.6	0.9	(*)	7.2	2.3	39.0
Bachelor's degree	40.1	7.1	(*)	14.8	4.9	33.1
Advanced degree	—	—	—	—	—	—
			Associate's degree goal			
High school diploma or less	6.6	12.6	(*)	33.3	4.2	43.4
Some college, including vocational/technical	5.3	13.0	(*)	30.9	7.9	42.9
Bachelor's degree	6.0	25.2	0.4	28.2	5.1	35.2
Advanced degree	0.9	10.8	(*)	22.9	33.3	32.1
			Bachelor's degree goal			
High school diploma or less	2.0	2.9	1.1	13.9	52.0	28.2
Some college, including vocational/technical	1.3	4.8	0.6	16.5	52.4	24.6
Bachelor's degree	1.6	2.4	0.5	14.8	67.2	13.5
Advanced degree	1.1	1.5	0.7	6.3	82.9	7.7

—Sample size too small for a reliable estimate.

*Value less than 0.05 percent.

NOTE: Percentages may not add to 100.0 due to rounding.

SOURCE: Berkner, Horn, and Clune (2000), tables 5.1c, 5.2c, and 5.3c. Data from U.S. Department of Education, NCES. Beginning Postsecondary Students Longitudinal Study, "First Follow-up" (BPS:1996/1998).

- *After 3 years, first-generation students with bachelor's degree goals are less likely than their counterparts whose parents have bachelor's or advanced degrees to remain enrolled in 4-year institutions.*

As parents' education increased, so did the likelihood of beginning postsecondary students with bachelor's degree goals remaining enrolled in 4-year institutions after 3 years. About half of those whose parents had no postsecondary education or only some college (52 percent in each case) were still enrolled, compared with 67 percent of those whose parents had bachelor's degrees and 83 percent of those whose parents had advanced degrees (table 7).

- *After 3 years, first-generation students are less likely than those whose parents have bachelor's or advanced degrees to remain on a persistence track to a bachelor's degree.*

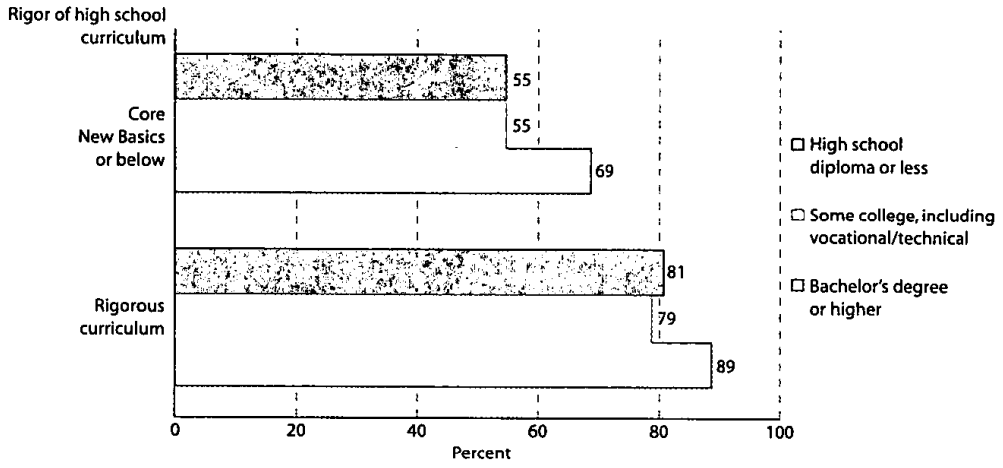
First-generation students who started at 4-year institutions in 1995–96 were less likely than their counterparts whose parents had bachelor's or advanced degrees to remain on a persistence track[10] to a bachelor's degree in 1998 (58 versus 77 percent) (Warburton et al. 2001). This relationship held after taking into account other factors that were associated with lower persistence rates, including less than rigorous high school coursetaking, having a first-year GPA in the lowest quartile (2.11 or less), enrolling part time, working full time, and being married.[11]

When first-generation students reported taking a rigorous curriculum in high school, the persistence gap narrowed. Among students who did not exceed the Core New Basics curriculum in high school, first-generation students persisted at a lower rate than students whose parents had bachelor's degrees (55 versus 69 percent) (figure 10). Among those who took a rigorous high school curriculum, however, the difference was not statistically significant (81 and 89 percent).

Persistence and attainment after 5 years

The second follow-up of students who began their postsecondary education in 1989–90 provides an opportunity to examine persistence and degree attainment after approximately 5 years, by which time rates of attainment for a bachelor's degree become meaningful.

Figure 10.—Percentage of 1995–96 beginning postsecondary students at 4-year institutions who stayed on the persistence track to a bachelor's degree, by rigor of high school curriculum and parents' highest level of education: 1998



SOURCE: Warburton, Bugarin, and Nuñez (2001), table 15. Data from U.S. Department of Education, NCES. Beginning Postsecondary Students Longitudinal Study, "First Follow-up" (BPS: 1996/1998).

- *After 5 years, first-generation students are less likely than others to have stayed enrolled and attained a degree.*

Overall, half of all 1989–90 beginning postsecondary students had earned some type of degree by 1994. Another 13 percent were still enrolled, and the remaining 37 percent had left without attaining and were not enrolled in 1994 (Nuñez and Cuccaro-Alamin 1998). First-generation students were less likely than other students to have earned a bachelor's degree (13 versus 33 percent), about as likely to have earned an associate's degree (13 and 14 percent, respectively), and more likely to have earned a vocational certificate (18 versus 9 percent). First-generation students were also more likely than others to have left without a degree (45 versus 29 percent).

Multivariate analysis confirms that, among those who intended to earn a degree or certificate, first-generation students were less likely to reach their goals even after controlling for other factors also related to persistence and attainment, including socioeconomic status, age, enrollment status, sex, race/ethnicity, type of institution, and academic and social integration. In other words, first-generation status appears to be a disadvantage throughout postsecondary education that is independent of other background and enrollment factors. For this

cohort, information on their financial aid history and high school coursetaking is not available. Thus their effects on persistence cannot be determined.

After College

Once students whose parents did not go to college overcome the barriers to access, persistence, and attainment, are they in the same position as other graduates? The data available to address this question are limited. Nevertheless, the answer in the short term seems to be a qualified yes, at least in terms of easily measured early labor market outcomes.

Labor market outcomes

- *Among postsecondary completers, short-term labor market outcomes appear to be similar regardless of first-generation status.*

Among those who completed a degree or certificate and entered the workforce, first-generation and other students were generally distributed similarly among broad occupation groups (table 8). This was true whether they earned a certificate, an associate's degree, or a bachelor's degree.

Average salaries did not differ either. Among 1992–93 bachelor's degree recipients who were employed full time in April 1994, the average salary was about $23,000 for both first-generation graduates and others (Nuñez and Cuccaro-Alamin 1998). On average, males earned higher salaries than females ($26,000 versus $21,000), but there was no difference according to first-generation status for either males or females.

Salary parity continued for at least 3 more years. In April 1997, the average salary for 1992–93 bachelor's degree recipients who had not enrolled in graduate education and who were employed full time was about $34,000 (Horn and Zahn 2001).[12] A multivariate analysis showed that salary was related to undergraduate major, sex, GPA, and type of institution attended, but not to parents' education.[13]

Table 8.—Percentage distribution of employed 1989–90 beginning postsecondary students according to occupation in 1993 or 1994, by highest degree earned and parents' highest level of education

Parents' highest level of education	Clerical	Craftsman	Manager	Professional	Sales	Service	Technical	Other
				Certificate recipients				
Total	**24.3**	**20.8**	**9.5**	**6.8**	**4.6**	**24.3**	**6.6**	**3.2**
High school diploma or less	26.8	21.6	9.5	7.3	4.4	22.7	5.6	2.0
Some college, including vocational/technical	20.4	21.8	12.0	5.6	7.4	24.3	8.3	0.2
Bachelor's degree or higher	23.3	12.9	9.3	6.7	4.2	27.0	6.9	9.6
				Associate's degree recipients				
Total	**28.7**	**8.3**	**14.6**	**12.4**	**6.0**	**16.2**	**8.3**	**5.5**
High school diploma or less	28.8	6.9	19.2	10.0	3.6	16.8	7.8	7.0
Some college, including vocational/technical	29.7	9.1	18.6	10.6	8.8	13.3	8.2	1.7
Bachelor's degree or higher	29.2	8.0	4.9	17.0	7.3	18.6	8.8	6.3
				Bachelor's degree recipients (1 year after degree)				
Total	**17.9**	**3.2**	**19.6**	**26.2**	**7.1**	**17.4**	**7.8**	**0.9**
High school diploma or less	18.6	3.0	19.4	25.4	6.4	18.3	8.3	0.7
Some college, including vocational/technical	17.2	2.7	21.5	26.1	8.4	15.9	7.1	1.1
Bachelor's degree or higher	17.7	3.4	19.0	26.6	7.0	17.6	8.0	0.8

NOTE: Data for certificate and associate's degree recipients are based on the primary 1993 occupation of 1989–90 beginning postsecondary students who received their certificate or degree by 1994, and data for bachelor's degree recipients are based on the April 1994 occupation of 1992–93 bachelor's degree recipients. Percentages may not add to 100.0 due to rounding.

SOURCE: Nuñez and Cuccaro-Alamin (1998), table 22. Data from U.S. Department of Education, NCES. Beginning Postsecondary Students Longitudinal Study, "Second Follow-up" (BPS:1990/1994) and Baccalaureate and Beyond Longitudinal Study (B&B:1993/1994).

Graduate enrollment

Graduate enrollment allows individuals to pursue their intellectual interests in greater depth. It also provides them with access to careers that require an advanced degree, such as law, medicine, and university-level teaching.

- *First-generation status is a factor in graduate enrollment.*

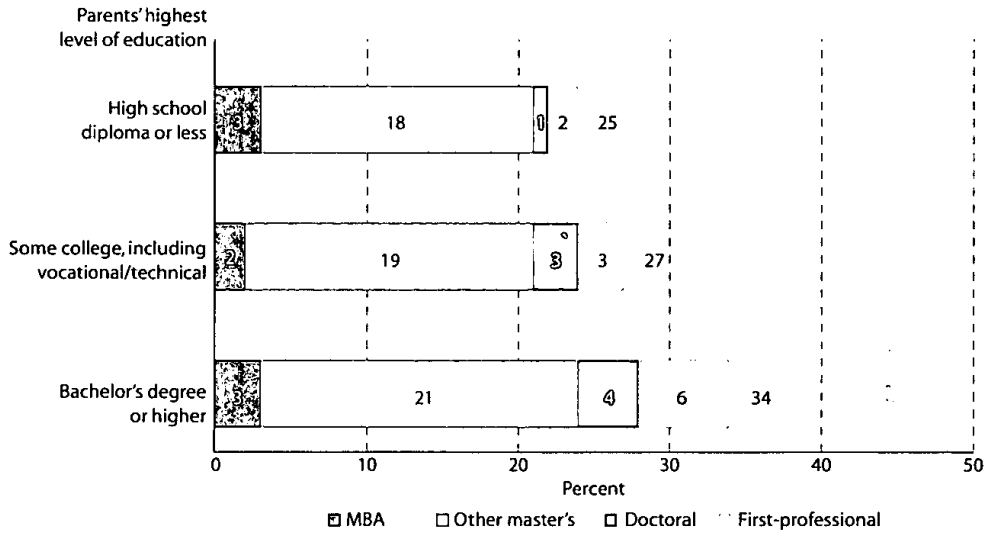
Overall, 30 percent of 1992–93 bachelor's degree recipients had enrolled in a graduate or first-professional program by 1997, but first-generation students were less likely than their peers whose parents had bachelor's or advanced degrees to have done so (25 versus 34 percent) (Choy 2000). This relationship held even after controlling for other factors significantly related to graduate enrollment including age, undergraduate major, GPA, and race/ethnicity, and also after controlling for selected other factors including sex, amount borrowed

as an undergraduate, and control of institution attended. First-generation students were as likely as others to enroll in MBA or other master's degree programs, but less likely to enroll in doctoral degree programs (figure 11). They were less likely than those whose parents' had a bachelor's degree or higher to enroll in a first-professional degree program.

Summary and Conclusions

Whether high school graduates enroll in postsecondary education and whether postsecondary students reach their degree goals depend on many factors, but those whose parents have no education beyond high school are considerably less likely to succeed than those whose parents have completed a bachelor's degree. Students who are nonwhite or from low-income families tend to be disproportionately represented among those whose parents have low education. Multivariate analysis confirms that parents' education remains significant for gaining access to postsecondary education and for persistence and bachelor's degree attainment at 4-year institutions even after controlling for other factors such as income, educational expectations, academic preparation, parental involvement, and peer influence.

Figure 11.—Percentage of 1992–93 bachelor's degree recipients who had enrolled in a graduate or first-professional degree program by 1997, by parents' highest level of education



SOURCE: U.S. Department of Education, NCES. Baccalaureate and Beyond Longitudinal Study, "Second Follow-up" (B&B:1993/1997).

Readers should not interpret the findings in this essay as implying that the availability of student financial aid has no effect on the postsecondary enrollment and persistence of first-generation students. The availability and awareness of financial aid help remove the barriers to enrolling in college and remaining there. The independent effects of financial aid on the enrollment and persistence of first-generation students have not been explicitly considered in this analysis.

Over time, increases in educational attainment among young adults (who may eventually become parents themselves) may reduce the proportion of students disadvantaged by low parental education. Between 1971 and 1998, the proportion of 25- to 29-year-olds who earned a bachelor's degree or higher rose (from 22 to 31 percent), as did the proportion who attended some college (from 44 to 66 percent) (*Indicator 59, The Condition of Education 1999*). Whether this will result in a net decline in the percentage of children whose parents did not attend college will depend on the balance between the trend toward a more highly educated population and demographic trends related to marriage, childbearing, and immigration.

In the meantime, evidence from the studies summarized here suggests that programs and practices that encourage first-generation students to take academically challenging courses in high school and counsel students and their parents about preparing for college may hold promise for broadening the access of these students to postsecondary education and helping them succeed once enrolled.

Notes

[1]The data from the most recent survey are just becoming available for analysis.

[2]The BPS samples are composed of students who participated in the 1989–90 and 1995–96 National Postsecondary Student Aid Studies (NPSAS) and who were identified as enrolling in postsecondary education for the first time in those years.

[3]First-professional degrees include the following: medicine (MD), chiropractic (DC or DCM), dentistry (DDS or DMD), optometry (OD), osteopathic medicine (DO), pharmacy (DPharm), podiatry (PodD or DPM), veterinary medicine (DVM), law (LLB or JD), and theology (MDiv, MHL, or BD).

[4]Berkner and Chavez (1997) developed an index of college qualification based on a number of factors related to performance in high school. The index is described in detail in the technical note to this essay.

[5]Levels of mathematics coursetaking are described in the technical note to this essay.

[6]Levels of mathematics proficiency are described in the technical note to this essay.

[7]These activities include: attending career-related lectures, participating in study groups, talking over academic matters with faculty, and meeting with an advisor concerning academic plans. An index was developed based on the number of times students participated in each of these activities during 1989–90.

[8]This index was based on how frequently students did the following in 1989–90: attended career-related lectures, participated in study groups, discussed academic matters with faculty, and met with an advisor.

[9]The measures of high school curriculum are described in the technical note to this essay.

[10]Persistence track means continuous enrollment (no break for more than 4 months) toward a bachelor's degree in any 4-year institution.

[11]When all these other factors were taken into account, family income, scores on college entrance examinations, and whether they took remedial courses in their first year were not associated with persistence.

[12]Among 1992–93 bachelor's degree recipients, 70 percent had not enrolled in graduate education by 1997, and 86 percent of those who had not enrolled were employed full time in April 1997.

[13]For this particular analysis the categories for parents' education were "bachelor's degree" and "less than a bachelor's degree."

Technical Note

College qualification index

The college qualification index is based on five measures—high school GPA, senior class rank, NELS 1992 test scores, SAT scores, and ACT scores. Students were classified according to the *highest* level they had achieved on *any* of the criteria. Thus, the qualification of students who were missing data on any of the measures were categorized based on nonmissing data. The "highly qualified" students were in the top 10 percent of those who attended a 4-year institution on at least one measure; "very qualified" students were in the top 25 percent; "minimally to somewhat qualified" were in the top 75 percent; and "marginally or not qualified" students had no value on any of the five measures that would place them in the top 75 percent. Some adjustments were made for curriculum, moving students up one level higher if they had taken a program of rigorous high school courses, and down from "highly to "very" qualified if they had not. See Berkner and Chavez (1997) for more detail.

Level of mathematics in high school

No mathematics or low or nonacademic mathematics: Student took no mathematics courses or took nonacademic or low academic courses including those classified as "general mathematics" or "basic skills mathematics," preliminary (e.g., prealgebra) or reduced rigor/paced mathematics courses (algebra 1 that is spread over 2 academic years and "informal geometry").

Middle academic I: Student completed 2 years of mathematics including algebra 1 and geometry, or 2 years of a unified mathematics sequence covering algebra 1, geometry, and algebra 2.

Middle academic II: Student completed 3 years of mathematics, including algebra 2 or a third year of a unified mathematics program.

Advanced academic: Student completed at least one class beyond algebra 2 labeled as "advanced," including courses such as algebra 3, precalculus, trigonometry, probability, statistics, or calculus.

NELS mathematics proficiency test level

Level 1: Can perform simple arithmetical operations on whole numbers.

Level 2: Can perform simple operations with decimals, fractions, and roots.

Level 3: Can perform simple problem solving requiring conceptual understanding or the development of a solution strategy.

Rigor of high school curriculum

The overall difficulty of students' coursework in high school is an indicator of their academic preparation for postsecondary education. Using previous research as a guide (Adelman 1999; Burkam, Lee, and Smerdon 1997), the variable "academic rigor" was created to reflect the following:

- the number of courses students had completed in academic subjects in mathematics, science, English, social studies, and foreign language;
- the level or intensity of courses that students had taken in mathematics and science; and
- whether students had taken any honors or AP courses.

When information on honors/AP coursetaking was missing, AP test-taking was used to provide supplementary data. It was assumed that, if AP records indicated that students had taken an AP test, students had taken a honors/AP course.

Coursetaking was compared with the New Basics curriculum recommended by the National Commission on Excellence in Education (NCEE) in 1983 that consists of 4 years of English, 3 years each of mathematics, science, and social studies, and one-half year of computer science. The Core New Basics is the most commonly implemented form of this curriculum and excludes the computer science requirement.

- *Core New Basics or below*: Student completed no more than 4 years of English and 3 years each of mathematics, science, and social studies.
- *Beyond Core New Basics I:* Student completed at least 4 years of English and 3 years each of mathematics (including algebra 1 and geometry), science (including 2 years of biology, chemistry, or physics), and social studies.
- *Beyond Core New Basics II:* Student completed at least 4 years of English and 3 years each of mathematics (including algebra 2), science (including biology, chemistry, and physics), and social studies.
- *Rigorous*: Student completed at least 4 years each of English and mathematics (including precalculus), 3 years each of science (including biology, chemistry, and physics) and social studies, 3 years of foreign language, and 1 honors/AP course or AP test score.

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