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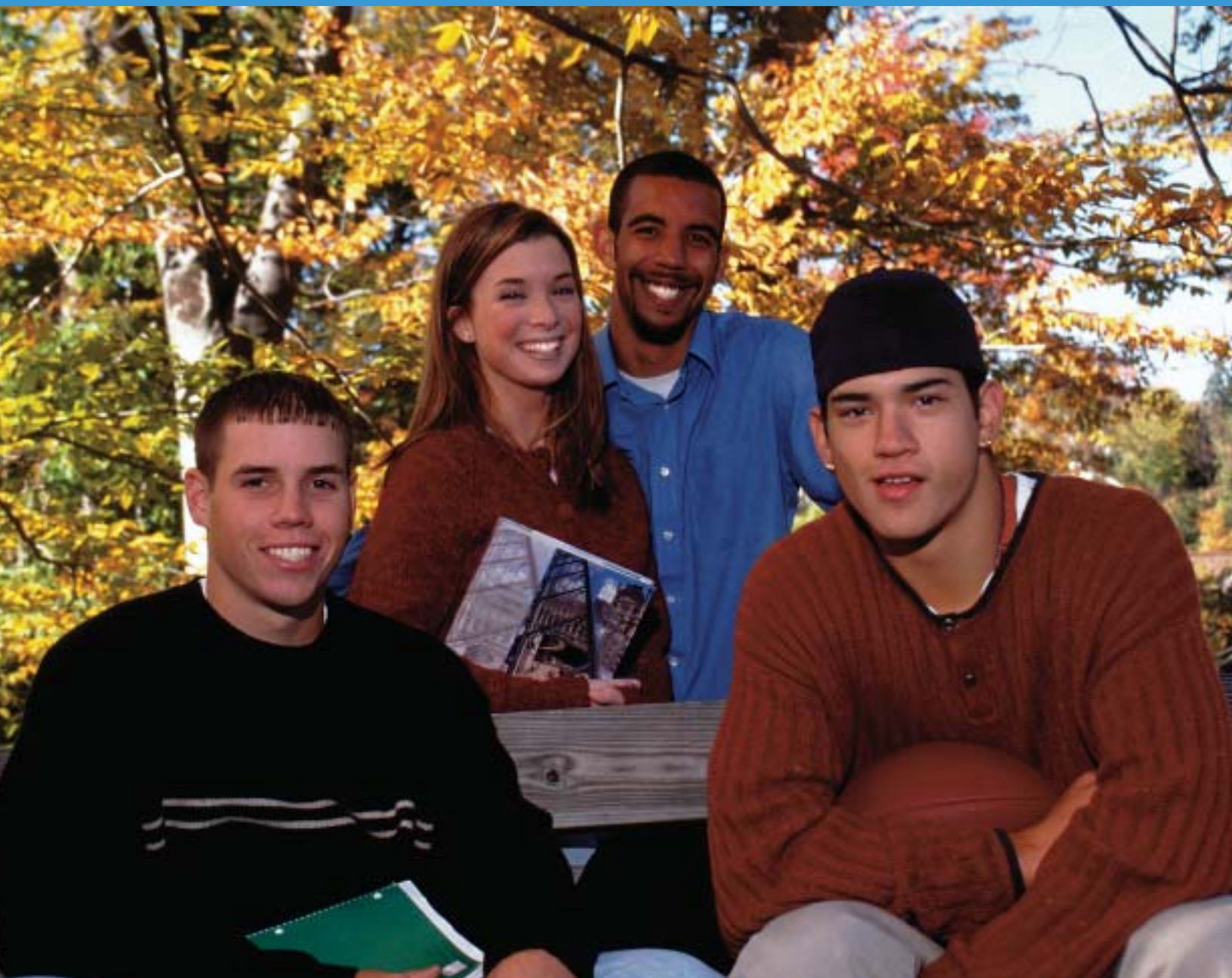
First-Generation Students in Postsecondary Education

A Look at Their College Transcripts

Postsecondary Education Descriptive Analysis Report



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A Look at Their College Transcripts

Postsecondary Education Descriptive Analysis Report

July 2005

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Executive Summary

Recent research has generated a large body of knowledge about students who are the first members of their families to attend college (referred to as "first-generation students" in this report).[1] The results show that such students are at a distinct disadvantage in gaining access to postsecondary education. Even those who overcome the barriers and do enroll have difficulty remaining enrolled and attaining a degree (Horn and Nuñez 2000; Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001).

What has not been well studied, however, are the coursetaking experiences of first-generation students after entering college. What do first-generation students study in college? How well do they do in their coursework? Is their coursework different from that of their peers whose parents went to college? This report explores these questions by using data from the Postsecondary Education Transcript Study (PETS) of the National Education Longitudinal Study of 1988 (NELS:88) to examine the majors and coursetaking patterns of first-generation students and to compare their postsecondary experiences and outcomes with those of students whose parents went to college.[2] This analysis focuses on a subset of the NELS 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and who also have complete postsecondary transcripts available; in addition, the analysis also required that parents' education levels be reported. The findings of this study contribute to earlier research by distinguishing between first-generation students and their counterparts with respect to major fields of study chosen, the types of courses taken, amount of coursework completed, academic performance, and postsecondary outcomes. The major findings are summarized below.[3]

First-Generation Students in Postsecondary Education: A Brief Portrait

About 28 percent of the NELS 1992 12th-graders were first-generation students (figure A). However, they represented 22 percent of those who entered postsecondary education between 1992 and 2000, indicating that first-generation students were less likely than other students to attend college within 8 years after high school.[4] Roughly 4 in 10 (43 percent) first-generation students who entered postsecondary education during this period left without a degree by 2000, while 24 percent had graduated with a bachelor's

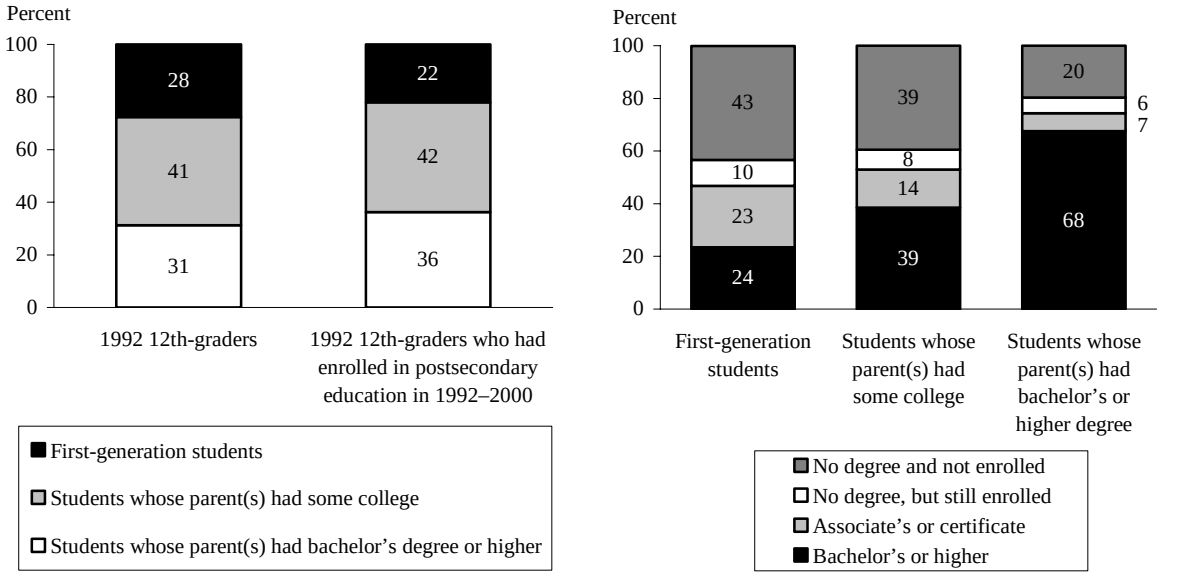
[1] See, for example, Choy (2001).

[2] Two comparison groups were included in this report: those who had at least one parent with some college education, but neither parent attained a bachelor's degree; and those who had at least one parent who earned a bachelor's or advanced degree. The latter group was also frequently referred to as "students whose parents were college graduates" in this report.

[3] For each indicator examined in this report, a parallel analysis was conducted for a restricted sample of students who attended a 4-year institution at any time in 1992–2000 and expected to attain a bachelor's degree. Most findings reported here also held for this subgroup.

[4] All comparisons made in the report were tested using Student's *t* statistic. All differences cited were statistically significant at the .05 level.

Figure A. Percentage distribution of generation status in 1992 12th-graders; and of those who had enrolled in postsecondary education between 1992 and 2000, generation status by percentage distribution of postsecondary attainment and enrollment in 2000



NOTE: Except for the first two bar charts, all figures included only students for whom complete postsecondary transcripts were available and for whom parents' education was known. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

degree (figure A). The opposite pattern was observed for students whose parents were college graduates: a large majority (68 percent) had completed a bachelor's degree, while 20 percent left without a degree.

As in earlier studies (Ishitani 2003), this report found that first-generation students had some family and background characteristics that are associated with attrition. Compared with their peers whose parents were college graduates, first-generation students were more likely to be Black or Hispanic and to come from low-income families (table 1). They were less prepared academically for college as demonstrated by their lower rates of taking higher-level mathematics courses in high school, their lower senior achievement test scores, and their lower college entrance examination scores. They were also more likely to delay postsecondary entry, begin at a 2-year institution, and attend part time and discontinuously (table 2). These characteristics, as shown in earlier research, put them at potential risk for not persisting in their postsecondary studies and completing a degree (Nuñez and Cuccaro-Alamin 1998).

Remedial Coursetaking

Reflecting their weaker high school academic preparation, many first-generation students needed remedial assistance after they enrolled in college. A majority of first-generation students (55 percent) took some remedial courses during their

college years, compared with 27 percent of students whose parents held a bachelor's or advanced degree (table 3). In particular, 40 percent of first-generation students took remedial mathematics courses, and 13 percent took remedial reading courses, compared with 16 and 6 percent, respectively, of students whose parents had a bachelor's degree or higher. The higher need for remedial education among first-generation students was apparent in many major fields of study.

Undergraduate Major

Choosing an undergraduate major appeared to pose a greater challenge for first-generation students than for other students. One-in-three first-generation students (33 percent) had not identified a major after entering postsecondary education, compared with 13 percent of students whose parents had a bachelor's or advanced degree (figure B).

Among those with a major, business and social sciences were the two most popular undergraduate fields for all three groups of students: between 7 and 14 percent of students majored in these two fields. Despite this similar pattern, the differences in the choice of majors were evident among the three comparison groups. For example, first-generation students were more likely to choose a major in a vocational or technical field, whereas their counterparts whose parents had a bachelor's or advanced degree were more likely to choose a major in science, mathematics, engineering and architecture, humanities, arts, or social sciences. Many factors are associated with a student's choice of major. Weak academic preparation, for example, may deter first-generation students from choosing certain "high-skill" fields, such as mathematics and science. Perceived low-earning potential may also deter them from entering such fields as humanities, arts, and social sciences (Montmarquette, Cannings, and Mahseredjian 2002).

Credits Earned

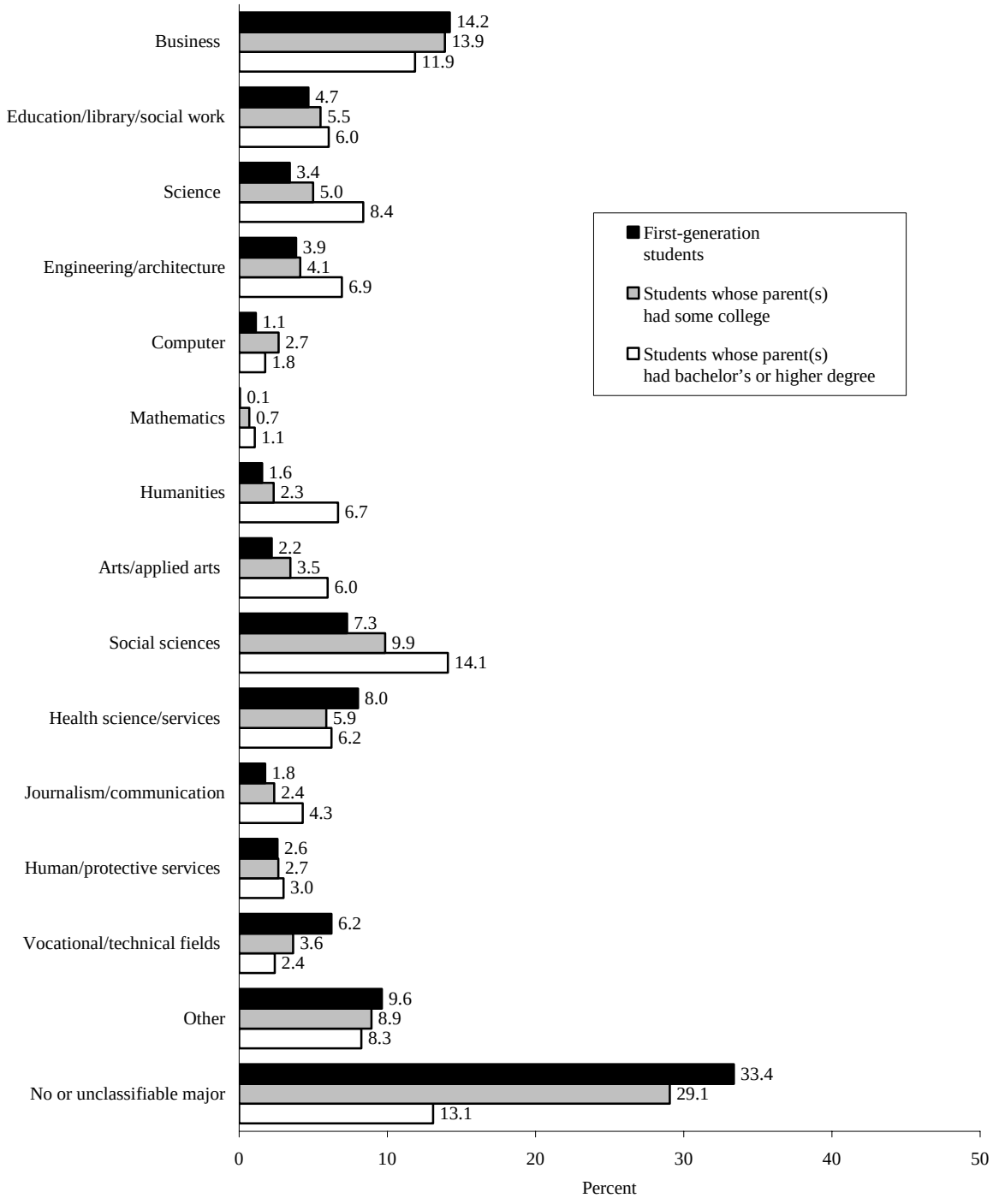
The sign that first-generation students trailed their peers in coursework appeared as early as the first year of college. First-generation students earned an average of 18 credits in their first year, compared with 25 credits earned by students whose parents had a bachelor's degree or higher (figure C). First-year credit accumulation bears an important relationship to long-term postsecondary outcomes. For example, earning fewer credits in the first year may not only prolong the time to degree, but is strongly associated with leaving postsecondary education without earning a degree (table 7).

As they progressed through postsecondary education, first-generation students continued to lag behind their peers in credit accumulation: overall, they earned an average of 66 credits during their entire enrollment, compared with an average of 112 credits earned by students whose parents were college graduates (figure C). The discrepancy in credits earned is due in part to first-generation students' higher rates of late starts, disrupted enrollment, part-time attendance (table 2), and leaving college without a degree (figure A).

Coursetaking in Selected Areas

Reflecting in part their preference for vocational/technical fields over academic ones, first-generation students were less likely than their peers whose parents were college graduates to take courses in various academic areas, including mathematics, science, computer science, social

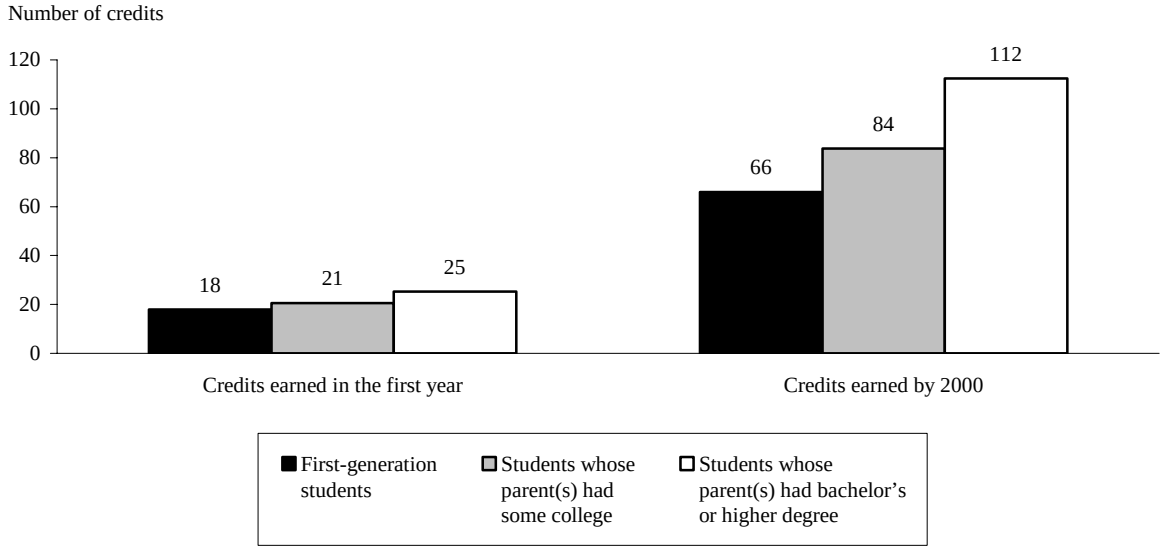
Figure B. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of undergraduate major



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Figure C. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by average number of undergraduate credits earned in the first year and by 2000



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

studies, humanities, history, and foreign languages (tables 8 to 11). They also tended to earn fewer credits if they took courses in these areas.

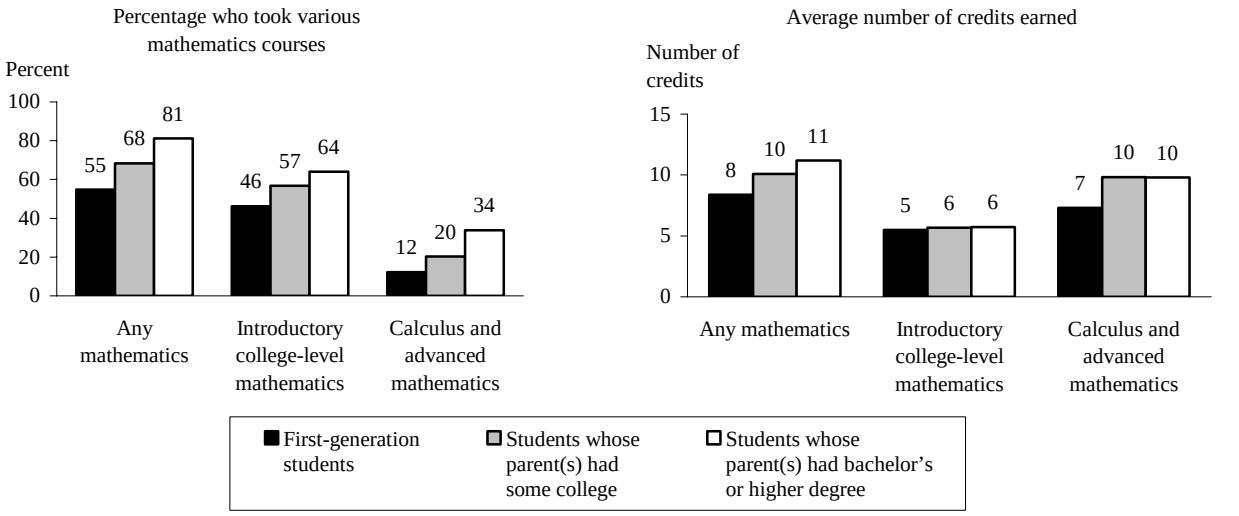
Taking mathematics as an example, 55 percent of first-generation students took at least one mathematics course in college, compared with 81 percent of students whose parents had a bachelor's degree or higher (figure D). Among those who took any mathematics, first-generation students earned an average of 8 credits, compared with 11 credits earned by their counterparts. Moreover, the gap in advanced mathematics coursetaking (in both the likelihood of taking courses and credits earned) remained even among those who majored in mathematics and science (table 8).

Postsecondary Performance

In line with their greater need for remediation, first-generation students did not perform as well as their peers whose parents were college graduates as early as the first year of college. First-generation students had lower first-year undergraduate grade point averages (GPAs) (2.5 versus 2.8) (figure E). This lower performance persisted throughout their entire undergraduate careers and was evident in many academic areas (e.g., mathematics, science, foreign language, history; table 14).

In addition to having lower GPAs, first-generation students were more likely than other students to withdraw or repeat courses they attempted. In all undergraduate courses attempted

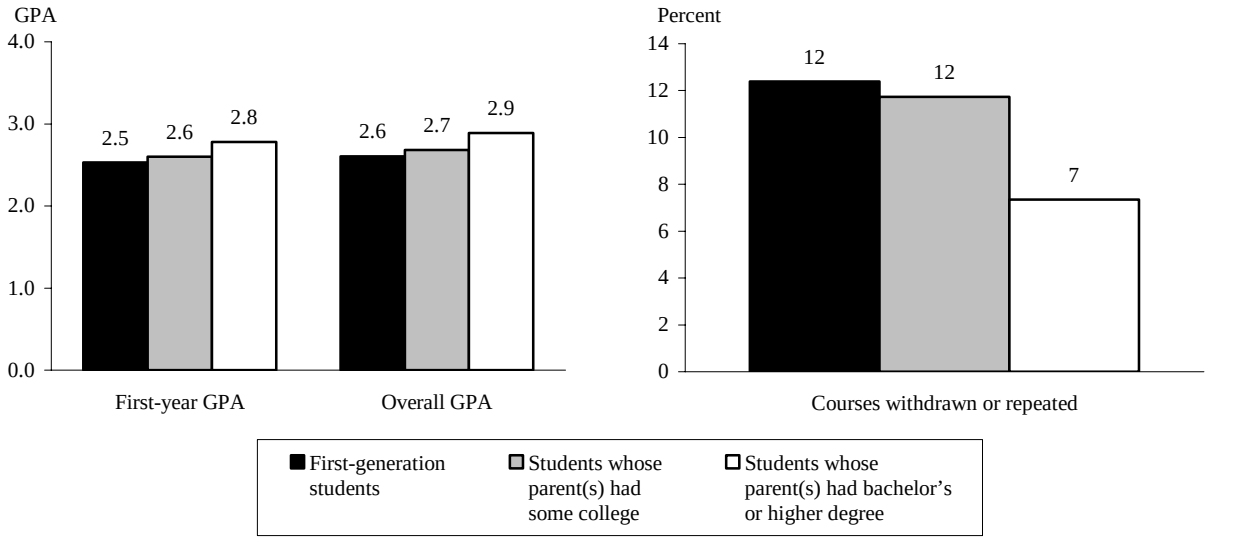
Figure D. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took various mathematics courses and average number of credits earned by those who took these courses



NOTE: Introductory college-level mathematics includes courses below the level of calculus and above the level of algebra 2. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Figure E. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by first-year and overall grade point average (GPA) and percentage of courses withdrawn or repeated



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

by students, the proportion of courses with withdrawal and repeat grades was 12 percent for first-generation students and 7 percent for students whose parents held a bachelor's degree or higher.

Factors Related to Degree Completion and Persistence

First-generation students were less likely than students with college-educated parents to earn a bachelor's degree even after taking into account many related factors, including students' demographic backgrounds, academic preparation, enrollment characteristics, credit production, and performance (table 15). This difference was observed even among students who attended a 4-year institution with the intention of earning a bachelor's degree.

When the analysis included persistence as the outcome, before taking into account related variables, first-generation students were less likely than their peers whose parents attended college to persist in postsecondary education (i.e., they were less likely to earn any postsecondary credential *or* to be still enrolled as of 2000) (table 16). However, unlike the results for bachelor's degree attainment, the difference in persistence disappeared after controlling for related factors. This finding differs from those of earlier studies, which found that first-generation students were less likely than other students to persist (e.g., Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001). The reason for the change in results between the earlier studies and the current study may in part be due to the additional postsecondary coursetaking and performance variables introduced in the current analysis. These variables were not available for analysis in the previous studies and therefore, were not controlled for.

Finally, this analysis demonstrated important associations between early credit production and academic performance and students' success in postsecondary education. More credits completed and higher grades earned in the first year, and fewer withdrawn or repeated courses throughout enrollment were strongly associated with postsecondary degree attainment and persistence.

Conclusion

The findings from this report indicate that compared with students whose parents attended college, first-generation students consistently remained at a disadvantage after entering postsecondary education: they completed fewer credits, took fewer academic courses, earned lower grades, needed more remedial assistance, and were more likely to withdraw from or repeat courses they attempted. As a result, the likelihood of attaining a bachelor's degree was lower for first-generation students compared to their peers whose parents attended college. This finding also held after taking into account variables related to degree completion including postsecondary credit production, performance, high school academic preparation, and student background characteristics. Even for students who attended a 4-year institution with the intention of earning a bachelor's degree, first-generation students were less likely to earn a bachelor's degree than were their counterparts whose parents held a bachelor's or higher degree.

However, when the outcome measure was broadened to include persistence (i.e., the likelihood of earning any postsecondary credential or still being enrolled), no difference between first-generation students and their peers whose parents attended college was detected after controlling for related variables.

Foreword

This report uses data from the Postsecondary Education Transcript Study (PETS) of the National Education Longitudinal Study of 1988 (NELS:88) to examine the majors and coursetaking patterns of first-generation students and to compare their experiences with those of students whose parents attended or graduated from college. The analysis presented in this report focused on a subset of the NELS 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and who also have complete postsecondary transcripts available and valid information on their parents' education levels.

The NELS:88 is a national longitudinal study that began in 1988 using a nationally representative sample of 8th-graders across U.S. schools. It tracked this cohort from middle school through secondary and postsecondary education and examined their labor market experiences, and marriage and family formation between 1988 and 2000. The PETS, collected as part of the NELS fourth follow-up survey in 2000, targeted the transcripts from all U.S. postsecondary institutions attended by NELS sample members in the 2000 survey. It supplements the postsecondary education information collected from the 1994 and 2000 follow-ups by including detailed information on the types of degree programs, periods of enrollment, majors or fields of study for instructional programs, specific courses taken, grades and credits attained, and credentials earned.

The estimates presented in this report were produced using the NELS:88/2000 Data Analysis Systems (DAS). The DAS is a computer application that allows users to specify and generate their own tables and produces the design-adjusted standard errors necessary for testing the statistical significance of differences between numbers shown in the tables. It is available for public use on the NCES website at http://nces.ed.gov/das. Appendix B of this report contains additional information on the DAS.

Acknowledgments

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Introduction

The college environment presents new academic, social, and personal challenges to many first-time students, but these challenges are often greater for students who are the first members in their families to attend college (referred to as "first-generation students" in this report) (London 1989; Levine and Nidiffer 1996; Weis 1992). The difficulties that such students experience are reflected in many indicators of postsecondary education success (Choy 2001). For example, compared with their peers who had college-educated parents, students from families in which neither parent attended college are at a distinct disadvantage in gaining access to postsecondary education (Berkner and Chavez 1997). Even those who overcome these barriers and do enroll have difficulty remaining enrolled and attaining a degree—a disadvantage that persists even after controlling for a wide range of demographic, academic, and enrollment characteristics (Horn and Nuñez 2000; Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001). Taken together, these results suggest that growing up in a family in which neither parent has gone to college may have long-term consequences on students' success in postsecondary education.

What has not been explored in depth, however, are a number of questions that pertain to first-generation students' coursetaking experiences. What do they study in college? How well do they do in their coursework? Is their coursework different from that of their peers whose parents went to college? Does coursetaking play a role in postsecondary outcomes? So far, answers to these questions are limited. Analyzing first-year data from 23 colleges (both 2- and 4-year institutions), Terenzini et al. (1996) found that compared with other students, first-generation students completed fewer first-year credit hours, took fewer humanities and fine arts courses, studied fewer hours, and were less likely to participate in an honors program. Similar findings were reported in another study that focused on first-generation students attending five community colleges located in five different states (Pascarella et al. 2003). While these studies are informative of first-generation students' coursetaking in college, they are limited by the fact that they used small-scale local data or followed students only during the first year of college.

This report provides a more comprehensive analysis of the coursetaking experiences of first-generation students by using national, longitudinal, and transcript-based data—the Postsecondary Education Transcript Study (PETS) of the National Education Longitudinal Study of 1988 (NELS:88). The advantages of using transcript-based data to analyze students' curricular activities are evident: they provide comprehensive information about the number and types of

courses students actually take and the data are less error prone and more objective than self-reported data, all of which permits a more accurate analysis (Adelman 2004b).

To be consistent with earlier studies (Nuñez and Cuccaro-Alamin 1998; Horn and Nuñez 2000; Warburton, Bugarin, and Nuñez 2001), this report defines students' generation status according to the highest level of education attained by their parents. First-generation students are defined as those from families where neither parent attained any education beyond high school. These students are compared with two groups of students whose parents went to college: those with at least one parent who had some college education, but neither attained a bachelor's degree; and those with at least one parent who earned a bachelor's or advanced degree.

Organization of the Report

The report begins with a brief description of the background characteristics of first-generation college students and their enrollment behaviors, postsecondary persistence, and degree attainment. It then addresses what first-generation students study in college by focusing on their remedial coursetaking, choices of undergraduate majors, number of credits completed, types of courses taken, and amount of coursework completed. Next, the report examines students' academic performance by focusing on two measures of performance: undergraduate grade point average (GPA) and the proportion of all attempted courses either withdrawn or repeated. The report concludes with an analysis of the relationship of first-generation status and coursetaking variables with selected postsecondary outcomes after taking into account interrelated variables.

Data and Analysis Sample

Data for the analysis are drawn from the Postsecondary Education Transcript Study (PETS) collected in 2000 as part of the National Education Longitudinal Study of 1988 (NELS:88). The NELS:88 is a national longitudinal study that began in 1988 using a nationally representative sample of 8th-graders across U.S. schools. This cohort was followed up in 1990, when most cohort members were in 10th grade; in 1992, when most cohort members were in 12th grade; and in 1994 and 2000, when most cohort members had been out of high school for 2 and 8 years, respectively.[1] In addition, the study was designed not only to follow a cohort of students over time but also to "freshen" the sample in the 1990 and 1992 surveys in order to create a representative sample of students enrolled in 10th grade in 1990 and in 12th grade in 1992 that could be compared with the earlier cohorts from the National Longitudinal Study of the High School Class of 1972 (NLS:72) and the High School and Beyond Longitudinal Study (HS&B).

[1] A summary of NELS base-year and follow-up surveys can be found in Ingels et al. (2002).

The data collection for the postsecondary transcripts began in fall 2000 and targeted approximately 9,600 students who participated in the 2000 fourth follow-up study and reported having attended at least one U.S. postsecondary institution (Adelman, Daniel, and Berkovits 2003). Transcripts were requested from a total of 3,200 postsecondary institutions that students reported having attended. Based on the transcripts received and, when they were not, other corroborating sources from the National Student Loan Data System files, Advanced Placement and College Entrance Examination Board tests, and other student responses, about 9,400 students were identified as "likely postsecondary participants." For more information about the NELS PETS data collection and design, see Adelman, Daniel, and Berkovits (2003).

The analysis sample for this report includes students who were in 12th grade in 1992 because that year marked the modal year of high school graduation and date of their initial entry into postsecondary education. Because this report focuses on coursetaking and requires full information on courses taken across all institutions attended, the sample was further restricted to NELS postsecondary participants who had a complete transcript record in the PETS file.[2] Finally, the definition of first-generation students requires the sample members to have valid information on their parents' education. Thus, students who did not have such information were excluded. These selections resulted in a final analysis sample of about 7,400 students, accounting for about 87 percent (weighted) of all the NELS 1992 12th-graders who entered postsecondary education between 1992 and 2000.

For most tables presented in this report, a parallel analysis was also conducted for a subsample of students who attended a 4-year institution at any time between 1992 and 2000 and expected to attain a bachelor's or higher degree.[3] This restriction allows examination of differences between first-generation students and their peers within the group of individuals who intend to earn a bachelor's degree and, therefore may be more comparable academically. The findings for this group may also reduce potential effects of some confounding factors such as type of institutions attended, expectations, and degree goals.

[2] A complete transcript record means receiving all transcripts from all institutions students reported attending. Including incomplete transcripts may distort analysis of students' coursetaking.

[3] These students are referred to as "students who attended a 4-year institution with bachelor's degree goals" in this report. This group accounted for 59 percent (weighted) of all the NELS 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000. Throughout this report, students' educational expectations in 1994 (as opposed to 1992) were used because 1994 expectations were probably more likely than 1992 expectations to reflect students' current expectations in relation to their postsecondary coursetaking.

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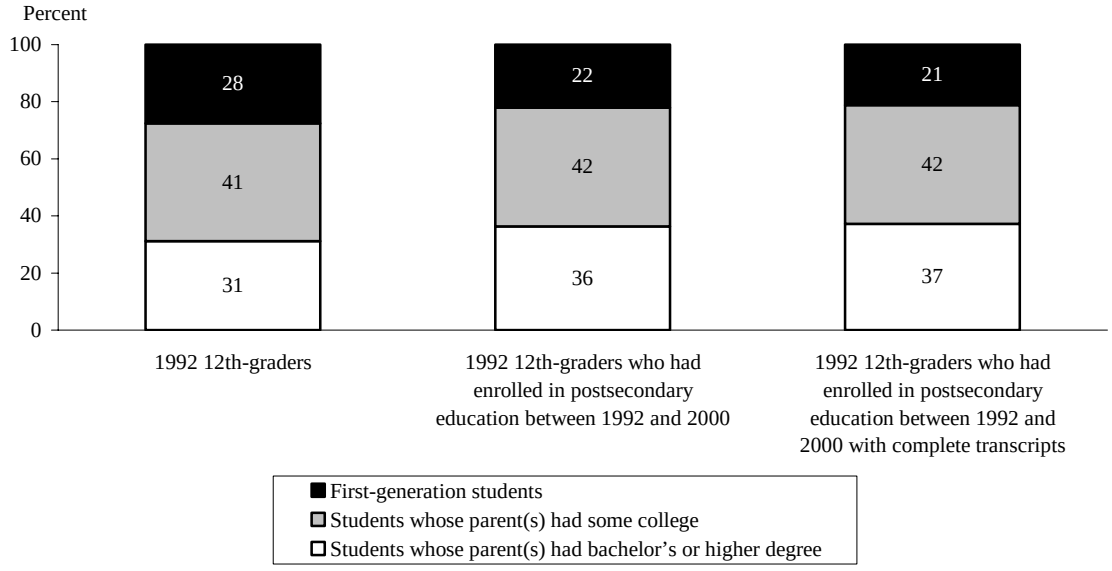
First-Generation Students in Postsecondary Education

About 28 percent of all the 12th-graders in the National Education Longitudinal Study (NELS) cohort were identified as having parents with no postsecondary education (figure 1). However, only 22 percent of the students who entered postsecondary education between 1992 and 2000 had parents who did not go to college, indicating that students of parents without any college education are less likely than others to attend college after high school. The focus of this report is on the 21 percent of the NELS cohort who became first-generation college students by enrolling in postsecondary education by 2000 and who also had a complete transcript, and comparing their postsecondary experiences and outcomes with those of students in postsecondary education whose parents went to college.

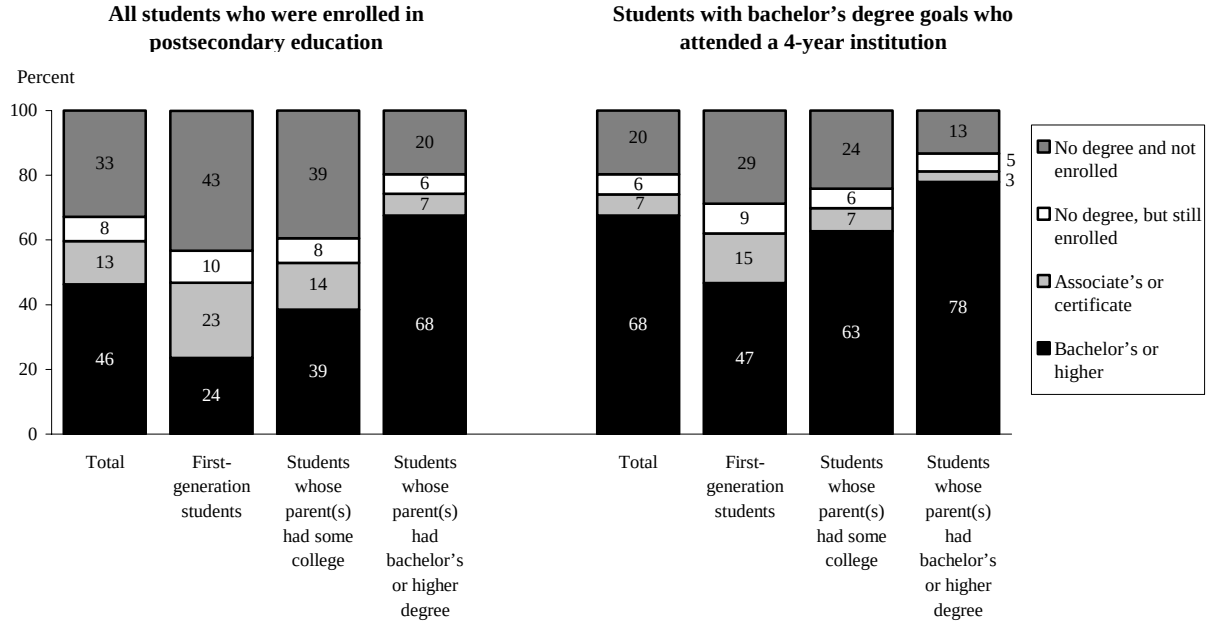
Figure 1. Percentage distribution of generation status among all 1992 12th-graders, among those who had enrolled in postsecondary education between 1992 and 2000, and among those who had enrolled and had complete postsecondary transcripts



NOTE: The column labeled "1992 12th-graders" includes students who had never enrolled in postsecondary education through 2000. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Consistent with findings reported previously (Choy 2001), first-generation students in the NELS cohort did not do as well as their peers in terms of postsecondary persistence and attainment. Of first-generation students who had enrolled in postsecondary education between 1992 and 2000, nearly one-half (43 percent) had left without a degree by 2000 and one-quarter had attained a bachelor's degree (figure 2). By contrast, roughly two-thirds (68 percent) of students whose parents had a bachelor's degree or higher finished their undergraduate education with a bachelor's degree, and 20 percent left without a credential. These differences held even among students who expected to earn a bachelor's degree and attended a 4-year college.

Figure 2. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of postsecondary attainment and enrollment in 2000



NOTE: In this figure and all subsequent figures in this report, only postsecondary students for whom complete transcripts were available and parents' education was known are included. Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

As reported in earlier research (Ishitani 2003), the family and background characteristics of first-generation college students were typically associated with characteristics that placed them at risk for attrition. For example, compared with their peers whose parents were college graduates, first-generation students were more likely to be Black or Hispanic and come from low-income families (table 1). They were less prepared academically for college as demonstrated by their

Table 1. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of selected demographic and academic characteristics

Demographic and academic characteristics	Total	First-generation students	Students whose parent(s) had some college	Students whose parent(s) had bachelor's or higher degree
Total	100.0	100.0	100.0	100.0
Gender				
Male	46.5	39.8	45.4	51.5
Female	53.5	60.2	54.6	48.5
Race/ethnicity[1]				
American Indian	0.5	0.6	0.6	0.4
Asian/Pacific Islander	5.1	4.7	3.9	6.5
Black	10.5	13.7	13.6	5.3
White	75.5	64.0	73.6	84.0
Hispanic	8.4	16.9	8.3	3.8
Family income in 1991				
Less than $25,000	24.1	50.3	25.9	7.4
$25,000–49,999	35.0	34.3	44.7	24.8
$50,000–74,999	24.4	12.7	23.1	32.3
$75,000 or more	16.5	2.7	6.3	35.5
Highest level of mathematics completed in high school				
Calculus or precalculus	28.3	15.2	22.5	41.5
Trigonometry	13.6	9.2	14.1	15.4
Algebra 2	31.4	30.4	34.0	29.1
Geometry	13.6	22.2	14.3	8.4
Algebra 1	10.4	15.3	12.8	5.2
Other mathematics	2.7	7.7	2.3	0.5
Composite achievement test score in 1992				
Low level	11.7	21.5	12.9	5.0
Middle level	52.3	60.6	57.2	42.3
High level	36.0	17.9	29.8	52.7
Highest level of education expected in 1994				
High school or less	1.9	3.3	2.0	1.1
Some college	12.7	22.2	15.6	4.1
Bachelor's or higher degree	85.4	74.6	82.4	94.8
Took SAT/ACT				
No	37.9	50.2	39.7	29.0
Yes	62.1	49.8	60.3	71.0
SAT/ACT composite score of those who took it				
Low level	23.0	40.0	27.5	12.1
Middle level	51.3	49.7	54.1	49.2
High level	25.7	10.3	18.4	38.7

[1] American Indian includes Alaska Native, Black includes African American, Asian/Pacific Islander includes Native Hawaiian, and Hispanic includes Latino. Race categories exclude Hispanic origin unless specified.

NOTE: In this table and all subsequent tables in this report, only postsecondary students for whom complete transcripts were available and parents' education was known are included. Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

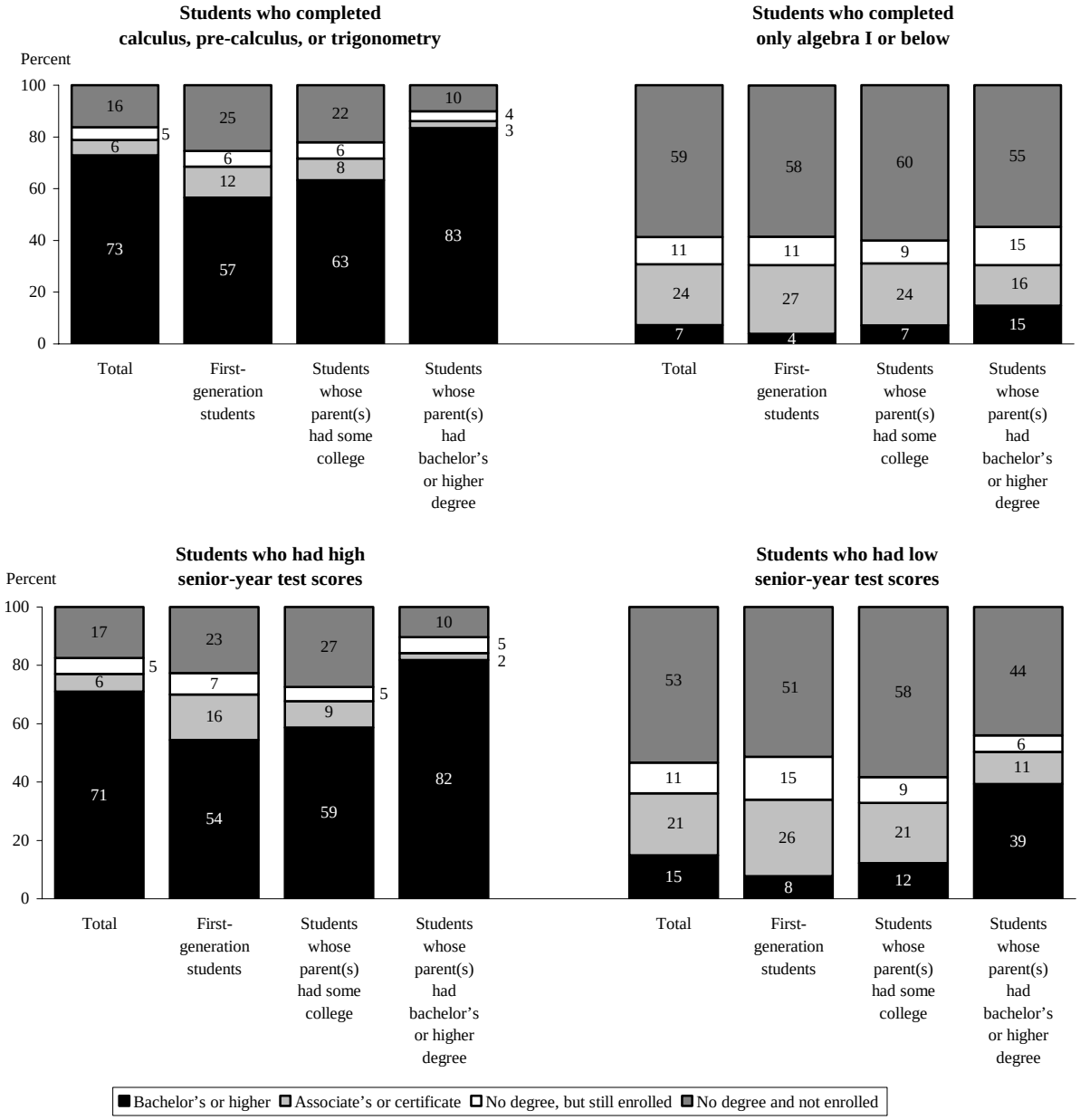
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

lower rates of taking higher-level mathematics courses in high school, their lower senior achievement test scores, and their lower college entrance examination scores. Although first-generation students had relatively lower educational expectations compared with their counterparts whose parents went to college or graduated with a bachelor's degree, three out of four first-generation students expected to attain a bachelor's degree. This high expectation, however, did not translate into a high bachelor's degree completion rate: just 24 percent of first-generation students attained a bachelor's degree by 2000 (figure 2).

Academic preparation is associated with student persistence toward long-term degree completion. As shown in figure 3, completing only low-level mathematics courses or earning low test scores in high school decreased all students' likelihood of obtaining a bachelor's degree and increased their likelihood of leaving college without a degree. However, academic preparation did not entirely explain the differences between first-generation students and their peers in postsecondary attainment and persistence. Even among those who were considered well prepared academically (i.e., those completing calculus, pre-calculus, or trigonometry in high school or earning high scores on achievement tests), first-generation students were less likely to attain a bachelor's degree and more likely to leave college without a degree than their counterparts whose parents graduated from college.

Table 2 displays students' postsecondary enrollment characteristics. Compared with the two groups of students whose parents went to college, first-generation students were less likely to begin their postsecondary education at a 4-year institution, enter college immediately after high school, and enroll full time and continuously. These enrollment characteristics may reflect first-generation students' relatively poor academic preparation, insufficient family and financial resources, as well as their personal goals and preferences; and have been shown in earlier research to have negative consequences for postsecondary persistence, performance, and attainment (Nuñez and Cuccaro-Alamin 1998; Terenzini et al. 1996; Warburton, Bugarin, and Nuñez 2001). The next section of the report explores the analysis of students' coursetaking experiences and performance in college.

Figure 3. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and who completed various levels of mathematics in high school or had various levels of senior-year test scores, by percentage distribution of postsecondary attainment and enrollment in 2000



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 2. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of selected postsecondary enrollment characteristics

Postsecondary enrollment characteristics	Total	First-generation students	Students whose parent(s) had some college	Students whose parent(s) had bachelor's or higher degree
Total	100.0	100.0	100.0	100.0
Type of first institution				
4-year	57.4	40.3	48.8	76.3
2-year	40.6	54.9	49.2	23.3
Less-than-2-year	2.0	4.8	2.0	0.4
Time between high school graduation and postsecondary entry				
Less than 1 year	85.8	78.3	82.8	93.2
1–2 years	6.8	10.0	7.3	4.5
More than 2 years	7.5	11.8	9.9	2.4
Continuity of enrollment				
Continuous	67.0	51.7	63.7	79.1
Stopout after 3 years of continuous	3.7	3.3	4.1	3.4
Discontinuous	18.0	24.4	19.2	13.1
Indeterminable	1.1	1.6	1.4	0.6
Enrolled for less than 1 year	10.2	19.0	11.6	3.8
Enrollment status				
Always full-time	62.7	55.5	60.3	69.4
Part-time at least at one institution	37.3	44.5	39.8	30.6

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

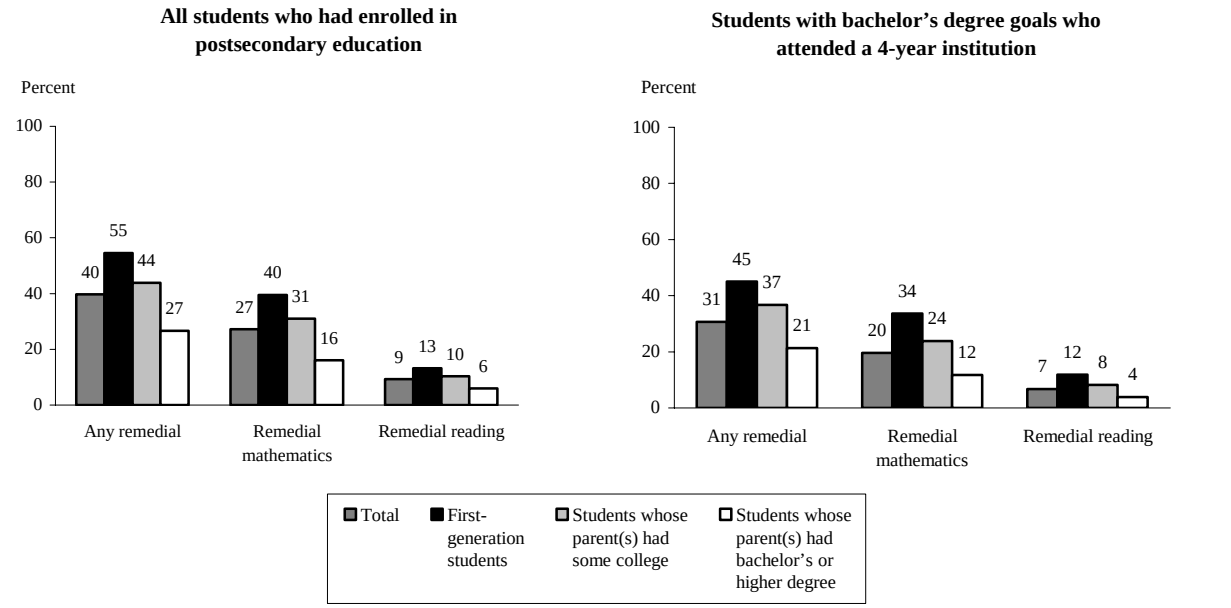
What Do First-Generation Students Study in College?

The following section examines what first-generation students study in college by focusing on their remedial coursetaking, choices of undergraduate majors, credit production, and types and amount of coursetaking in various areas.

Remedial Coursetaking

Many high school graduates lack adequate academic preparation for higher education and need remedial assistance to do college-level work (Parsad and Lewis 2003). Among the 1992 12th-graders who had enrolled in postsecondary education in 1992–2000, 4 in 10 (40 percent) took at least one remedial course, about 3 in 10 (27 percent) took remedial mathematics courses, and nearly 1 in 10 (9 percent) took remedial reading courses (figure 4).

Figure 4. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage who took any remedial courses



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

First-generation students, in particular, needed remedial help: 55 percent took remedial courses during their college years, compared with 27 percent of their counterparts whose parents held bachelor's or advanced degrees (figure 4). Among those with bachelor's degree goals who attended 4-year institutions, 45 percent of first-generation students took at least one remedial course, compared with 21 percent of students whose parents had at least bachelor's degrees.

Examining specific types of courses revealed that 40 percent of first-generation students took one or more remedial mathematics course, and 13 percent took one or more remedial reading course during their college years, compared with 16 and 6 percent, respectively, of those whose parents had at least bachelor's degrees. As shown in table 3, the greater need for remedial education for first-generation students was also apparent in many major fields of study.[4] For example, 59 percent of first-generation students majoring in social sciences/journalism/ communications took at least one remedial course, compared with 17 percent of students whose parents had a bachelor's degree or higher.

It should be noted that taking remedial courses in college was also common among students whose parents had just some college experience: 44 percent of these students took at least one remedial course, and close to one-third took at least one mathematics course during their college years (figure 4).

Undergraduate Major

During the early stage of an undergraduate education, every student must choose a major field of study (Montmarquette, Cannings, and Mahseredjian 2002). To fulfill graduation requirements, students must earn enough credits in their major. Thus, to a large extent, students' coursetaking is concentrated in those courses that fit into their major field of study.

While choosing a major is difficult for many students, it may pose a greater challenge to first-generation students because their parents may be less able to offer them guidance. Table 4 provides some evidence of first-generation students' uncertainty in choosing a major: one-in-three first-generation students (33 percent) did not have a classified major[5] after entering

[4] Except for mathematics/science and humanities/arts majors where no significant differences were found between first-generation students and those whose parents held a bachelor's degree or higher.

[5] This included "no" or "unclassifiable" majors. The undergraduate major field of study was created by taking 1) the major field code of the first bachelor's degree for those who earned a bachelor's degree; 2) the major code of the first associate's degree for those who earned an associate's degree but no bachelor's degree; 3) the major code of the certificate for those who earned a certificate but neither a bachelor's nor associate's degree; and 4) the major code of those who did not earn any degree. For students who earned an associate's degree or certificate, subsequently transferred to a 4-year institution, and earned more than 10 credits from the 4-year institution, but had not earned a bachelor's degree by 2000, their major fields were adjusted by taking the major codes from their non-degree transcripts from 4-year institutions.

Table 3. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and majored in various undergraduate fields, by percentage distribution of remedial courses taken

	All remedial courses				Remedial mathematics			Remedial reading		
Generation status and undergraduate major	At least one	One	Two or three	Four or more	At least one	One	Two or more	At least one	One	Two or more
All students	39.7	16.3	14.4	9.0	27.2	15.6	11.6	9.3	7.0	2.3
First-generation students	54.6	18.3	22.1	14.2	39.6	21.5	18.1	13.2	9.8	3.4
Students whose parent(s) had some college	43.9	19.1	14.2	10.7	31.0	18.5	12.5	10.3	7.2	3.1
Students whose parent(s) had bachelor's or higher degree	26.6	12.1	10.3	4.3	16.1	9.1	7.0	5.9	5.1	0.9
Undergraduate major										
Business										
First-generation students	54.6	13.1	29.7	11.8	27.7	13.2	14.5	8.1	6.1	2.0
Students whose parent(s) had some college	40.4	17.0	12.3	11.1	20.7	10.2	10.5	8.6	6.3	2.3
Students whose parent(s) had bachelor's or higher degree	24.8	9.5	13.0	2.4	10.4	7.3	3.1	9.1	8.6	0.4
Education/library/social work										
First-generation students	52.3	16.3	27.4	8.7	38.9	13.7	25.2	13.6	7.4	6.2
Students whose parent(s) had some college	36.2	18.6	8.6	9.1	24.3	12.3	12.0	10.1	4.2	5.8
Students whose parent(s) had bachelor's or higher degree	30.3	16.3	10.7	3.3	16.7	8.2	8.6	5.0	4.6	0.3
Mathematics/science										
First-generation students	22.9	10.6	7.6	4.7	14.5	11.4	3.0	0.6	0.6	#
Students whose parent(s) had some college	26.4	13.8	11.8	0.8	18.2	15.4	2.8	3.9	3.9	#
Students whose parent(s) had bachelor's or higher degree	16.2	9.4	6.1	0.7	1.6	1.3	0.3	2.4	1.7	0.7
Engineering/architecture/computer										
First-generation students	37.5	11.7	21.7	4.1	26.4	19.9	6.5	4.4	4.1	0.3
Students whose parent(s) had some college	34.4	21.0	7.1	6.3	23.3	16.2	7.1	1.5	1.5	#
Students whose parent(s) had bachelor's or higher degree	7.5	2.8	3.3	1.4	2.9	1.6	1.3	1.6	1.2	0.5
Humanities/arts										
First-generation students	33.6	5.4	15.4	12.7	28.1	8.4	19.8	8.1	6.9	1.2
Students whose parent(s) had some college	27.9	14.6	7.1	6.2	17.4	11.6	5.9	6.0	3.3	2.7
Students whose parent(s) had bachelor's or higher degree	18.0	8.7	3.4	5.9	13.1	5.7	7.3	2.6	1.8	0.8
Social sciences/journalism/communication										
First-generation students	58.6	26.9	17.5	14.1	47.9	33.1	14.8	7.2	6.7	0.5
Students whose parent(s) had some college	36.2	22.6	8.9	4.7	26.1	19.6	6.5	6.0	5.7	0.3
Students whose parent(s) had bachelor's or higher degree	16.7	10.7	4.8	1.3	11.1	8.2	2.9	2.4	1.9	0.5
Health sciences/services										
First-generation students	49.9	23.0	22.1	4.9	37.4	27.7	9.7	13.6	9.1	4.5
Students whose parent(s) had some college	39.6	19.2	13.1	7.3	23.9	18.2	5.7	9.8	9.8	#
Students whose parent(s) had bachelor's or higher degree	24.4	7.4	11.7	5.3	17.3	8.0	9.3	4.4	3.3	1.1

See notes at end of table.

Table 3. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and majored in various undergraduate fields, by percentage distribution of remedial courses taken—Continued

	All remedial courses				Remedial mathematics			Remedial reading		
Generation status and undergraduate major	At least one	One	Two or three	Four or more	At least one	One	Two or more	At least one	One	Two or more
Human/protective services/vocational fields										
First-generation students	54.2	15.9	25.1	13.2	43.6	28.1	15.5	13.8	8.4	5.4
Students whose parent(s) had some college	45.4	17.8	17.3	10.2	30.9	18.7	12.2	13.1	9.2	3.9
Students whose parent(s) had bachelor's or higher degree	36.6	13.9	16.8	5.9	25.1	14.4	10.7	10.0	9.4	0.5
Other										
First-generation students	58.5	8.6	31.5	18.4	49.4	24.4	25.0	16.0	9.5	6.5
Students whose parent(s) had some college	59.7	18.5	22.2	19.0	45.6	21.5	24.1	22.9	12.4	10.5
Students whose parent(s) had bachelor's or higher degree	40.6	16.8	14.1	9.7	26.9	10.7	16.3	10.5	9.5	1.0
No major or unclassifiable										
First-generation students	62.1	24.1	18.1	19.9	44.9	21.5	23.4	19.0	15.4	3.7
Students whose parent(s) had some college	54.8	20.5	19.1	15.3	43.3	24.8	18.6	12.8	9.1	3.7
Students whose parent(s) had bachelor's or higher degree	57.3	24.4	23.8	9.1	39.1	23.7	15.4	13.4	11.0	2.4

Rounds to zero.

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

postsecondary education, compared with 13 percent of students whose parents had a bachelor's or advanced degree.

Among those with a major, the most popular field for first-generation students was business: 14 percent chose this field as their major. Following business, the next most popular fields were health science/services and social sciences: 8 and 7 percent, respectively, of first-generation students majored in these areas. Business and social sciences were the two most frequently selected fields for other students as well: between 10 and 14 percent of students whose parents went to college majored in these two fields. Despite this similar pattern, the differences in the choice of majors were evident among the three comparison groups. For example, although a relatively small percentage of students major in a vocational or technical field, first-generation students were more likely to do so than their peers whose parents attended college or held bachelor's degrees (6 versus 4 and 2 percent). In contrast, students whose parents held bachelor's degrees were more likely to choose a major in science, mathematics, engineering/architecture, humanities, arts, social sciences, and journalism/communication than first-generation students.

Table 4. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of undergraduate major

Generation status	Business	Education/ library/ social work	Science	Engineering/ architecture	Computer	Mathematics	Humanities	Arts/ applied arts	Social sciences	Health science/ services	Journalism/ communication	Human/ protective/ services	Vocational/ technical fields	Other	No major/ unclassifiable
All students who had enrolled in postsecondary education	13.2	5.5	5.9	5.1	2.0	0.7	3.8	4.1	10.9	6.5	3.0	2.8	3.7	8.8	24.0
First-generation students	14.2	4.7	3.4	3.9	1.1	0.1	1.6	2.2	7.3	8.0	1.8	2.6	6.2	9.6	33.4
Students whose parent(s) had some college	13.9	5.5	5.0	4.1	2.7	0.7	2.3	3.5	9.9	5.9	2.4	2.7	3.6	8.9	29.1
Students whose parent(s) had bachelor's or higher degree	11.9	6.0	8.4	6.9	1.8	1.1	6.7	6.0	14.1	6.2	4.3	3.0	2.4	8.3	13.1
Students with bachelor's degree goals who attended a 4-year institution	13.4	7.6	7.8	6.3	2.5	1.0	5.5	5.2	14.8	6.5	4.2	3.1	1.2	7.4	13.5
First-generation students	14.2	7.8	5.8	5.2	2.0	0.1	2.5	3.6	10.7	8.1	3.5	2.9	0.4	9.6	23.8
Students whose parent(s) had some college	14.2	8.4	6.5	4.7	3.7	1.1	3.8	4.4	15.0	6.4	3.7	3.1	1.6	7.2	16.2
Students whose parent(s) had bachelor's or higher degree	12.5	6.9	9.5	8.0	1.8	1.2	7.7	6.3	16.1	6.1	4.9	3.1	1.1	6.8	8.0

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Such differences were also observed among students with bachelor's degree goals who attended 4-year colleges at any time during 1992–2000: first-generation students were less likely than those whose parents were college graduates to have a classified major and to choose a major field in science, mathematics, humanities, arts, and social studies in particular. Many factors are associated with a student's choice of major. For example, poor academic preparation may limit the ability of first-generation students to choose certain "high-skill" fields, such as mathematics and science. The perceived low-earning potential of certain fields may also deter them from entering such fields as humanities, arts, and social sciences (Montmarquette, Cannings, and Mahseredjian 2002; Nuñez and Cuccaro-Alamin 1998).

Comparing degree attainment by major field revealed some obvious differences in outcomes. Regardless of their parents' education levels, students without a major or who had majored in human/protective services/vocational fields or "other" fields were consistently less likely than other students to earn a bachelor's degree (table 5).[6] Also, at least 81 percent of students without a major and at least 56 percent of students who had majored in "other" fields left college without earning any credential.

Looking at the first-generation group, students with the highest rate of bachelor's degree completion included those who had majored in education/library science/social work (72 percent), social sciences/journalism/communications (67 percent), and mathematics and science (66 percent). Business and health sciences/services majors tended to lag behind (32 percent), but they were more likely than students with other majors (except for human/protective services/vocational fields) to earn a certificate.

Credits Earned

Previous research has found that students from disadvantaged backgrounds do not earn as many college credits as their more advantaged peers (McCormick 1999). They trail their peers in credit accumulation as early as the first year of their enrollment. Because first-generation students are more likely to come from low-income families and have similar risk characteristics, they exhibited the same patterns. As shown in figure 5, first-generation students trailed their peers in the number of credits earned beginning in their first year of college: on average, they earned about 18 credits in the first year, compared with 25 credits earned by students whose parents had a bachelor's degree or higher. One-in-three first-generation students (33 percent) earned 10 or fewer credits in the first year, compared with 12 percent of those whose parents had at least a

[6] Due to small sample sizes, certain categories of majors were combined in table 5.

Table 5. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and majored in various undergraduate fields, by percentage distribution of postsecondary attainment and enrollment in 2000

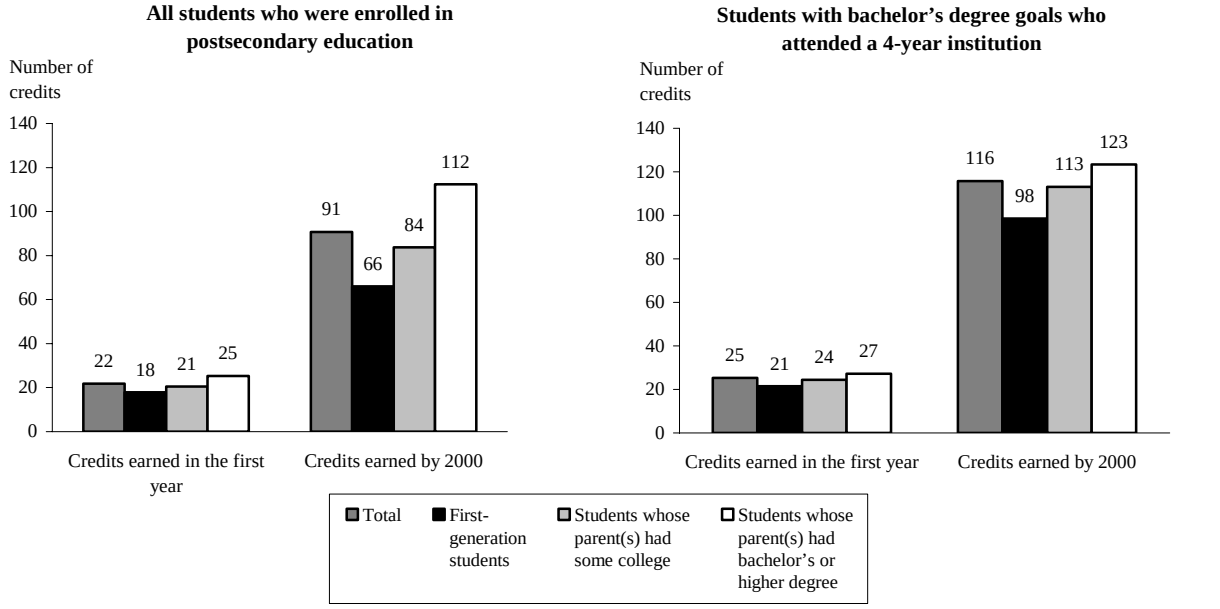
	Earned a degree				Did not earn a degree		
Generation status and undergraduate major	Total	Bachelor's or higher	Associate's degree	Certificate	Total	Still enrolled	Not enrolled
Total	59.7	46.3	8.2	5.2	40.3	7.5	32.8
First-generation students	46.8	23.5	12.7	10.5	53.2	9.9	43.3
Business	78.5	31.9	19.4	27.2	21.5	3.5	18.0
Education/library/social work	78.5	71.9	2.1	4.5	21.6	2.1	19.5
Mathematics/science	80.6	65.5	15.1	#	19.4	5.1	14.3
Engineering/architecture/computer	73.9	40.9	28.8	4.3	26.1	7.7	18.4
Humanities/arts	55.9	42.4	13.4	#	44.1	9.6	34.5
Social sciences/journalism/communication	80.2	67.2	12.1	1.0	19.8	3.1	16.7
Health sciences/services	88.6	31.9	22.2	34.5	11.3	1.6	9.7
Human/protective services/vocational fields	66.8	9.9	21.7	35.2	33.2	8.5	24.7
Other	32.0	1.9	27.1	2.9	68.0	11.1	56.9
No major or unclassifiable	#	#	#	#	100.0	18.5	81.3
Students whose parent(s) had some college	52.9	38.5	9.5	4.9	47.1	7.6	39.4
Business	81.1	50.4	19.2	11.4	18.9	2.1	16.8
Education/library/social work	88.4	81.1	6.1	1.2	11.6	2.1	9.5
Mathematics/science	83.0	70.0	3.5	9.5	17.0	6.5	10.5
Engineering/architecture/computer	84.3	58.7	20.9	4.7	15.7	3.5	12.2
Humanities/arts	79.9	70.2	8.8	0.9	20.1	3.4	16.7
Social sciences/journalism/communication	85.4	80.4	4.8	0.2	14.6	3.3	11.3
Health sciences/services	90.1	52.6	23.8	13.8	9.9	1.7	8.2
Human/protective services/vocational fields	62.8	28.4	13.3	21.1	37.2	6.8	30.4
Other	23.3	3.9	17.4	2.0	76.7	12.5	64.2
No major or unclassifiable	#	#	#	#	100.0	15.0	85.0
Students whose parent(s) had bachelor's or higher degree	74.3	67.5	4.3	2.5	25.7	6.0	19.7
Business	95.3	86.9	4.6	3.8	4.7	1.6	3.1
Education/library/social work	93.2	91.3	1.8	0.2	6.8	2.6	4.2
Mathematics/science	92.8	90.5	2.3	#	7.2	2.8	4.4
Engineering/architecture/computer	95.1	89.8	5.2	0.2	4.9	2.0	2.9
Humanities/arts	85.0	81.9	2.5	0.7	15.0	6.8	8.2
Social sciences/journalism/communication	93.9	91.9	1.5	0.5	6.1	2.0	4.1
Health sciences/services	90.9	74.7	10.7	5.5	9.1	1.9	7.2
Human/protective services/vocational fields	80.7	49.9	5.6	25.3	19.3	3.3	16.0
Other	27.7	8.9	17.8	1.0	72.3	16.7	55.6
No major or unclassifiable	0.6	0.6	#	#	99.4	17.9	81.6

Rounds to zero.

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Figure 5. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by average number of undergraduate credits earned in the first year and by 2000



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

bachelor's degree (table 6). Like earlier studies demonstrating the relationship between credits earned and postsecondary outcomes (Adelman 1999; McCormick 1999), the current analysis shows that the fewer credits earned in the first year was associated with a reduced likelihood of attaining a degree and an increased time to degree for those who earned one (table 7).

First-generation students continued to trail their peers in overall credit accumulation as they progressed through postsecondary education: they earned an average of 66 credits during their entire period of enrollment through 2000, compared with an average of 112 credits earned by students whose parents were college graduates (figure 5). Part of this difference reflects the fact that first-generation students were more likely than students whose parents had graduated from college to start college late, disrupt their enrollment, attend part time (table 2), and leave without a degree within the time period of the study (figure 2). The gaps in credits, both overall and in the first year, were also found among those with bachelor's degree goals who attended 4-year institutions (figure 5).

Table 6. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by average number and percentage distribution of total undergraduate credits earned in the first year and by 2000

	Credits earned in the first year				Credits earned by 2000				
Generation status	Average	0–10 credits	11–29 credits	30 credits or more	Average	0–10 credits	11–59 credits	60–119 credits	120 credits or more
All students who had enrolled in postsecondary education	21.8	21.9	48.5	29.7	90.8	10.1	23.7	18.6	47.7
First-generation students	17.9	33.2	48.6	18.2	66.0	17.2	35.0	23.2	24.7
Students whose parent(s) had some college	20.5	24.7	50.7	24.6	83.7	12.0	27.9	17.5	42.6
Students whose parent(s) had bachelor's or higher degree	25.3	12.4	45.9	41.7	112.4	3.9	12.8	17.1	66.2
Students with bachelor's degree goals who attended a 4-year institution	25.3	10.0	52.5	37.6	115.8	3.2	11.5	17.1	68.3
First-generation students	21.5	19.8	57.6	22.6	98.5	8.0	16.9	27.6	47.6
Students whose parent(s) had some college	24.5	10.8	56.6	32.6	113.1	4.1	13.7	15.3	67.0
Students whose parent(s) had bachelor's or higher degree	27.2	6.2	47.6	46.3	123.4	0.9	7.9	15.1	76.1

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 7. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000 and earned various numbers of undergraduate credits in the first year, by percentage distribution of postsecondary attainment and average time to bachelor's degree for those who earned a bachelor's degree

	Postsecondary attainment					
Generation status and credits earned in first year	Any degree	Bachelor's or higher	Associate's	Certificate	No degree	Average number of years to BA
Total	59.7	46.3	8.2	5.2	40.3	4.5
First-generation students	46.8	23.5	12.7	10.5	53.2	4.8
0–10 credits	20.0	1.3	8.2	10.6	80.0	‡
11–29 credits	50.8	30.1	14.5	6.2	49.2	5.1
30 credits or more	84.8	46.6	16.2	22.1	15.2	4.2
Students whose parent(s) had some college	52.9	38.5	9.5	4.9	47.1	4.7
0–10 credits	14.3	4.4	4.9	5.0	85.7	‡
11–29 credits	55.3	39.8	10.8	4.7	44.7	5.0
30 credits or more	86.9	70.2	11.5	5.2	13.1	4.3
Students whose parent(s) had bachelor's or higher degree	74.3	67.5	4.3	2.5	25.7	4.4
0–10 credits	22.4	9.4	5.8	7.3	77.6	6.7
11–29 credits	71.3	63.6	5.4	2.3	28.7	4.7
30 credits or more	93.1	89.1	2.8	1.2	7.0	4.1

‡Reporting standards not met. (Too few cases for a reliable estimate.)

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Coursetaking in Various Curricular Areas

First-generation students were less likely than their peers whose parents were college graduates—and to some extent those whose parents had some college—to take courses in various academic areas, including mathematics, science, computer sciences, engineering, social sciences, humanities, history, and foreign languages. Possible reasons for this difference include first-generation students being more likely to attend 2-year colleges and major in vocational or technical fields and taking fewer courses overall than their counterparts. The following analysis looks at the types of courses taken and amount of coursework completed in these curricular areas.[7]

Mathematics Courses

About 71 percent of students took at least one mathematics course in college (figure 6).[8] First-generation students, however, were less likely to do so than their peers: 55 percent, compared with 68 percent of students whose parents had some college education and 81 percent of students whose parents held a bachelor's degree or higher. The difference existed at both introductory and advanced levels.

Among students who took mathematics courses, first-generation students completed fewer credits in the subject than other students: an average of 8, compared with 10 to 11 credits earned by students in the two groups whose parents had attended college. This discrepancy was mainly due to the difference in credits earned in advanced mathematics courses, because no differences were detected between first-generation students and their counterparts in the number of credits earned in introductory mathematics courses.

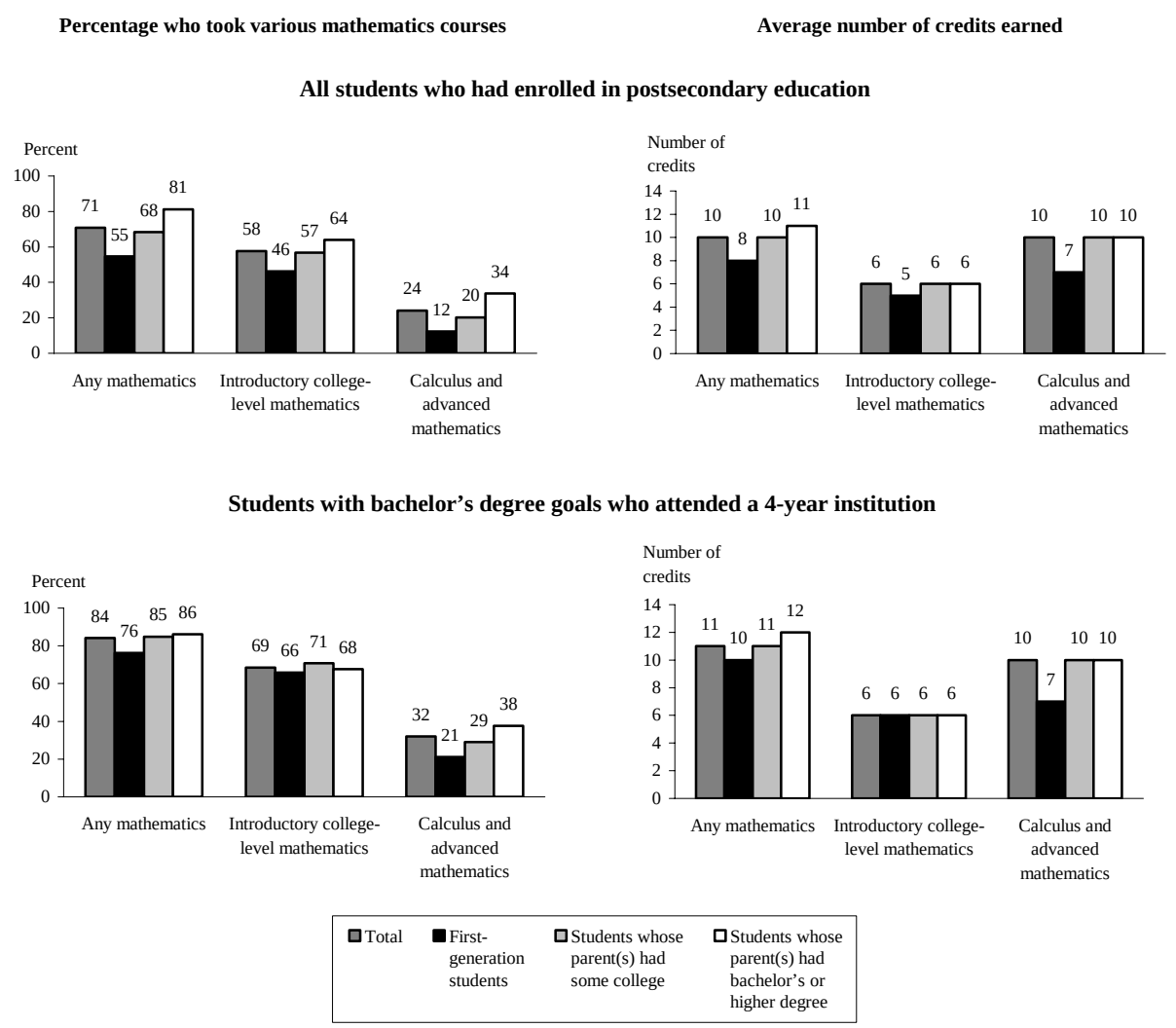
When examining mathematics coursetaking within major,[9] differences were also evident. For instance, first-generation students majoring in business, social sciences/journalism/communication, humanities/arts, health sciences/services, and human/protective services/vocational fields were all less likely than their counterparts whose parents were college graduates to take

[7] The analysis in this section excluded students who earned just 10 or fewer credits during their postsecondary education. This criterion has been applied in many analyses of postsecondary transcripts (e.g., McCormick 1999; Adelman 1999, 2004a, 2004b). This group, often referred as "incidental students," accounted for 12 percent of 1992 12th-graders who had enrolled in postsecondary education in 1992–2000 (see Adelman 2004b for more information about their demographic and academic characteristics).

[8] College-level remedial mathematics was excluded.

[9] Between 1 and 7 percent of students who majored in mathematics or sciences did not take any mathematics course (table 7). This is probably due to students who took only remedial mathematics courses, which were not counted as college-level mathematics courses, students who dropped or stopped out before taking any mathematics course, or students with science majors who used advanced/AP mathematics credits earned in high school to fulfill their degree requirements for mathematics coursework in college.

Figure 6. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took various mathematics courses and average number of credits earned by those who took these courses



NOTE: Introductory college-level mathematics includes courses below the level of calculus and above the level of algebra 2. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

any mathematics courses (table 8). The gaps in advanced mathematics (both in the likelihood of taking courses and credits earned) between first-generation students and those whose parents were college graduates remained, even among those who majored in mathematics or sciences.

Finally, the discrepancies held when the analysis was limited to only those with bachelor's degree goals who attended 4-year institutions: first-generation students were not only less likely

Table 8. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took various mathematics courses and average number of credits earned by those who took these courses

	Any mathematics[1]		Introductory college-level mathematics[2]		Calculus and advanced mathematics	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
All students	70.8	10.4	57.6	5.7	24.2	9.6
First-generation students	54.7	8.4	46.2	5.5	12.3	7.3
Students whose parent(s) had some college	68.3	10.1	56.8	5.7	20.3	9.8
Students whose parent(s) had bachelor's or higher degree	81.2	11.2	64.0	5.7	33.8	9.8
Undergraduate major						
Business						
First-generation students	54.6	8.9	45.9	5.3	20.0	4.5
Students whose parent(s) had some college	72.1	10.3	64.4	5.8	33.2	4.4
Students whose parent(s) had bachelor's or higher degree	92.8	11.7	78.8	6.2	52.2	4.5
Education/library/social work						
First-generation students	80.0	6.8	53.1	4.8	5.6	‡
Students whose parent(s) had some college	87.8	8.1	71.6	4.8	9.5	‡
Students whose parent(s) had bachelor's or higher degree	89.3	9.0	65.7	5.6	11.8	‡
Mathematics/science[3]						
First-generation students	92.8	11.8	85.0	6.9	41.7	7.9
Students whose parent(s) had some college	94.5	19.6	83.3	7.5	58.7	16.6
Students whose parent(s) had bachelor's or higher degree	98.6	16.8	79.6	6.7	70.8	12.7
Engineering/architecture/computer						
First-generation students	93.4	14.8	84.7	6.9	42.9	14.0
Students whose parent(s) had some college	92.6	20.3	72.5	8.1	64.4	15.4
Students whose parent(s) had bachelor's or higher degree	94.9	23.0	61.7	7.1	83.5	17.8
Humanities/arts						
First-generation students	50.4	6.2	44.6	4.2	7.4	‡
Students whose parent(s) had some college	63.2	5.3	45.7	4.4	11.8	‡
Students whose parent(s) had bachelor's or higher degree	70.1	5.9	51.0	4.4	17.2	6.0
Social sciences/journalism/communication						
First-generation students	59.0	9.1	44.1	5.6	12.0	‡
Students whose parent(s) had some college	86.3	7.8	70.8	5.2	12.8	5.2
Students whose parent(s) had bachelor's or higher degree	89.5	9.0	68.3	5.4	28.4	6.0
Health sciences/services						
First-generation students	54.3	6.7	49.8	4.9	3.8	‡
Students whose parent(s) had some college	75.9	8.3	63.2	4.9	13.8	‡
Students whose parent(s) had bachelor's or higher degree	82.2	8.5	72.2	5.2	26.3	4.4
Human/protective services/vocational fields						
First-generation students	34.1	4.3	20.2	‡	1.9	‡
Students whose parent(s) had some college	44.8	6.1	30.4	5.1	3.4	‡
Students whose parent(s) had bachelor's or higher degree	70.3	7.0	52.1	5.7	10.4	‡

See notes at end of table.

Table 8. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took various mathematics courses and average number of credits earned by those who took these courses —Continued

	Any mathematics[1]		Introductory college-level mathematics[2]		Calculus and advanced mathematics	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
Other						
First-generation students	75.2	7.2	72.1	5.8	9.5	‡
Students whose parent(s) had some college	63.1	7.6	55.6	5.6	10.6	6.1
Students whose parent(s) had bachelor's or higher degree	74.9	8.9	70.7	5.6	17.4	7.5
No major or unclassifiable						
First-generation students	27.9	6.2	25.1	4.7	4.8	‡
Students whose parent(s) had some college	39.9	5.4	33.6	4.6	5.1	‡
Students whose parent(s) had bachelor's or higher degree	40.7	7.2	35.0	5.1	7.0	‡

‡Reporting standards not met. (Too few cases for a reliable estimate.)

[1] Credits earned in pre-collegiate and remedial mathematics were excluded.

[2] Introductory college-level mathematics includes courses below the level of calculus and above the level of algebra 2.

[3] Students who majored in mathematics or science and did not take any mathematics course may include those who took only remedial mathematics or those who dropped or stopped out before taking any mathematics course.

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

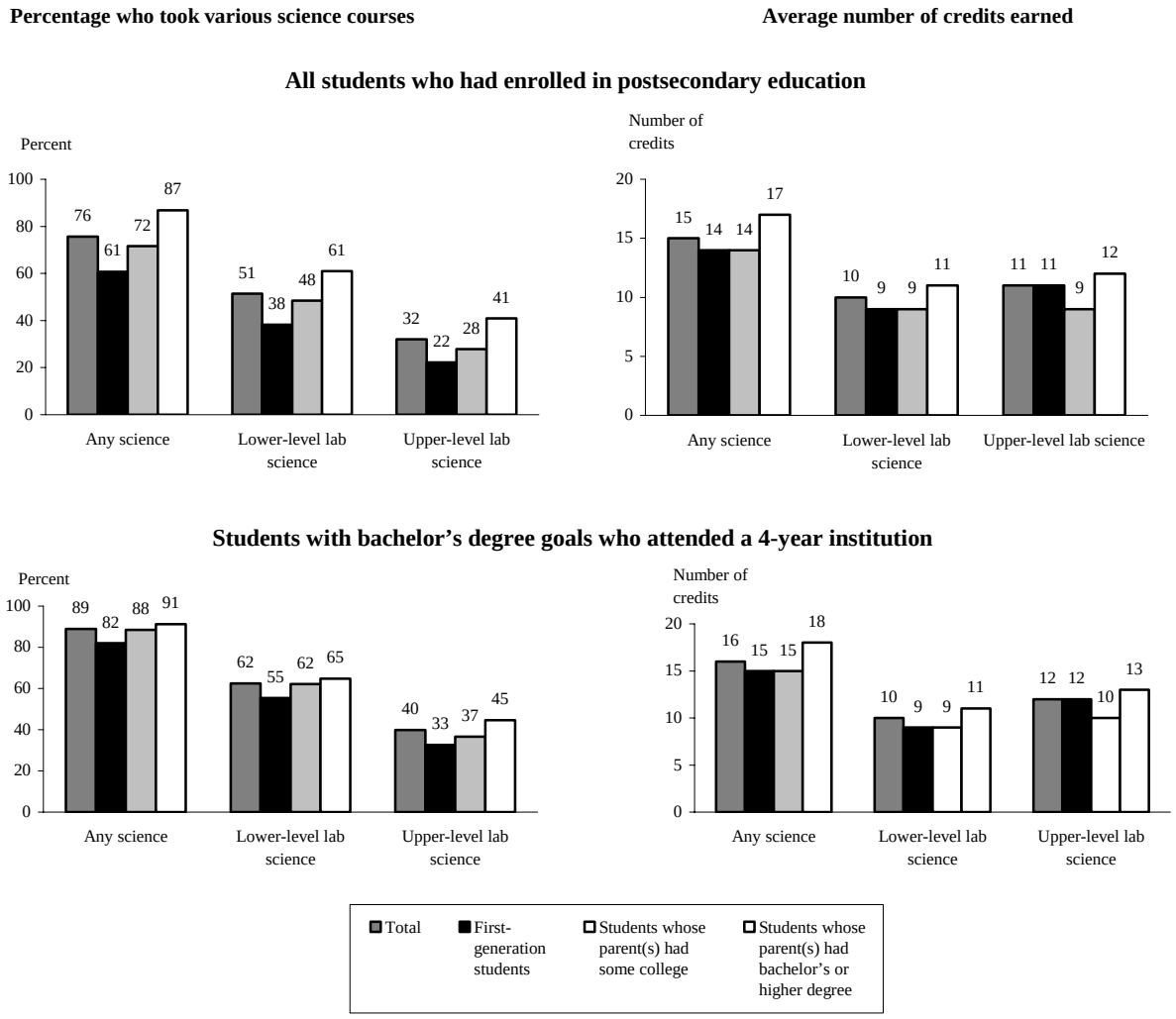
than other students to take mathematics courses, they also earned fewer credits if they took any mathematics courses (figure 6).

Science Courses

A majority of students (76 percent) took at least one science course in college (figure 7), but upper-level science coursetaking was most prevalent among mathematics/science and health science/service majors (table 9). As in mathematics, first-generation students were less likely than their peers whose parents held a bachelor's degree or higher to take science courses, and they earned fewer credits if they took any science courses. The gaps in coursetaking existed in both lower and upper levels of science courses and among students with bachelor's degree goals who attended 4-year institutions (figure 7).[10] Unlike the pattern in mathematics, differences in science coursetaking (both in the likelihood of taking courses and credits earned at lower and

[10] Except for credits earned in upper-level lab sciences where no significant differences were detected between first-generation students and their counterparts whose parents had a bachelor's degree or higher.

Figure 7. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took various science courses and average number of credits earned by those who took these courses



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 9. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took various science courses and average number of credits earned by those who took these courses

	Any science		Lower-level lab science		Upper-level lab science	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
All students	75.6	15.1	51.5	9.7	32.0	11.1
First-generation students	60.8	13.7	38.2	8.8	22.2	10.6
Students whose parent(s) had some college	71.6	13.6	48.5	8.7	27.9	9.4
Students whose parent(s) had bachelor's or higher degree	86.8	16.9	60.9	10.7	41.0	12.4
Undergraduate major						
Business						
First-generation students	51.6	7.1	23.2	5.9	12.2	4.6
Students whose parent(s) had some college	66.7	8.3	39.2	6.0	15.3	5.2
Students whose parent(s) had bachelor's or higher degree	87.9	8.2	51.9	5.8	23.9	5.5
Education/library/social work						
First-generation students	81.4	10.8	55.5	5.8	22.2	‡
Students whose parent(s) had some college	93.7	11.2	70.7	6.0	29.1	5.0
Students whose parent(s) had bachelor's or higher degree	97.4	11.2	72.2	6.4	31.5	5.8
Mathematics/science						
First-generation students	100.0	49.7	97.8	20.0	85.3	29.0
Students whose parent(s) had some college	99.1	44.2	96.7	18.8	81.6	22.8
Students whose parent(s) had bachelor's or higher degree	99.6	53.5	96.9	22.3	87.8	30.4
Engineering/architecture/computer						
First-generation students	60.9	14.6	54.5	12.2	12.8	‡
Students whose parent(s) had some college	80.9	14.9	74.1	11.1	30.3	6.9
Students whose parent(s) had bachelor's or higher degree	96.0	18.7	90.4	13.4	48.1	8.6
Humanities/arts						
First-generation students	65.6	10.4	37.4	7.5	27.9	‡
Students whose parent(s) had some college	71.9	8.0	39.3	5.5	28.0	4.4
Students whose parent(s) had bachelor's or higher degree	84.5	8.7	50.4	6.6	33.8	5.6
Social sciences/journalism/communication						
First-generation students	74.9	9.7	41.5	7.2	29.2	4.7
Students whose parent(s) had some college	90.9	10.6	56.1	6.8	40.9	5.2
Students whose parent(s) had bachelor's or higher degree	95.7	11.7	56.5	7.9	48.3	6.8
Health sciences/services						
First-generation students	91.9	17.8	44.0	9.4	53.0	11.1
Students whose parent(s) had some college	91.6	21.2	70.5	10.1	63.6	9.5
Students whose parent(s) had bachelor's or higher degree	97.5	25.9	79.2	12.1	74.7	12.3
Human/protective services/vocational fields						
First-generation students	31.5	7.7	19.0	‡	6.7	‡
Students whose parent(s) had some college	48.4	7.1	21.7	5.1	13.6	‡
Students whose parent(s) had bachelor's or higher degree	74.6	7.9	50.2	5.8	20.6	4.1

See notes at end of table.

Table 9. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took various science courses and average number of credits earned by those who took these courses —Continued

	Any science		Lower-level lab science		Upper-level lab science	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
Other						
First-generation students	87.0	12.2	64.9	7.4	27.4	5.8
Students whose parent(s) had some college	74.7	9.5	49.0	6.6	20.5	6.0
Students whose parent(s) had bachelor's or higher degree	82.4	10.6	48.7	8.3	26.5	6.5
No major or unclassifiable						
First-generation students	33.4	7.5	20.5	5.2	6.6	‡
Students whose parent(s) had some college	43.6	6.3	23.7	5.5	7.6	6.1
Students whose parent(s) had bachelor's or higher degree	46.9	10.3	29.4	7.8	11.8	12.3

‡Reporting standards not met. (Too few cases for a reliable estimate.)

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

upper levels) were not found between first-generation students and the other two groups of students among those who majored in mathematics and science.

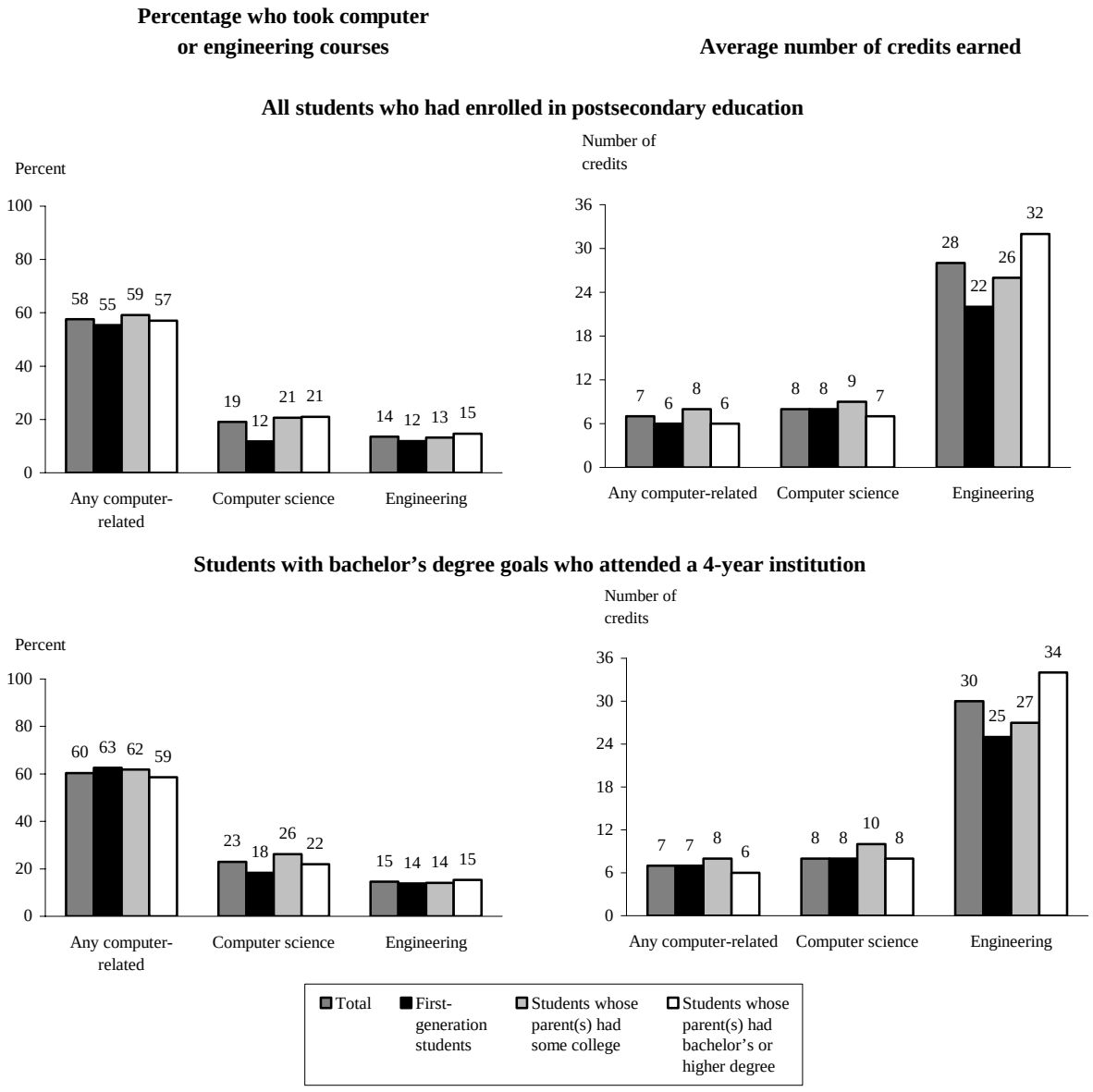
Computer and Engineering Courses

Given the rapid growth and widespread use of information and computer technology, one might expect most students to take some computer courses in college. Based on the NELS transcript data, 58 percent of students took at least one computer course (figure 8).[11] Fewer (19 percent) took computer science courses, and those who took such courses were mostly engineering/architecture/computer majors (table 10). The likelihood of students taking at least one computer-related course was similar across the three groups of students, but first-generation students were less likely than students from the two other groups to take computer science courses.

About 14 percent of students took at least one engineering course. Courses in this field were primarily taken by majors: between 86 and 92 percent of students who majored in engineering/architecture/computers took some engineering courses, but 25 percent or fewer of students majoring in other fields did so (table 10). Although no significant difference was found

[11] It is a broader category that aggregates all explicitly computer-focused courses, including core computer science courses, computer applications courses, basic computer operations training, computer engineering, computer engineering technology, computer repair, data processing, and business information system courses (see Adelman 2004b).

Figure 8. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took any computer or engineering courses and average number of credits earned by those who took these courses



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 10. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took any computer or engineering courses and average number of credits earned by those who took these courses

	Any computer-related		Computer science		Engineering	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
All students	57.6	7.1	19.1	8.3	13.6	28.0
First-generation students	55.4	6.3	11.8	7.5	11.9	21.8
Students whose parent(s) had some college	59.1	8.2	20.7	9.3	13.3	25.6
Students whose parent(s) had bachelor's or higher degree	57.0	6.4	21.0	7.5	14.7	32.5
Undergraduate major						
Business						
First-generation students	84.5	7.2	8.4	‡	3.2	‡
Students whose parent(s) had some college	86.7	8.7	23.2	5.4	4.3	‡
Students whose parent(s) had bachelor's or higher degree	93.0	6.4	22.7	4.4	5.2	‡
Education/library/social work						
First-generation students	56.2	4.3	8.5	‡	6.4	‡
Students whose parent(s) had some college	65.5	3.8	12.3	‡	0.3	‡
Students whose parent(s) had bachelor's or higher degree	67.7	3.8	12.9	‡	3.7	‡
Mathematics/science						
First-generation students	61.0	4.7	16.1	‡	21.5	‡
Students whose parent(s) had some college	59.4	5.1	33.3	4.9	25.1	15.0
Students whose parent(s) had bachelor's or higher degree	45.1	5.3	27.0	6.0	17.1	7.9
Engineering/architecture/computer						
First-generation students	79.2	17.1	52.4	15.1	88.0	37.1
Students whose parent(s) had some college	86.6	26.9	75.4	21.3	86.0	39.8
Students whose parent(s) had bachelor's or higher degree	82.8	15.9	74.6	13.2	91.7	48.5
Humanities/arts						
First-generation students	43.4	7.0	10.7	‡	9.7	‡
Students whose parent(s) had some college	48.1	5.5	16.2	‡	5.7	‡
Students whose parent(s) had bachelor's or higher degree	42.3	4.1	8.8	3.9	5.9	‡
Social sciences/journalism/communication						
First-generation students	46.6	4.2	13.1	‡	1.7	‡
Students whose parent(s) had some college	59.6	4.7	16.2	4.2	3.6	‡
Students whose parent(s) had bachelor's or higher degree	45.6	3.8	13.3	4.1	4.0	‡
Health sciences/services						
First-generation students	51.8	4.0	9.9	‡	5.5	‡
Students whose parent(s) had some college	50.6	3.6	20.9	‡	8.6	‡
Students whose parent(s) had bachelor's or higher degree	54.6	3.4	9.8	‡	2.7	‡
Human/protective services/vocational fields						
First-generation students	37.8	4.1	2.8	‡	16.3	‡
Students whose parent(s) had some college	47.9	4.7	9.1	‡	14.9	16.2
Students whose parent(s) had bachelor's or higher degree	62.2	5.7	12.3	‡	12.0	‡

See notes at end of table.

Table 10. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took any computer or engineering courses and average number of credits earned by those who took these courses—Continued

Generation status and undergraduate major	Any computer-related		Computer science		Engineering	
	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
Other						
First-generation students	60.8	4.2	13.7	‡	6.2	‡
Students whose parent(s) had some college	55.8	5.5	13.4	5.1	6.3	‡
Students whose parent(s) had bachelor's or higher degree	53.6	5.0	21.1	4.9	9.8	‡
No major or unclassifiable						
First-generation students	38.3	4.9	6.8	‡	6.4	‡
Students whose parent(s) had some college	37.4	4.9	8.7	5.2	6.5	10.1
Students whose parent(s) had bachelor's or higher degree	36.9	6.0	11.7	6.9	6.5	‡

‡Reporting standards not met. (Too few cases for a reliable estimate.)

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

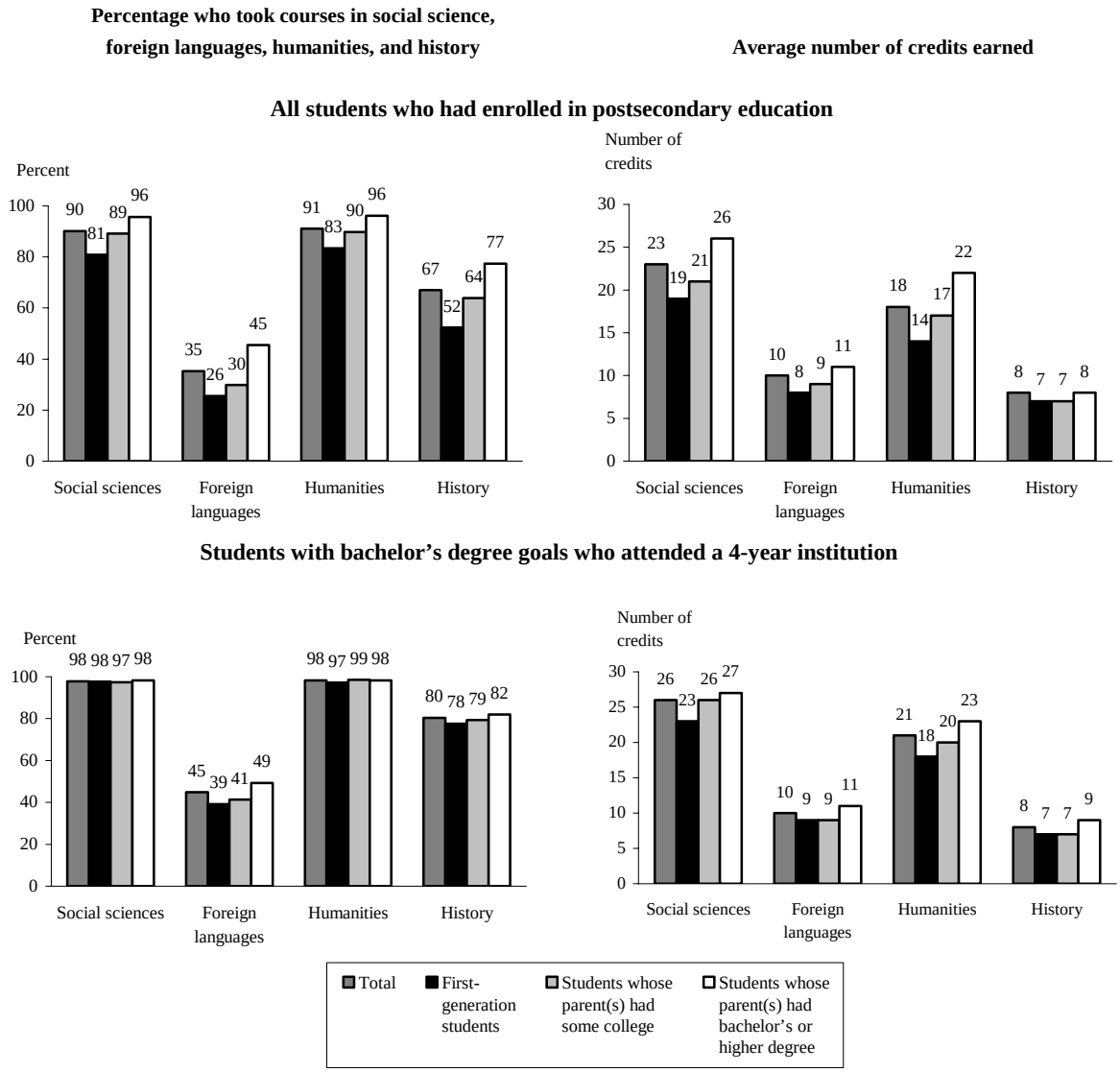
in the likelihood of taking engineering courses, first-generation students earned fewer credits in engineering (if they took any) than students whose parents held a bachelor's degree or higher. A similar difference was found for students who majored in engineering/architecture/computers, as well as among those with bachelor's degree goals who attended 4-year institutions (figure 8).

Social Sciences, Foreign Languages, Humanities, and History Courses

Reflecting the requirements of most colleges, coursetaking in social sciences and humanities was widespread: 9-in-10 students took courses in these subject areas (figure 9). About two-thirds of students took history courses, and one-third took foreign language courses. However, consistent with their lower likelihood to major in social sciences and humanities (table 4), first-generation students were less likely than students whose parents were college graduates to take social science, foreign language, humanities, or history courses. They also earned fewer credits if they took any courses in these areas. These differences remained for number of credits earned among students with bachelor's degree goals who attended 4-year institutions, although they appeared to be smaller.

For those who majored in humanities/arts and social sciences/journalism/communication, differences between first-generation students and other students were not detected in their likelihood of taking social science, humanities, and history courses (table 11), but differences in

Figure 9. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took any courses in social sciences, foreign languages, humanities, and history, and average number of credits earned by those who took these courses



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 11. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took any courses in social sciences, foreign languages, humanities, and history, and average number of credits earned by those who took these courses

	Social sciences		Foreign languages		Humanities		History	
Generation status and undergraduate major	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
All students	90.2	22.7	35.3	9.9	91.1	18.4	67.0	7.6
First-generation students	80.8	18.5	25.5	8.5	83.4	13.9	52.4	6.6
Students whose parent(s) had some college	89.2	21.3	29.8	8.7	89.7	16.6	63.9	6.9
Students whose parent(s) had bachelor's or higher degree	95.7	25.7	45.5	11.1	96.2	22.0	77.4	8.4
Undergraduate major								
Business								
First-generation students	71.8	16.9	15.6	7.1	72.1	13.1	41.7	5.1
Students whose parent(s) had some college	88.3	17.5	26.2	7.2	82.0	15.0	55.4	5.4
Students whose parent(s) had bachelor's or higher degree	96.5	23.9	37.3	8.9	96.3	17.8	78.0	6.2
Education/library/social work								
First-generation students	98.7	22.0	31.7	8.2	96.0	19.7	79.7	7.7
Students whose parent(s) had some college	99.3	25.8	36.9	7.4	98.3	19.5	87.8	8.6
Students whose parent(s) had bachelor's or higher degree	99.8	25.9	46.5	8.6	100.0	21.0	95.4	7.7
Mathematics/science								
First-generation students	100.0	17.1	41.1	‡	98.9	16.0	80.8	6.8
Students whose parent(s) had some college	99.1	17.9	30.7	7.8	98.9	15.9	85.4	6.1
Students whose parent(s) had bachelor's or higher degree	98.5	18.4	52.5	10.1	100.0	19.1	77.2	6.9
Engineering/architecture/computer								
First-generation students	91.5	10.5	18.7	‡	97.5	10.0	55.4	5.3
Students whose parent(s) had some college	88.2	13.8	20.5	6.3	90.1	14.6	59.1	6.9
Students whose parent(s) had bachelor's or higher degree	98.9	14.0	20.0	6.9	99.3	11.1	73.7	8.1
Humanities/arts								
First-generation students	96.8	16.7	48.6	14.6	96.6	30.7	86.2	9.4
Students whose parent(s) had some college	88.9	19.7	59.5	10.3	97.9	35.6	76.3	9.2
Students whose parent(s) had bachelor's or higher degree	99.7	21.5	66.1	17.5	99.9	45.7	88.3	11.3
Social sciences/journalism/communication								
First-generation students	99.8	44.1	42.2	10.9	88.5	21.1	78.5	9.5
Students whose parent(s) had some college	99.6	47.7	56.6	11.5	98.5	24.2	84.0	9.6
Students whose parent(s) had bachelor's or higher degree	100.0	50.1	68.5	11.6	99.4	25.9	88.7	11.4

See notes at end of table.

Table 11. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by percentage who took any courses in social sciences, foreign languages, humanities, and history, and average number of credits earned by those who took these courses—Continued

Generation status and undergraduate major	Social sciences		Foreign languages		Humanities		History	
	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits	Percent with any	Average credits
Health sciences/services								
First-generation students	76.4	14.1	16.8	‡	83.1	10.5	36.2	5.7
Students whose parent(s) had some college	90.3	17.2	24.5	8.2	94.7	14.0	64.6	5.4
Students whose parent(s) had bachelor's or higher degree	95.0	18.2	22.9	8.0	94.1	14.8	61.6	5.6
Human/protective services/vocational fields								
First-generation students	48.7	18.7	18.8	‡	63.8	10.4	28.0	5.7
Students whose parent(s) had some college	62.8	23.5	19.1	6.7	63.5	14.4	44.4	6.4
Students whose parent(s) had bachelor's or higher degree	84.1	28.2	28.3	8.0	86.5	17.8	65.3	7.7
Other								
First-generation students	84.3	15.5	31.1	6.3	96.6	12.9	66.9	5.6
Students whose parent(s) had some college	94.2	16.4	24.4	8.3	93.3	13.6	73.9	6.1
Students whose parent(s) had bachelor's or higher degree	99.3	16.2	44.7	7.7	98.1	15.2	75.9	6.4
No major or unclassifiable								
First-generation students	79.0	9.1	21.4	7.4	79.4	8.4	37.8	4.8
Students whose parent(s) had some college	82.9	9.8	14.0	5.5	86.6	8.0	42.4	4.7
Students whose parent(s) had bachelor's or higher degree	76.5	12.7	24.4	6.3	80.5	11.4	50.5	5.1

‡Reporting standards not met. (Too few cases for a reliable estimate.)

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

the number of credits earned remained. For example, first-generation students majoring in humanities/arts earned an average of 31 credits in humanities, compared with an average of 46 credits earned by those whose parents had at least a bachelor's degree. The pattern of first-generation students earning relatively fewer credits in humanities or social sciences was also found in other major fields, including business, mathematics/science, engineering/architecture/computers, and health sciences/services.

Coursetaking Across Curricular Areas

Students whose parents were college educated appeared to have a wider range of curricular interests than first-generation students. For example, as parental education levels increased,

students were more likely to take courses in every curricular area listed in table 12. The pattern was also observed among students with bachelor's degree goals who attended 4-year institutions. For example, students whose parents held a bachelor's or advanced degree were more likely than first-generation students to take courses in non-Western cultures/societies, environment/natural resources, ethics, fine and performing arts, media studies, religious studies, upper-level writing, international studies, and graphic arts/design.

First-generation students were more likely than students whose parents held a bachelor's or advanced degree to take various vocational courses. Such courses included business and legal support, computer support, construction technology/trade, and protective services (table 13). Similar differences were also found among students with bachelor's degree goals who attended 4-year institutions: first-generation students were more likely than students whose parents were college graduates to take courses in business and legal support, computer support, protective services, and medical/health support.

Table 12. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took any courses in various curricular areas

Generation status	Western culture/ society	Edu- cation	Non- Western cultures/ societies	Environ- ment/ natural resources	Ethics	Family/ child/ youth studies	Fine and perform- ing arts	Media studies	Ethnic/ women/ culture	Religious studies	Sports/ PE/recre- ation	Upper- level writing	Interna- tional studies	Graphic arts/ design
All students who had enrolled in postsecondary education	71.1	20.4	17.0	11.1	17.5	21.3	50.3	20.8	27.4	24.6	56.9	24.6	21.2	12.8
First-generation students	55.3	16.9	9.6	8.2	9.2	16.9	38.5	13.6	20.4	14.2	46.1	18.6	10.7	7.9
Students whose parent(s) had some college	69.4	19.6	13.4	9.8	16.2	20.9	46.1	16.4	25.3	21.4	57.4	22.5	17.8	12.2
Students whose parent(s) had bachelor's or higher degree	80.4	22.8	24.1	13.8	22.7	23.8	60.4	28.7	33.0	32.7	61.7	29.7	29.7	15.7
Students with bachelor's degree goals who attended a 4-year institution	84.1	25.6	22.3	13.6	22.2	25.8	60.8	25.8	35.1	31.7	65.5	29.9	27.7	13.9
First-generation students	80.6	24.6	15.9	10.1	14.2	23.0	55.6	20.6	30.2	24.5	59.9	24.7	18.5	9.8
Students whose parent(s) had some college	84.9	27.2	19.4	13.2	21.8	27.2	58.7	21.9	36.1	29.0	69.5	29.0	24.9	13.2
Students whose parent(s) had bachelor's or higher degree	84.5	24.6	26.5	14.9	24.9	25.6	64.1	30.2	35.7	35.8	64.2	32.1	32.6	15.7

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Table 13. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000, by percentage who took any courses in various vocational areas

Generation status	Personal develop-mental/ skills	Business and legal support	Computer support	Electronic/ communi-cations technology	Construc-tion tech/trade	Industrial/ mechanical occupa-tions	Market/ sales/ hospitality	Personal/ food/home service	Protective services	Medical/ health support
All students who had enrolled in postsecondary education	36.9	18.7	7.1	7.3	3.9	7.1	7.4	3.4	9.8	27.7
First-generation students	38.1	27.8	8.6	7.2	5.9	8.3	7.1	3.9	10.4	29.6
Students whose parent(s) had some college	40.0	21.1	8.9	7.6	3.7	7.1	7.9	2.6	12.2	28.8
Students whose parent(s) had bachelor's or higher degree	33.3	11.8	4.6	7.0	3.2	6.4	7.1	3.8	7.1	25.6
Students with bachelor's degree goals who attended a 4-year institution	37.3	13.5	5.8	7.1	3.2	5.7	6.8	3.1	9.5	27.8
First-generation students	36.2	22.5	7.0	7.2	4.2	5.2	7.0	2.5	12.1	30.6
Students whose parent(s) had some college	42.4	14.1	7.2	7.1	3.0	5.9	7.0	2.6	11.9	29.8
Students whose parent(s) had bachelor's or higher degree	33.8	10.3	4.3	7.0	3.1	5.8	6.5	3.6	6.9	25.5

NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

How Well Do First-Generation Students Perform?

Do first-generation students perform as well in college as other students? To address this question, the following analysis examined students' overall undergraduate grade point average (GPA), first-year GPAs, average GPAs in various curricular areas, and the proportion of withdrawals and repeated courses.

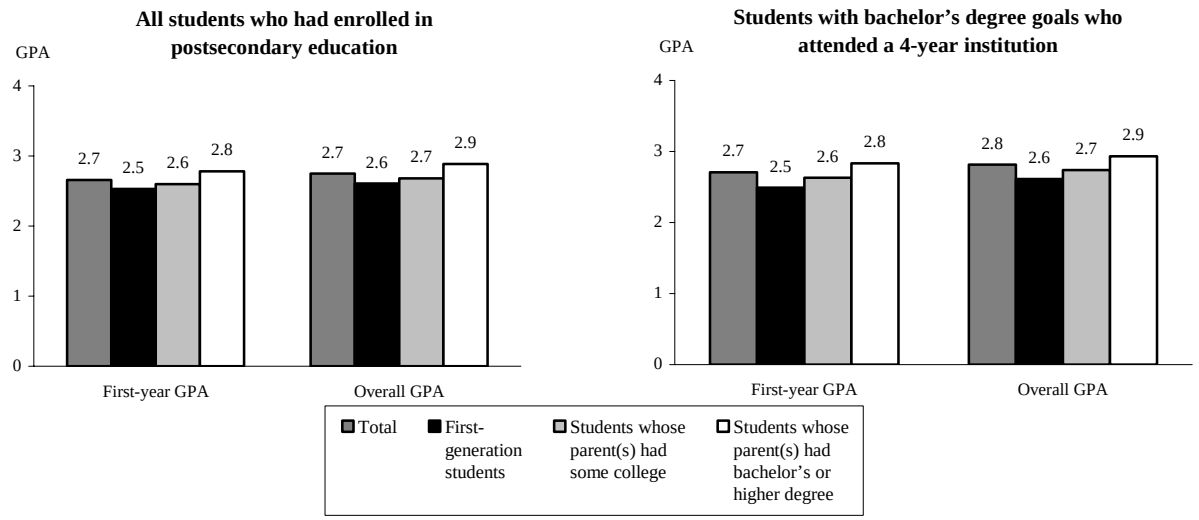
Undergraduate Grade Point Average

First-generation students did not perform as well as their peers starting from the first year of college. As shown in figure 10, first-generation students had lower first-year GPAs than students whose parents had a bachelor's or advanced degree (2.5 vs. 2.8).[12] This observation also held among those with bachelor's degree goals who attended 4-year institutions. Like first-year credit production, academic performance in the first year bears an important relationship to long-term degree completion. Previous research found that the higher a student's first-year GPA, the more likely that student was to receive a bachelor's degree (McCormick 1999).

The lower GPAs of first-generation students persisted throughout their entire undergraduate enrollment. Overall, first-generation students had an average GPA of 2.6, compared with an average GPA of 2.9 for students whose parents had a bachelor's degree or higher. This difference was also observed among students with bachelor's degree goals who attended 4-year institutions. The lower performance of first-generation students was also evident in most academic areas shown in table 14, including mathematics, science, computer science, foreign language, and history. Some of these differences remained even after controlling for major fields of study. For example, first-generation students majoring in mathematics and science on average earned GPAs of 2.6 in mathematics and 2.5 in science, compared with 3.1 and 2.9, respectively, for their counterparts whose parents completed college. First-generation students majoring in humanities/arts earned an average GPA of 2.5 in history, compared with an average GPA of 2.9 for students whose parents completed college.

[12] Differences in GPAs, however, were not found between first-generation students and those whose parents had some college education.

Figure 10. Generation status of 1992 12th-graders who earned more than 10 credits in postsecondary education between 1992 and 2000, by first-year and overall grade point average (GPA)



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Withdrawn and Repeated Courses

In addition to lower GPAs, first-generation students were more likely than other students to withdraw from or repeat courses they attempted to study. As shown in figure 11, in all undergraduate courses attempted by the student, the proportion of courses with no-penalty withdrawal and no-credit-repeat grades was 12 percent for first-generation students and 7 percent for students whose parents held a bachelor's degree or higher. The difference was also observed among students with bachelor's degree goals who attended a 4-year institution. Enrolling in a course and then withdrawing from or repeating it may delay their progress toward completing a degree.

Table 14. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by first-year and overall grade point average (GPA) and GPA in various academic areas

			GPA in various academic areas						
Generation status and undergraduate major	GPA in first year	Overall GPA	Mathematics	Science	Computer science	Engineering	Foreign language	History	Allied health
All students	2.7	2.7	2.6	2.5	2.9	2.9	2.9	2.7	3.1
First-generation students	2.5	2.6	2.5	2.4	2.7	2.8	2.7	2.5	3.1
Students whose parent(s) had some college	2.6	2.7	2.5	2.5	2.9	2.8	2.9	2.6	3.1
Students whose parent(s) had bachelor's or higher degree	2.8	2.9	2.7	2.6	3.0	2.9	3.0	2.8	3.1
Undergraduate major									
Business									
First-generation students	2.8	2.9	2.7	2.7	‡	‡	3.0	2.6	3.3
Students whose parent(s) had some college	2.8	2.9	2.6	2.6	2.8	‡	3.1	2.6	3.3
Students whose parent(s) had bachelor's or higher degree	2.9	3.0	2.8	2.8	3.2	‡	3.1	2.8	3.3
Education/library/social work									
First-generation students	2.6	2.9	2.7	2.5	‡	‡	3.0	2.5	‡
Students whose parent(s) had some college	2.8	3.1	2.7	2.5	‡	‡	2.9	2.7	3.3
Students whose parent(s) had bachelor's or higher degree	2.8	3.1	2.6	2.6	‡	‡	2.9	2.7	3.2
Mathematics/science									
First-generation students	2.9	2.9	2.6	2.5	‡	‡	‡	3.0	‡
Students whose parent(s) had some college	2.8	2.8	2.8	2.6	3.0	2.6	3.3	2.9	3.1
Students whose parent(s) had bachelor's or higher degree	3.1	3.1	3.1	2.9	3.0	2.7	3.3	3.2	3.5
Engineering/architecture/computer									
First-generation students	2.8	2.8	2.5	2.5	2.9	3.0	‡	2.5	‡
Students whose parent(s) had some college	2.9	3.0	2.9	2.7	3.0	3.0	3.4	2.9	‡
Students whose parent(s) had bachelor's or higher degree	3.0	3.0	2.8	2.7	3.1	3.0	3.2	3.1	‡
Humanities/arts									
First-generation students	2.6	2.7	2.6	2.6	‡	‡	3.0	2.5	‡
Students whose parent(s) had some college	3.0	3.0	2.4	2.7	‡	‡	3.0	2.7	‡
Students whose parent(s) had bachelor's or higher degree	2.9	3.0	2.5	2.5	2.4	‡	3.1	2.9	2.7
Social sciences/journalism/communication									
First-generation students	2.7	2.8	2.6	2.5	‡	‡	2.7	2.6	3.2
Students whose parent(s) had some college	2.7	2.9	2.5	2.6	2.8	‡	2.9	2.8	3.0
Students whose parent(s) had bachelor's or higher degree	2.9	3.0	2.7	2.6	2.9	‡	3.1	2.9	3.2

See notes at end of table.

Table 14. Generation status of 1992 12th-graders who earned more than 10 postsecondary credits between 1992 and 2000 and majored in various undergraduate fields, by first-year and overall grade point average (GPA) and GPA in various academic areas—Continued

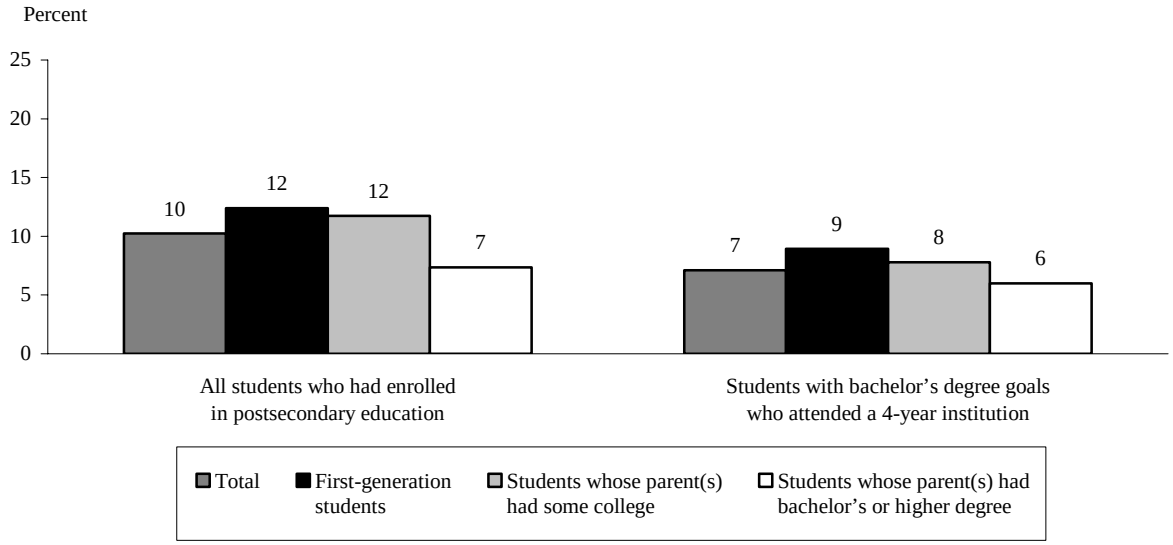
			GPA in various academic areas						
Generation status and undergraduate major	GPA in first year	Overall GPA	Mathematics	Science	Computer science	Engineering	Foreign language	History	Allied health
Health sciences/services									
First-generation students	2.9	2.9	2.7	2.7	‡	‡	‡	2.8	3.2
Students whose parent(s) had some college	2.7	3.0	2.6	2.6	‡	‡	3.0	2.9	3.1
Students whose parent(s) had bachelor's or higher degree	2.9	3.1	2.9	2.7	‡	‡	3.3	2.9	3.2
Human/protective services/vocational fields									
First-generation students	2.7	2.9	‡	2.2	‡	3.3	‡	2.7	‡
Students whose parent(s) had some college	2.7	2.8	2.4	2.4	‡	2.9	2.8	2.5	2.8
Students whose parent(s) had bachelor's or higher degree	2.7	2.8	2.5	2.2	‡	‡	2.7	2.6	2.8
Other									
First-generation students	2.3	2.4	2.3	2.1	‡	‡	3.0	2.4	3.1
Students whose parent(s) had some college	2.3	2.4	2.3	2.1	2.7	‡	2.8	2.2	3.0
Students whose parent(s) had bachelor's or higher degree	2.5	2.5	2.5	2.2	3.0	‡	2.5	2.6	3.1
No major or unclassifiable									
First-generation students	1.9	2.0	2.3	2.0	‡	‡	2.0	1.9	2.4
Students whose parent(s) had some college	2.1	2.0	2.1	2.0	2.8	2.4	2.2	1.9	2.3
Students whose parent(s) had bachelor's or higher degree	2.1	2.1	2.0	1.9	2.5	‡	2.5	2.2	2.6

‡Reporting standards not met. (Too few cases for a reliable estimate.)

NOTE: Detail may not sum to totals because of rounding. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Figure 11. Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage of withdrawn or repeated courses in all courses attempted



NOTE: Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.
SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

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Factors Related to Degree Completion and Persistence

The tabular analyses described above revealed obvious differences between first-generation students and those with college-educated parents in terms of major fields chosen, number of credits completed, types of courses taken, amount of coursework completed, and academic performance. While these differences are noteworthy, college administrators, state legislators, parents, and, most importantly, students are most concerned with degree completion. The fact that 4-in-10 first-generation students left college without earning a credential is of concern (figure 2). When a student drops out, much is lost in terms of both financial resources and individual potential (Tinto 1993). To address some of these issues, the next stage of the analysis examines students' degree completion. Because many factors related to degree completion are interrelated, an analysis was conducted to examine the unique relationship of each individual factor with selected outcomes while taking interrelated factors into account. This approach is sometimes referred to as "commonality analysis," in which multiple linear regression is used to adjust for the common variation among a group of independent variables.[13] This analysis focused on two main questions: How do the gaps between first-generation students and other students change after controlling for all the relevant variables? Are students' coursetaking behaviors and academic performance ultimately related to degree attainment after taking such factors as demographic characteristics, academic preparation, and enrollment behaviors into account?

For the purposes of this study, two separate commonality analyses were performed.[14] The first analysis examined factors related to whether 12th-graders who had enrolled in postsecondary education in 1992–2000 had earned a bachelor's degree by 2000. The second analysis broadened the definition of degree completion to include students who had completed any postsecondary credential or were still enrolled (referred to as persistence to a degree) as of 2000. The independent variables included in each commonality analysis were as follows:[15]

Students' background:

Generation status

Gender

[13] See Technical Notes and Methodology in appendix B for more information about multivariate commonality analysis.

[14] These two commonality analyses were also performed on the restricted sample of students who attended 4-year institutions with bachelor's degree goals. Most findings drawn from all enrolled students also held for this restricted sample.

[15] These independent variables were selected based on the tabular analyses described in the first part of the report rather than on a theoretical model.

Race/ethnicity
Family income

Academic preparation and expectations:
Highest level of mathematics completed in high school
Highest level of education expected
College entrance examination scores

Enrollment behaviors:
Type of first institution
Delayed entry
Continuity of enrollment
Enrollment status

Postsecondary coursetaking and performance:
Major field of study
First-year credit production
Number of remedial courses taken
First-year GPA
Proportion of withdrawn/repeated courses in all attempted courses

Completion of Bachelor's Degrees

Table 15 presents the results of the analysis for students' likelihood of earning a bachelor's degree. The first column provides the observed percentages—that is, the proportion of students who had earned a bachelor's degree by 2000 before controlling for all independent variables included in the analysis. The second column presents the least squares coefficients (expressed as percentages) from the commonality analysis. These coefficients represent the difference (either higher or lower) in percentage points that might be expected between the analysis group (i.e., students whose parents had a bachelor's degree or higher) and the comparison group (e.g., first-generation students) after controlling for the interrelationship of all other independent variables included in the analysis. Comparison groups are shown in italics. Significant least squared coefficients (indicated by asterisks) mean that the observed differences in the likelihood of attaining a bachelor's degree between the comparison groups and the analysis groups remain even after taking into account the covariation of all other independent variables.

Before controlling for any independent variables, first-generation students were less likely than their peers whose parents went to college to earn a bachelor's degree. They continued to be

Table 15. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had earned a bachelor's degree by 2000, and least squared coefficients and standard errors, by selected student characteristics

	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
Student characteristics	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Total	46.3	34.2	4.32	67.5	59.0	4.72
Generation status						
Students whose parent(s) had some college	38.5 *	3.1 *	1.19	62.7 *	2.7	1.65
Students whose parent(s) had bachelor's or higher degree	67.5 *	8.1 *	1.30	78.0 *	6.1 *	1.77
First-generation students	*23.5*	*†*	*†*	*46.7*	*†*	*†*
Gender						
Male	43.8 *	-0.7	0.86	62.8 *	-2.0	1.06
Female	*48.4*	*†*	*†*	*71.8*	*†*	*†*
Race/ethnicity[4]						
Asian/Pacific Islander	51.1	0.2	1.94	68.2	-4.3	2.36
Hispanic	25.7 *	1.4	1.51	50.4 *	1.2	2.24
Black	34.0 *	0.6	1.40	51.9 *	-2.8	1.89
American Indian	31.5	4.2	5.61	‡	1.8	8.15
White	*50.1*	*†*	*†*	*70.9*	*†*	*†*
Family income in 1991						
Less than $25,000	28.8 *	-6.3 *	1.51	52.3 *	-4.3 *	1.89
$25,000–49,999	40.2 *	-6.1 *	1.30	62.1 *	-5.6 *	1.54
$50,000–74,999	55.2 *	-1.8	1.30	73.0 *	-0.7	1.54
$75,000 or more	*73.1*	*†*	*†*	*81.9*	*†*	*†*
Highest level of mathematics completed in high school						
Calculus or precalculus	79.0 *	12.3 *	1.83	82.8 *	5.4 *	3.07
Trigonometry	60.2 *	9.9 *	1.94	70.9 *	5.8 *	3.07
Algebra 2	42.0 *	2.8	1.62	61.7 *	1.8	2.95
Geometry	22.2 *	-0.7	1.73	45.7 *	-0.6	3.19
Other mathematics	4.4	3.6	2.81	28.5	1.1	7.20
Algebra 1	*8.0*	*†*	*†*	*30.2*	*†*	*†*
Highest level of education expected in 1994						
Some college	2.0 *	-8.1 *	3.13	—	—	—
Bachelor's or higher degree	53.7 *	8.8 *	3.02	—	—	—
High school or less	*9.0*	*†*	*†*	—	—	—
SAT/ACT composite score						
Middle level	57.3 *	5.9 *	1.40	68.7 *	6.6 *	1.77
High level	82.3 *	7.0 *	1.83	85.7 *	5.7 *	2.24
Did not take/missing	28.2	4.3 *	1.30	58.8 *	4.2 *	1.89
Low level	*29.1*	*†*	*†*	*49.2*	*†*	*†*

See notes at end of table.

Table 15. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had earned a bachelor's degree by 2000, and least squared coefficients and standard errors, by selected student characteristics—Continued

	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
Student characteristics	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Type of first institution						
2-year	18.3 *	-13.8 *	1.08	55.4 *	-3.3 *	1.42
Less than 2-year	1.3 *	-29.5 *	3.24	‡	-24.1	14.88
4-year	*68.6*	†	†	*71.1*	†	†
Time between high school graduation and postsecondary entry						
Less than 1 year	52.5 *	5.9 *	1.30	69.9 *	3.6	2.13
More than 1 year	*10.6*	†	†	*34.1*	†	†
Continuity of enrollment						
Discontinuous	8.7 *	-15.1 *	1.08	19.4 *	-22.2 *	1.54
Indeterminable	18.4 *	-14.7 *	3.99	36.9 *	-8.6	5.79
Continuous	*64.6*	†	†	*80.4*	†	†
Enrollment status						
Always full-time	59.9 *	8.0 *	0.97	78.2 *	8.1 *	1.18
Part-time at least at one institution	*24.5*	†	†	*43.7*	†	†
Undergraduate major						
Education/library/social work	83.6 *	15.9 *	2.05	89.0	4.0	2.36
Mathematics/science	80.5 *	2.9	1.73	87.9	-1.1	2.01
Engineering/architecture/computer	70.3 *	1.3	2.70	83.3	-4.1	3.07
Humanities/arts	74.4 *	2.6	1.83	80.8	-6.1 *	2.13
Social sciences/journalism/ communication	84.3 *	13.5 *	1.62	89.5 *	3.6	1.89
Health sciences/services	55.2	-5.1 *	1.94	78.9	-7.1 *	2.48
Human/protective services/vocational fields	29.8 *	-13.3 *	2.05	65.2	-11.8 *	2.83
Other	5.2 *	-39.2 *	1.83	9.2 *	-57.7 *	2.48
No major or unclassifiable	0.1 *	-31.0 *	1.62	0.3 *	-53.0 *	2.36
Business	*58.5*	†	†	*84.2*	†	†
Credits earned in the first year						
0–10	4.4 *	-0.8	1.62	14.2 *	-7.2 *	2.36
11–29	46.2 *	-2.9 *	1.08	62.2 *	-1.4	1.30
30 or more	*77.1*	†	†	*89.1*	†	†
GPA in the first year						
Less than 2.00	16.3 *	-9.2 *	1.40	27.4 *	-9.3 *	1.89
2–2.49	46.1 *	-4.7 *	1.30	63.6 *	-4.9 *	1.65
2.50–2.99	59.3 *	-0.7	1.08	76.1 *	-0.4	1.42
3.00 or higher	*64.0*	†	†	*86.2*	†	†
Number of remedial courses taken						
None	59.4 *	1.1	0.97	75.6 *	1.4	1.30
At least one	*26.2*	†	†	*49.1*	†	†

See notes at end of table.

Table 15. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had earned a bachelor's degree by 2000, and least squared coefficients and standard errors, by selected student characteristics—Continued

	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
Student characteristics	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Proportion of withdrawn/repeated courses to all courses						
None	55.0 *	10.9 *	1.19	82.2 *	15.7 *	1.65
Less than 10 percent	66.6 *	15.3 *	1.08	78.9 *	16.3 *	1.42
10 percent or more	*14.7*	*†*	*†*	*28.0*	*†*	*†*

—Not applicable. (The variable was used to select the sample for this analysis.)

†Not applicable for the reference group.

‡Reporting standards not met. (Too few cases for a reliable estimate.)

*p < .05.

[1] The estimates are from the National Education Longitudinal Study of 1988 (NELS:88) Data Analysis System.

[2] Least squares coefficients, multiplied by 100 to reflect percentage (see appendix B).

[3] Standard error of least squares coefficient, adjusted for design effect, multiplied by 100 to reflect percentage (see appendix B).

[4] American Indian includes Alaska Native, Black includes African American, Asian/Pacific Islander includes Native Hawaiian, and Hispanic includes Latino. Race categories exclude Hispanic origin unless specified.

NOTE: The italicized group in each category is the reference group being compared. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

so after controlling for all other independent variables included in the analysis. In other words, first-generation students still lagged behind their peers even if they had similar demographic backgrounds, academic preparation, enrollment characteristics, undergraduate majors, amounts of first-year credits earned, and postsecondary performance. Among students with bachelor's degree goals who attended a 4-year institution, first-generation students were also less likely than their peers whose parents had a bachelor's degree to earn a bachelor's degree themselves after controlling for various factors.

In addition to parents' education levels, credit completion and performance in the first year bore an important relationship with students' success in completing their bachelor's degree programs. After controlling for first-generation status and a wide range of demographic, academic, and enrollment characteristics, students who completed at least 30 credits or earned a 3.0 GPA or higher in the first year were more likely to complete a bachelor's degree than their counterparts with fewer credits or lower grades. Also, students with fewer withdrawn or repeated courses (i.e., less than 10 percent in all attempted courses) were more likely than their counterparts with 10 percent or more of withdrawn or repeated courses to earn a bachelor's degree. Major field was related to students' success as well. Compared with business majors,

students who majored in education/library science/social work and social sciences/journalism/communication were more likely to earn a bachelor's degree after controlling for all other variables; those with majors in health sciences/services, human/protective services/vocational fields, or other fields were less likely to do so.

Academic preparation played a positive role in bachelor's degree completion. After controlling for all other variables, students who completed calculus, pre-calculus, and trigonometry in high school or obtained high scores on college entrance examinations were more likely to attain a bachelor's degree than their counterparts who completed only algebra 1 or had low test scores. Other characteristics associated with higher bachelor's degree completion rates included having higher educational expectations, entering postsecondary education immediately after high school, beginning postsecondary education at 4-year institutions, and enrolling full time and continuously. While family income continued to be independently associated with bachelor's degree completion, neither race/ethnicity nor gender appeared to matter once other variables were taken into account. Remediation also did not appear to be independently associated with bachelor's degree completion once other attributes were controlled.

Persistence in Postsecondary Education

Earlier studies found that first-generation students were less successful than their peers whose parents were college educated in terms of their postsecondary persistence (a concept defined as "either attaining a degree or being still enrolled") even after controlling for relevant variables (Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001). However, in this analysis, this finding was not observed after controlling for all other variables (table 16). The reason may be attributed to the fact that additional transcript-based coursetaking and academic performance variables were included in this analysis, which were not available to the previous studies.

In addition to generation status, there were other variables that were significantly related to bachelor's degree completion but not significantly related to persistence. These variables include family income, education expectations, type of first institution, time between high school graduation and enrollment, and enrollment status.

As with degree completion, after controlling for all other variables, postsecondary coursetaking and academic performance were still significantly related to students' persistence. Clearly, more credits completed in the first year, higher grades earned in the first year, and a lower proportion of withdrawn or repeated courses were related to students' persistence in postsecondary education, regardless of their backgrounds, preparation, and enrollment behaviors.

Table 16. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had attained a degree or certificate or were still enrolled by 2000, and least squared coefficients and standard errors, by selected student characteristics

	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
Student characteristics	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Total	67.2	81	5.06	80.3	82.9	5.23
Generation status						
Students whose parent(s) had some college	60.6	-2.1	1.35	75.9	-2.7	1.74
Students whose parent(s) had bachelor's or higher degree	80.3 *	2.5	1.58	86.7 *	1.5	1.87
First-generation students	*56.8*	*†*	*†*	*71.2*	*†*	*†*
Gender						
Male	63.9 *	-1.7	1.01	76.7 *	-2.9 *	1.24
Female	*70.0*	*†*	*†*	*83.6*	*†*	*†*
Race/ethnicity[4]						
Asian/Pacific Islander	70.9	-1.8	2.25	84.8	-1.8	2.49
Hispanic	51.2 *	-2.2	1.80	67.9 *	-1.3	2.37
Black	58.7 *	0.8	1.69	70.0 *	-2.2	1.99
American Indian	54.8	1.3	6.64	‡	5	8.84
White	*70.1*	*†*	*†*	*82.3*	*†*	*†*
Family income in 1991						
Less than $25,000	59.5 *	-0.2	1.80	72.1 *	-1.7	2.12
$25,000–49,999	63.4 *	-4.1	1.58	77.2 *	-4.4 *	1.74
$50,000–74,999	71.5 *	-1.5	1.58	83.2 *	-0.9	1.62
$75,000 or more	*83.2*	*†*	*†*	*89.0*	*†*	*†*
Highest level of mathematics completed in high school						
Calculus or precalculus	87.2 *	6.3 *	2.25	88.8 *	4.0 *	3.36
Trigonometry	76.6 *	6.3 *	2.25	82.5 *	4.3 *	3.36
Algebra 2	66.2 *	2.8	1.91	78.2 *	2.9	3.11
Geometry	57.0 *	3.0	2.03	68.5	0.7	3.49
Other mathematics	32.7 *	-7.0 *	3.38	55.6	-1.3	7.84
Algebra 1	*43.7*	*†*	*†*	*59.2*	*†*	*†*
Highest level of education expected in 1994						
Some college	43.9	-6.6	3.83	—	—	—
Bachelor's or higher degree	71.2 *	4.0	3.60	—	—	—
High school or less	*41.3*	*†*	*†*	—	—	—
SAT/ACT composite score						
Middle level	75.3 *	4.3 *	1.69	81.8 *	7.7 *	1.99
High level	88.6 *	2.5 *	2.14	90.5 *	7.1 *	2.37
Did not take/missing	54.1	0.2	1.58	74.2	3.8	1.99
Low level	*59.7*	*†*	*†*	*70.1*	*†*	*†*

See notes at end of table.

Table 16. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had attained a degree or certificate or were still enrolled by 2000, and least squared coefficients and standard errors, by selected student characteristics—Continued

	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
Student characteristics	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Type of first institution						
2-year	51.8 *	-1.3	1.24	83.5	8.1 *	1.62
Less than 2-year	67.6 *	-5.4	3.94	‡	13.8	16.06
4-year	*78.9*	*†*	*†*	*80.0*	*†*	*†*
Time between high school graduation and postsecondary entry						
Less than 1 year	71.0 *	1.0	1.58	81.8 *	2.6	2.37
More than 1 year	*46.7*	*†*	*†*	*60.6*	*†*	*†*
Continuity of enrollment						
Discontinuous	44.2 *	4.3 *	1.35	58.3 *	5.0 *	1.62
Indeterminable	35.8 *	-8.3	4.73	53.8 *	-1.2	6.22
Continuous	*78.6*	*†*	*†*	*86.3*	*†*	*†*
Enrollment status						
Always full-time	75.6 *	-0.7	1.13	85.4 *	0.4	1.37
Part-time at least at one institution	*54.3*	*†*	*†*	*69.6*	*†*	*†*
Undergraduate major						
Education/library/social work	90.9	0.5	2.48	93.1	-2.8	2.61
Mathematics/science	92.3	0.0	2.03	94.1	-1.2	2.12
Engineering/architecture/computer	91.2	-1.3	3.26	94.3	-4.1	3.36
Humanities/arts	86.6	-5.4 *	2.25	88.6 *	-8.2 *	2.37
Social sciences/journalism/ communication	91.6	0.2	1.91	94.3	-2.0	1.99
Health sciences/services	91.8	1.5	2.36	95.8	-2.7	2.74
Human/protective services/vocational fields	75.7 *	-5.3 *	2.36	87.1 *	-7.0 *	3.11
Other	40.5 *	-41.0 *	2.14	46.9 *	-44.6 *	2.61
No major or unclassifiable	16.8 *	-60.2 *	2.03	21.7 *	-66.6 *	2.49
Business	*87.6*	*†*	*†*	*95.7*	*†*	*†*
Credits earned in the first year						
0–10	32.8 *	-5.9 *	1.91	47.7 *	-3.3 *	2.61
11–29	67.6 *	-4.4 *	1.35	76.9 *	-2.2	1.37
30 or more	*91.8*	*†*	*†*	*93.7*	*†*	*†*
GPA in the first year						
Less than 2.00	40.0 *	-8.7 *	1.69	50.6 *	-6.6 *	1.99
2–2.49	64.4 *	-10.7 *	1.58	77.0 *	-4.5 *	1.74
2.50–2.99	80.2 *	-0.9	1.35	87.6 *	0.7	1.49
3.00 or higher	*84.2*	*†*	*†*	*92.6*	*†*	*†*
Number of remedial courses taken						
None	74.7 *	-3.7 *	1.13	83.5 *	-5.1 *	1.49
At least one	*55.7*	*†*	*†*	*73.0*	*†*	*†*

See notes at end of table.

Table 16. Among 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, percentage who had attained a degree or certificate or were still enrolled by 2000, and least squared coefficients and standard errors, by selected student characteristics—Continued

Student characteristics	Among all students who had enrolled in postsecondary education			Among students with bachelor's degree goals who attended a 4-year institution		
	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]	Unadjusted percentages[1]	Least squares coefficient[2]	Standard error[3]
Proportion of withdrawn/repeated courses to all courses						
None	74.2 *	8.9 *	1.35	87.4 *	10.3 *	1.74
Less than 10 percent	85.1 *	14.4 *	1.35	89.9 *	12.5 *	1.62
10 percent or more	*40.2*	*†*	*†*	*53.9*	*†*	*†*

—Not applicable. (The variable was used to select the sample for this analysis.)

†Not applicable for the reference group.

‡Reporting standards not met. (Too few cases for a reliable estimate.)

*p < .05.

[1] The estimates are from the National Education Longitudinal Study of 1988 (NELS:88) Data Analysis System.

[2] Least squares coefficients, multiplied by 100 to reflect percentage (see appendix B).

[3] Standard error of least squares coefficient, adjusted for design effect, multiplied by 100 to reflect percentage (see appendix B).

[4] American Indian includes Alaska Native, Black includes African American, Asian/Pacific Islander includes Native Hawaiian, and Hispanic includes Latino. Race categories exclude Hispanic origin unless specified.

NOTE: The italicized group in each category is the reference group being compared. Standard error tables are available at http://nces.ed.gov/das/library/reports.asp.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Although remedial coursetaking was not significantly related to bachelor's degree completion (table 15), it was significantly related to students' persistence in postsecondary education, even after controlling for generation status and other demographic, academic, and enrollment characteristics. One possible explanation for this result is that students who take remedial courses may need more time to complete their regular college program, therefore increasing their likelihood of remaining in school.

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Summary and Conclusions

This report used data from the Postsecondary Education Transcript Study (PETS) of the National Education Longitudinal Study of 1988 (NELS:88) to examine the coursetaking experiences of first-generation students after they entered postsecondary education. Earlier research indicates that first-generation students are at a disadvantage in terms of their access to, persistence through, and completion of postsecondary education. While the results from this report were consistent with those of earlier research, this study further revealed that once in college, the relative disadvantage of first-generation students continued with respect to coursetaking and academic performance. For example, first-generation students were less likely than their peers whose parents were college graduates to major in academic fields such as mathematics and science, humanities and arts, and social sciences, and were more likely to have no major or to major in vocational and technical fields. First-generation students also completed fewer credits, were less likely to take academic courses, and lagged behind their peers in academic performance. Furthermore, they needed more remedial help for college-level work and were more likely than their peers to withdraw from or repeat the courses they attempted to study.

As with earlier research, this study demonstrated that first-generation status was significantly and negatively associated with lower bachelor's degree completion rates even after controlling for a wide range of interrelated factors, including students' demographic backgrounds, academic preparation, enrollment characteristics, postsecondary coursetaking, and academic performance.

On the other hand, when combining degree attainment and persistence as the outcome (i.e., students either earned a credential or were still enrolled as of 2000), after controlling for the variables mentioned above, no significant differences were detected between first-generation students and their peers whose parents attended college. This result differs from those of earlier studies, which found that first-generation students were less likely than other students to persist (e.g., Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001). The change in outcomes between the earlier studies and the current study may in part be attributed to the additional postsecondary coursetaking and performance variables introduced in the current analysis. These variables were not available for analysis in the previous studies (Nuñez and Cuccaro-Alamin 1998; Warburton, Bugarin, and Nuñez 2001).

Finally, as in Adelman (1999) and McCormick (1999), this report confirmed associations between early credit production, academic performance, and withdrawing from or repeating courses and students' success in postsecondary education. More credits and higher grades in the first year and fewer withdrawn or repeated courses were strongly related to the chances of students persisting in postsecondary education and earning a bachelor's degree.

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Appendix A—Glossary

This glossary describes the variables used in this report. The variables were taken directly from the NCES NELS:88/2000 Data Analysis System (DAS), which is an NCES software application that generates tables from the NELS:88/2000 database. Many variables from the Postsecondary Education Transcript Study are included in this DAS. A general description of the DAS software and of the NELS:88/2000 surveys can be found in appendix B. In the index below, the variables are organized by general topic and, within topic, listed in the order in which they appear in the tables. The glossary is in alphabetical order by variable names (displayed in capital letters to the right of the variable label) from the NELS:88/2000 database.

GLOSSARY INDEX

Construction technology and trade occupations credits OCC4CRD
Industrial and mechanical occupations credits OCC5CRD
Market, sales, and hospitality occupations credits OCC6CRD
Personal, food, and home service occupations credits OCC7CRD
Protective services occupations credits OCC8CRD
Medical and health support occupations credits OCC9CRD
Number of remedial courses taken ..... REMCRSE
Number of remedial math courses ..... REMMATH
Number of remedial reading courses ..... REMREAD

ACADEMIC PERFORMANCE

GPA of first calendar year of attendance GPA1
Overall undergraduate GPA ..... GPA_PETS
Undergraduate GPA in college-level math. GPACMTH
Undergraduate GPA in science ..... GPASCI
Undergraduate GPA in computer science ... GPACMPS
Undergraduate GPA in engineering ..... GPAENG
Undergraduate GPA in foreign language .... GPAFLAN
Undergraduate GPA in history courses ..... GPAHIST
Undergraduate GPA in allied health ..... GPAHLTH
Ratio of withdraw/repeats to all courses.... WRPRATIO

DAS Variable

Time to bachelor's degree ***BACHTM2***

A transcript-based variable indicating the time from the true first date of postsecondary attendance to the last date enrolled for bachelor's degree for those who earned a bachelor's degree through 2000.

Basic Western culture/society credits ***BWCSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in introductory level courses dealing with Western history, culture, arts, and society.

Completeness of transcript records ***COMPLETE***

A transcript-based variable indicating whether a student has complete transcript records. This variable has three categories: complete, likely complete, and incomplete. In this report, this variable was used as a filter to select students who had complete or likely complete transcript records.

Computer science credits ***COMPSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in computer science, which is narrowly defined and excludes the basic computer literacy course and all computer applications courses except those in engineering.

Continuity of enrollment ***CONTIN***

A transcript-based variable indicating whether a student was enrolled continuously. In an 8.5-year transcript history, continuity of enrollment is defined more liberally than it would be in a 3-year history. The judgment of "non-continuous" requires a break of more than one semester or two quarters or their equivalent, not including summer terms. This variable has five categories: continuous enrollment, stopout after 3 years of continuous enrollment, discontinuous, indeterminable, and enrolled for less than 1 year.

Attainment through 2000 ***CREDRET***

A transcript-based variable indicating credit-retention account of highest level of attainment through 2000. The categories include bachelor's degree or higher, associate's degree, certificate, no degree but earned 60 or more credits, no degree but earned 30–50 credits, no degree but earned 11–29 credits, and no degree and earned 0–10 credits.

All computer-related credits ***CRELCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in all explicitly computer-focused courses in undergraduate study, including those in COMPSCRD.

Time between high school graduation and postsecondary entry ***DELAY***

A transcript-based variable indicating time between high school graduation and postsecondary entry. This variable was coded into three categories: less than 1 year, 1–2 years, and more than 2 years.

DAS Variable

Graphics arts/design credits ***DESCRED***

A transcript-based variable indicating the total number of undergraduate credits earned in design and graphics fields.

Education credits ***EDCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in education.

Education expectations in 1994 ***EDEXPECT***

Response to the question in the third follow-up survey on the highest level of education the student ever expect to complete. Three categories were used in this report: high school or less, some college, bachelor's degree or higher.

Engineering credits ***ENGINCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in engineering and engineering technology courses (construction technology and industrial safety were excluded).

Environment/natural resources credits ***ENVIRCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in fields dealing directly with environmental issues and natural resources.

Ethics credits ***ETHCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in ethics and applied ethics areas (including bioethics, environmental ethics, etc.).

Senior achievement test score ***F22XCEN***

This is an equally weighted average of the 1992 reading and mathematics scores divided into centiles. This variable was recoded into three categories in this report: low level (i.e., scored the lowest 25 percent), middle level (i.e., scored the middle 50 percent), and high level (i.e., scored the highest 25 percent).

Family income in 1991 ***F2P74***

Responses to the question to parents in the first follow-up survey on the total gross family income from all sources before taxes in 1991. Four categories were used in this report: less than $25,000, $25,000–49,999, $50,000–74,999, and $75,000 or more.

DAS Variable

Generation status ***F2PARED***

This variable was derived from the composite variable that characterizes the highest level of education attained by either parent of the student. The highest level of parental education was constructed using the second follow-up parent questionnaire data. Students were classified into one of the following three groups:

First-generation	Neither parent had attained education beyond high school
Some college	At least one parent had some college education, but neither attained a bachelor's degree
Bachelor's degree or higher	At least one parent earned a bachelor's or advanced degree

Race/ethnicity ***F3RACE***

This variable is based on the 1992 response (second follow-up) unless it was missing or incorrect. In addition, if it became apparent from responses to other questions that the 1992 response was incorrect, the value was corrected in 1994 (third follow-up). Sample members with the value of "Other" were coded as missing for the analysis. The categories used in this report are:

American Indian	A person having origins in any of the original peoples of North America and who maintains cultural identification through tribal affiliation or community recognition. Includes Alaska Natives.
Asian/Pacific Islander	A person having origins in any of the peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands. This includes people from China, Japan, Korea, the Philippine Islands, India, Vietnam, Hawaii, and Samoa.
Black	A person having origins in any of the black racial groups of Africa. Includes African Americans.
White	A person having origins in any of the original peoples of Europe, North Africa, or the Middle East.
Hispanic	A person of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race. Includes Latino.

Gender ***F3SEX***

Response to the question in the second follow-up survey on student's gender: male and female.

Family/child/youth studies credits ***FAMCRED***

A transcript-based variable indicating the total number of undergraduate credits earned in courses dealing directly with family, children, and youth.

DAS Variable

Foreign languages credits ***FLANCR3***

A transcript-based variable indicating the total number of undergraduate credits earned in all languages (at all levels) other than English, but excluding credits earned by examination.

Fine and performing arts credits ***FPACRD***

A transcript-based variable indicating the total number of undergraduate credits earned in fine and performing arts.

Overall undergraduate GPA ***GPA_PETS***

A transcript-based variable indicating overall undergraduate grade point average.

GPA of first calendar year of attendance ***GPA1***

A transcript-based variable indicating undergraduate grade point average for courses taken between the true first date of postsecondary education attendance and 11 months later.

Undergraduate GPA in computer science ***GPACMPS***

A transcript-based variable indicating undergraduate grade point average in computer science, narrowly defined, and excluding the basic computer literacy course

Undergraduate GPA in college-level math ***GPACMTH***

A transcript-based variable indicating undergraduate grade point average in college-level mathematics courses below the level of calculus.

Undergraduate GPA in engineering ***GPAENG***

A transcript-based variable indicating undergraduate grade point average in all engineering and engineering technology courses.

Undergraduate GPA in foreign language ***GPAFLAN***

A transcript-based variable indicating undergraduate grade point average in all foreign language courses (but not language proficiency tests).

Undergraduate GPA in history courses ***GPAHIST***

A transcript-based variable indicating undergraduate grade point average in all history courses, including art history and American Civilization.

DAS Variable

Undergraduate GPA in allied health ***GPAHLTH***

A transcript-based variable indicating undergraduate grade point average in allied health sciences/services and related fields, including nursing.

Undergraduate GPA in science ***GPASCI***

A transcript-based variable indicating undergraduate grade point average in all science courses at all levels.

12th-grader in 1992 ***GRADE12A***

Derived from the variable for the membership of 1992 12th-graders (G12COHRT), this variable includes students who were not identified as a member in G12COHRT but had evidence of receiving high school diplomas between January and July of 1992. This variable has two categories: 1992 member or not a member. It was used as a filter in this report to select students who were in 12th grade in 1992.

Highest level of math in high school ***HIGHMATH***

A transcript-based variable indicating the highest level of mathematics courses completed in high school. The categories used in this report are the following: calculus or precalculus, trigonometry, algebra 2, geometry, algebra 1, and other mathematics.

History credits ***HISTCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in history courses, including the history of art and architecture, and American Civilization.

Humanities credits ***HUMCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in humanities fields and interdisciplinary humanities.

Combination of institutions attended ***INSTCOMB***

A transcript-based variable indicating combination of institutional types attended, determined by requested transcripts, student claims, and unrequested transcript evidence found on received transcripts (e.g., cases where the student did not tell us about a school attended but where transfer credits were listed on a received document from a school the student had attended). Institutions attended prior to high school graduation are not included. The original categories include: 4-year only, 4-year then 2-year, 2-year then 4-year, alternating 2- and 4-year, 4-year plus incidental 2-year, 4-year plus other, 2-year only, 2-year plus other, other subbaccalaureate only, 4-year plus 2-year and other. This variable, combined with EDEXPECT (education expectations), was used as a filter to select a subgroup of students with bachelor's degree goals who attended a 4-year institution.

International studies credits ***INTLCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in international and area studies exclusive of courses dealing with literature, arts, and history.

DAS Variable

Media studies credits ***MEDIACRD***

A transcript-based variable indicating the total number of undergraduate credits earned in the study of mass media, radio, television, video, film, advertising, public relations, and journalism.

Introductory college-level math credits ***MTHCRD2***

A transcript-based variable indicating the total number of undergraduate credits earned in college-level mathematics courses other than calculus and post-calculus math.

Calculus and advanced math credits ***MTHCRD3***

A transcript-based variable indicating the total number of undergraduate credits earned in calculus, differential equations, post-calculus topics, advanced mathematical statistics, engineering mathematics/statistics, numerical methods/analysis in computer science, and physics-with-calculus.

Undergraduate credits in math ***MTHCRD6***

A derived variable that sums the number of undergraduate credits earned in college-level mathematics courses (MTHCRD2), calculus and advanced mathematics courses (MTHCRD3), statistics (STATCRD), and other mathematics courses (MTHCRD4).

Ethnic/women/culture credits ***MWSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses dealing with domestic ethnic minorities, women and gender studies, and multiculturalism.

NELS enrollment status ***NELSSTAT***

This is the sorting variable for students in the fourth follow-up survey who claimed to have attended a postsecondary institution at any time. There are 10 categories for this variable:

1. Received one or more transcripts, at least one of which was not either a GED-level/all-basic-skills transcript or a one-course transcript.
2. Either (a) one undergraduate transcript was imputed when a graduate transcript was received with the undergraduate school referenced—but the undergraduate transcript was not received, or (b) the primary institution of undergraduate attendance refused to send transcripts and where the student's story line of attendance and degree attainment is credible and consistent.
3. Received one or more transcripts, but all were either GED-level and (if more than one received) one-course documents.
4. Received only one transcript with only one course or fewer than five attempted credits of any kind.
5. Transcript(s) requested, none received, but student is a likely postsecondary participant based on loan disbursement records in the NSDLS file.
6. Transcript(s) requested, none received, but student is a likely postsecondary participant based on his/her account of attendance, postsecondary experiences, attainment, occupation, income, financing of postsecondary education, and high school background.
7. Student claimed postsecondary attendance but transcript was not requested, but student is a likely postsecondary participant based on either a loan disbursement in the NSDLS file or account of attendance, attainment, etc.

DAS Variable

NELS enrollment status—Continued ***NELSSTAT***

8. Transcript requested, but student is not a likely postsecondary participant either because (a) all received transcripts were out-of-scope (blank records or secondary school transcripts) or (b) the student's account of attendance, attainment, etc., was contradictory, insufficient, and not credible.
9. Student claimed postsecondary attendance but transcript was not requested and student is not a likely postsecondary participant because the student's account of attendance, attainment, etc., was contradictory, insufficient, and not credible.
10. No claim of postsecondary attendance was made either in FU3 (1994) or FU4 (2000).

In this report, this variable was used as a filter to select students who had enrolled in postsecondary education between 1992 and 2000.

Non-Western culture/society credits ***NWCSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in upper division or specialized courses dealing with history, culture, and arts of non-Western societies.

Business and legal support occupations credits ***OCC1CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in business and legal support occupations.

Computer support occupation credits ***OCC2CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in computer support occupations.

Electronic/communication technology occupations credits ***OCC3CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in technical occupations in electronic and communications technology fields.

Construction technology and trade occupations credits ***OCC4CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in construction technology, construction management, and construction trades.

Industrial and mechanical occupations credits ***OCC5CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in industrial and mechanical technologies and trades.

Market, sales, and hospitality occupations credits ***OCC6CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in specialized marketing, retail, sales, and hospitality occupations.

DAS Variable

Personal, food, and home service occupations credits ***OCC7CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in personal, food, and home service occupations.

Protective services occupations credits ***OCC8CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in protective services occupations, ranging from police and fire academy courses to the administration of criminal justice systems and hazardous materials control.

Medical and health support occupations credits ***OCC9CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses preparing students for work in medical and health support occupations ranging from laboratory technology to nursing to nutrition to medical office specialties.

Personal developmental skills credits ***PERSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses dealing with personal development, relationships, applied psychology, and personal skills.

Enrollment status in 2000 ***PERSIST***

This variable was derived from enrollment status in 2000 and highest degree attained and has three categories: 1) attained a degree or certificate; 2) no degree, but still enrolled in 2000; 3) no degree and not enrolled in 2000.

Type of first institution enrolled ***REFTYPE***

A transcript-based variable indicating aggregated Carnegie Class type of first true institution attended. The categories were collapsed into three categories: 4-year, 2-year, and less-than-2-year.

Religious studies credits ***RELIGCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in religious studies, theology, history and philosophy of religion, and Bible studies.

Number of remedial courses taken ***REMCRSE***

A transcript-based variable indicating the total number of remedial courses taken. Remedial courses counted included designated codes in English, mathematics, basic skills, basic science skills, preparatory chemistry, business English, and arithmetic-based business mathematics.

DAS Variable

Number of remedial math courses ***REMMATH***

A transcript-based variable indicating the total number of remedial mathematics courses taken, including general pre-collegiate mathematics, arithmetic/pre-algebra, arithmetic-based business mathematics, basic algebra, plane geometry, and intermediate algebra when additive credit was not granted.

Number of remedial reading courses ***REMREAD***

A transcript-based variable indicating the total number of remedial reading courses taken, including basic reading, reading improvement, speed reading, college reading, advanced reading, and similar titles.

College entrance exam score ***SATREVQ***

A derived variable made from the transcript-based variable (SATREV). SATREV is a composite variable that consolidates the college entrance examination test scores of SAT, ACT, and PSAT on a single band-scale. SATREVQ was recoded from SATREV and had four categories: low level (i.e., lowest quarter), middle level (i.e., middle two quarters), high level (i.e., highest quarter), and did not take or missing.

Level-1 lab science credits ***SCI1CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in introductory laboratory science courses in biology, chemistry, and physics. The category excludes introductory applied and generalized renderings of the same subjects.

Upper-level lab science credits ***SCI2CRD***

A transcript-based variable indicating the total number of undergraduate credits earned in laboratory sciences normally requiring, as prerequisites, SCI1CRD-level courses.

Science credits ***SCICRD***

A transcript-based variable indicating the total number of undergraduate credits earned in all science courses, exclusive of applied sciences and engineering.

Social sciences credits ***SOCSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in all social science fields, including selected courses in communications and interdisciplinary topics.

Sports/PE/recreation credits ***SPTSCRD***

A transcript-based variable indicating the total number of undergraduate credits earned in sports, physical education, health education, and recreation, including courses in the study of sports, sports management, and recreation marketing.

DAS Variable

Enrollment status ***STUPTANY***

This variable was made from responses to a question in the fourth follow-up survey of whether students had ever "attended less than full-time" for each school attended. This variable has two categories: always full-time, part-time at least one institution.

Total undergraduate credits earned ***TCREDB***

A transcript-based variable indicating additive undergraduate credits from all sources (including examination and dual-enrollment—but not transfer).

Undergraduate credits earned in the first calendar year ***TCREDG***

A transcript-based variable indicating additive undergraduate credits earned in terms with dates within first calendar year.

Aggregated major field of study for postsecondary education ***UGMJR***

A derived variable made by taking 1) the major code of the first bachelor's degree for those who earned a bachelor's degree or higher; 2) the major code of the first associate's degree for those who earned an associate's degree but no bachelor's degree; 3) the major code of the undergraduate certificate for those who earned a certificate but neither a bachelor's nor associate's degree; 4) the major code of those who did not earn any degree. For students with an associate's degree or certificate who subsequently moved to a 4-year institution and earned more than 10 credits from a 4-year institution; but had not yet earned a bachelor's degree by 2000, their major fields were adjusted by taking the codes of non-degree major codes. The detailed major fields were aggregated into the following categories:

Business	Agriculture business/production, accounting, finance, operations research/administration science, business administration/management, human resources management/labor relations, other business, secretarial/clerical, other business support, medical office support, marketing/distribution retailing, hospitality management, real estate
Education/library/social work	Early childhood education, elementary education, secondary education, special education, physical education, other education, child study/guidance, library/archival science, social work
Science	Agriculture/animal/plant science, conservation/natural resources, forestry, biochemistry, other biological science, environmental studies, biopsychology, integrated/general science, chemistry, geology/earth science, physics, other physical science
Engineering/architecture	Architecture/environment design, electrical/communications engineering, chemical engineering, civil engineering, mechanical engineering, other engineering, computer engineering, engineering technologies, computer technology

DAS Variable

Aggregated major field of study for postsecondary education—Continued ***UGMJR***

Computer	Information technology, computer programming, data/information management, computer science
Mathematics	Mathematics/statistics
Humanities	Foreign languages, English/American literature, creative/technical writing, inter-discipline humanities, philosophy, religious studies
Arts/applied arts	Textiles/fashion, interior design, graphic/print communications, graphic/industrial design, drama, speech, film arts, music, fine arts/art history, other FPA
Social sciences	American studies/civilization, area studies, ethnic studies, human ecology, law, woman's studies, general social science, psychology, clinic/counsel psychology, anthropology/archaeology, economics, geography, history, sociology, political science, international relations
Health science/services	Medical/veterinary laboratory technology, dental assistance/Hygiene, HPER, practical nursing, other allied health, physical therapy, occupational therapy, respiratory therapy/technology, other therapies, radiological technology, speech path/audiology, clinical health sciences, nursing, health/hospital administration, public health, other health science profession, nutrition/food science
Journalism/communication	Journalism, communications, radio/TV/film
Human/protective services	Theology, bible studies, administration of justice, fire science, public administration, human/community services
Vocational/technical fields	Communication technologies, cosmetology, other personal service, culinary arts/food management, military science, recreation/sports, construction, mechanics and repairs, precision production, air transportation, other transportation
Other	General studies, basic skills, and all other fields not specified above.
No or unclassifiable major	No major or major that is unclassifiable.

Upper-level writing credits ***WRITECRD***

A transcript-based variable indicating the total number of undergraduate credits earned in courses dedicated to writing above the level of freshman composition, including writing for different media, technical writing, and creative writing.

DAS Variable

Ratio of withdraw/repeats to all courses ***WRPRATIO***

A transcript-based variable indicating ratio of withdraw/repeats to all courses, i.e., the total number of courses with no-penalty Withdrawal and No-Credit-Repeat grades to all undergraduate courses attempted by the student.

Appendix B—Technical Notes and Methodology

The National Education Longitudinal Study of 1988

The National Education Longitudinal Study of 1988 (NELS:88), a major longitudinal study sponsored by the U.S. Department of Education, National Center for Education Statistics (NCES), began in 1988 with a nationally representative, two-stage stratified probability sample of 1,052 8th-grade schools across the nation and 26,432 sampled students in the schools. Of the sampled students, 24,599 participated. This cohort were followed up in 1990, when most of the cohort members were in 10th grade; in 1992, when most of the cohort members were in 12th grade; and in 1994 and 2000, when most of the cohort members had been out of high school for 2 and 8 years, respectively. In addition, the study was designed not only to follow a cohort of 8th-grade students over time but also to "freshen" the sample in the 1990 and 1992 surveys to obtain a representative sample of students enrolled in 10th grade in 1990 and in 12th grade in 1992 that could be compared with the earlier cohorts from the National Longitudinal Study of the High School Class of 1972 (NLS:72) and the High School and Beyond Longitudinal Study (HS&B).

Along with the student survey, NELS:88 included surveys of parents, teachers, school administrators, and school dropouts. A majority of sample members also completed cognitive tests administered in 1988, 1990, and 1992. In 1992, high school transcripts were collected for sample members, and in 2000, postsecondary transcripts were collected, further increasing the analytic potential of the data. Consequently, NELS:88 represents an integrated system of data that tracked students from middle school through secondary and postsecondary education and examined their labor market experiences, and marriage and family formation between 1988 and 2000. For more technical information about the NELS:88 surveys, see *The National Education Longitudinal Study of 1988: Base-Year to Fourth Follow-Up Data File User's Manual* (Curtin et al. 2002).

The NELS:88 Postsecondary Education Transcript Study

The major source of data for this report came from the Postsecondary Education Transcript Study (PETS), collected as part of NELS:88 in 2000. The PETS targeted the transcripts from all U.S. postsecondary institutions attended by NELS sample members in the fourth follow-up survey. It supplements the postsecondary education information collected from the 1994 and

2000 follow-ups by including detailed information on the types of degree programs, periods of enrollment, majors or fields of study for instructional programs, specific courses taken, grades and credits attained, and credentials earned. Compared with self-reported data, transcript data are less prone to error and more objective and permit a more accurate analysis for studies like this one.

Approximately 12,100 students participated in the NELS fourth follow-up study in 2000 (Adelman, Daniel, and Berkovits 2003). Within this panel, about 9,600 students (75 percent, weighted) reported having attended at least one postsecondary institution according to either the third follow-up study in 1994 or the fourth follow-up study in 2000. Within this sample of students, the transcript data collection further targeted students who attended only postsecondary institutions identified in the Integrated Postsecondary Education Data System (IPEDS) institutional data file, therefore, excluding postsecondary information collected from foreign institutions, non-degree-granting programs, and non-credit-granting institutions. Transcripts were requested from a total of 3,200 postsecondary institutions. Based on the transcripts received and, when they were not, other corroborating sources from National Student Loan Data System files, Advanced Placement and College Entrance Examination Board tests, and other student responses, about 9,400 students were identified as "likely postsecondary participants," resulting in a weighted overall response rate of 95 percent. These students form the base from which the analysis sample was selected.

Analysis Sample and Weights

The analysis sample for this report was first selected from 12th-graders in 1992 because that year marks the modal year of high school graduation and date of initial entry into postsecondary education. Because this report focuses on coursetaking and requires full information on courses taken across all institutions attended, the sample was further restricted to postsecondary participants who had a complete transcript record in the PETS. Finally, the definition of first-generation students requires the sample members to have valid information on their parents' education. Thus, students for whom parental education was missing were excluded.[1] These selections resulted in a final analysis sample of about 7,400 students, accounting for about 87 percent of all the NELS 1992 12th-graders who entered postsecondary education between 1992 and 2000.

The sample selection process requires the weight used in this report to be applied to 1992 12th-graders who participated in postsecondary education and had complete transcript records.

[1] Among all the NELS 1992 12th-graders who had enrolled in postsecondary education in 1992–2000, about 8 percent did not have complete transcript records and 9 percent did not have information on their parents' education.

Thus, throughout the report—with one exception—the weight variable WTN00 (corresponding to F4F2P3WT in the original data file) was used for all tables and figures. For figure 1, the 1992–1994 panel weight (WTG00) was used; it represents 12th-graders in 1992. Both are poststratified and balanced repeated replication weights. For more information about the NELS/PETS data and survey design, see *Postsecondary Attainment, Attendance, Curriculum, and Performance: Selected Results From NELS:88/2000 Postsecondary Education Transcript Study (PETS), 2000* (Adelman, Daniel, and Berkovits 2003).

Accuracy of Estimates

The statistics in this report are estimates derived from a sample. Two broad categories of error occur in such estimates: sampling and nonsampling errors. Sampling errors occur because observations are made only on samples of students, not entire populations. Nonsampling errors occur not only in sample surveys but also in complete censuses of entire populations. Nonsampling errors can be attributed to a number of sources: inability to obtain complete information about all students in all institutions in the sample (some students or institutions refused to participate, or students participated but answered only certain items); ambiguous definitions; differences in interpreting questions; inability or unwillingness to give correct information; mistakes in recording or coding data; and other errors of collecting, processing, sampling, and imputing missing data. See *The National Education Longitudinal Study of 1988: Base-Year to Fourth Follow-Up Data File User's Manual* (Curtin et al. 2002) for details on efforts to minimize such nonsampling errors.

Item Response Rates

From the selected sample of this report, weighted item response rates were calculated for all variables used in this report by dividing the weighted number of valid responses by the weighted population for which the item was applicable. Most items had a high response rate (i.e., above 85 percent). For these variables, it is unlikely that reported differences are biased because of missing data. Two variables that had relatively lower item response rates (below 85 percent) are the highest level of mathematics completed in high school (84 percent) and senior achievement test score in 1992 (80 percent). These two variables were used as row variables in table 1, which shows the distribution of first-generation status according to selected demographic and academic characteristics. However, a bias analysis on these two variables did not find significant differences between first-generation students and the two other groups in terms of the proportion of missing cases on these two variables. Therefore, the statements drawn from these two variables based on table 1 should not be biased due to missing data on these two items.

Data Analysis System

The estimates presented in this report were produced using the NCES Data Analysis System (DAS) for the NELS:88/2000 data. This DAS includes selected transcript variables from the PETS file. The DAS software makes it possible for users to specify and generate their own tables. With the DAS, users can replicate or expand upon the tables presented in this report. In addition to the table estimates, the DAS calculates proper standard errors[2] and weighted sample sizes for these estimates. For example, table B-1 contains standard errors that correspond to estimates in table 2 in the report. If the number of valid cases is too small to produce a reliable estimate (fewer than 30 cases), the DAS prints the message "low-N" instead of the estimate. All standard errors for estimates presented in this report can be viewed at http://www.nces.ed.gov/DAS [table center]. In addition to tables, the DAS will also produce a correlation matrix of selected variables to be used for linear regression models. Included in the output with the correlation matrix are the design effects (DEFTs) for each variable in the matrix. Since statistical procedures generally compute regression coefficients based on simple random sample assumptions, the standard errors must be adjusted with the design effects to take into account the stratified sampling method used in the NELS surveys.

The DAS can be accessed electronically at http://nces.ed.gov/DAS. For more information about the NELS Data Analysis System, contact:

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[2] The NELS samples are not simple random samples, and therefore, simple random sample techniques for estimating sampling error cannot be applied to these data. The DAS takes into account the complexity of the sampling procedures and calculates standard errors appropriate for such samples. The method for computing sampling errors used by the DAS involves approximating the estimator by balanced repeated replication of the sampled population. The procedure is typically referred to as the balanced repeated replication method. The website address to view standard errors for all report estimates is http://nces.ed.gov/das/library/reports.asp.

Table B-1. Standard errors for table 2: Generation status of 1992 12th-graders who had enrolled in postsecondary education between 1992 and 2000, by percentage distribution of selected postsecondary enrollment

Postsecondary enrollment characteristics	Total	First-generation students	Students whose parent(s) had some college	Students whose parent(s) had bachelor's or higher degree
Type of first institution				
4-year	1.54	2.53	1.94	1.09
2-year	1.59	2.58	2.01	1.12
Less-than-2-year	0.21	0.71	0.43	0.15
Time between high school graduation and postsecondary entry				
Less than 1 year	0.87	1.75	1.33	0.97
1–2 years	0.64	1.21	0.94	0.89
More than 2 years	0.50	1.20	0.89	0.51
Continuity of enrollment				
Continuous	1.05	2.67	1.19	1.21
Stopout after 3 years of continuous	0.31	0.53	0.53	0.46
Discontinuous	0.72	2.01	0.95	1.17
Indeterminable	0.19	0.55	0.35	0.22
Enrolled for less than 1 year	0.60	1.65	0.86	0.54
Enrollment status				
Always full-time	1.12	2.39	1.53	1.32
Part-time at least at one institution	1.11	2.39	1.53	1.32

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Education Longitudinal Study of 1988 (NELS:88/2000), "Fourth Follow-up, Postsecondary Education Transcript Study (PETS), 2000."

Differences Between Means

The descriptive comparisons were tested in this report using Student's *t* statistic. Differences between estimates are tested against the probability of a Type I error,[3] or significance level. The significance levels were determined by calculating the Student's *t* values for the differences between each pair of means or proportions and comparing these with published tables of significance levels for two-tailed hypothesis testing ($p<.05$).

Student's *t* values may be computed to test the difference between estimates with the following formula:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2}} \quad (1)$$

[3] A Type I error occurs when one concludes that a difference observed in a sample reflects a true difference in the population from which the sample was drawn, when no such difference is present.

where E_1 and E_2 are the estimates to be compared and se_1 and se_2 are their corresponding standard errors. This formula is valid only for independent estimates. When estimates are not independent, a covariance term must be added to the formula:

$$t = \frac{E_1 - E_2}{\sqrt{se_1^2 + se_2^2 - 2(r)se_1\ se_2}} \quad (2)$$

where r is the correlation between the two estimates.[4] This formula is used when comparing two percentages from a distribution that adds to 100. If the comparison is between the mean of a subgroup and the mean of the total group, the following formula is used:

$$t = \frac{E_{sub} - E_{tot}}{\sqrt{se_{sub}^2 + se_{tot}^2 - 2p\,se_{sub}^2}} \quad (3)$$

where p is the proportion of the total group contained in the subgroup.[5] The estimates, standard errors, and correlations can all be obtained from the DAS.

There are hazards in reporting statistical tests for each comparison. First, comparisons based on large *t* statistics may appear to merit special attention. This can be misleading since the magnitude of the *t* statistic is related not only to the observed differences in means or percentages but also to the number of respondents in the specific categories used for comparison. Hence, a small difference compared across a large number of respondents would produce a large *t* statistic.

A second hazard in reporting statistical tests is the possibility that one can report a "false positive" or Type I error. In the case of a *t* statistic, this false positive would result when a difference measured with a particular sample showed a statistically significant difference when there is no difference in the underlying population. Statistical tests are designed to control this type of error, denoted by alpha. The alpha level of .05 selected for findings in this report indicates that a difference of a certain magnitude or larger would be produced no more than one time out of 20 when there was no actual difference in the quantities in the underlying population. When we test hypotheses that show *t* values below the .05 significance level, we treat this finding as rejecting the null hypothesis that there is no difference between the two quantities. Failing to reject the null hypothesis (i.e., finding no difference), however, does not necessarily imply the values are the same or equivalent.

[4] U.S. Department of Education, National Center for Education Statistics, *A Note from the Chief Statistician*, no. 2, 1993.
[5] Ibid.

A third hazard in reporting statistical tests for each comparison occurs when making multiple comparisons among categories of an independent variable. For example, when making paired comparisons among different race/ethnicities, the probability of a Type I error for these comparisons taken as a group is larger than the probability for a single comparison. When more than one difference between groups of related characteristics or "families" are tested for statistical significance, one must apply a standard that assures a level of significance for all of those comparisons taken together. In this analysis, adjustments for multiple comparisons were not made because a subsequent multivariate analysis was conducted, which included all independent variables where significant differences were found (see description below). A difference that was significant by chance alone would not be found significant in the multivariate analysis.

Linear Trends

While many descriptive comparisons in this report were tested using Student's *t* statistic, some comparisons among categories of an ordered variable with three or more levels involved a test for a linear trend across all categories (in particular for persistence risk index and income), rather than a series of tests between pairs of categories. In this report, when differences among percentages were examined relative to a variable with ordered categories, Analysis of Variance (ANOVA) was used to test for a linear relationship between the two variables. To do this, ANOVA models included orthogonal linear contrasts corresponding to successive levels of the independent variable. The squares of the balanced repeated replication standard errors (that is, standard errors that were calculated by the balanced repeated replication method), the variance between the means, and the unweighted sample sizes were used to partition total sum of squares into within- and between-group sums of squares. These were used to create mean squares for the within- and between-group variance components and their corresponding *F* statistics, which were then compared with published values of *F* for a significance level of .05.[6] Significant values of both the overall *F* and the *F* associated with the linear contrast term were required as evidence of a linear relationship between the two variables. Means and balanced repeated replication (BRR) standard errors were calculated by the DAS. Unweighted sample sizes are not available from the DAS and were provided by NCES.

[6] More information about ANOVA and significance testing using the *F* statistic can be found in any standard textbook on statistical methods in the social and behavioral sciences.

Multivariate Commonality Analysis

There are many ways for members of the public and other researchers to make use of NCES results. The most popular way is to read the written reports. (Other ways include obtaining and analyzing public use and restricted use data files. These allow researchers to carry out and publish their own secondary analyses of NCES data.)

It is very important when reading NCES reports to remember that they are descriptive in nature. That is, they are limited to describing some aspect of the condition of education. These results are usefully viewed as suggesting various ideas to be further examined in light of other data, including state and local data, and in the context of the large research literature elaborating on the many factors predicting and contributing to educational achievement or to other outcome variables of interest.

However, some readers are tempted to make unwarranted causal inferences from simple cross tabulations. It is never the case that a simple cross tabulation of any variable with a measure of educational achievement is conclusive proof that differences in that variable are a cause of differential educational achievement or that differences in that variable explain any other outcome variable. The old adage that "correlation is not causation" is a wise precaution to keep in mind when considering the results of NCES reports. Experienced researchers are aware of the design limitations of many NCES data collections. They routinely formulate multiple hypotheses that take these limitations into account and readers of this volume are encouraged to do likewise. As part of the Institute of Education Sciences, NCES has a responsibility to try to discourage misleading inferences from the data presented and to educate the public on the genuine difficulty of making valid causal inferences in a field as complex as education. Our reports are carefully worded to achieve this end.

This focus on description, eschewing causal analysis, extends to multivariate analyses as well as bivariate ones. Some NCES reports go beyond presenting simple crosstabulations and present results from multiple regression equations that include many different independent ("predictor") variables. This can be useful to the reader, especially those without the time or training to access the data on their own. Because many of the independent variables included in descriptive reports are related to each other and to the outcome they are predicting, a multivariate approach can help users to understand their interrelation. For example, students' generation status and delayed enrollment are associated with each other and are each predictors of bachelor's degree attainment. What happens to the relationship between students' generation status and bachelor's degree attainment when delayed enrollment differences are accounted for? This question cannot be answered using bivariate techniques alone.

One way of answering the question is to create three variable tabulations. This method is sometimes used in NCES reports. When the number of independent variables increases to four or more, however, the number of cases in individual cells of such a table often becomes too small to find significant differences simply because there are too few cases to achieve statistical significance. To make economical use of the many available independent variables in the same data display, other statistical methods must be used that can take multiple independent variables into account simultaneously.

Multiple linear regression is often used for this purpose: to adjust for the common variation among a list of independent variables.[7] This approach is sometimes referred to as commonality analysis,[8] because it identifies lingering relationships after adjustment for "common" variation. This method is used simply to confirm statistically significant associations observed in the bivariate analysis while taking into account the interrelationship of the independent variables.

Thus, this multiple regression approach is descriptive. Significant coefficients reported in the regression tables indicate that when the variable is deleted from (or added to) the set of independent variables, it results in a non-zero change in R-squared, which is the basis of the commonality analysis. In other words, a significant coefficient means that the independent variable has a relationship with the outcome variable that is unique, or distinct from its relationship with other independent variables in the model.

Multivariate description of this sort is distinct from either a modeling approach in which an analyst attempts to identify the smallest relevant set of causal or explanatory independent variables associated with the dependent variable or variables or an approach using one of the many varieties of structural equation modeling. In contrast, a multivariate descriptive or commonality approach provides a richer understanding of the data without needing to make any kind of causal assumptions, which is why descriptive multivariate commonality analysis is often employed in NCES statistical reports.

When should commonality analysis be employed? It should be used in statistical analysis reports when independent variables are correlated with both the outcome variable and with each other. This will allow the analyst to determine how much of the effect of one independent variable is due to the influence of other independent variables, since in a multiple regression procedure these effects are adjusted for. For example, since the strength of the statistical relationship between students' generation status and bachelor's degree attainment may be affected by time of enrollment, computing a multiple regression equation that contains both

[7] For more information about least squares regression, see Lewis-Beck (1980) and Berry and Feldman (1987).
[8] For more information about commonality analysis, see Pedhazur (1997).

variables allows the analyst to determine how much if any difference in bachelor's degree attainment between first-generation students and other students is due to differences in the time of enrollment.

As discussed in the section "Data Analysis System" above, all analyses included in PEDAR reports must be based on the DAS, which is available to the public online (http://www.nces.ed.gov/DAS). Exclusively using the DAS in this way provides readers direct access to the findings and methods used in the report so that they may replicate or expand on the estimates presented. However, the DAS does not allow users access to the raw data, which limits the range of covariation procedures that can be used. Specifically, the DAS produces correlation matrices, which can be used as input in standard statistical packages to produce least squares regression models. This means that logit or probit procedures, which are more appropriate for dichotomous dependent variables cannot be used.[9] However, empirical studies have shown that when the mean value of a dichotomous dependent variable falls between 0.25 and 0.75 (as it does in this analysis), regression and log-linear models are likely to produce similar results.[10]

The independent variables analyzed in this study and subsequently included in the multivariate model were chosen based largely on earlier empirical studies (cited in the text), which showed significant associations with the key analytic variable, bachelor's degree attainment. Before conducting the study, a detailed analysis plan was reviewed by a Technical Review Panel (TRP) of experts in the field of higher education research and additional independent variables requested by the TRP were considered for inclusion. The analysis plan listed all the independent variables to be included in the study. The TRP also reviewed the preliminary results as well as the first draft of this report. The analysis plan and subsequent report were modified based on TRP comments and criticism.

Missing Data and Adjusting for Complex Sample Design

The DAS computes the correlation matrix using pairwise missing values. In regression analysis, there are several common approaches to the problem of missing data. The two simplest approaches are pairwise deletion of missing data and listwise deletion of missing data. In pairwise deletion, each correlation is calculated using all of the cases for the two relevant variables. For example, suppose you have a regression analysis that uses variables X1, X2, and X3. The regression is based on the correlation matrix between X1, X2, and X3. In pairwise deletion, the correlation between X1 and X2 is based on the nonmissing cases for X1 and X2.

[9] See Aldrich and Nelson (1984). Analysts who wish to estimate other types of models can apply for a restricted data license from NCES.

[10] See for example, Goodman (1976) and Knoke (1975).

Cases missing on either X1 or X2 would be excluded from the calculation of the correlation. In listwise deletion, the correlation between X1 and X2 would be based on the nonmissing values for X1, X2, and X3. That is, all of the cases with missing data on any of the three variables would be excluded from the analysis.

The correlation matrix produced by the DAS can be used by most statistical software packages as the input data for least squares regression. The DAS provides either the SPSS or SAS code necessary to run least squares regression models. The DAS also provides additional information to incorporate the complex sample design into the statistical significance tests of the parameter estimates. Most statistical software packages assume simple random sampling when computing standard errors of parameter estimates. Because of the complex sampling design used for the survey, this assumption is incorrect. A better approximation of their standard errors is to multiply each standard error by the design effect associated with the dependent variable (DEFT),[11] where the DEFT is the ratio of the true standard error to the standard error computed under the assumption of simple random sampling. The DEFT is calculated by the DAS and displayed with the correlation matrix output.

Interpreting the Results

The least squares regression coefficients displayed in the regression tables in this report are expressed as percentages. Significant coefficients represent the observed differences that remain between the analysis group (such as students whose parents had a bachelor's or higher degree) and the comparison group (i.e., first-generation students) after controlling for the relationships of all the selected independent variables. For example, in table 15, the least squares coefficient for students whose parents had a bachelor's or higher degree is 8.1. This means that compared to first-generation students, roughly 8 percent *more* of the group whose parents had a bachelor's or higher degree would be expected to attain a bachelor's degree, after controlling for the relationships among all the other independent variables.

[11] The adjustment procedure and its limitations are described in Skinner, Holt, and Smith (1989).