ACT Research Report Series 2015 (2)

Who Goes to Graduate School?

Tracking 2003 ACT®-Tested High School Graduates for More Than a Decade

Krista Mattern, PhD
Justine Radunzel, PhD

ACT®

Krista Mattern, a principal research scientist in the Statistical and Applied Research Department, works on the validity and fairness of assessment scores, as well as more general higher education issues, such as enrollment, persistence, and graduation.

Justine Radunzel, a principal research scientist in the Statistical and Applied Research Department, works on postsecondary outcomes research and validity evidence for The ACT®.

The authors thank Jeff Allen, Wayne Camara, Ty Cruce, Richard Sawyer, Jim Sconing, and Karen Zimmerman for their helpful comments and suggestions on earlier drafts of this report.

Contents

Abstract

Many students who earn a bachelor's degree also aspire to earn a graduate degree. In this study, we examined student and institutional characteristics that are related to graduate school enrollment. Student characteristics included demographic characteristics; high school performance measures, coursework taken, and extracurricular activities; college intentions and educational plans; and undergraduate enrollment and degree measures. Institution-level characteristics included college control, college selectivity, and Historically Black College or University (HBCU) designation.

The sample for this study consisted of more than 14,000 ACT-tested students who graduated from high school in 2003, who enrolled in college, and who earned a bachelor's degree within eight years of initial enrollment. Nearly one-half (46%) of the bachelor's degree recipients subsequently enrolled in a graduate program. Graduate enrollment rates varied significantly by student and institutional characteristics. Higher graduate enrollment rates were observed for students who were more academically prepared upon high school graduation (as measured by ACT test scores, high school coursework taken, and grades earned), those who had intentions of taking advanced college coursework and graduate school aspirations, and those who earned a bachelor's degree in four years or less. Females were more likely than males to enroll in a graduate program (50% vs. 40%). Among all racial/ethnic groups, African American students had the highest graduate enrollment rate (55%); likewise, HBCU students had higher graduate enrollment rates than non-HBCU students. Graduate enrollment rates were also found to vary by undergraduate major. For example, business majors had one of the lower graduate enrollment rates (31%), whereas biological and biomedical science majors had one of the higher rates (68%).

Controlling for multiple variables simultaneously, study results indicated that gender, race/ethnicity, ACT Composite score, graduate school aspirations, earning a bachelor's degree in a timely manner, and graduating from a HBCU institution were strongly related to graduate school enrollment. Other variables that were positively related to graduate school enrollment, but to a lesser extent, included: taking advanced, accelerated, or honors courses in high school, receiving a leadership award in high school, planning to take an independent study course while in college, intending to receive college credit by exam, and planning not to work while in college.

The results of this study demonstrate the importance of sound academic preparation for college so that students are well equipped to achieve their educational goals; many students' goals include earning a post-baccalaureate degree. Enrolling in graduate school has potential benefits to the individual student such as greater self-esteem and long-term earning potential. This is particularly noteworthy in light of our findings that African American students and students attending HBCUs were more likely to enroll in graduate school, holding all else constant. Interventions aimed at promoting post-baccalaureate pursuits for these populations could potentially help reduce the economic disparities that exist by race/ethnicity. Equipping students to achieve such goals also helps the United States build a more highly skilled workforce and preserve the nation's global competitiveness.

Introduction

As the economic landscape of the United States has evolved from a largely manufacturing economy in the mid-1900s to one characterized as a knowledge economy today (Apte, Karmarkar, & Nath, 2008; Powell & Snellman, 2004), so too have the educational pathways of US students, with more and more students choosing to pursue advanced degrees. Within the last fifty years, we have witnessed a 227% increase in the number of students enrolling in a graduate program—less than 900,000 students in 1967 as compared to the nearly three million in 2010 (Snyder & Dillow, 2012)[1]. Growth in post-baccalaureate enrollment has been more dramatic for females and racial/ethnic minority students. Of the roughly 900,000 students enrolled in a graduate program in 1967, 65% were male. In 1988, the number of females enrolling in a graduate program surpassed that of males. Since then, the gender representation in graduate education has increasingly favored females, with females representing 59% of all graduate program enrollees in 2011. It is projected that females will continue to comprise an increasingly larger proportion of graduate school enrollees over time. In a similar vein, the representation of racial/ethnic minority students in graduate programs has increased over time: African American and Hispanic students comprised about 19% of all post-baccalaureate enrollees in 2010, as compared to less than 8% in 1976.

In addition to these national statistics, a good deal of research has been conducted to identify variables that are related to graduate enrollment. Besides being able to model and explain post-baccalaureate enrollment decisions, many researchers have also been interested in understanding graduate enrollment given the monetary benefits associated with higher levels of education. Specifically, the median income of full-time, full-year wage and salary workers ages 25–34 in 2011 was $59,230 for those with a master's degree or higher as compared to $44,970 for those with a bachelor's degree (Aud, Wilkinson-Flicker, Kristapovich, Rathbun, Wang, & Zhang, 2013). Educational level is also associated with better occupational opportunities. Pointedly, the unemployment rate is inversely related to educational level: 2.2% of individuals with a doctoral degree were unemployed in 2013, as compared to 4.0% for individuals with a bachelor's degree and 7.5% for individuals with a high school diploma (US Bureau of Labor Statistics, 2014). Given these economic differences and its ensuing impact on social class and mobility with educational and occupational advantages tending to accumulate over one's lifetime (Kerckhoff, 1993), researchers are interested in identifying variables that may promote or hinder post-baccalaureate enrollment. With this in mind, the purpose of the current study was to examine the predictive relationships between various student and institutional characteristics and graduate school enrollment. The inclusion of variables in our model was informed by previous research on predictors of educational attainment, specifically results as they pertain to graduate enrollment. A brief overview of the literature is provided on the following pages.

[1] For comparison, the total US population increased by only 51% from 1970 to 2010 (Snyder & Dillow, 2013).

Variables Associated with Graduate School Enrollment

Much of the research on graduate school enrollment has focused on its relationship with students' educational aspirations, academic preparation, sociodemographic characteristics, and institutional characteristics (Heller, 2001; Nevill & Chen, 2007; Mullen, Goyette, & Soares, 2003; Perna, 2004; Sewell, Haller, & Portes, 1969; Walpole, 2003). Previous findings as they relate to each of these broad categories are reviewed.

Educational Aspirations

Results across various studies have shown that a student's educational degree aspiration is one of the best predictors of the likelihood of graduate school enrollment (Heller, 2001; Mullen et al., 2003; Sewell et al., 1969; Walpole, 2003). For example, based on a sample of students from the Baccalaureate and Beyond (B&B) Study who earned their bachelor's degree in 1992–1993, Nevill and Chen (2007) found that only 17% of students with educational aspirations of a bachelor's degree or less enrolled in a graduate program as compared to 41% of students with master's degree aspirations, 63% of students with doctoral degree aspirations, and 69% of students with professional degree aspirations. Even after controlling for other variables in a multivariate model, degree aspirations remained significantly related to graduate school enrollment. These findings are consistent with the theory of planned behavior where intentions are one of the strongest predictors of future behavior (Ajzen, 1991).

Academic Preparation

In addition to educational aspirations, various measures of academic preparation and performance—including undergraduate admission test scores, Graduate Record Examinations (GRE) scores, high school grade point averages (HSGPAs), undergraduate grade point averages (GPAs), and time to bachelor's degree completion—have consistently been found to be associated with graduate school enrollment (Heller, 2001; Millett, 2003; Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004). Even after statistically controlling for other relevant variables, these studies tend to find positive support for the role of academic preparation on graduate enrollment.

The field of study in which a student receives their undergraduate degree has also been shown to be related to a student's likelihood of pursuing a post-baccalaureate degree. Specifically, majors that can be classified as having a more pure or theoretical focus with an emphasis on research (e.g., biological, social, and physical sciences) have higher graduate enrollment rates as compared to more applied majors which focus on the practical applications of the content (e.g., engineering, computer science, and business) (e.g., Heller, 2001; Millett, 2003; Nevill & Chen, 2007). One explanation for the differences in graduate enrollment rates by undergraduate degree major is the differences in the amount of estimated foregone wages for different fields of study (Weiler, 1991).

Sociodemographic Characteristics

Differences in graduate enrollment rates by gender have been found to vary by the type of graduate program (Millet, 2003; Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004). For example, Nevill and Chen (2007) did not find differences in the overall graduate enrollment rates between males and females; they did, however, find that males were more likely to enroll in MBA programs (9% vs. 6%), professional programs (6% vs. 4%), and doctoral degree programs (6% vs. 4%), whereas

females were more likely to enroll in MEd programs (13% vs. 4%). Results from their multivariate analyses suggested that gender remained unrelated to graduate school enrollment. However, they only modeled overall graduate enrollment rates, not rates by program of study. Therefore, it is unclear whether gender differences in enrollment rates by type of graduate program (e.g., MBA) would persist when other variables are taken into account. In addition, based on data from the 1992–1993 sample of the B&B study, Perna (2004) examined graduate enrollment within four to five years of bachelor's degree obtainment. Similar to Nevill and Chen (2007), Perna found that males were more likely to enroll in a doctoral and professional degree program whereas females were more likely to enroll in a master's program. However, once other relevant student characteristics were taken into account, gender differences in graduate enrollment rates at the master's level disappeared but remained at the doctoral and professional level.

The research findings on graduate enrollment rates by race/ethnicity have also been mixed and seem to vary by type of graduate program (Heller, 2001; Millet, 2003; Nevill & Chen, 2007; Perna, 2004). Nevill and Chen (2007) found that African American students were more likely than White students to enroll in a graduate program (45% vs. 39%); however, when other variables were statistically controlled for in the model, differences in enrollment rates by race/ethnicity disappeared. On the other hand, Perna (2004) found no differences in observed graduate enrollment rates between White and African American students. But, when other background characteristics were taken into account, African American students were found to be more likely than White students to enroll in a master's or professional degree program. As for Asian/Pacific Islander students, they were more likely to enroll in a professional degree program than students from other racial/ethnic groups (Nevill & Chen, 2007), even when controlling for other relevant student characteristics (Perna, 2004).

Research has also shown that younger students are more likely to enroll in graduate school than older students (Bradburn, Berger, Li, Peter, & Rooney, 2003; Clune, Nuñez, & Choy, 2001; Mullen et al., 2003; Nevill & Chen, 2007). Being married or a parent has also been shown to decrease the likelihood of enrolling in a graduate program (Clune et al., 2001; Nevill & Chen, 2007).

Socioeconomic variables tend to be positively associated with graduate school enrollment, especially when measured by parental education level (Heller, 2001; Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004). For example, Ethington and Smart (1986) found a direct effect of parental education on graduate enrollment. On the other hand, research findings on household income and undergraduate indebtedness with graduate enrollment have been inconsistent with the results tending to indicate that these variables have little to no effect on graduate school enrollment, particularly once other variables are taken into account and when more years of data post-bachelor obtainment are available (Choy & Geis, 1997; Choy, 2000; Ethington & Smart, 1986; Heller, 2001; Millett, 2003; Nevill & Chen, 2007; Weiler, 1991). For example, Ethington and Smart (1986) found that the effect of family income was indirect through its influence of student's choice on undergraduate institution and the resulting social and academic integration at that institution. Further complicating the matter, researchers have found that the relationship between socioeconomic variables and graduate enrollment tends to vary by type of graduate program. For example, parental educational level seems to be more strongly related to enrollment in a professional or doctoral program than a master's program (Mullen et al., 2003).

Institutional Characteristics

Institutional characteristics also have been examined as potential predictors of graduate school enrollment (Ethington & Smart, 1986; Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004; Stage, John, & Hubbard, 2011; Zhang, 2005). Mullen et al. (2003) found that first attending a two-year institution was negatively related to graduate enrollment, though the effect was no longer significant once students' academic achievement levels were taken into account. The selectivity of the undergraduate institution has been shown to be positively related to graduate school enrollment (Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004; Zhang, 2005), especially among males (Ethington & Smart, 1986). It has been suggested that more selective institutions provide an environment or climate that fosters graduate school pursuits through research opportunities and interactions with faculty (Eagan, Hurtado, Chang, Garcia, Herrera, & Garibay, 2013; Hathaway, Nagda, & Gregerman, 2002; Hearn, 1987; Russell, Hancock, & McCullough, 2007). Likewise, Historically Black Colleges and Universities (HBCUs) have been found to promote the number of African American students enrolling in a graduate program, which may also be linked to their mission and targeted programs (Stage et al., 2011).

In summary, past research clearly provides useful information on the various student and institutional characteristics to be considered when trying to identify students who are likely to enroll in graduate school. But, additional studies on this topic are warranted. For example, the majority of prior research has been based on a cohort of students who earned their undergraduate degree in 1993 (e.g., Heller, 2001; Nevill & Chen, 2007; Perna, 2004). Given the changes in the gender and racial/ethnic representation of graduate enrollees over the last couple of decades, as well as the increasing demands for a more skilled workforce to preserve our global competitiveness (Wendler, Bridgeman, Cline, Millett, Rock, Bell, & McAllister, 2010), it is of great interest to study more recent cohorts to determine if previous findings generalize to today's population of graduate enrollees. In addition, a majority of past research relied on survey responses to determine if, when, and where students enrolled in a graduate program, as opposed to evaluating actual enrollment records.

Current Study

Building on previous research, the current study identifies student and institutional characteristics that are related to graduate school enrollment for a more recent cohort of students, namely ACT-tested students who graduated from high school in 2003, immediately enrolled in college, and then completed a bachelor's degree within eight years of initial enrollment. In addition, actual enrollment into postsecondary institutions was tracked over an extended period of time (more than 10 years) for the immediate college enrollees to identify who enrolled in graduate school after completing their undergraduate degree. Additionally, the current study examined a variety of variables at both the student and institution level—many of which have not been examined previously in relation to graduate school enrollment. Many of the student-level variables were obtained from their responses to The ACT® registration form that students completed while in high school and represent a broader array of academic preparation indicators (e.g., rigorous high school coursework) as well as noncognitive variables (i.e., extracurricular activities) and college plans (e.g., independent study). Including a wide range of pre-college variables may further our understanding of graduate enrollment given the fact that research clearly indicates that a multitude of factors—both cognitive and noncognitive—are related to subsequent academic success (Mattern, Burrus, Camara et al., 2014). With this in mind, the purpose of this study was to identify the key student and institutional characteristics that are associated with graduate school enrollment.

Data

Sample

Our analyses are based on a subsample of the ACT-tested 2003 high school graduating cohort, which includes nearly 1.2 million students. Through a partnership with the National Student Clearinghouse (NSC), we obtained two years of postsecondary enrollment data for these students. Of the original 1,175,059 students, 779,765 of them (66%) immediately enrolled[2] in an undergraduate institution, which approximates the national enrollment rate of 67% (Snyder, Tan, & Hoffman, 2006). From a stratified random sample of the 779,765 enrolled students who had provided their gender, race/ethnicity, and family income range (N= 24,450), we obtained from NSC more than 10 years of term-by-term postsecondary enrollment and degree records through fall 2013. These data allowed examining bachelor's degree completion and subsequent enrollment in a graduate program. In the stratified random sample, African American and Hispanic students were oversampled to ensure these racial/ethnic groups had sufficient sample sizes for analysis. In this stratified random sample of students enrolled in undergraduate study, 58%[3] obtained a bachelor's degree in eight years or less, and these students served as the primary sample for analyses (N=14,186).[4]

Measures

Data for students' demographic characteristics, college intentions, high school coursework taken, and grades earned in those courses were obtained primarily from The ACT student record. Specifically, at the time students registered to take The ACT, they were asked to indicate their gender, race/ethnicity, parents' combined annual family income, the high school coursework taken and the grades earned in those courses, their involvement in high school extracurricular activities, and their college intentions and educational aspirations. If students took The ACT more than once, only data from the most recent ACT test score report were used. Institutional characteristics were obtained primarily from the Integrated Postsecondary Education Data System (IPEDS). College enrollment, degree major, and graduation data were provided by NSC.

Graduate Enrollment Indicator

For the outcome variable of graduate school enrollment, a student was classified as enrolling in a graduate program if he or she enrolled in a four-year institution during any term following the completion of the bachelor's degree.[5] Approximately 10.5 years of longitudinal postsecondary

[2] Students had initially enrolled in college in fall 2003.

[3] For reference, among first-time, full-time students who first enrolled in a four-year institution in 2005, 59% had earned a bachelor's degree within six years (Aud et al., 2013). The two undergraduate completion rates—58% for the current study and 59% for the National Center for Educational Statistics (NCES) study—are not directly comparable since the current study also included students who had first enrolled in a two-year institution (about 13%; as opposed to being based solely on four-year students) and evaluated completion over an eight-year period (as opposed to a six-year period).

[4] Typical (median) time to bachelor's degree completion was 51 months (ranging from 16 months to 96 months).

[5] Because we were unable to distinguish between students who enrolled in graduate school and those who subsequently enrolled for further undergraduate studies (e.g., continuing education units, a second bachelor's degree), there is the potential that our graduate school enrollment outcome was misclassified for some students. For example, it is possible that some students were enrolled at a postsecondary institution after their graduation date but were not formally enrolled in a graduate program (e.g., picking up additional college credits). However, only 1% of students earned more than one bachelor's degree, and among graduate school enrollees, 56% had completed a post-baccalaureate degree over the course of the study period. According to IPEDS data, 97% of the students classified as having enrolled in graduate school had enrolled at a four-year institution that offers graduate programs. For students with multiple bachelor's degrees, graduate enrollment was determined by enrollment status after the latest bachelor's degree was completed.

enrollment and degree completion data were available for each student from the time of initial enrollment in college in fall 2003. We therefore decided to include only students who earned a bachelor's degree within 8 years to allow an ample amount of time (i.e., 2.5 years) for them to enroll in graduate school after earning a bachelor's degree. As a result, students who graduated sooner (e.g., within 4 years) had a longer time frame for which enrollment in a graduate program could be observed. For example, students who graduated in 4 years had up to 6.5 years to enroll in a graduate program and be classified as a graduate enrollee as compared to 2.5 years for students who took 8 years to complete their undergraduate degree. To examine the influence of this decision on the study findings, we also restricted the sample to students who graduated within six years of initial enrollment. Defining bachelor's attainment within six years rather than eight years, 91% of the original sample of bachelor's recipients was retained. Then among this subsample, we identified graduate enrollment by examining enrollment data four years from the undergraduate degree for each student. By doing so, all students had the same length of time to enroll in a graduate program. Using this decision rule, analyses based on this subsample of students mirrored the findings presented below; therefore, only results based on the original definition of the graduate enrollment indicator are presented.

Predictors

Variables[6] examined as predictors of graduate enrollment in the current study are listed below.

Demographic characteristics included:

- Gender
- Race/ethnicity[7] (African American, Asian, Hispanic, White, and Other/Multiracial)
- Family income range (categorized as less than $30,000; $30,000 to $60,000; and more than $60,000)

High school performance measures included:

- ACT Composite scores[8] (1 to 19; 20 to 23; 24 to 27; 28 to 36)
- High school GPA[9] (HSGPA of less than 3.00; 3.00 to 3.49; 3.50 or higher)
- Class rank (top quarter; second quarter; third quarter; bottom quarter).

Indicators for high school coursework taken[10] and participation in extracurricular activities included:

- Taking higher-level high school mathematics coursework beyond Algebra II
- Taking higher-level high school science coursework

[6] Additional variables that were measured in high school were examined but were not reported because they failed to show a significant relationship with graduate enrollment, had limited variability, and/or had a large percentage of missing data. These additional variables included English being the primary language spoken at home, marital status, receiving the highest grade on a scientific paper, completing an independent scientific experiment, participating in a National Science Foundation summer program, satisfaction with high school's academic provisions, help seeking intentions, college location preference, major and occupational decidedness and sureness, satisfaction with their high school's career/guidance program, interest-intended major fit, importance of major for college selection, participating in a work-study/distributive work program in high school, and high school control.

[7] American Indian/Alaskan Native students were included in the Other/Multiracial racial/ethnic group. At the time of data collection, an individual category for Native Hawaiian/other Pacific Islanders was not a possible response; this racial/ethnic group was collected in combination with Asian students.

[8] The ACT Composite score is the rounded arithmetic average of the four subject area scores in English, Mathematics, Reading, and Science. Test scores are reported on a scale of 1 to 36.

[9] HSGPA was based on students' self-reports of their coursework taken in 23 specific courses in English, mathematics, social studies, and science, and the grades earned in these courses. The decision to categorize both the ACT Composite score and HSGPA was to ease interpretation of the findings.

[10] Students are asked to indicate courses that they have taken, are currently taking, or are planning to take. Only courses that students had or were currently taking are included.

- Taking a high school core curriculum[11]
- Taking advanced, accelerated, or honors courses in high school in at least one subject area (labeled as *advanced courses*)
- Earning college credit while in high school
- Participating in departmental clubs (such as a science or math club)
- Receiving a leadership award

College intentions and educational plans included indicators for plans of:

- Taking an independent study course while in college
- Taking freshman honors[12] college courses
- Placing into advanced college courses
- Receiving college credit by examination
- Participating in departmental clubs while in college
- Living on campus
- Enrolling as a full-time student
- Working while in college
- Applying for financial aid
- Completing a post-baccalaureate[13] degree

Student-related undergraduate enrollment and degree measures included:

- Initially enrolling in a four-year institution
- Earning a bachelor's degree within four years of initial enrollment
- Completing the bachelor's degree from the initial institution attended
- Graduating from an in-state institution
- Undergraduate degree major[14,15]

Institutional characteristics of the bachelor-conferring institution included:

- College control (public, private)
- College selectivity (based on average ACT Composite score of enrolled students,[16] categorized as: < 21, 21 to 23.49, 23.50 to 27.49, >= 27.5)
- HBCU classification
- Graduate program offerings (Yes/No)

[11] ACT defines a core curriculum as at least 4 years of English and at least 3 years each of mathematics, social studies, and natural sciences (4-3-3-3).

[12] Freshman honors courses were defined to students as courses that are designed to challenge academically superior students.

[13] Includes a master's degree, doctoral degree, or a professional level degree (e.g., MD, JD).

[14] Degree major was categorized according to the first two digits of the classification of instructional program (CIP) code (developed by the National Center for Education Statistics in 1980, with revisions occurring in 1985, 1990, 2000, and 2010). The six-digit CIP code was provided for about 60% of the NSC degree records. For the records missing CIP code, the two-digit CIP classification was inferred from the degree title or major label when it was possible to do so. As a result, some of the inferred degree or major information might have been miscoded. However, the distribution of undergraduate degrees conferred by major was in general agreement with that reported elsewhere (Snyder & Dillow, 2012).

[15] Although undergraduate degree CIP code was available or could be inferred for a majority (95%) of the records, this was not the case for the enrollment records. NSC did not begin collecting term-by-term major information for the enrollment records until recently. Even for the most recent terms included in this study, a substantial percentage of the enrollment records were missing major information.

[16] To measure college selectivity, institutional average ACT Composite scores of first-time entering students from the 2003 to 2013 ACT-tested high school graduating classes were calculated. Multiple years were used to have sufficient numbers at an institution. For institutions with fewer than 50 ACT-tested students, the typical average ACT score for institutions with the same self-reported admissions selectivity level was used. Self-reported institutional selectivity level was obtained from the annual ACT Institutional Data Questionnaire; possible categories included: highly selective, selective, traditional, liberal, or open.

Method

Descriptive statistics, including means and percentages, were used to examine differences in student and institutional characteristics among various student subsamples (e.g., the subsample of students who earned a bachelor's degree, the subsample of students who subsequently enrolled in a graduate program). In these comparisons, weighted descriptive analyses were used to account for the oversampling of African American and Hispanic students in the initial stratified random sample of students (see Radunzel & Noble [2012a] for more details on the weights used).

Hierarchical logistic models were developed to predict graduate enrollment from the student and institutional characteristics.[17] Hierarchical models account for the variability in graduate enrollment rates across the bachelor-conferring institutions, as well as for students being clustered within these institutions. In estimating the models, the intercept was allowed to vary across institutions (i.e., random-intercept models were used); the coefficients for the student characteristics were fixed across institutions.[18] Single-predictor models were estimated to evaluate the bivariate relationship between each predictor and graduate school enrollment. In addition, because many of the predictors were highly related to one another, a multivariate model was estimated to evaluate which predictors remained significantly related to graduate enrollment when other student characteristics were taken into account.[19] A backward elimination selection approach was used to estimate a final multivariate model. This means that all variables were initially included in the model and then, one by one, the least significant variable was dropped from the model, until only those variables that were statistically significant at the 0.01 level remained in the model.

For each predictor of graduate enrollment, the odds ratio (OR) was reported and used to evaluate the strength of the predictor-enrollment relationship among student characteristics. The OR represents the odds of graduate school enrollment for a certain subgroup of students (i.e., female students or students completing a bachelor's degree in four years or less), compared to the odds of graduate enrollment for another subgroup of students (i.e., male students or students taking longer than four years to complete a bachelor's degree; the latter group is often referred to as the referent or comparison group).[20] In comparison to members in the referent group, an OR greater than 1.0 indicates that students in the subgroup of interest are generally more likely to enroll in a graduate program, whereas an OR less than 1.0 indicates that they are less likely to do so. ORs estimated from single-predictor models are labeled as *unadjusted ORs*, while ORs estimated from a multiple-predictor model are labeled as *adjusted ORs* (because other student characteristics were adjusted for in the model). The change from the unadjusted to the adjusted OR for a predictor is one indication of the degree to which the other variables influence the strength of the predictor-enrollment relationship. The 99% confidence interval for the OR provides an indication of whether the relationship is statistically significant at the 0.01 level (that being when the interval does not include the null value of 1.0).

[17] Hierarchical logistic models were run in SAS 9.2 using the GLIMMIX procedure and the Laplace method.

[18] There were 1,147 bachelor-conferring institutions represented in the sample. In this study, the variability in the intercepts was significantly different from zero, but this was not the case for the slopes, resulting in the decision to use a random-intercept model. This result is likely partially explained by the relatively smaller institutional sample sizes (average number of students was 12; number ranged from 1 to 229).

[19] Due to the incompleteness of the major information and the number of major categories, undergraduate degree major was not included as a predictor in the modeling process; however, given that previous research has shown that they are related (e.g., Heller, 2001; Millett, 2003; Nevill & Chen, 2007), graduate enrollment rates by undergraduate major are provided in Table 5.

[20] The odds of graduate school enrollment is the ratio of the probability of a student enrolling in graduate school to the probability of a student not enrolling in graduate school.

Some students did not respond to high school coursework and grade items, or to other items about their high school activities and college intentions, when they completed The ACT registration materials. Multiple imputation was used to estimate missing values for these student characteristics; missing rates ranged from 1% to 8% across variables for the study data.[21] Five data sets were imputed. The final model was developed for all five imputed data sets; no differences of practical significance in the adjusted ORs were found across the data sets. The results reported are therefore based only on the initial imputed data set.

A limitation to the NSC degree data was that for about 7% of students only the degree date and the awarding institution were provided, and not the actual type of degree that was earned. Rather than excluding these students from the analyses, we inferred the type of degree based on the following information: type of awarding institution; status of whether a prior, less advanced degree was earned; status of whether a subsequent, more advanced degree was earned; and the time to degree completion from the initial college start date.[22]

Results

Student and Institutional Characteristics by Education Level

Because many of the variables shown to be related to graduate school enrollment also have been shown to be related to undergraduate degree attainment, we compared the student and institutional characteristics of bachelor's degree recipients (primary study sample) to those of student groups from which the sample was drawn (i.e., all 2003 ACT-tested high school graduates[23] and 2003 ACT-tested high school graduates who immediately enrolled in college the fall following high school graduation[24] [labeled as *immediate undergraduate enrollees*], as well as to those of students who enrolled in a post-baccalaureate program [labeled as *graduate school enrollees*]). Descriptive characteristics of the four groups are provided in the Appendix, Tables A-1 through A-6, with the main findings summarized below.

In these comparisons, we found that as educational attainment level increased:

- The percentages of females and higher-income students increased (Table A-1).
- The percentages of racial/ethnic minority students tended to decrease, with the exception of a higher percentage of African American students being observed among graduate school enrollees than among bachelor's degree recipients (Table A-1).
- The academic achievement levels (as measured by ACT scores, HSGPA, and HS class rank) increased, on average (Table A-2).

[21] Missing values were imputed using the MI procedure in SAS 9.2. The MI procedure replaces missing values of variables with plausible values based on non-missing data.

[22] For students who had not earned a prior, less advanced degree nor a subsequent, more advanced degree, unknown degrees from four-year institutions were classified as a bachelor's degree if the degree was earned in 44 or more months. As a result, some of the inferred degree information might have been miscoded. However, the typical total enrolled time (adjusted and unadjusted for level of enrollment) and typical time to degree completion (including and excluding summer terms) were comparable between students with known degrees and those with implied degrees. Moreover, the six-year degree completion rate of students starting at a four-year institution from our initial stratified random sample was in line with the rate from another nationally representative sample (63% vs. 59%; Aud et al., 2013).

[23] Imputed values for selected variables for the entire ACT-tested 2003 graduating class as discussed in Radunzel & Noble (2012a) were used here. For the other variables, percentages were based on non-missing responses only.

[24] Of the original 1.2 million 2003 ACT-tested high school graduates, 66% enrolled in an undergraduate institution, which approximates the national enrollment rate of 67% (Snyder, Tan, & Hoffman, 2006).

- The percentages of students taking higher-level high school coursework increased. For example, an increasingly larger percentage of students took math courses beyond Algebra II, took advanced, accelerated, or honors courses, and earned college credit while still in high school (Table A-3).
- The percentages of students involved in extracurricular activities (e.g., departmental clubs, leadership awards) increased (Table A-3) .
- The percentages of students with plans to take advanced college coursework, participate in extracurricular college activities, and live on campus tended to increase, whereas the percentages of students with plans to work while in college decreased (Table A-4).
- The percentages of students aspiring to complete a post-baccalaureate degree increased (for both master's and professional degrees; Table A-4).
- The percentages of students starting at four-year institutions, out-of-state institutions, private institutions, institutions that offer graduate programs, and more selective institutions increased (Table A-5).

In terms of undergraduate degree characteristics, greater percentages of students graduating in four years or less and graduating from their initial institution attended were seen among graduate school enrollees than among bachelor's degree recipients (Table A-6). In contrast, a smaller percentage of graduate school enrollees completed an undergraduate degree in business as compared to that for bachelor's degree recipients (Table A-6).

Characteristics of the undergraduate institutions for each of the samples are provided in the Appendix, Table A-7. Whether the institution was classified as a HBCU was included as one of the institutional characteristics; however, HBCUs comprised a relatively small percentage of the institutions (5% for the primary sample of bachelor's degree recipients).

These findings suggest that some of the relationships between the predictors and graduate enrollment may be attenuated given their restricted variance. As mentioned above, average ACT scores increased and the standard deviation decreased as level of educational attainment increased. That is students with low ACT scores were less likely to: enroll in college; and among those who did enroll, they were less likely to graduate with a bachelor's degree. If we had examined the effect of ACT scores on graduate enrollment for high school students, a larger effect would be found, given its effect on college enrollment and undergraduate degree attainment—both of which are prerequisites for inclusion in the sample. The decision to focus on bachelor's degree recipients was made because earning a bachelor's degree is a required precursor to graduate enrollment.

Graduate Enrollment Rates by Student Characteristics

Overall, 46% of bachelor's degree recipients enrolled in a graduate program, which is slightly higher than the 40% reported by Nevill and Chen (2007); though given the increasing numbers of students enrolling in post-baccalaureate programs over time and the current study utilizing a sample that is roughly 15 years more recent, a higher percentage was expected. Modeled graduate enrollment rates varied across institutions from 30% to 61% (Appendix, Table A-8).[25] Graduate school students enrolled in a post-baccalaureate program within 18 months of completing their bachelor's degree, on average (time span ranged from 0 to 80 months); more than 50% had enrolled within 12 months of completing their undergraduate degree.[26]

Demographics. Table 1 provides the modeled graduate enrollment rate, unadjusted OR, and 99% confidence interval of OR (CI) by student demographic characteristics. Females were more likely than males to enroll in a graduate program (50% vs. 40%, unadjusted OR = 1.51). Among the racial/ethnic groups, African American students had the highest graduate enrollment rate (55%); their enrollment rate was significantly higher than that of White students (44%; unadjusted OR = 1.54). Graduate enrollment rates did not significantly differ among the family income groups.[27]

Table 1. Graduate Enrollment Rates by Student Demographic Characteristics

Characteristic	Category	N	Graduate enrollment rate	Unadjusted OR	99% CI	
Gender	Female	8,379	50	1.51	1.37	1.65
	Male	5,807	40			
Race/ethnicity	African American	1,226	55	1.54	1.31	1.81
	Hispanic	823	47	1.11	0.91	1.36
	Asian	540	49	1.20	0.94	1.51
	Other	501	43	0.95	0.75	1.22
	White	11,096	44			
Family income	> $60,000	7,256	47	1.01	0.88	1.14
	$30,000 to $60,000	4,705	44	0.89	0.77	1.02
	< $30,000	2,225	47			

Note. Italics indicate referent group. OR = odds ratio; CI = confidence interval of OR.

[25] According to the random-intercept model, intercepts were allowed to vary across institutions. Table A-8 includes estimates for the random intercept variance for the null model and the multivariate model. The variation in intercepts across undergraduate institutions corresponds to wide variability in graduate school enrollment rates across institutions. In multivariate analyses, modeled graduate enrollment rates ranged from 35% to 56%, holding all else constant at the grand means.

[26] For students who did not enroll in a graduate program, the average follow-up period after completion of their bachelor's degree was 68 months (median = 72 months; ranged from 27 to 104 months).

[27] This result was seen for alternative categorizations of family income.

High school performance. As shown in Table 2, as ACT Composite score increased, the modeled graduate enrollment rate increased from 37% for students with a score of 19 or lower to 57% for students with an ACT score of 28 or higher. Compared to students with an ACT Composite score of 19 or below, students with scores between 24 and 27, as well as those with scores between 20 and 23, were also significantly more likely to enroll in graduate school (Table 2; unadjusted ORs = 1.65 and 1.21, respectively). In addition, students with higher HSGPAs were more likely than those with lower HSGPAs to enroll in graduate school, especially when comparing students with a HSGPA of 3.50 or higher to those with a HSGPA below 3.00 (Table 2; 51% vs. 37%; unadjusted OR = 1.79).

Table 2. Graduate Enrollment Rates by High School Performance Measures[28]

Characteristic	Category	N	Graduate enrollment rate	Unadjusted OR	99% CI	
ACT Composite score	28 to 36	3,243	57	2.21	1.92	2.54
	24 to 27	3,180	50	1.65	1.44	1.89
	20 to 23	4,640	42	1.21	1.07	1.37
	1 to 19	3,123	37			
HSGPA	3.50 or higher	7,963	51	1.79	1.57	2.04
	3.00 to 3.50	3,902	41	1.19	1.03	1.38
	Less than 3.00	2,321	37			

Note. Italics indicate referent group. OR = odds ratio; CI = confidence interval of OR.

High school coursework and extracurricular activities. Taking higher-level coursework in high school was also associated with higher graduate enrollment rates. Students who took advanced, accelerated, or honors courses in high school enrolled in a graduate program at a higher rate than those who did not (49% vs. 36% as shown in Table 3). Higher graduate enrollment rates were also predicted for students who earned college credit while in high school, those who took high school math courses beyond Algebra II, those who took a high school science course of Biology, Chemistry, and Physics, and those who took a high school core curriculum as compared to those who did not take such coursework (Table 3). Among the high school coursework variables evaluated, the largest difference in graduate enrollment rates was associated with taking advanced, accelerated, or honors courses. In terms of extracurricular high school activities, students who reported receiving a leadership award were more likely to enroll in graduate school than students who did not report receiving such an award (Table 3; 49% vs. 43%). Participation in departmental clubs (e.g., science or math clubs) was also positively related to graduate school enrollment (49% vs. 44%).

[28] Additional analyses were run with the original scales of the variables, and similar results were found: ACT Composite Score Unadjusted OR = 1.07 (1.06, 1.08) and Adjusted OR = 1.05 (1.04, 1.06). For HSGPA, Unadjusted OR = 1.006 (1.005, 1.007).

Table 3. Graduate Enrollment Rates by High School Coursework Taken and Extracurricular Activities

Characteristic	Category	N	Graduate enrollment rate	Unadjusted OR	99% CI	
Took math courses beyond Algebra II	Yes	8,699	48	1.31	1.20	1.44
	No	5,487	42			
Took science sequence of Bio, Chem, & Phys	Yes	4,477	48	1.16	1.05	1.27
	No	9,709	45			
Took advanced courses in HS	Yes	10,545	49	1.76	1.58	1.95
	No	3,641	36			
Earned college credit in HS	Yes	2,352	51	1.27	1.13	1.44
	No	11,834	45			
Took core curriculum	Yes	10,560	47	1.16	1.05	1.28
	No	3,626	43			
Received leadership award	Yes	6,868	49	1.29	1.18	1.41
	No	7,318	43			
Participated in departmental clubs	Yes	5,028	49	1.23	1.12	1.35
	No	9,158	44			

Note. Italics indicate referent group. Advanced courses in HS include advanced, accelerated, or honors courses. OR = odds ratio; CI = confidence interval of OR; Bio = Biology; Chem = Chemistry; Phys = Physics; HS = high school.

College intentions and plans. Students' college intentions were also related to the likelihood of enrolling in a graduate program. Similar to the finding for taking more advanced coursework in high school, students who intended to take an independent study in college, take a freshman honors course, be placed into advanced college coursework, or receive college credit by exam were more likely to enroll in graduate school than students who did not have such plans (Table 4). Among these comparisons, the largest difference in graduate enrollment rates was associated with students' intentions to take a freshman honors course (53% vs. 40%).

Table 4. Graduate Enrollment Rates by College Intentions and Plans

College intentions	Category	N	Graduate enrollment rate	Unadjusted OR	99% CI	
Take independent study	Yes	6,359	50	1.41	1.29	1.54
	No	7,827	42			
Take freshman honors courses	Yes	6,236	53	1.73	1.58	1.89
	No	7,950	40			
Place into advanced coursework	Yes	8,962	50	1.60	1.46	1.76
	No	5,224	38			
Receive college credit by exam	Yes	9,512	49	1.47	1.34	1.62
	No	4,674	39			
Enroll as a full-time student	Yes	13,907	46	1.59	1.13	2.22
	No	279	35			
Work while in college	Yes	11,269	45	0.83	0.74	0.92
	No	2,917	50			
Live on campus	Yes	10,801	47	1.25	1.13	1.39
	No	3,385	42			
Aspire to graduate degree	Yes	8,916	52	2.04	1.85	2.24
	No	5,270	35			
Apply for financial aid	Yes	12,005	46	1.18	1.04	1.33
	No	2,181	42			

Note. Italics indicate referent group. OR = odds ratio; CI = confidence interval of OR.

Additional college intentions were also found to be related to graduate school enrollment (Table 4). Students who intended to enroll in college as full-time students were more likely than those without such intentions to enroll in graduate school (46% vs. 35%), whereas students who planned to work while in college were less likely to do so (45% vs. 50% for those who did not plan to work). Among the various college intentions examined, students' educational aspirations were associated with the largest differences in graduate school enrollment rates. In particular, students who had educational aspirations of a graduate degree were substantially more likely to enroll in a graduate program than students who had educational aspirations of a bachelor's degree or lower (52% vs. 35%; unadjusted OR = 2.04).

Undergraduate enrollment and degree characteristics. Undergraduate enrollment and degree characteristics were also found to be related to graduate school enrollment. For example, starting at a four-year institution, graduating in a timely manner, and graduating from the initial institution attended were all characteristics that were positively related to graduate school enrollment (Table 5). In particular, compared to those who took longer, students who completed their undergraduate degree in four years or less were substantially more likely to enroll in a graduate program (54% vs. 37%; unadjusted OR = 2.00). Graduate enrollment rates did not significantly differ between students who did and did not graduate from an in-state institution.

Table 5. Graduate Enrollment Rates by Undergraduate Enrollment and Degree Characteristics

Characteristic	Category	N	Graduate enrollment rate	Unadjusted OR	99% CI	
Started at four-year institution	Yes	12,446	47	1.62	1.41	1.87
	No	1,740	36			
Graduated in four years or less	Yes	6,930	54	2.00	1.82	2.19
	No	7,256	37			
Graduated from initial institution	Yes	10,362	48	1.32	1.19	1.47
	No	3,824	41			
Graduated from an in-state institution	Yes	11,056	45	0.92	0.82	1.03
	No	3,130	48			
Undergraduate degree major (CIP)	Communication & Journalism (09)	922	31	0.56	0.45	0.69
	Education (13)	1,127	56	1.59	1.32	1.92
	Engineering (14)	730	38	0.76	0.61	0.95
	English Language (23)	456	54	1.50	1.15	1.95
	Biological & Biomedical Sciences (26)	891	68	2.69	2.17	3.33
	Psychology (42)	853	63	2.18	1.77	2.70
	Social Sciences (45)	1,055	54	1.47	1.21	1.77
	Visual/Performing Arts (50)	702	33	0.63	0.50	0.79
	Health Professionals (51)	870	48	1.16	0.95	1.43
	Business, Management, Marketing, & Related Support Services (52)	2,606	31	0.58	0.50	0.67
	History (54)	285	57	1.68	1.21	2.34
	Missing/unclassified	756	48	1.18	0.94	1.47
	Other majors (each 2% or below)	2,933	44			

Note. Italics indicate referent group. OR = odds ratio; CI = confidence interval of OR.

Congruent with past research, business majors had one of the lowest graduate enrollment rates (31%) along with communication and journalism majors (31%), whereas biological/biomedical science and psychology majors were among those with the highest graduate enrollment rates (68% and 63%, respectively).

Institutional characteristics of the bachelor-conferring institutions. Relationships between institutional characteristics of the bachelor-conferring institutions and graduate school enrollment were also examined (Table 6). Students who earned their degree from a private institution were more likely to pursue a post-baccalaureate education than those who earned their degree from a public institution (48% vs. 44%). In terms of the selectivity of the bachelor-conferring institutions, students from the most selective institutions had higher graduate enrollment rates than those from less selective institutions (59% vs. 43% to 48% for the other three selectivity categories). In addition, a relatively large difference in graduate enrollment rates was seen between HBCU students and

non-HBCU students (60% vs. 45%; unadjusted OR = 1.85). On the other hand, graduate enrollment rates did not significantly differ by whether the bachelor-conferring institution offered a graduate program (unadjusted OR = 1.08).

Table 6. Graduate Enrollment Rates by Bachelor-Conferring Institutional Characteristics

Institution characteristics	Category	N	Graduate enrollment rate	OR	99% CI	
Control	Public	10,244	44	0.84	0.75	0.96
	Private	3,942	48			
Selectivity (Average ACT Composite score)	>= 27.5	793	59	1.81	1.37	2.40
	23.5 to 27.5	5,812	48	1.15	0.97	1.36
	21 to 23.5	5,600	43	0.95	0.81	1.12
	< 21	1,981	44			
HBCU	Yes	282	60	1.85	1.29	2.65
	No	13,904	45			
Offers graduate programs	Yes	13,414	46	1.08	0.86	1.34
	No	772	47			

Note. Italics indicate referent group. OR = odds ratio; CI = confidence interval of OR; HBCU = Historically Black College and University.

Multivariate Results

Table 7 provides the unadjusted and adjusted modeled graduate enrollment rates and OR for the variables that remained statistically significant in the multivariate model. Based on an R2 analog for multilevel logistic models suggested by Snijders and Bosker (1999; p. 225), the percentage of variance explained by the multivariate model was around 10%.[29] Gender, race/ethnicity, ACT Composite score, graduate degree aspirations, and earning a bachelor's degree in four years or less remained strong predictors of graduate enrollment.[30] For most predictors, the adjusted OR was smaller than the unadjusted OR. The exception to this finding was for African American students. In particular, the odds of enrolling in a graduate program for African American students was 1.70 times that of the odds for White students, after taking other student characteristics into account (as compared to the unadjusted OR of 1.54). Graduate enrollment rates for students from the other racial/ethnic groups did not significantly differ from the rate for White students.

Although to a lesser degree, other variables that were found to be related to graduate school enrollment included: taking advanced, accelerated, or honors courses in high school, receiving a leadership award in high school, planning to take an independent study course while in college, intending to receive college credit by examination, and planning to work while in college (as shown

[29] For reference, the percentage of variance explained by the single predictor models ranged from 0.2% (for plan to work while in college) to 3.4% (for plan to go to graduate school and completed a bachelor's degree within four years of initial enrollment). For ACT Composite score, the value was 2.4%.

[30] The multivariate model did not include college major as a predictor given the large amount of missing data. However, follow-up analyses were conducted to examine the impact of including college major in the model on the parameter estimates of the other predictors provided in Table 7. Results from the additional analyses indicated that the inclusion of college major in the model had virtually no impact on the results reported above.

in Table 7).[31] It is worth noting that while ACT test scores and taking advanced courses in high school remained in the multivariate model, most of the other academic performance measures, such as HSGPA and the other high school coursework variables, were no longer significantly related to a student's likelihood of enrolling in graduate school.[32]

Table 7. Multivariate Model for Graduate School Enrollment

		Unadjusted				Adjusted			
Characteristic	**Category**	**Rate**	**OR**	**99% CI**		**Rate**	**OR**	**99% CI**	
Gender	Female	50	1.51	1.37	1.65	49	1.40	1.27	1.54
	Male	40				40			
Race/ethnicity	African American	55	1.54	1.31	1.81	57	1.70	1.41	2.06
	Hispanic	47	1.11	0.91	1.36	48	1.17	0.96	1.44
	Asian	49	1.20	0.94	1.51	46	1.09	0.86	1.39
	Other	43	0.95	0.75	1.22	44	1.00	0.78	1.29
	White	44				44			
ACT Composite score	28 to 36	57	2.21	1.92	2.54	53	1.70	1.45	2.00
	24 to 27	50	1.65	1.44	1.89	48	1.41	1.21	1.64
	20 to 23	42	1.21	1.07	1.37	42	1.14	0.99	1.30
	1 to 19	37				39			
Took advanced courses in HS	Yes	49	1.76	1.58	1.95	46	1.19	1.06	1.34
	No	36				42			
Received HS leadership award	Yes	49	1.29	1.18	1.41	46	1.10	1.00	1.21
	No	43				44			
Intend to take independent study	Yes	50	1.41	1.29	1.54	47	1.14	1.03	1.25
	No	42				44			
Intend to receive college credit by exam	Yes	49	1.47	1.34	1.62	46	1.12	1.01	1.24
	No	39				43			
Plan to work while in college	Yes	45	0.83	0.74	0.92	45	0.87	0.78	0.97
	No	50				48			
Graduate degree aspirations	Yes	52	2.04	1.85	2.24	50	1.66	1.50	1.83
	No	35				38			
Graduated in four years or less	Yes	54	2.00	1.82	2.19	52	1.66	1.51	1.83
	No	37				39			
Graduated from HBCU institution	Yes	60	1.85	1.29	2.65	55	1.49	1.01	2.19
	No	45				45			

Note. Italics indicate referent group. Advanced courses in HS include advanced, accelerated, or honors courses. OR = odds ratio; CI = confidence interval of OR; HS = high school; HBCU = Historically Black College and University.

[31] The adjusted ORs for these variables were near the null value of 1.0 suggesting a small effect when other variables were taken into account. Moreover, most of these variables were considered to be marginally significant at the 0.01 level as evidenced by the confidence interval nearly including the null value of 1.0.

[32] Refer to the discussion section for an explanation of why these variables may have dropped out of the model.

The only institutional variable found to be significantly related to graduate school enrollment was whether the bachelor-conferring institution was an HBCU institution (adjusted OR = 1.49). The selectivity and control of the institutions were no longer significantly related to graduate school enrollment, once other student characteristics were taken into account. These findings are most likely due to these institutional characteristics being highly related to students' academic achievement levels. That is, students with higher ACT scores were more likely to enroll in more selective, private institutions. This is particularly true for selectivity because it was defined as the average ACT scores for enrolled students. Moreover, students at these types of institutions were also more likely to complete a bachelor's degree within four years of initial enrollment—another variable that remained significant in the multivariate model for graduate school enrollment.[33]

To illustrate the increased likelihood of enrolling in graduate school for students having more than one of the key characteristics, we estimated the modeled graduate enrollment rates for specific subgroups of students based on the multivariate model[34]. For example, both race/ethnicity and graduating from an HBCU institution remained significant predictors of graduate school enrollment, indicating that African American students were not only more likely than other racial/ethnic groups to enroll in graduate school, but that African American students attending HBCUs were even more likely to enroll in graduate school (66% for HBCU students vs. 57% for non-HBCU students;

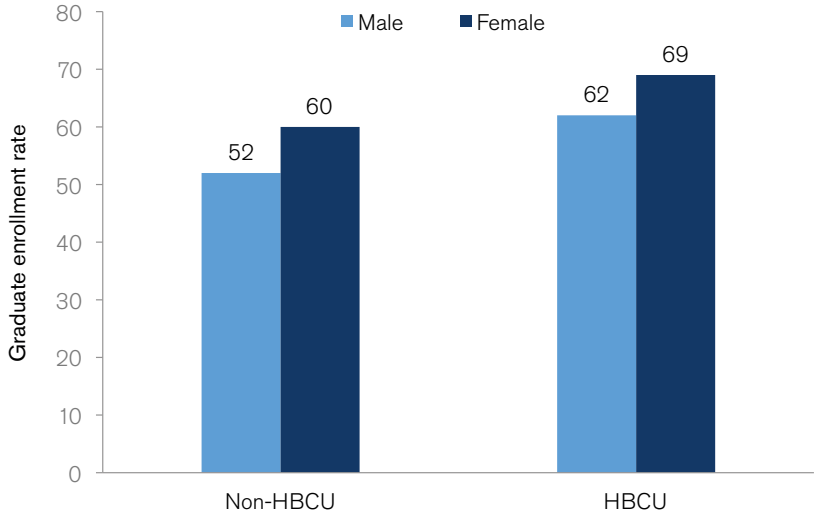

Figure 1. Graduate enrollment rates of African American students by gender for HBCU and non-HBCU institutions. HBCU = Historically Black College and University.

[33] Interested readers are referred to Bowen, Chingos, and McPherson (2009) to learn more about the relationship between institutional characteristics (e.g., selectivity, control) and four- and six-year completion rates.

[34] The estimated graduate enrollment rates are based on the main effects as provided in Table 7. Additional follow-up analyses were conducted to test for interaction effects based on the six predictors exhibiting the largest relationships with graduate enrollment (gender, race/ethnicity, ACT Composite score, graduate degree aspirations, graduating within four years, and attending a HBCU). Among the 15 two-way interactions evaluated, only the interaction between graduate degree aspirations and graduating within four years was significant ($p = .004$). However, in analyses that were based on the restricted subsample of students who earned a bachelor's degree within six years (91% of the initial sample), the interaction was no longer statistically significant ($p = .019$) for graduate enrollment status within four years.

compared to 57% for all African American students).[35] Gender was another variable that was found to be strongly related to graduate school enrollment. Figure 1 displays the modeled graduate enrollment rates for African American students by gender and HBCU designation of bachelor-conferring institution, holding all else constant at the sample means. At both HBCU and non-HBCU institutions, African American female students were more likely than African American male students to enroll in a graduate program.

Compared to their corresponding peers, students who had graduate degree aspirations were more likely to enroll in graduate school, as were students who received their bachelor's degree in four years or less. Students who had both of these attributes were more likely to enroll in graduate school, compared to students who had only one of these attributes (Figure 2; 56% vs. 44%). Moreover, students who had both attributes were 1.8 times as likely to enroll in graduate school as students who had neither attribute (56% vs. 32%). Interestingly, a significant proportion of bachelor's degree recipients who indicated no plans to enroll in graduate school when they took The ACT ended up enrolling. One potential explanation could be the 2008 recession. In fact, the number of Americans taking the Graduate Record Examination, a standardized admission test used for graduate school admissions, increased 13% in 2009 from the prior year (Ruiz, 2010).

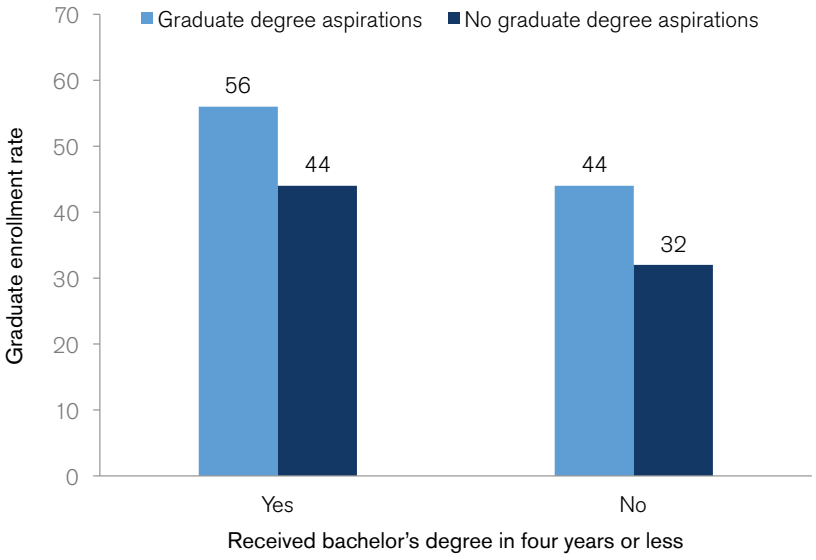

Figure 2. Graduate enrollment rates by graduate degree aspirations and time to bachelor's degree completion.[36]

[35] The racial/ethnic breakdown for HBCU institutions was 94% African American students, 2% White students, 1% Hispanic students, 1% Asian students, and 1% multiracial and other racial/ethnic students (percentages do not sum to 100 due to rounding).

[36] Based on the model that included the interaction between these two predictors, the modeled graduate enrollment rate for the four bars in the graph from left to right changed to: 57%, 42%, 43%, and 33%.

ACT Composite score was also one of the stronger predictors of graduate school enrollment in the multivariate analysis (Table 7); students with scores of 24 to 27 or of 28 to 36 were significantly more likely to enroll in graduate school, compared to those with scores of 19 or below. Figure 3 provides the estimated graduate enrollment rates by ACT Composite score range and degree aspirations, holding all other variables constant at the sample means. For each ACT Composite score range, students with graduate degree aspirations were considerably more likely than those without graduate degree aspirations to enroll in a graduate program (by 12 percentage points). Also of note is the compensatory nature of these variables. For example, the modeled graduate enrollment rate of students with low ACT Composite scores (i.e., < 20) and graduate degree aspirations was nearly identical to that of students with high ACT scores (i.e., ≥ 28) but no graduate degree aspirations (44% vs. 45%). These findings underscore the impact of both cognitive and noncognitive factors on subsequent academic success.

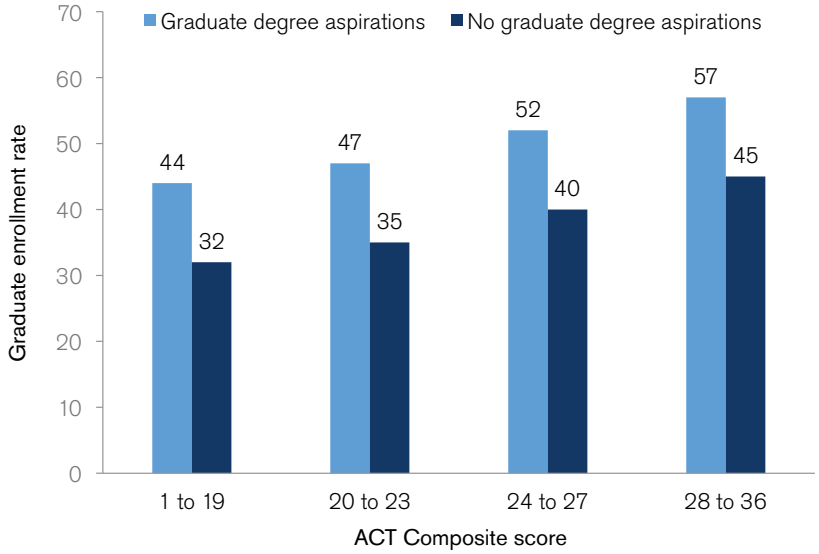

Figure 3. Graduate enrollment rates by graduate degree aspirations and ACT Composite score range.

Discussion

This study builds on the existing literature related to graduate school enrollment, by identifying student and institutional characteristics that are associated with graduate school enrollment for a large, national sample of more than 14,000 ACT-tested bachelor's degree recipients attending postsecondary institutions across the country. In most cases, results from this study are in agreement with previous findings from other studies on earlier student cohorts. We did, however, observe a higher graduate enrollment rate, especially among females. This finding was expected given the dramatic changes in the demographic make-up and enrollment patterns of graduate students over the last couple of decades (Snyder & Dillow, 2012). Moreover, given the richness of the student-level data that was available in this study, we were able to examine myriad student and institutional characteristics in a single study, allowing for the examination of the unique effect of

each of these various variables on graduate enrollment. This is particularly important since many of the variables examined here and in previous studies are related to each other.

In summary, the results of the current study underscore the fact that students who enroll in graduate programs differ in meaningful ways from students who do not pursue advanced degrees. Moreover, many of these differences are under the volition of the student and influenced by decisions students make in high school, if not earlier. Specifically, graduating from high school academically ready for college is not only related to more proximal outcomes, such as performance in the first year of college (Allen, 2013), but also has lasting effects over a decade later in its relationship with graduate enrollment. For example, students with an ACT Composite score of 28 or higher were found to be considerably more likely to enroll in a graduate program as compared to their peers with ACT scores of 19 or lower, even after statistically controlling for other student and institutional characteristics. Additionally, the estimated effect for ACT on graduate enrollment is downwardly biased given the restricted sample of bachelor's degree recipients as compared to all high school graduates, as mentioned earlier.

The courses students took in high school were also related to graduate enrollment; however, many of these variables were not included in the final multivariate model. This finding may be partially explained by the fact that taking rigorous, higher-level courses in high school better prepares students for college and career success; and therefore, including ACT scores (measures of college and career readiness) in the multivariate model accounted for the effect of the coursework variables (ACT, 2013a; 2013b; 2013c; 2013d; Noble & McNabb, 1989). In other words, students who take higher-level courses in high school tend to achieve higher ACT scores, on average, than those who do not, and in turn, students with higher academic achievement levels are more likely to enroll in a graduate program.

Congruent with previous research, this study also found that aspirations to pursue a post-baccalaureate degree were strongly related to the likelihood of enrolling in graduate school, even after other student characteristics were taken into account. Intuitively, this finding makes sense, as it seems reasonable to expect that what individuals say they are going to do will be related to what they actually end up doing. Research on human behavior has repeatedly confirmed that this is indeed the case (Ajzen, 1991). In a similar vein, the plans students had for college—namely their intentions to enroll in advanced college coursework—were also related to graduate school enrollment. These variables were, however, not as strongly related to graduate enrollment, especially after other variables were included in the model.

On the other hand, obtaining a bachelor's degree in four years or less remained a strong predictor of graduate enrollment, even after controlling for other variables. Even though the prescribed time frame for undergraduate degree completion is four years, the majority of students typically take longer than this. Nationally, less than four out of ten students obtained their bachelor's degree within four years of initial enrollment in college (Snyder et al., 2006). Therefore, timely undergraduate degree completion may signify not only higher levels of academic preparedness, but also perhaps higher academic determinedness, a characteristic that has also been shown to be related to positive educational outcomes (Duckworth, Peterson, Matthews, & Kelly, 2007). From a policymaker perspective, the results from the current study could help inform interventions that graduate school recruiters and undergraduate colleges might use to boost graduate school enrollment.

Another interesting finding of this study was the differences in graduate enrollment rates among racial/ethnic groups. Specifically, even though African American students tend to graduate from high school less academically prepared (ACT, 2013e), among bachelor's degree recipients, they were more likely than students from other racial/ethnic groups to enroll in graduate school. Along these same lines, HBCUs were found to enroll a larger percentage of their bachelor's degree recipients into graduate programs as compared to non-HBCUs. These results are in alignment with previous findings (e.g., Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, & Gary, 2009; Stage et al., 2011). One explanation for the positive effect for HBCUs may be linked to their institutional policies, practices, and structures that promote self-efficacy among their student body (Perna et al., 2009). Such findings are encouraging and should be further studied, especially in light of the educational and occupational disparities that often exist among racial/ethnic groups. Moreover, considering the monetary and occupational opportunities associated with higher levels of education, increasing the pipeline of racial/ethnic minority and lower-income students who are academically prepared and well equipped to achieve their educational aspirations, including completing graduate-level degrees, should be considered a priority among educators and policymakers.

Even though there was a wealth of information on the students and the institutions they attended, we were limited to the variables that were available from The ACT and NSC student records. In particular, we did not have data on students' college GPAs, a variable that has been shown to be significantly related to graduate school enrollment (Heller, 2001; Millett, 2003; Mullen et al., 2003; Nevill & Chen, 2007; Perna, 2004). Given the strong relationship between test scores and college grades (Allen, 2013; Radunzel & Noble, 2012b; Sawyer, 2010), it is unclear whether ACT scores would have remained a significant predictor of graduate school enrollment if college GPA (a more proximal measure of achievement) was also included in the model.[37] We did, however, include other measures of undergraduate performance, namely completion of a bachelor's degree in four years or less, suggesting that ACT Composite scores have a unique effect on graduate enrollment, independent of graduate performance.[38] Corroborating these findings, another study found that both admission test scores and college grades exhibited unique effects on graduate school enrollment (Mullen et al., 2003). Interestingly, HSGPA did not remain significantly related to graduate school enrollment in the final multivariate model.

Given that our study included younger adults (namely, 2003 ACT-tested high school graduates who immediately enrolled in college after high school and completed a bachelor's degree within eight years), it is unclear whether the study findings generalize to those for the entire population of graduate school enrollees, a group that also includes older adults who return to school for a post-baccalaureate degree after being in the workforce for some time (Nevill & Chen, 2007; Schoenfeld, 2012). In general, Nevill and Chen (2007) found that, on average, two to three years elapsed between earning a bachelor's degree and entering any graduate program, but that the time to enrollment differed by program of study.[39] In the current study, the typical time to subsequent

[37] Even if ACT Composite score was not found to exhibit a direct effect on graduate school enrollment above and beyond the effect of college GPA, ACT Composite score would have an indirect effect on graduate school enrollment that is mediated through undergraduate performance.

[38] Timely degree completion has been shown to be strongly related to college grades (Allen & Robbins, 2010; Radunzel & Noble, 2012b), as well as to ACT test scores (Radunzel & Noble, 2012a).

[39] These values are probably underestimated as well since only ten years had elapsed between undergraduate degree completion and the collection of survey responses; therefore, some participants in their study may still enroll in a graduate program in the future.

enrollment into a graduate program was 18 months. Since students in the current study were around 28 years old by the end of the data collection period, it is likely that if students were tracked over a longer period of time, additional graduate school enrollees would be identified.

Although this study was based on students' actual postsecondary enrollment and degree records as provided by NSC, some of the data on degree type and CIP codes were incomplete as described in the methods section. We tried to infer this information based on other available data sources; however, this may have led to some misclassifications. Additionally, the data provided by NSC did not allow for the examination of graduate program type (e.g., MA, PhD, professional). For graduate students who completed their degree, this information was available in the degree awarded field, but was not provided for students who had not yet completed a degree (44% of the sample).

In conclusion, the implications of the current study findings for career and educational planning are paramount. The benefits of being academically prepared and having well-defined career plans upon high school completion have been well documented (ACT, 2008; 2009). Students may be unaware of the long-term consequences that their early educational choices and actions, particularly as they relate to course selection and educational and career planning, can have on their future educational endeavors and opportunities. Students may be best served by educational and career guidance programs that are targeted at helping younger students (ACT, 2005; Wimberly & Noeth, 2005) to:

- Know what it means to be ready for college and career and to understand the benefits of being better prepared academically
- Explore educational and career options that are based on their own skills, interests, and aspirations
- Align their coursework plans and academic behaviors with their educational degree aspirations

In addition, lower-income or racial/ethnic minority students often lack the guidance and support at home that can help contribute to their educational success (Noeth & Wimberly, 2002; Wimberly & Noeth, 2004). These students may benefit from educational and career guidance programs that are targeted at meeting their specific needs. ■

Appendix

Table A-1. Demographic Characteristics by Educational Attainment Level

Characteristic		2003 ACT-tested high school graduates	Immediate undergraduate enrollees	Bachelor degree recipients	Graduate school enrollees
Number of students		1,175,059	779,765	14,186	6,472
Gender	Male	43	42	41	36
	Female	57	58	59	64
Race/ Ethnicity	African American/Black	12	10	8	9
	American Indian	1	1	1	1
	White	74	76	80	78
	Hispanic	7	5	5	5
	Asian American/Pacific Islander	3	4	4	5
	Other/Multiracial	3	3	3	3
Income	< $30,000	24	20	16	16
	$30,000 to $60,000	35	35	33	32
	> $60,000	41	46	51	53

Note. Table includes percentages. Percentages may not sum to 100 due to rounding. Percentages for the first two groups are based on non-missing responses only; missing values were imputed for the study sample of bachelor's degree recipients. For the latter two student groups, weighted percentages are reported. The immediate undergraduate enrollee group includes 2003 ACT-tested high school graduates who immediately enrolled in college. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program.

Table A-2. High School Performance by Educational Attainment Level

Characteristic		2003 ACT-tested high school graduates	Immediate undergraduate enrollees	Bachelor degree recipients	Graduate school enrollees
Number of students		1,175,059	779,765	14,186	6,472
		Mean	Mean	Mean	Mean
ACT scores	ACT English	20.3	21.2	22.7	23.5
	ACT Math	20.6	21.3	22.7	23.3
	ACT Reading	21.2	22.0	23.3	24.2
	ACT Science	20.8	21.5	22.6	23.1
	ACT Composite	20.8	21.6	23.0	23.7
HSGPA		3.17	3.27	3.46	3.52
		Percent	Percent	Percent	Percent
HS class rank	Top quarter	42	47	60	67
	Second quarter	37	36	30	26
	Third quarter	19	15	9	6
	Bottom quarter	3	2	1	1
HSGPA	3.50 or higher	37	42	56	62
	3.00 to 3.50	29	30	28	25
	Less than 3.00	34	28	16	13

Note. Table includes means and percentages. Percentages may not sum to 100 due to rounding. For the latter two student groups, weighted means and percentages are reported. The immediate undergraduate enrollee group includes 2003 ACT-tested high school graduates who immediately enrolled in college. HS = high school; HSGPA = high school grade point average. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program.

Table A-3. High School Coursework and Extracurricular Activities by Educational Attainment Level

Characteristic		2003 ACT-tested high school graduates	Immediate undergraduate enrollees	Bachelor degree recipients	Graduate school enrollees
Number of Students		1,175,059	779,765	14,186	6,472
HS math course sequence	Beyond Algebra II	46	51	61	64
	Alg I, Geom, & Alg II	34	33	30	27
	< Alg I, Geom, & Alg II	15	11	6	5
	Other combinations	5	5	4	4
HS science course sequence	Bio, Chem, & Phys	24	26	31	33
	Bio & Chem	48	50	52	52
	Bio	20	16	10	9
	Other combinations	9	8	6	6
Took advanced courses in HS	Yes	62	66	74	80
	No	38	34	26	20
Earned college credit in HS	Yes	15	16	17	19
	No	85	84	83	81
Took HS core curriculum	Yes	63	66	74	75
	No	37	34	26	25
Participated in departmental club in HS	Yes	29	31	35	37
	No	71	69	65	63
Received leadership award in HS	Yes	42	44	48	52
	No	58	56	52	48

Note. Table includes percentages. Percentages may not sum to 100 due to rounding. Percentages for the first two groups are based on non-missing responses only; missing values were imputed for the study sample of bachelor's degree recipients. For the latter two student groups, weighted percentages are reported. Advanced courses in HS include advanced, accelerated, or honors courses. The immediate undergraduate enrollee group includes 2003 ACT-tested high school graduates who immediately enrolled in college. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program. HS = high school; Alg = Algebra; Geom = Geometry; Bio = Biology; Chem = Chemistry; Phys = Physics.

Table A-4. College Intentions and Plans by Educational Attainment Level

College intentions		2003 ACT-tested high school graduates	Immediate undergraduate enrollees	Bachelor degree recipients	Graduate school enrollees
Number of Students		1,175,059	779,765	14,186	6,472
Take independent study	Yes	42	42	45	50
	No	58	58	55	50
Take freshman honors courses	Yes	34	36	44	51
	No	66	64	56	49
Place into advanced coursework	Yes	55	57	63	69
	No	45	43	37	31
Receive college credit by exam	Yes	62	62	67	71
	No	38	38	33	29
Participate in departmental clubs	Yes	31	33	36	38
	No	69	67	64	62
Live on campus	Yes	63	68	76	78
	No	37	32	24	22
Enroll as a full-time student	Yes	92	95	98	98
	No	8	5	2	2
Apply for financial aid	Yes	84	83	84	86
	No	16	17	16	14
Work while in college	Yes	85	84	80	78
	No	15	16	20	22
Educational Aspirations	< Bachelor's degree	11	8	3	2
	Bachelor's degree	37	36	34	26
	Master's degree	22	24	27	28
	Professional degree	30	32	36	43

Note. Table includes percentages. Percentages may not sum to 100 due to rounding. Percentages for the first two groups are based on non-missing responses only; missing values were imputed for the study sample of bachelor's degree recipients. For the latter two student groups, weighted percentages are reported. The immediate undergraduate enrollee group includes 2003 ACT-tested high school graduates who immediately enrolled in college. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program.

Table A-5. Undergraduate Initial Enrollment Characteristics by Educational Attainment Level

Student Characteristic		Immediate undergraduate enrollees	Bachelor degree recipients	Graduate school enrollees
Number of Students		779,765	14,186	6,472
Started at four-year institution	Yes	76	87	90
	No (2-year)	24	13	10
Started at an in-state institution	Yes	81	79	77
	No	19	21	23
Started at a public institution	Yes	78	74	71
	No (private)	22	26	29
Started at an HBCU institution	Yes	2	2	3
	No	98	98	97
Started at an institution that offers graduate programs	Yes	70	82	84
	No	30	18	16
College selectivity of initial institution (average ACT Composite score)	>= 27.5	4	5	7
	23.5 to 27.5	27	36	39
	21 to 23.5	31	35	34
	< 21	37	23	20

Note. Table includes percentages. Percentages may not sum to 100 due to rounding. For the latter two student groups, weighted percentages are reported. The immediate undergraduate enrollee group includes 2003 ACT-tested high school graduates who immediately enrolled in college. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program.

Table A-6. Undergraduate Degree Characteristics by Educational Attainment Level

Student Characteristic		Bachelor degree recipients	Graduate school enrollees
Number of Students		14,186	6,472
Graduated in four years or less	Yes	49	58
	No	51	42
Graduated from initial institution	Yes	73	76
	No	27	24
Graduated from an in-state institution	Yes	78	77
	No	22	23
Graduated from a public institution	Yes	72	70
	No (private)	28	30
Graduated from an HBCU institution	Yes	2	3
	No	98	97
Graduated from an institution that offers graduate programs	Yes	95	94
	No	5	6
College selectivity of degree-granting institution	>= 27.5	6	7
	23.5 to 27.5	41	42
	21 to 23.5	40	38
	< 21	14	13
Degree major (CIP)	Communication & Journalism (09)	7	4
	Education (13)	8	10
	Engineering (14)	5	4
	English Language (23)	3	4
	Biological & Biomed Sciences (26)	6	9
	Psychology (42)	6	9
	Social Sciences (45)	8	9
	Visual/Performing Arts (50)	5	4
	Health Professionals (51)	6	6
	Business, Management, Marketing, & Related (52)	18	13
	History (54)	2	3
	Other majors (each 2% or below)	21	19
	Missing/unclassified	5	6

Note. Table includes weighted percentages. Percentages may not sum to 100 due to rounding. A stratified random sample of 24,450 students from the immediate undergraduate enrollees group was matched to National Student Clearinghouse records to obtain 10.5 years of postsecondary enrollment and degree information through fall 2013. Of those students, 14,186 (58%) had immediately enrolled in college and obtained a bachelor's degree within eight years of initial enrollment and comprise the Bachelor degree recipient group. The graduate school enrollee group includes students from the bachelor degree recipient group who subsequently enrolled in a graduate program.

Table A-7. Description of Institutions in Samples

Institution characteristic		Immediate undergraduate enrollees	Bachelor degree recipients		Graduate school enrollees	
			Initial	Bachelor	Initial	Bachelor
Number of institutions		2,111	1,470	1,147	1,166	948
College type	Two-year	39	30		25	
	Four-year	61	70	100	75	100
College control	Public	58	59	41	58	44
	Private	42	41	59	42	56
HBCU	Yes	3	3	5	4	5
	No	97	97	95	96	95
Offers graduate programs	Yes	47	58	84	64	86
	No	53	41	16	36	14
College selectivity (average ACT Composite score)	< 21	60	50	31	43	28
	21 to 23.5	24	28	39	31	39
	23.5 to 27.5	14	18	24	21	27
	>= 27.5	3	4	6	5	7

Note. Table includes percentages. Percentages may not sum to 100 due to rounding. Under the immediate undergraduate enrollee column, the institutions where 2003 ACT-tested high school graduates initially enrolled in fall 2003 are described; 4% of these institutions were missing information on college selectivity. Under the bachelor degree recipient column, undergraduate institutions where bachelor degree recipients initially enrolled in, as well as graduated from are described. Under the graduate school enrollee column, institutions where graduate school enrollees initially enrolled in, as well as graduated from are described.

Table A-8. Estimates for the Random Intercept Variance

	Random intercept effects		Range across institutions			
			Intercept		Predicted probability	
Model	Variance estimate	Standard error	Min	Max	Min	Max
Null	0.127	0.022	-0.844	0.464	0.301	0.614
Multivariate	0.067	0.017	-1.902	-1.032	0.347	0.559

Note. The multivariate model includes the student and institution characteristics presented in Table 7. The predicted probabilities based on the multivariate model were calculated by holding the student and institutional characteristics constant at their respective grand means.

References

ACT. (2005). *Career planning: Students need help starting early and staying focused*. Iowa City, IA: Author.

ACT. (2008). *The economic benefits of academic and career preparation*. Iowa City, IA: Author.

ACT. (2009). *The path to career success: High school achievement, certainty of career choice, and college readiness make a difference*. Iowa City, IA: Author.

ACT. (2013a). *English courses taken and ACT college readiness benchmark performance in English.* (ACT Information Brief No. 2013-19). Iowa City, IA: Author.

ACT. (2013b). *Social sciences courses taken and ACT college readiness benchmark performance in reading*. (ACT Information Brief No. 2013-20). Iowa City, IA: Author.

ACT. (2013c). *Mathematics courses taken and ACT college readiness benchmark performance in math*. (ACT Information Brief No. 2013-21). Iowa City, IA: Author.

ACT. (2013d). *Science courses taken and ACT college readiness benchmark performance in science*. (ACT Information Brief No. 2013-22).

ACT. (2013e). *ACT profile report—national: Graduating class 2013—national.* Iowa City, IA: Author.

Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, *50*(2), 179–211.

Allen, J. (2013). *Updating the ACT college readiness benchmarks*. (ACT Research Report No. 2013-6). Iowa City, IA: ACT Inc.

Allen, J., & Robbins, S. (2010). Effects of interest-major congruence, motivation, and academic performance on timely degree attainment. *Journal of Counseling Psychology*, 57(1), 23–35.

Apte, U., Karmarkar, U. S., & Nath, H. K. (2008). Information services in the US economy: value, jobs and management implications. *California Management Review*, *50*(3), 12–30.

Aud, S., Wilkinson-Flicker, S., Kristapovich, P., Rathbun, A., Wang, X., & Zhang, J. (2013). *The condition of education 2013* (NCES 2013-037). US Department of Education. Washington, DC: National Center for Education Statistics.

Bowen, W. G., Chingos, M. M., & McPherson, M. S. (2009). Crossing the finish line: Completing college at America's public universities. Princeton University Press.

Bradburn, E.M., Berger, R., Li, X., Peter, K., & Rooney, K. (2003). *A descriptive summary of 1999–2000 bachelor's degree recipients 1 year later* (NCES 2003-165). US Department of Education. Washington, DC: National Center for Education Statistics.

Choy, S.P. (2000). *Debt burden four years after college* (NCES 2000-188). US Department of Education. Washington, DC: National Center for Education Statistics.

Choy, S.P., & Geis, S. (1997). *Early labor force experiences and debt burden* (NCES 97286). US Department of Education. Washington, DC: National Center for Education Statistics.

Clune, M. S., Nuñez, A., & Choy, S. P. (2001). *Competing choices: Men's and women's paths after earning a bachelor's degree* (NCES 2001-154). US Department of Education. Washington, DC: National Center for Education Statistics.

Duckworth, A. L., Peterson, C., Matthews, M. D., & Kelly, D. R. (2007). Grit: perseverance and passion for long-term goals. *Journal of personality and social psychology*, *92*(6), 1087.

Eagan, M. K., Hurtado, S., Chang, M. J., Garcia, G. A., Herrera, F. A., & Garibay, J. C. (2013). Making a difference in science education: The impact of undergraduate research programs. *American Educational Research Journal*, *50*(4), 683–713.

Ethington, C. A., & Smart, J. C. (1986). Persistence to graduate education. *Research in Higher Education, 24*(3): 287–303.

Hathaway, R. S., Nagda, B. A., & Gregerman, S. R. (2002). The relationship of undergraduate research participation to graduate and professional education pursuit: An empirical study. *Journal of College Student Development*, 43(5), 614–631.

Hearn, J. C. (1987). Impacts of undergraduate experiences on aspirations and plans for graduate and professional education. *Research in Higher Education, 27*(2), 119–141.

Heller, D. E. (2001). Debts and decisions: Student loans and their relationship to graduate school and career choice. Indianapolis, IN: USA Group Foundation. Retrieved March 25, 2014, from http://www.luminafoundation.org/publications/debtsdecisions.pdf.

Kerckhoff, A. C. (1993). *Diverging Pathways: Social Structure and Career Deflections.* Cambridge: Cambridge University Press.

Mattern, K.D., Burrus, J., Camara, W. J., O'Connor, R., Gambrell, J., Hanson, M. A., Casillas, A., & Bobek, B. (2014). Broadening the definition of College and Career Readiness: A Holistic Approach. Iowa City: IA, ACT, Inc.

Millett, C. (2003). How undergraduate loan debt affects application and enrollment in graduate or first professional school. *The Journal of Higher Education, 74*(4): 386–427.

Mullen, A. L., Goyette, K. A., & Soares, J. A. (2003). Who goes to graduate school? Social and academic correlates of educational continuation after college. *Sociology of Education*, *76*(2), 143–169.

Nevill, S. C., & Chen, X. (2007). The path through graduate school: A longitudinal examination 10 years after bachelor's degree (NCES 2007-162). US Department of Education. Washington, DC: National Center for Education Statistics.

Noble, J., & McNabb, T. (1989). *Differential coursework and grades in high school: Implications for performance on the ACT assessment*. (ACT Research Report No. 1989-5). Iowa City, IA: ACT, Inc.

Noeth, R. J., & Wimberly, G. L. (2002). *Creating seamless educational transitions for urban African American and Hispanic students*. Iowa City, IA: ACT, Inc.

Powell, W. W., & Snellman, K. (2004). The knowledge economy. *Annual review of sociology*, 199–220.

Perna, L. W. (2004). Understanding the decision to enroll in graduate school: Sex and racial/ethnic group differences. *Journal of Higher Education, 75*(5), 487–527.

Perna, L., Lundy-Wagner, V., Drezner, N. D., Gasman, M., Yoon, S., Bose, E., & Gary, S. (2009). The contribution of HBCUs to the preparation of African American women for STEM careers: A case study. *Research in Higher Education*, *50*(1), 1–23.

Radunzel, J., & Noble, J. (2012a). *Tracking 2003 ACT®-tested high school graduates: College readiness, enrollment, and long-term success.* (ACT Research Report No. 2012-2). Iowa City, IA: ACT, Inc.

Radunzel, J., & Noble, J. (2012b). *Predicting long-term college success through degree completion using ACT® Composite score, ACT Benchmarks, and high school grade point average.* (ACT Research Report No. 2012-5). Iowa City, IA: ACT, Inc.

Ruiz, Rebecca R. (2010, January 9). Recession Spurs Interest in Graduate, Law Schools. *The New York Times*. Retrieved from http://www.nytimes.com/2010/01/10/education/10grad.html?_r=0.

Russell, S. H., Hancock, M. P., & McCullough, J. (2007). The pipeline: Benefits of undergraduate research experiences. *Science*, 316(5824), 548–549.

Sawyer, R. (2010). *Usefulness of high school average and ACT scores in making college admissions decisions.* (ACT Research Report No. 2010-2). Iowa City, IA: ACT, Inc.

Schoenfeld, G. (2012). *Prospective Students Survey. 2012 Survey report.* McLean, VA: Graduate Management Admissions Council.

Sewell, W. H., Haller, A. O., & Portes, A. (1969). The educational and early occupational attainment process. *American Sociological Review, 34*, 82–92.

Snijders, T., & Bosker, R. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage.

Snyder, T. D., & Dillow, S. A. (2013). *Digest of education statistics 2012* (NCES 2014-015). US Department of Education. Washington, DC: National Center for Education Statistics.

Snyder, T. D., & Dillow, S. A. (2012). *Digest of education statistics 2011* (NCES 2012-001). US Department of Education. Washington, DC: National Center for Education Statistics.

Snyder, T. D., Tan, A. G., & Hoffman, C. M. (2006). *Digest of education statistics 2005* (NCES 2006-030). US Department of Education. Washington, DC: National Center for Education Statistics.

Stage, F. K., John, G., & Hubbard, S. M. (2011). Undergraduate institutions that foster Black scientists. In H. T. Frierson & W. F. Tate (Eds.), Diversity in Higher Education: Vol. 11. Beyond stock stories and folktales: African Americans' paths to STEM fields (pp. 3–21). Bingley, UK: Emerald.

US Bureau of Labor Statistics. (2014). Current Population Survey, 2013. *US Bureau of Labor Statistics, US Department of Labor*. Retrieved on March 25, 2014, from http://www.bls.gov/emp/ep_chart_001.htm.

Walpole, M. (2003). Socioeconomic status and college: How SES affects college experiences and outcomes. *Review of Higher Education, 27*(1), 45–73.

Weiler, W.C. (1991). The effect of undergraduate student loans on the decision to pursue postbaccalaureate study. *Education Evaluation and Policy and Analysis, 13*(3): 212–220.

Wendler, C., Bridgeman, B., Cline, F., Millett, C., Rock, J., Bell, N., & McAllister, P. (2010). *The path forward: The future of graduate education in the United States*. Princeton, NJ: Educational Testing Service.

Wimberly, G. L., & Noeth, R. J. (2004). *Schools involving parents in early postsecondary planning*. Iowa City, IA: ACT, Inc.

Wimberly, G. L., & Noeth, R. J. (2005). *College readiness begins in middle school*. Iowa City, IA: ACT, Inc.

Zhang, L. (2005). Advance to graduate education: The effect of college quality and undergraduate majors. *Review of Higher Education, 28*(3), 313–338.

05020150 Rev 1