THE PATHS TO BECOMING
A MATHEMATICS TEACHER

by

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ABSTRACT

Increasing numbers of mathematics teachers must be recruited in coming years, because of a growing student population, teacher attrition, calls for smaller class size, and the need to replace out-of-subject teachers. Recruitment can be made more effective and efficient, if better information on career paths is provided to decision makers. This study attempts to analyze the academic decisions which lead to the outcome “becoming a mathematics teacher”.

Four groups were compared and contrasted: mathematics teachers, science teachers, other teachers, and non-teachers. Science teachers were removed from the “other teachers” category because of their many similarities to mathematics teachers on the variables examined. The question of whether these groups differ in ways that could help predict the outcome of interest was examined using the NCES dataset Baccalaureate &Beyond:93/97, which provides thousands of variables on academic path, demographics, and labor market histories for over 8,000 individuals. It was analyzed using the NCES online analytic tool DAS to generate tables showing percentage distribution of the four groups on variables organized according to the concepts demographics, family environment, academic path, and academic achievement. Further examination was conducted by entering the variables into a discriminant analysis.

Mathematics teachers were found to differ from teachers of other K-12 fields on all of the four conceptual categories. However, only a few such differences were statistically significant. More significant differences were observed when the analyses were conducted separately for women and men. The trend observed was that those who became mathematics teachers were more likely to have attended public high schools and to have first attended two-year colleges; to have lower GPAs, more mathematics credits, and midrange CEE scores; and to be female.

Keywords: teacher characteristics; mathematics; recruitment; national dataset; pipeline

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LIST OF ACRONYMS/ABBREVIATIONS

B&B	Baccalaureate & Beyond
CEE	College Entrance Examination
DAS	Data Analysis System (of NCES)
DOE	Department of Education
ECBW	Electronic Code Book for Windows
GPA	Grade Point Average
K-12	Kindergarten to 12^{th} grade
NCES	National Center for Education Statistics
NCTM	National Council of Teachers of Mathematics
NPSAS	National Postsecondary Student Aid Study
OPPI	Office of Policy Planning and Innovation
SMET	Science, Math, Engineering & Technical
SPSS	trademarked name of statistical software, ©SPSS Inc.

CHAPTER ONE: INTRODUCTION

A continuing supply of competent mathematics teachers is vital to the interests of our nation, as it is to any society. Students who do not learn mathematics cannot go on to become the doctors, engineers, or medical and scientific researchers, among many other essential careers, upon which progress and prosperity depend.

In 2005, the National Academies (the umbrella organization comprising the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine) produced the report *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future.* This work, written by a team of prominent scientists, CEOs, and university presidents, gives a detailed picture of the eroding state of American science and technology superiority. The picture of the current situation in mathematics teaching and learning is troubling:

- Fewer than one-third of US 4th-grade and 8th-grade students performed at or above a level called "proficient" in mathematics; "proficiency" was considered the ability to exhibit competence with challenging subject matter. Alarmingly, about one-third of the 4th graders and one-fifth of the 8th graders lacked the competence to perform even basic mathematical computations.
- In 1999, 68% of US 8th grade students received instruction from a mathematics teacher who did not hold a degree or certification in mathematics.

- US 15-year-olds ranked 24th out of 40 countries that participated in a 2003 administration of the Program for International Student Assessment examination, which assessed students' ability to apply mathematical concepts to real-world problems (National Academies, 2005, p. 12).

Making the reasonable connection that student performance is linked to the availability of qualified teachers, the authors of *Rising* made several recommendations that would result in greater numbers of mathematics teachers being recruited. Perhaps most notable of these is the call for "merit-based scholarships [that] would provide up to $20,000 a year for 4 years for qualified educational expenses, including tuition and fees, and require a commitment to 5 years of service in public K-12 schools" (p. 5).

However, this and other suggestions made by the report will have an effect only if implemented. In his 2006 State of the Union address, President George W. Bush announced an "American Competitiveness Initiative", which contains provisions for spending intended to improve the quality of mathematics (along with science and technological) education in K-12 schools. It would appear that these provisions are not as extensive as those recommended by the National Academies; most funding seems to be targeted at creating panels to study the problem, to retrain existing mathematics teachers to teach Advanced Placement courses, and to implement research projects which could improve current mathematics curricula and instruction. One provision which does seems likely to put additional mathematics teachers in classrooms is the "Adjunct Teacher Corps", a program aimed at encouraging current mathematics and science professionals to become adjunct high school teachers (Whitehouse Office of the Press Secretary, 2006).

These new policies are a hopeful sign that the necessity to improve mathematics education has been acknowledged. Recruitment of additional mathematics teachers is not the sole focus of the new initiative, nor should it be, but at least this aspect of the problem is receiving some needed attention.

In its 2000 report *Before It's Too Late,* the National Commission on Mathematics and Science Teaching for the 21st Century (NCMST) cited four prominent reasons for improving mathematics and science competence:

- The rapid pace of change in both the increasingly interdependent global economy and in the American workplace demands widespread mathematics-and science-related knowledge and abilities;
- Our citizens need both mathematics and science for their everyday decision-making;
- Mathematics and science are inextricably linked to the nation's security interests;
- The deeper, intrinsic value of mathematical and scientific knowledge shapes and defines our common life, history, and culture. (p. 7)

From many viewpoints, the situation of insufficient supply of mathematics teachers is alarming. The US Department of Education projects a 5% rise in the prekindergarten through grade 8 school-age population between 2000 and 2014, and a 2% rise in enrollment in grades 9 through 12 during that same period (Hussar, 2005); more teachers will be needed to serve these students. According to some estimates, as much as two-thirds of the current teaching workforce will retire in the same period (NCMST, 2000). State mandates for smaller class size create a need for yet more teachers. Finally, a call to replace out-of-subject teachers further increases the demand for qualified teachers of mathematics. A 2005 study found that 8,431 teachers on subject-area certificate waivers were staffing mathematics classrooms nationwide (US DOE, 2005). The problem intensifies in urban schools: 95% of urban districts cite an immediate need for high school mathematics and science teachers, and 80% report a need for middle school science and mathematics teachers (NCMST, 2000).

All these factors contribute to the pressing need to find a dependable supply of people who want to teach mathematics (Seastrom et al, 2003). But, on what type of prospective mathematics teachers should recruitment efforts focus? This question has been addressed as a matter of national policy; the most minimal answer has been that teachers should be certified in the field which they teach. A more comprehensive answer has been built on the concept of what makes a teacher "highly qualified".

The volume of recent attention paid to the question of teacher quality, inspired by provisions of the federal "No Child Left Behind" Act of 2001, points up the reality that simply increasing the supply of mathematics teachers is not enough. The Act requires that, by the end of the 2005-06 school year, all teachers of core academic subjects (including mathematics) must be "highly qualified". The supply of such teachers must therefore be the focus of recruitment efforts.

Studies sponsored by the federal government, such as the afore-mentioned report *Before It's Too Late* (NCMST, 2000), cite research supporting the primacy of teacher certification and possession of a degree in the subject being taught, as measures of teacher effectiveness. The controversy is addressed in some detail in the 2001 Abell Foundation report *Teacher Certification Reconsidered: Stumbling for Quality.* This report examined the actual research claimed as evidence for the value of certification and found that "the academic research attempting to link teacher certification with student achievement is astonishingly deficient" (p. iii). Problems observed included selective citation of research supporting certification, citation of research which is too old to be reliable or retrievable, citation of research which was not peer reviewed or even published, and violation of basic principles of sound statistical analysis (such as failure to control for key variables or to use sample sizes large enough for reliable statistical inference).

Regardless of the final disposition of the dispute over what creates teacher effectiveness, the end result, a codified set of requirements, will have an effect on the numbers of potential teachers who must be recruited. If, for example, it is determined that the best way to ensure gains in student achievement is to staff every mathematics classroom with a mathematics major, then, clearly, many more mathematics majors will have to be recruited as classroom teachers, than current levels reflect.

Recruitment efforts will have to be especially effective in view of the notable decline in the number of bachelor's degrees awarded in mathematics; from a peak of 27,565,000 in 1970, to 11,455,000 in 2001 (National Science Foundation, n.d.). This decrease of over 58% represents a severe challenge to the plausibility of implementing of a "mathematics major in every mathematics classroom" policy.

The objective of the present research, better information on the question of who has made the choice to teach mathematics, has obvious limitations as a solution to the problem of staffing classrooms with qualified teachers, in the face of so precipitous a decline in the number of people attaining degrees in mathematics. Better information alone will not place a highly qualified teacher in every mathematics classroom. But such information does have the potential to save time and resources for those who attempt to recruit mathematics teachers, and as such, might be thought of as one of the several areas of effort that will be needed to solve our current (and projected future) staffing predicament.

Statement and Significance of the Problem

Effective teachers of mathematics are needed; the task of recruiting greater numbers of them can be made more efficient by better information on the questions:

- What are the characteristics of those who become mathematics teachers?
- How do mathematics teachers differ from other teachers?
- How do teachers in general differ from those who do not become teachers?
- Do the demographic characteristics and paths taken by each of the three above-mentioned groups through high school, college, and into the labor force, differ in ways that could help predict who is likely to become a mathematics teacher?

Because of hypothesized similarities between teachers of mathematics and science teachers, the above questions are examined in this study by means of four groups: the aforementioned mathematics teachers, science teachers, teachers of K-12 fields other than mathematics or science, and people who never taught during the time period of the study.

It should be noted that the question "what makes a teacher effective", while vitally important, is not the focus of this study. The problem addressed here is "how do mathematics teachers differ from others"; the intent is to find a pattern of differences that could inform recruitment efforts. The type and magnitude of these recruitment efforts will be influenced by the numbers of mathematics teachers needed; this is the reason for the present discussion of teacher quality. If a society wants more teachers of high quality, it must make more effort to recruit, than if it were satisfied with any level of quality.

Mathematics teachers come to the profession by means of many different paths. Some go directly from high school into a college major that will lead to certification. Others change colleges, and/or majors, many doing so more than once. Adelman, in his 1998 study “Women and Men of the Engineering Path”, found that during the period 1982-1993, only about 30% of college graduates had received their degrees in the major they had declared upon entering college. This pattern of migration has been noted by many who study the field, and reported on in the “Postsecondary Persistence and Progress” sections of recent NCES *The Condition of Education* reports (US DOE, NCES, 2001, 2003, 2004, and 2005).

Students who change from one major to another, or from one institution of higher learning to another, or from full-time college to full-time work and back, may have a genuine need to explore their options. However, from a purely costs-oriented perspective—however limited such a perspective may be—this stopping-out or migratory behavior might be considered to be wasteful and counterproductive.

Those who make policy decisions affecting higher education might be said to have an obligation to make such education accessible, efficient, and cost-effective. One way to contribute to this goal is to make the signs along the path to a degree readable and understandable; that is, to provide good information to students to help them make career and curriculum decisions.

Such information might be provided by an analysis of what paths previous students have taken. Prior studies have approached the subject with either comprehensive descriptions of all who become teachers, or close-up pictures of particular demographic groups, or particular variables which are characteristic of those who enter teaching. Some have examined the phenomenon of under representation in mathematics (and science) teaching by females and by members of ethnic or cultural minorities (Chang, 2002). Others have focused on the SAT scores of those who go into teaching, versus those who do not (US DOE, NCES, 2003). Still others have looked at the effect that an individual's commitment to teach (LaTurner, 2002), or attitude towards mathematics and science (Moses, 1997), might have on the decision to become a teacher. This type of study adds to the store of knowledge that can help decision-makers; it does, however, require the researcher to make an arbitrary (though usually logical) choice of variables to study. In the face of thousands of variables, any of which might make some contribution to the decision to prepare for and enter mathematics teaching, the researcher is obliged to make a choice of those most likely to be salient.

Research Questions

Operationally restating the research questions, detailed in the section Statement and Significance of the Problem, results in these hypotheses:

- *For the descriptive portion of the study:* The characteristics of those who become mathematics teachers, expressed in the conceptual categories Demographics, Family Environment, Academic Path, and Academic Achievement, will differ from the characteristics of K-12 teachers of fields other than mathematics or science, and will differ from those of non-teachers.
- *For the multivariate portion of the study:* On variables representing the conceptual categories Demographics, Family Environment, Academic Path, and Academic

Achievement, “mathematics teachers” will constitute a well-defined group, which will be significantly different from the groups “science teachers”, “teachers of K-12 fields other than mathematics or science”, and “non-teachers”. Specifically, the null hypothesis that the average discriminant scores are equal for all groups will be rejected for each of the three discriminant functions that will be obtained from analysis of the four groups.

The dataset employed is the *Baccalaureate and Beyond Longitudinal Study* (B&B:93/97), conducted by the National Center for Education Statistics (NCES). This massive study details the post baccalaureate experiences of about 11,200 men and women who received bachelor’s degrees between July 1992 and June 1993. The focus of data collection was “adult decisions” such as academic enrollments, degree completions, employment, and public service. Data gathered on these individuals include college transcripts, labor market histories, demographic information, and qualitative items such as career aspirations, parental support, and satisfaction with schooling and with work (US DOE, NCES, 1999).

This study examines the paths of mathematics teachers, in part, by contrasting them with the paths taken by two other groups: teachers of something other than mathematics, and non-teachers. The research on this topic is at the stage in which inductive investigation of a huge data collection is necessary to produce findings which could lead to more sophisticated statistical analyses. The present study aims at examining the variables available to determine if they can provide the framework for future analyses that could, it is hoped, make it possible to predict who will become a mathematics teacher, by simply plugging variables into an equation. Such an analysis might prove to require a dataset which includes even more variables than the impressive number (over five thousand) that the *Baccalaureate & Beyond* makes available. For several good reasons having to do with the goals of the researchers who created it, the B&B study's data collection was limited to the most basic of demographic and personal information; it is possible that truly accurate prediction might require a more extensive consideration of such as-yet uncollected data as (for example) the influence of previous schooling experiences on the decision to become a mathematics teacher.

However, the still-impressive amount of information found in the B&B, and examined in the present study, has the potential to make more efficient and effective the necessary work of recruiting teachers of mathematics, for now and for the future.

CHAPTER TWO: LITERATURE REVIEW

The question of who chooses to become a teacher of mathematics, as noted in the introduction, has not been well-studied. In fact, current (published) work that bears on this question bears on it only peripherally, as a detail in the larger picture of who chooses to teach at all.

Back in 1979, Schalock observed:

> …relatively little research has been done on the teacher selection process. A great deal of research has been done that relates to teacher preparation, the most cogent being research on teacher effectiveness, but it turns out that this research has little to contribute to decisions affecting the entry of new teachers to the work force. (p. 35)

In the intervening years more work on the question of decisions affecting the entry of new teachers to the work force has been accomplished, notably by the National Center for Education Statistics (NCES). However, the focus has not been specifically on those who choose to become mathematics teachers (as the NCES mission is to collect, report on, and analyze data relating to all areas of education; mathematics is only one of many areas of study).

In searching the literature, the goal was to find works that explicate the choice to become a mathematics teacher. By beginning with terms such as “recruitment”, “mathematics teachers”, and “teacher characteristics”, the following list of general categories of research was created. Because there was so little specifically examining mathematics teachers, literature was sought in the following categories, with the first-mentioned type in each bulleted point being the ideal, and the second being the type that was sought as a compromise (when the first was unavailable):

- Research on mathematics teachers, specifically, in addition to (or instead of) research on teachers in general
- Research on working teachers in preference to research focusing solely on prospective teachers (such as students majoring in education)
- Research on the recruitment and supply of teachers, rather than on the recruitment and supply of *effective* teachers
- Research on the characteristics of those who have made the choice to become teachers, rather than on the characteristics of quality teachers

In every case, research of the type *not* preferred was found in abundance. Much less of the type that was sought is presently obtainable. Therefore, this review must take on the form, metaphorically speaking, of a photographic negative. The topic will be explored with regard to what is missing rather than what is there.

Research on mathematics teachers, as distinguished from that on teachers in general, is heavily weighted toward aspects of teaching effectiveness. Certainly there is good reason for this: researchers intend, among other goals, to improve the quality of mathematics education. To this end, studies of classroom culture, teacher beliefs and values, teacher knowledge, professional development, and specific practices (such as small-group work) have proliferated, as can be seen in any perusal of leading journals in the field (such as the *Journal for Research in Mathematics Education*, and *School Science and Mathematics*.) The monumental NCTM *Handbook of Research on Mathematics Teaching and Learning*, (Grouws, 1992), is largely made up of authoritative articles on effective teaching practice. Though this emphasis is obvious given the work's title, the question of supply of mathematics teachers (effective or otherwise) might be expected to be touched upon. However, an inspection of the index, as well as the chapter titles, reveals no information on such topics as the recruitment or supply of mathematics teachers, and nothing on the choice to become one.

Interesting descriptive statistics on mathematics teachers (sometimes given in the form of comparison with other teachers) have been compiled by such bodies as the National Council of Teachers of Mathematics (NCTM) in its 2000 monograph *Mathematics Education in the United States---2000* (Dossey & Usiskin), and Horizon Research in its 2002 work *The National Survey of Science and Mathematics Education* (Smith, Banilower, McMahon, & Weiss). However, the information gathered (mainly on certification levels and requirements) has no direct bearing on the question of choice of career.

Research on the reasons behind the career choice of working teachers is sparse in relation to the body of research on choices made by students in colleges of education. It should be remembered that the group of education majors and the group of beginning teachers do overlap, but are not equivalent. Thus, studies that examine "why do you want to teach" for education majors may not be generalizable to the group of those who enter teaching.

Research on the systems of teacher recruitment, and of various models of supply and demand, has had different foci in different eras. In the 1979 Schalock study, then-current predictions of an oversupply of teachers led to an emphasis on selecting for effective teaching candidates. In the 1990s, predictions of long-term shortages led to a focus on recruitment in large numbers.

Research on characteristics of those who choose to become teachers has long been eclipsed by studies of characteristics of effective (or often, "quality") teachers. Frequently this takes the form of a focus on the question, "who is highly qualified to teach?"

The definition of “highly qualified” is the subject of much current debate, as can be seen from any casual perusal of the Internet. (An especially pertinent resource is Education Week Online, found at http://www.edweek.org.) The Office of Postsecondary Education of the U.S. Department of Education has attempted a definition of “highly qualified” in the 2003 publication, *Meeting the Highly Qualified Teachers Challenge* (US DOE, OPPI, 2003). This work cites research in support of the contention that the most important attributes of effective teachers are general cognitive ability, teaching experience, and content knowledge. Research was not found to support links between student achievement and the factors: training in pedagogy; practice teaching; attainment of a master’s degree, and being certified.

Whatever form might be taken by a future set of requirements meant to ensure effectiveness in those hired to teach mathematics (possession of a degree in mathematics being only one possibility), the chance of success in recruiting effective teachers can only be enhanced by better information on the question of characteristics of those who decide to become mathematics teachers.

Literature specifically targeting the paths to becoming a mathematics teacher is sparse. Information on such paths can be glimpsed in the more common studies of career path choices leading to so-called SMET (science, mathematics, engineering, and technology) employment of all types (including, but often not limited to, teaching). The focus of such studies is often the participation of women, and ethnic/cultural minority males (Adelman, 1998; Anderson, 1991; Huang, Tadese, Walker, & Peng, 2000; Stage, 2000; etc.).

Access to SMET careers by underrepresented groups is a research topic of great value; however, the emphasis in the present work is on the paths taken by all who became mathematics teachers. (Though the focus of this study is not gender or ethnicity, those characteristics are examined and reported on.)

The studies mentioned generally organize the concepts of progress toward a career under the term “pipeline”. The teacher pipeline, in particular, organizes graduates by the number of steps they have taken to become teachers (US DOE, NCES, 2001). The particular definition of “teacher pipeline” employed in the present study is given below, in the discussion of the dataset used.

The 1998 Adelman study *Women and Men of the Engineering Path: A Model for Analyses of Undergraduate Careers* provides an enlightening look at a career pipeline (in this case, the pipeline leading to engineering careers). This researcher would like to follow Adelman in referring to career “paths” rather than “pipelines”; as he points out:

> The metaphor of “paths” is a far more flexible and accurate way to describe student histories than “pipelines”. We cannot micromanage choice, and judge a system to be deficient because students are constantly exploring, acquiring, and changing academic identity. “Pipelines” with “leaks” are convenient metaphors of institutional policy, but they neglect the texture of student histories, and the nature of the paths students discover, sometimes with many detours. What we can do is to improve the signs along the pathways… (p. xii)

(However, when referring to prior research which employed the term “pipeline”, that terminology will, of course, be preserved in the present discussion.)

Adelman took advantage of a notable feature of the dataset he was using, the NCES’s *High School & Beyond* (HS&B), which began in 1980 with about 14,000 high school sophomores, and followed their academic and labor market histories for thirteen years. For about 8,400 of the original participants, there exist not only demographic and survey data, but also transcripts from both high school and college. The NCES has organized transcript data in English, science, mathematics, and foreign language into levels. These levels are based on the “normal progression and difficulty of courses within these subject areas. Each level includes courses either of similar academic challenge and difficulty or at the same stage in the progression of learning in that subject area. In the mathematics pipeline, for example, algebra I is placed at a level lower in the pipeline hierarchy than is algebra II because algebra I is traditionally completed before (and is generally less academically difficult or complex) than algebra II” (US DOE, NCES, 2003, p. 201).

The NCES system allows the researcher to tally the percentage of graduates who completed courses at each level, permitting comparisons of the percentage of high school graduates, in a given year, who reach each of the levels. A comparison among different years’ graduating classes is also possible. Courses are coded according to the NCES’s Classification of Secondary School Courses (CSSC); they are assigned to broad groups, forming the academic levels of the pipeline for each subject area. This system has allowed research to find significant differences between highest level of academic courses completed, and scores on academic achievement tests (US DOE, NCES, 2003).

Adelman chose to study, in the aforementioned monograph, the career paths of women who became engineers. His focus was on those (both men and women) who crossed the “engineering threshold”, which consists of a collection of undergraduate courses, without which no student can complete a degree in engineering. He then followed the group who had crossed the threshold, finding that they fanned out into subgroups: those who became engineers, those who made their careers in some other SMET (science, mathematics, engineering, and technology) field, and those who did not end up in a SMET career.

This study takes the opposite tack. Instead of beginning with students who take certain courses and seeing what becomes of them, this study takes those who became mathematics teachers and works backwards, as it were, to see what paths they took to reach that goal.

Two reasons underlie this direction for the work. First, there is no mathematics-teacher equivalent for the “engineering threshold”. An engineering major involves very specific coursework; by contrast, mathematics teachers can arrive at their careers from several majors. Mathematics or education may be the most common, but anyone with a certain amount of mathematics in his or her transcript can be hired as a mathematics teacher (at least provisionally). The group of “engineering threshold” students was small in relation to the entire HS&B sample; the number who could potentially become mathematics teachers is too large to be of use.

A study which, like the present work, begins with teachers and works backward is the 1996 NCES report *Out of the Lecture Hall and Into the Classroom: 1992-93 College Graduates and Elementary/Secondary Teaching, With an Essay on Undergraduate Academic Experiences* (US DOE, NCES 96-899) (referred to hereafter as *Out of the Lecture Hall*). This study examined the question of 1992-93 Bachelor’s degree recipients’ activities in the areas of undergraduate experience, graduate education, and labor market participation, at the (approximate) one-year mark after graduation. As the title implies, the focus is on the question of entry into the “teacher pipeline”. (The follow-up NCES Statistical Analysis Report, the 2000 *Progress Through the Teacher Pipeline,* is described below.)

The concept “teacher pipeline” was used to guide data collection in the dataset upon which the report *Out of the Lecture Hall* was based, the aforementioned Baccalaureate & Beyond Longitudinal Study (B&B:93/97). As mentioned in connection with careers in engineering, which require a fairly rigid course sequence, circumscribed by the specialized needs of the profession, those who enter a career in teaching can approach it by many differing paths. Therefore, to study the backgrounds of those who teach, a more inclusive set of criteria is needed than when studying those who become engineers.

Another aspect of the teacher pipeline concept stems from the relative ease with which college graduates may enter or leave teaching (Provasnik & Dorfman, 2005). The concept of certification, while meant in theory to impose controls on this process, in practice is undercut by a variety of means (such as emergency certification, alternative certification, time-limited permissions for teaching out of field, etc.). And certification is generally moot in the case of private school teachers (Seastrom, 2003).

Yet another phenomenon which should be accounted for in the teacher pipeline concept is the time elapsed between receipt of degree, and entry into teaching; time is a factor, too, in the question of how long an individual teaches before choosing to leave the profession.

For both these 1996 and 2000 NCES studies, those who had taught before completing the 1992-93 bachelor's degree were excluded, as:

> These graduates had, at the time they received their degrees, already entered the teacher pipeline and had varying experiences of it at different points of time. So as not to confound decades-old experiences of teaching or teacher preparation with contemporary experiences, it was important to be able to distinguish new from previous entrants….Overall, of those who received bachelor's degrees in 1992-93, only about 3% had taught before obtaining their 1992-93 degrees or had been certified 1 year or more before receiving these degrees. (US DOE, NCES 96-899, p. 6)

Teacher pipeline participants were defined in both studies as those who have reported any combination of these criteria: considered teaching, or completed a student-teaching assignment, or received a teaching certificate at "the probationary level or higher (that is, not an emergency or temporary certificate), applied for at least one teaching job, or taught in any of grades K-12" (US DOE, NCES 2000-152, p. 5).

As will be discussed, the present work uses a narrower definition of “teacher” than that of “teacher pipeline”, classing as “teachers” only those who actually worked as a classroom teacher in the period covered by the dataset utilized (which, in common with both *Out of the Lecture Hall* and *Progress,* is the B&B 93/97). However, the conclusions reached by both NCES Statistical Analysis Reports on characteristics of those who were in the teacher pipeline are suggestive, and form the primary basis for the present researcher’s choice of variables to study. Furthermore, the findings detailed in both Reports are based on the same dataset utilized in the present research; many results concerning the groups “teachers” and “nonteachers” are directly relevant to this study. For these reasons, the pertinent findings of both NCES works are reported here.

By the time of the 1994 B&B First Followup survey, 26% of 1992-93 bachelor’s degree recipients had entered the teacher pipeline; this number includes those who had actually taught, had prepared to teach, or were considering a teaching career. Women were more likely to be in the pipeline than were men. The racial/ethnic characteristics of those in the pipeline differed from those not in the pipeline: the pipeline had a higher representation of black, non-Hispanic graduates (8% in the pipeline versus 5% in the non-pipeline group), and a lower representation of Asian/Pacific Islander graduates (2% in the pipeline, as opposed to 6% in the non-pipeline population). Graduates in the pipeline earned less than graduates not in the pipeline, with pipeline participants significantly less likely to have earned incomes above $25,000 per year. Those in the pipeline group were more likely than non-pipeline graduates to come from families in which parents’ education level was lower:

> Among those who were in the teacher pipeline, those who applied for teaching positions were more likely than those who did not apply to come from families where neither parent had pursued education beyond high school (36% versus 30%). {t=2.57, k=1, cv=1.96} Similarly, those who applied for positions were less likely than those who did

> not apply to come from families where at least one parent had earned an advanced degree (23% versus 28%). {t=2.5, k=1, cv=1.96} (US DOE NCES 96-899, p. 49)

The *Out of the Lecture Hall* researchers found that "the amount of time between graduates' entry into postsecondary education and receipt of the bachelor's degree was not associated with their teaching status" (p. 57). However, a difference in number or credits earned towards those degrees was found, by amount of inclination to teach: "Those who taught or only prepared to teach earned between 140 and 142 credits, compared with the 133-135 credits earned by those who were only considering teaching or who were not in the pipeline" (p. 57).

The *Out of the Lecture Hall* authors found that "in general, new teachers began their postsecondary careers in and graduated from the same types of postsecondary institutions as other graduates" (p. 17). Specifically, they found that:

> Most graduates first attended a 4-year institution after high school: 55% began in public 4-year institutions, 28% in private 4-year institutions, and 17% in less-than-4-year institutions. These proportions did not vary with graduates' interest in teaching, and varied little with their undergraduate fields of study. (p. 19)

The likelihood of teaching in a public school as opposed to a private one was found to be associated with the type of college first attended: "whereas more than one-fifth of new graduates who taught in public schools first attended less-than-4-year institutions, about one-tenth of their classmates who taught in private schools did" (p. 19).

Academic achievement for those in the teacher pipeline, as reflected in scores on standardized college entrance examinations, was found to be lower at all stages of the pipeline than that of those graduates not in the pipeline. Specifically, those who had considered teaching, had prepared to teach, or had actually taught were all more likely to score less well than those who did not fall into any of those pipeline groups: "at each step toward a long-term career in teaching, those who were more inclined to teach scored less well than those less inclined.: (p. 21)

Conversely, achievement as reflected in grade point averages (GPA) was found to have a positive association with membership in the teacher pipeline: “teachers and those who had only prepared to teach had higher cumulative GPAs than did both those who had not entered the pipeline and those who were only considering teaching” (p. 23). Education majors were found to have higher cumulative GPAs than majors in all other undergraduate categories except humanities.

This contradictory finding—that those who teach, or even are simply inclined to teach, are likely to have both higher GPAs and lower CEE scores than their non-teaching peers, has been found in several studies (Abell Foundation, 2001). This observed discrepancy has led to suggestions that GPAs are a less useful measure of achievement, and that “teachers…had higher GPAs not because they achieved more academically but because the courses they took in college were less rigorous than those taken by other college graduates” (US DOE, NCES 96-899, p. 23). This question of relative rigor may be difficult to assess objectively; however, it could be argued that a nationally standardized test such as the SAT gives better information about academic achievement than do grades, which are not easily compared from institution to institution, from course to course, or even from professor to professor.

In view of these drawbacks to using the GPA as a measure of achievement, the *Out of the Lecture Hall* researchers examined actual coursework undertaken by those in the teacher pipeline, as contrasted with those not in the pipeline. Information on pipeline graduates who were education majors was also analyzed.

On the question of remedial course taking, they found:

> There was only a 3% difference between pipeline and nonpipeline graduates in the proportion who had taken precollegiate mathematics, no difference in the proportion who had taken remedial English, and no differences between teachers and their classmates outside the pipeline. However, those who majored in education were more likely than

> those who majored in other fields to take remedial courses in both mathematics and English. (p. 28)

On the question of course taking in advanced mathematics, the researchers found a difference in the likelihood of earning at least some such credit by pipeline status (with about one third of nonpipeline graduates having done so, as compared with only one fifth of pipeline peers); a difference for education majors versus others, with education majors less likely to have the advanced mathematics credits; and no difference for secondary school teachers as compared with nonpipeline graduates to have earned the credits. Grades earned in such courses were not found to vary by teaching and/or pipeline status.

By contrast with advanced mathematics course-taking, “the proportion of graduates who earned credit in science or engineering did not vary with teaching status” (p.31). Grades for pipeline versus nonpipeline graduates were about the same. However, those who taught were likely to have fewer credits (averaging 12) in science or engineering than those in all other groups, with those outside the pipeline averaging 20 credits, and those classed as only considering teaching, who averaged 17 such credits.

The 2000 NCES Statistical Analysis Report *Progress Through the Teacher Pipeline: 1992-93 College Graduates and Elementary/Secondary School Teaching as of 1997* (US DOE, NCES, 2000), hereafter *Progress,* is the follow-up to *Out of the Lecture Hall.* It continued the examination of the question of 1992-93 college graduates’ choices in the area of career preparation and labor market experience, this time about four years after graduation.

As with *Out of the Lecture Hall,* those studied met the researchers’ definition of “teacher-pipeline-eligible”. As before, this meant that the graduates had done one or more of the following: had taught in an elementary or secondary school; had become certified to teach; had applied for a teaching position; or were considering teaching. By 1994, the researchers found, 26% of the 1992-93 bachelor's degree recipients had entered the teacher pipeline. By 1997, four years after degree completion, 36% had done so. The proportion of graduates who had taught increased from 8% in 1994 to 13% by 1997.

The findings indicated that many graduates who teach in the years immediately after graduation do not plan to make a career of teaching. (As the researchers point out, this may be true for other professions as well; the phenomenon has not been well studied.) The implication is that "educators and policymakers who want to improve teacher retention rates may need to address undergraduate career development more generally in addition to teachers' professional preparation, working conditions, and support" (US DOE, NCES, 2000, p. x)

The researchers found that white, non-Hispanic graduates were more likely than minority graduates to teach. These findings suggest that the proportion of minority teachers will continue to be smaller than the proportion of minority students, unless trends change. Such a discrepancy is a concern of many parents, as well as educators; a 1998 NCES study found that whites have constituted about 90% of the teacher work force for nearly 30 years (Riley, cited in US DOE, NCES, 2000, p. 11).

Graduates with higher college entrance exam (CEE) scores were much less likely to teach, while graduates with higher college grade point averages (GPAs) were more likely to teach. This is partly explained by the finding that education majors, who were more likely to teach than were graduates receiving degrees in other majors, tended to have higher GPAs. Education majors had lower college entrance exam scores than did students with other majors.

By 1997, four years after graduation, 55% of education majors had applied for a teaching position, as opposed to 12 to 30% of graduates with other majors. The breakdown of majors used by the researchers, and the corresponding percentages of those with that major who had applied for a teaching job, are:

- Education……………………………….55.1%
- Humanities………………………………30.4%
- Social sciences……………………….....25.5%
- Math/computer/natural sciences………...20.5%
- Other majors…………………………….12.8%
- Business/management…………………..12.1%

Women were more likely than men to teach; women were more likely than men to have a cumulative GPA of 3.5 or higher (in all coursework), and less likely than men to score in the top quartile of CEE scores. These gender differences, the researchers point out, could explain in part the divergent CEE and GPA finding. Consistent, also, is the finding that secondary-level teachers are more likely than elementary-level teachers to be men, and also are more likely to have scored in the top quartile of the CEE score distribution than are elementary teachers.

About the greater likelihood of women to teach, the researchers point out: "Although it is not perceived as an urgent policy issue, the dominance of women in teaching has also persisted over time" (p. 11).

This observation highlights a difference between the present study and the 1996 *Out of the Lecture Hall* and 2000 *Progress* reports on the Baccalaureate & Beyond study just discussed: when mathematics teachers are considered apart from teachers as a whole, all or most of the numbers in the above-mentioned findings are changed. The descriptive statistics presented in earlier studies for teachers as a whole, are herein examined for those who teach mathematics.

CHAPTER THREE: METHODOLOGY

The dataset employed in the present study is the 1993 *Baccalaureate and Beyond Longitudinal Study* (B&B:93/97), compiled by the National Center for Education Statistics (NCES). This massive study details the post-baccalaureate experiences of about 11,200 men and women who received bachelor's degrees between July 1992 and June 1993; the respondents were first contacted during the 1993 National Postsecondary Student Aid Study (NPSAS:93). The focus of data collection was "adult decisions" such as academic enrollments, degree completions, employment, and public service. Data gathered on these individuals include college transcripts, labor market histories, post-baccalaureate enrollment, demographic information, and qualitative items such as career aspirations, parental support, and satisfaction with schooling and with work. The focus was on participation and progress in the labor force, with an emphasis on perceived returns on the investment involved in acquiring a bachelor's degree.

Three surveys have collected follow-up data from participants: the B&B:93/94, the B&B:93/97 and the B&B:93/03. A total of 9,274 participants, 83% of the original sample, responded to the first three rounds of the study (the initial NPSAS:93, the 1994 First Follow-up, and the 1997 Second Follow-up). This is referred to as the "B&B panel sample". This group is the base sample of the analyses described in the present study.

The rationale for the B&B study, an examination of the returns on the investment committed by the students, by their families, and by private and public sources of financial aid to the earning of a bachelor's degree, helps explain the types of variables on which information was collected. Large sections of variables were devoted to such topics as community service, experiences with financial aid, and the choice to enroll in post-baccalaureate education. All these are highly relevant to the question of return on the investment that went into attainment of a bachelor's degree, but less so to the question of contributions to the outcome of becoming a mathematics teacher. However, a substantial portion of the variables do describe the experiences of those who chose to teach at the kindergarten to 12th grade level; these variables are the basis of the present research.

As described in the 1996 *Baccalaureate & Beyond Longitudinal Study: 93/94 First Follow-up Methodology Report* (US DOE, NCES, 1996, p. 3):

> B&B:93 examines the rates of return from postsecondary education from the perspectives of both the individual and society….Another important feature of the B&B:93 program is that the sample has been designed to facilitate the study of elementary and secondary school teaching careers. Data from B&B:93 will be used in the monitoring of supply and demand characteristics of the labor market, and career patterns of teachers, including movements into and away from this profession over time. Many…issues…concerning initial aspirations and expectations versus ultimate decisions, will be examined. Additional considerations include measuring quality, noting comparative values, and measuring monetary returns to teaching.

The B&B was designed to produce results which could be generalized, and the sample was constructed accordingly. The *First Follow-up Methodology Report* provides a detailed look at every step of this process, as summarized here (US DOE, NCES, 1996, pp. 4-5):

> Baseline data for the B&B:93 cohort were collected as part of the National Postsecondary Student Aid Study (NPSAS:93). The first follow-up interview (B&B:93/94) collected information from respondents one year after they received their bachelor's degree….The B&B:93 cohort comprised approximately 12,500 individuals who were determined, in NPSAS, to be potentially eligible for follow-up in 1994….The NPSAS:93 survey employed a stratified multi-stage sample design with postsecondary institutions as the first-stage unit and students within schools as the second-stage unit. The institution sample was stratified by type of control (private vs. public), highest degree offered, size of enrollment in professional programs, graduate student enrollment, and the number of bachelor's degrees awarded in education. The target population for NPSAS:93 contained nearly all postsecondary institutions in the 50 states, the District of Columbia, and Puerto Rico.

The B&B sample was designed to be nationally representative, but, as discussed, is not a simple random sample. The three-step procedure employing stratification resulted in differential probabilities of selection at each level. Therefore, analyses in the present study are weighted to compensate for the unequal probability of selection into the B&B sample, and to adjust for nonresponse. A detailed discussion of the creation of the weighting variable used here may be found in the *First Follow-up Methodology Report* (US DOE, NCES, 1996).

Definition of "Teacher"

As mentioned in the introduction, this study does not follow the use of the concept of "teacher pipeline" employed in the two major NCES Statistical Analysis Reports covering teachers in the B&B: *Out of the Lecture Hall and into the Classroom* (US DOE, NCES, 1996) and *Progress Through the Teacher Pipeline* (US DOE, NCES, 2000). However, the concept deserves further explanation, in order that a reasonable explanation of why it isn't being employed in the current study can be advanced.

In the reports mentioned above, the total sample was split by the concept of eligibility to teach. "Eligible" is defined to mean that the participant had received a bachelor's degree, but had not taught or been certified to teach one year or more before receiving the degree. Such non-eligible participants are about 3% of the total 1992-93 graduates in the dataset; these graduates were excluded from analysis in the 1996 and 2000 reports.

To be classified "in the teacher pipeline", graduates had to be "eligible" and one or more of the following had to be true:

- graduates reported that they had taught in an elementary or secondary school
- graduates had become certified to teach
- graduates had applied for a teaching position

- graduates had completed a student-teaching assignment as an undergraduate
- graduates were considering teaching at the time of either the 1994 or 1997 follow-up interview (DOE, 2001, p.207).

Only the first characteristic in this list fits the present study's definition of "teacher." The rationale for this restriction is the importance of examining the ways in which characteristics of those who actually taught mathematics differ from those of graduates who did not teach that subject. Including in the classification "mathematics teachers" the group of graduates who merely reported considering doing such work, or applied for a teaching job, or became certified, or student-taught—as opposed to those who did indeed work as mathematics teachers—would not accomplish the goal of this study. Therefore, the concept of the teacher pipeline was not employed.

The choice of a variable to divide the 1992-93 graduates into the groups "mathematics teachers", "science teachers", "teachers of K-12 fields other than mathematics or science", and "non-teachers" was no simple task. The B&B dataset contains hundreds of variables which touch on the employment experience of the graduates. The ideal variable would distinguish between teachers who teach mathematics for only part of their work day (as is true of most elementary school teachers) and those who spend most of their days teaching mathematics; yet not exclude teachers who do that most-of-the-day teaching of mathematics in elementary schools.

The reason this was a goal is that several studies (Darling-Hammond & Sclan, 1996; Ishler, Edens, & Berry, 1996; Freeman, Martin, Brousseau, & West, 1989) have found a pattern of differences between secondary school teachers and elementary school teachers, a pattern that exists no matter what the field the secondary-level educator teaches might happen to be. Thus, dividing the groups into “secondary mathematics teachers”, “secondary science teachers”, “non-teachers”, and “all elementary school teachers plus secondary teachers in fields other than math and science” would subject analyses to the possible interpretation that the differences found are due in part to the historically-observed secondary versus elementary difference. Because the goal is to distinguish those who teach mathematics from others, it would be counterproductive to muddy the analysis with considerations of the differences between all secondary teachers and all elementary teachers.

It was therefore deemed desirable to avoid the secondary/elementary divide by including in the group “mathematics teachers” those at the elementary level who teach mathematics for most of their workday. This restricted the choice of possible grouping variables.

Another consideration was that in the four-year period under study (1993-1997), some people may have taught (mathematics or any other field), but might not have been teaching at the time of the 1997 survey. Ideally, it would be useful to have as complete information as possible about the detailed employment patterns of every person who taught mathematics at all during that period. Studying who became a teacher when, and for how long, would be of great interest. However, given that this present study is a doctoral dissertation and not a multi-volume work, it was found to be impractical to identify and analyze the relevant aspects of the post-baccalaureate lives of all those who ever entered or left mathematics teaching. While this would make for a very interesting and potentially valuable research project, it would perhaps be fatally compromised by the fact that each of the groups that would result (for example, those who taught for six months, those who taught for one year, those who taught for 18 months, etc.) would have too few members for statistical analysis. The most reasonable solution to this probable difficulty was to study, as a single group, all those who taught mathematics at all during the study period.

Fortunately, among the more than five thousand variables on which the B&B creators gathered information, was one, “B2FIELD”, which asked graduates what was the field in which they taught most recently. This wording meant that anyone who had taught during any portion of the 1993-97 period would be classed as a teacher. It should be noted that some who might have taught mathematics at some time in the study period might have taught some other field “most recently”, and thus would miss out on being part of the “mathematics teachers” group. Nevertheless, this variable came as close to ideal for this study as was possible.

Choice of Variables

The next task was to identify those variables most relevant to the questions being considered. As mentioned, thousands of variables were recorded for each of the participants in the B&B study. A description of the mathematics teachers, as well as of each of the other three groups (science teachers, other teachers and non-teachers) using a judicious selection of the thousands of variables recorded for each individual, has the potential to provide a foundation for the goal of describing the groups in practical terms which might be of use to those responsible for recruiting additional mathematics teachers.

However, as discussed, complete analysis of over five thousand variables for each of the more-than-nine-thousand participants is not practical in the context of a doctoral dissertation; furthermore, many of the variables are not of potential use in the context of teacher recruitment. For instance, those targeting certain groups for informational campaigns would not be able to ethically or practically aim their efforts at people who married or divorced at a certain age, had children at a certain age, participated in certain types of volunteer work, or owed certain amounts of money on their spouse's student loans---all topics on which the B&B gathered data. The question was how to choose variables so as to create an accurate yet serviceable portrait of each of the groups, as they differ from one another, with a view towards utility for recruiting efforts.

The present research follows some of the previously mentioned studies in grouping variables according to conceptual categories. For each, two to five variables have been chosen. Sullivan & Feldman (1979) point out that "since abstract concepts are by definition not capable of being directly reduced to observable events or characteristics, we must then develop indicators of these concepts that are grounded in the empirical world and that may, as a result, be tested….But specifying such indicators is not always a simple matter…selecting an appropriate indicator for any particular concept is far from a purely logical exercise" (p.10). This process might not be purely logical, but can be guided by both a common-sense assessment of the goals of the research, and by what past researchers have done.

In choosing the variables to be examined, this author was guided by previous studies that have attempted to characterize those who become teachers. As mentioned, such studies do not yet exist specifically for individuals who enter mathematics teaching (which is a large part of the rationale for the present study). Studies of characteristics of working mathematics teachers, especially with a focus on what characteristics make teachers effective, are not uncommon. But that is not the topic under consideration here. The difference might be described through an analogy: A study of the top thirty movie stars, in terms of box office receipts, might well reveal that a common characteristic of these people is good muscle tone. Does that mean that every individual with good muscle tone will become a movie star? Obviously, no. It is also the case that not every movie star has good muscle tone. So, having good muscle tone is not an adequate predictor of the likelihood of becoming a movie star, though there may be some association between the predictor variable and the outcome. In the same way, characteristics of effective mathematics teachers may be shared by many other people who do not become mathematics teachers, and they may not be characteristic of all people who do become mathematics teachers. Thus the characteristics identified in studies of effective teaching of mathematics are not optimal choices for study of the outcome, “becoming a mathematics teacher”.

However, a small number of studies looking at characteristics of those who “become teachers” (in general) exist, and can provide clues as to which variables are most salient. Those studies which employed the same dataset used in the present research, the Baccalaureate & Beyond, were of particular interest.

For almost all of the characteristics which were used to describe teachers in the literature review of the present study, the B&B dataset contains several variables, each expressing another aspect or way of looking at the characteristic. This researcher was guided in the choice of which variable to use for the different traits by consulting the choices made by the authors of the NCES Statistical Analysis Reports which utilize the B&B: the aforementioned *Out of the Lecture Hall*(NCES 96-899) and *Progress Through the Teacher Pipeline* (2000-152), as well as *Life after College: A Descriptive Summary of 1992-93 Bachelor’s Degree Recipients in 1997* (1999-155), *Competing Choices: Men’s and Women’s Paths After Earning a Bachelor’s Degree* (2001-154), *From Bachelor’s Degree to Work* (2001-165), *Attrition of New Teachers Among Recent College Graduates: Comparing Occupational Stability Among 1992-93 Graduates Who Taught and Those Who Worked in Other Occupations* (2001-189), and *Beyond 9 to 5: The Diversity of Employment Among 1992-93 College Graduates in 1997* (2003-152). All these reports, including those not directly cited in the present study, are available from the NCES website **http://nces.ed.gov/.**

A 2000 NCES report, *Entry and Persistence of Women and Minorities in College Science and Engineering Education* (Huang et al, 2000), employs a different NCES dataset than does the present study, but was still a useful guide to the choice of variables to be analyzed. The dataset which that report uses, the NELS:88, does offer national survey data for studying postsecondary education, although it is not so focused on that topic as is the B&B. It is a larger dataset than the B&B, with 24,599 participants in the first year, 1988. Follow-up surveys were conducted in 1990, 1992, and 1994.

The *Entry and Persistence* study employed three constructs: family environment and support (made up of three variables), student behavior (made up of seven variables), and school factors (made up of two variables). The variables to be analyzed were found by “examining potentially relevant variables in two National Center for Education Statistics (NCES) surveys” (p. vii), the National Education Longitudinal Survey of 1988 (NELS:88) and the Beginning Postsecondary Student Longitudinal Study (BPS). Rationales for the choice of specific variables were along the lines of this discussion from Chapter 4: “Among family environment and support variables, parents’ educational attainment is widely accepted as a significant factor related to children’s educational attainment, though its effect on success in *specific subjects* is not clear” (p.73).

The study that is closest in intent to the present study, the 2000 NCES *Progress Through the Teacher Pipeline* (described in Chapter 2), employs 80 variables, sorted into the categories: academic characteristics, demographic characteristics, and teaching-related characteristics. The majority of the variables illuminate the subject of “leaks” in the pipeline; that is, the decisions that might lead a graduate towards or away from teaching as a career, such as reasons for not applying for, or not accepting, a teaching job; and characteristics of, and satisfaction with, particular conditions at the school employing the graduate. Of the 47 tables of estimates on which *Progress* is based, only three break down results according to K-12 subject field taught; and they treat mathematics and science teachers as a single group. The study emphasizes descriptive statistics. In some cases, two types of statistical procedures were employed: testing differences between means (using Student's *t* statistic), and analysis of variance (ANOVA), used to test for a linear relationship between two particular variables, when making comparisons across categories of those ordered variables that had three or more levels.

The present research follows the aforementioned studies in choosing variables which, it is believed, are most likely to provide a means of differentiating the groups "mathematics teachers", "science teachers", "other teachers", and "non-teachers". Divided into conceptual categories to organize the analysis, these are:

- Demographics, including gender and race/ethnicity
- Family environment, including parents' educational attainment, parents' income, dependency status of the graduate, and family financial support for graduates' college education
- Academic path, including type of high school, and type of first post-secondary institution attended, time from high school graduation to bachelor's degree, whether or not age was typical for bachelor's degree recipients, and major
- Academic achievement, including college entrance examination score, college grade point average, and number of mathematics credits earned.

<u>Descriptive Analysis</u>

The variables examined in this portion of the research were as follows, with each marked as to whether a categorical or continuous version was employed. NCES has taken many continuous-data variables and recoded them into a categorical format, sometimes by employing logical cuts in the continuous measure, and sometimes by recoding the information into a dichotomous format. For example, a continuous variable showing the dollar amount of financial aid given by parents to the graduate might exist also as a variable showing the dollars split into six intervals (making it categorical) or as yet another variable showing “received some financial support from parents” versus “received no financial support from parents” (making it a dichotomous categorical variable). In most cases where a choice existed in the dataset, a categorical version of a variable was chosen in preference to a continuous one in this descriptive portion of the present study. This was done to contribute to the clarity and readability of the results.

Brief descriptions of the variables used are presented here. The full descriptions and frequencies (provided by the NCES’s Data Analysis System [DAS] in the case of this descriptive portion of the study, and provided by the ECBW in the case of the raw data employed in the multivariate portion, can be found in Appendix B. Some variables not described here nevertheless appear in that Appendix, as the percentages their descriptions contain were used to provide demographic information about the graduates.)

The Demographic variables:

- Gender of student; categorical.

- Respondent ethnicity; categorical.

The Family Environment variables:

- Highest education level completed by either parent; categorical.
- Parents helped with loan or contribution. Equal to 1 if either student or parent reported that parent had given student money, either as a direct contribution or as a loan; dichotomous categorical variable with 0=no, 1=yes.
- Income and dependency level; dependency status and categorical income level (ten income levels for students classified as dependents of their parents, and six income levels for students classified as independent); categorical.

The Academic Path variables:

- Type of high school graduated from; public or private high school, and if private, was it a Catholic, other religious, or non-religious high school; categorical.
- First postsecondary institution attended; type of school the student first attended; created by looking for the earliest enrollment date from the sample school and any other school attended (before receiving the bachelor's degree at the sample school); categorical.
- Number of months from HS grad to BA; this composite calculates the number of months between the date a respondent graduated from high school and the date of BA receipt. If a respondent was missing either date, BATIME1 was set to missing (-2). In some cases, the value for BATIME1 was lower than 30 months; these cases were set to -3 (out of range). BATIME1 was calculated only for those students receiving their first bachelor's degree at the sample school; continuous.

- Age, typical/older classification; derived based on student classification and age. Freshman 20 or older, sophomores who were 21 or older, juniors who were 22 or older, and seniors who were 23 or older were classified assigned a value of 1, older. All others were assigned a value of 0; dichotomous categorical.
- Bachelor’s degree field recoded; B2BAMAJR identifies a respondent's undergraduate major field of study. The major codes were collapsed into 12 categories.

The Academic Achievement variables:

- Merged SAT and ACT score quartile; categorizes graduates into quartiles based on SATQTR2 and ACTQTR2. If graduates had a value > 0 on SATQTR2, that value was assigned to SATACTQ2. If graduates did not have a value > 0 on SATQTR2, but did have a value > 0 on ACTQTR2, the value on ACTQTR2 was assigned to SATACTQ2; 1=bottom quartile, 2=second quartile, 3=third quartile, 4=top quartile.
- Overall grades in undergraduate major; combines student-reported grade average in the major (GPAMAJ) with categorical responses to the CATI item asked only of students who were unable to supply an exact GPA (GRDSMAJ). Exact GPAs were mapped to categories as follows:

>374	1 Mostly As
325-374	2 As & Bs
275-324	3 Mostly Bs
225-274	4 Bs and Cs
175-224	5 Mostly Cs
125-174	6 Cs and Ds

<125	7 Mostly Ds or below

- Credits for all mathematics courses, in normalized credits; post-secondary; continuous.

Group and Weighting Variables:

The groups “mathematics teachers”, “science teachers”, “teachers in K-12 fields other than mathematics or science”, and “non-teachers” were determined by **B2FLD**, a DAS version of B2FIELD; the original codes and frequencies are given here. These were lumped for all analyses into the Groups: 1=mathematics teachers, 2=science teachers, 3=other teachers, and 4=non-teachers.

B2FLD: Main field taught in B97 recoded into:

Value	Percentage	Label
1	0.5	Art, drama, music
2	0.2	Business
3	4	Elementary, early childhood education
4	1	English, journalism, reading, writing
5	0.2	ESL, bilingual
6	0.5	Foreign languages
7	0.4	Health, physical education
8	1.2	Mathematics
9	1.1	Science
10	0.7	Special education
11	0.5	Social studies/sci, history, civics
12	0.3	Vocational, occupational

13 0.3 Other

-1 89.2 Missing Value

All analyses were run employing:

BNBPANEL: Panel weight for NPSAS and B&B; this is the panel weight for B&B:93/97, which is B0 adjusted for nonresponse (nonrespondents have PANEL2=0). The B0 is the B&B:93/94 weight, which in turn is the NPSAS :93 base weight post-stratified to baccalaureate degree control totals, by institution stratum (US DOE, NCES, 1999, p. 36). Panel respondents are those who responded to all three surveys: NPSAS:93, B&B:93/94, and B&B:93/97. Therefore, this is greater than 0 for only those persons who responded to all three surveys.

Descriptive Statistics

The variables chosen were developed into tables using NCES's Data Analysis System (DAS). These tables show, for each of the four groups (mathematics teachers, science teachers, other teachers, and non-teachers), percentage distribution according to group status by the selected characteristics mentioned above.

The DAS software (available to all online at **http://nces.ed.gov/das/**) enables users to generate their own tables from the B&B:93/97 data. It generates not only table estimates, but also standard errors and weighted sample sizes for the estimates.

The DAS does not give unweighted sample sizes; all estimates produced are intended to be interpreted as the percentage of all 1992-93 bachelor's degree recipients (in the case of the B&B) having the characteristic expressed in the variable that was entered into the analysis. Thus, the descriptive statistics produced in this report—as in all reports which analyze NCES datasets—refer to all American graduates from 1992-93, not simply to the sample (Smith & Ingersoll, 2004; Adelman, 1998; Huang, et al, 2000; US DOE, NCES, 1996; US DOE, NCES, 2000; US DOE, NCES, 2003-165; and so on). Although these analyses are considered to apply to the underlying population rather than to the sample, the present study follows NCES practice in using the terms "statistics" and "statistical procedures", rather than the terms "parameter" and "parametric procedures". This study also follows NCES practice in reporting all weighted sample sizes, along with standard errors, in an appendix (Appendix A).

National datasets such as those produced by NCES do not report on the sample for two main reasons: confidentiality and generalizability. Confidentiality was guaranteed to those who participated in the surveys, and protected by the Privacy Act of 1974, as amended; the National Education Statistics act of 1994, as amended; and the USA Patriot Act of 2001. Violation of confidentiality is considered to be a Class E felony, and persons who "knowingly publish or communicate any individually identifiable information will be subject to fines of up to $250,000, or up to 5 years in prison, or both" (US DOE, NCES, 2003-601R, p.74).

DAS produces only tables and matrices that have been edited so as to prevent any possible disclosure of respondent data. The present researcher has taken care to do the same with the analyses of the raw data that are reported here under the heading Multivariate Statistics. For example, where it is clear that only one or two respondents to the B&B survey fit a particular category (for instance, having majored in Dance), then no descriptions of variables applying to that category are given.

As mentioned, reports on NCES surveys do not describe their samples because of generalizability; these surveys were very carefully constructed, and weighting applied, so that any estimates produced from them would reflect the entire population of interest (in the case of the B&B, this would be bachelor's degree recipients in the school year 1992-93). Accordingly, studies employing these surveys generally refer to "graduates" (for instance) rather than to "participants", "subjects", or "respondents". The weighting procedure makes the results of analyses both more generalizable and more reliable. As Hahs-Vaughn stated,

> When the unit of analysis (i.e., an individual) is sampled with unequal probability of selection, the sample weight represents the number of units (i.e., individuals) in the population that each unit (i.e., individual) represents….Ignoring disproportionate sampling may result in biased parameter estimates and poor performance of test statistics and confidence intervals….The results of analyses from unweighted samples cannot be generalized to any population other than that which was included in the original sample (i.e., the finite population). In most cases, this defeats the purpose of using a dataset that is nationally representative of some underlying population. (2005, p. 224)

It should be noted that, as mentioned, the B&B sample is not a simple random sample, and therefore simple random sample techniques for estimating sampling error cannot be employed without adjusting for design effects. The DAS uses a method for computing sampling errors involving approximating the estimator by the linear terms of a Taylor series expansion. This is usually referred to as the Taylor series method. A consequence of the use of this method is that there must be a minimum of 30 valid cases for a reliable estimate to be produced; if fewer valid cases exist, the system produces the notation "low n" instead of a numerical estimate. In the present study, this situation was encountered most often when graduates were examined by race/ethnicity (with the group "American Indian/Alaska Native" always being too small for the DAS to produce reliable estimates; accordingly, this group is not shown in the tables which display results by ethnicity).

The DAS requires users to specify whether variables should appear in rows or in columns. Because the focus of this portion of the study was to describe how the values of the differing levels of a variable affected the outcome of becoming a mathematics teacher, most analyses were run with the predictor variables as the row variables, and the outcome variable

Group as the column variable. This allowed testing of significance between the different levels of the predictor variables. However, in order to describe the graduates by group on their demographic characteristics, some analyses were run with Group as the row variable, and the predictor demographic variables as the columns.

An illustration of the difference is that using Group as row and Major as the column variable, one obtains results that could be stated “44.9% of those who taught mathematics during the study period had majored in Education, and only 27.5% of the mathematics teachers had majored in Mathematics.” By contrast, when using Major as the row variable and Group as the column, results of the analysis indicate that “4.9% of Education majors taught mathematics during the study period, and 6.9% of the Mathematics majors did the same. Mathematics majors were not significantly more likely to teach mathematics than were Education majors.”

In order to examine differences in the effects of different characteristics on the likelihood of becoming a mathematics teacher for men as compared with women, and for various ethnic classifications as compared among themselves, analyses were also run using DAS’s ability to split results with the “span” command. Those which revealed a pattern of differences (whether or not such differences were found to be statistically significant) are reported herein.

It should be noted that these results were arrived at using the most conservative procedures possible; the DAS’s automatic adjustment for effects of the design of the survey result in standard errors of the estimates which are larger than they would be if no adjustment were made. The result is that *t*-tests are less likely to produce test statistics that are greater than the critical value (always derived using alpha=.05 in this study). Thus, the adjustment means that it is much less likely that significant differences will be found (or that the null hypothesis of no difference would be rejected), than if no adjustment were made. This reduces the chance of committing Type I error (that of concluding a difference exists when, in fact, it does not).

Multivariate Analysis

Discriminant analysis was determined to be the correct type of multivariate analysis for this research, given that the goal was to "devise one or more predictive equations to maximally discriminate people in one group from those in another group" (Leech, Barrett, and Morgan, 2005, p.119). In essence this technique combines the predictor variables into a new variable, called the discriminant function; each case (or participant) in the dataset is assigned a score on the function which, in a successful analysis, separates the cases into groups. Or in other words, the functions are determined in such a way that cases in the same group will have similar scores. With discriminant analysis, there will be one fewer function than the number of groups; for this research, three functions were obtained. The functions are derived in way "analogous to the maximization procedure in multiple regression, where the regression equation was designed to maximize predictive power" (Stevens, 2002, p. 308).

In the present study, the four groups of interest were: those who taught mathematics at the kindergarten to 12^{th} grade level sometime within the study period of 1993 through 1997; those who had taught science within the period; those who had taught something other than mathematics or science; and finally those who had not taught at all. Discriminant analysis requires that all groups be mutually exclusive; all participants in the dataset were classifiable into one, and only one, of these four groups by means of the variable “B2FIELD”, which had to be recoded in order to create the groups (with “1” representing mathematics teachers, and so on.)

The first task was to pull the variables of interest into an SPSS dataset. As discussed in the previous section of this chapter, the types of variables to be examined were determined from a search of the literature, with an emphasis on works which have employed the same dataset, the NCES Baccalaureate & Beyond. The guiding principle in considering whether to use a variable that appeared in one of these studies, or in the dataset, was that only variables which might be made practical use of in recruitment efforts should be analyzed. Thus, for example, variables such as those having to do with spousal income, volunteer work, or the timing of the birth of graduates’ children were not considered for inclusion in the analysis.

Many variables on which data were gathered for the B&B exist in both categorical and continuous form. As discussed earlier in this chapter, for the most part the categorical versions were chosen for the descriptive portion of the present study. However, for the purposes of performing discriminant analysis, it is desirable that as many variables be of the continuous type as possible. It proved possible to find seven of the original categorical variables used here in continuous versions (in all cases, the data had been gathered in continuous form and then had been cut into categorical form for the convenience of researchers). These continuous versions were those entered into the discriminant analysis. The categorical variable GENDER was dummy-coded and included in that form, as according to Huberty (1994, p. 151):

> …ordered two-category, ordered multicategory, and unordered two-category, are easily handled by transforming them to a form that is adaptable for normal-based analyses. A binary or dichotomous variable can be scaled (or metricized or calibrated) by using a 0-1 assignment. It has been shown…that this scaling is optimal….Thus, for a variable such as Gender, the value for male could be 0, and that for female, 1.

The variables employed in the multivariate analysis were as follows, with the groups determined by **B2FIELD** (which was recoded as described above into the four groups, with mathematics teachers as 1, and so on). All analyses were weighted according to:

BNBPANEL: Panel weight for NPSAS and B&B; this is the panel weight for B&B:93/97, which is B0 adjusted for nonresponse (nonrespondents have PANEL2=0). Panel respondents are those who responded to all three surveys: NPSAS:93, B&B:93/94, and B&B:93/97. Therefore, this is greater than 0 for only those persons who responded to all three surveys.

(As noted in before the brief descriptions of the variables used in the descriptive portion of this study, full versions of the descriptions and frequencies for all these variables are provided in Appendix B.)

The categorical variable:

- Gender of student; recoded in dummy fashion as 0=female, 1=male.

The nine continuous variables:

- ACT score; This composite variable replaces ACT and ACTSCORR, which were included in the DAS's for B&B:93/94. It combines information from graduates' records at the NPSAS institution and self-reported scores. (ACTSCOR2)
- SAT score; this composite variable replaces SATTOTAL and SATSCORR, which were included in the DAS's for B&B:93/94. It combines information from ETS, the company that administers the SAT; graduates' records at the NPSAS institution; and self-reported scores. (SATSCOR2)

- Age at college entry; this composite calculates a respondent's age when he/she entered college. The age was calculated by subtracting date of birth in months from date of college entry in months and dividing by 12 to obtain years. (AGECOLL)
- Credits for all mathematics courses, in normalized credits; post-secondary. (TCRED11Z)
- Cumulative undergrad GPA. (CUMULGPA)
- GPA in undergraduate major. (GPAMAJOR)
- Number of months from HS grad to BA (BATIME1)
- Total income (parents and independent students); Total income (continuous) parents and independent students. Total family income from the 1991 calendar year (continuous); equal to DEPINC if the student was dependent and INDEPINC if the student was independent. (CINCOME)
- Total direct contribution from parent; student-reported amount of direct monetary contribution from both parents together for AY 1992-93 school expenses. (SPARSPRT)

These ten variables were tagged, and the resulting syntax was run. The weight was applied, and the grouping variable Group was created by recoding B2FIELD as described above.

Next, several tests were run to check that the assumptions necessary for an optimal discriminant analysis were satisfied for this body of data. A case processing summary was produced to look for missing values; the B&B is a very carefully constructed dataset, and 99.8% of the cases were found to be valid.

SPSS's Explore function was used to look for extreme scores and outliers in the predictors, by examining the distributions of those predictors within the different categories (mathematics teachers, science teachers, other teachers, and non-teachers) of Group. Box plots and stem-and-leaf displays were obtained. Several variables did display outliers, most notably BATIME1 (time from high school graduation to receipt of bachelor's degree). Normal Q-Q plots showed that some variables had distributions that approached normality (TCRED11Z, CUMULGPA, CINCOME, ACTSCOR2, and SATSCOR2), while others departed from normality fairly notably (SPARSPRT, AGECOLL, GPAMAJOR, and BATIME1).

To get an idea about possible problems with multicollinearity, and to check on satisfaction of the assumption of linearity, matrix scatterplots were run. It was not possible to obtain them for more than seven variables at a time, and therefore the results were suggestive rather than conclusive. The scatterplots did not exhibit the completely evenly distributed "clouds" of data points that would have been ideal as a hedge against the possibility of multicollinearity, but no lines could be well-fitted in the plotted points between any two pairs of variables examined. (However, Box's M was also run, and this did indicate that the assumption of homogeneity of variance-covariance matrices is not supported for this data.) One encouraging sign was the fact that no clusters of points appeared to form curves; this was taken as a sign that the assumption of linearity for this data is not violated.

As Leech, et al. wrote (2005, p.119),

> Discriminant analysis is, however, fairly robust to these assumptions, although violations of multivariate normality may affect accuracy of estimates of the probability of correct classification….It is also important that the sample size of the smallest group exceed the number of predictor variables in the model.

In the present study, the smallest group is 140 cases (and this number increases because of the weighting employed). Accordingly, the variables were entered into the SPSS discriminant analysis; because of problems inherent in the stepwise method of entry of variables, the option "enter independents together" was chosen.

Cross-validation of the results was accomplished through SPSS's "leave-one-out" procedure, in which each case is classified by the functions derived from all cases other than that case. According to the *SPSS 12.0 Statistical Procedures Companion* (Norusis, 2003, p. 296):

> Because models almost always fit the data from which they are estimated better than the population, you know that 74.8% [referring to an example in the text] is an overly optimistic guess for the percentage of correctly classified cases. If you applied the model to another sample from the same population, you would expect a smaller correct-classification rate. One way to estimate the true correct-classification rate is to predict the group a case belongs to when the case is excluded from the computation of the discriminant function. You can exclude each case in turn and then compare the observed and predicted groups. This is called leave-one-out validation….In leave-one-out classification, only the omitted case is reclassified.

Results of the cross-validation are given in tandem with the classification results of the original discriminant analysis. As might be expected from the nature of the procedure, the cross-validated percentages of groups correctly classified, along with the overall percentage of cases correctly classified, will always be smaller than or equal to the original discriminant analysis results.

CHAPTER FOUR: FINDINGS

The results of this study are presented in terms of the four conceptual categories utilized as an organizing scheme, with the goal of describing the way the variables making up the categories were distributed among the four groups studied: those who taught mathematics sometime during the period of study (1993-1997), those who taught science, those who taught some other K-12 field, and those who did not teach.

Descriptive Analysis

The dataset was examined by means of a conceptual framework employing four general families or types of characteristics. These four categories were:

- **Demographics** (the gender and race/ethnicity of the graduates);
- **Family environment** (parental help with loans or direct contribution to the graduates' Bachelor's degree expenses; highest education level achieved by either parent, family income level, and dependency status of the graduate with respect to family);
- **Academic path** (type of high school attended, type of college first attended, time to degree from high school graduation, whether or not age was typical for bachelor's degree recipients, and major); and
- **Academic achievement** (college entrance examination scores, considered as a measure of pre-college achievement, and GPA in the major, and number of mathematics credits earned, as measures of college achievement).

Demographics

The groups analyzed in this report are: those who taught mathematics, those who taught science, those who taught some other K-12 subject, and those who never taught during the study period. This section of the report gives basic demographic information on 1992-93 bachelor's degree recipients, by group. Table 1 summarizes the percentage distribution of groups (mathematics teachers, science teachers, and so on) by the demographic characteristics "gender" and "race/ethnicity".

Table 1

Of 1992-93 bachelor's degree recipients, percentage distribution of groups by selected demographic characteristics, with weighted N and unweighted n: 1997

			Main field taught in:			
	Weighted N (n /1,000s)	unweighted n	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Total	1,174.4	11,152	1.4	1.2	9.4	88.0
Male	528.8	4,821	1.0	1.2	4.3	93.5
Female	645.6	6,331	1.8	1.2	13.5	83.5
American Indian/Alaska Native, or other	6.3	64	2.4	0.7	7.9	88.9
Asian or Pacific Islander	56.4	429	1.0	0.0	2.1	96.9
Black, non-Hispanic	69.7	605	0.4	0.6	9.4	89.6
Hispanic	59.5	524	2.3	0.9	11.6	85.2
White, non-Hispanic	975.6	8,375	1.5	1.3	9.6	87.6

Source: NCES, B&B:93/97 Baccalaureate and Beyond Longitudinal Study; computation by DAS-T Online Version 4.0, and by ECBW via SPSS; 2005. Unweighted n given for general informational purposes only (all inferences are based on the Panel-weighted Ns.) Percentages may not sum to 100 because of rounding and/or missing values.

In table 1, weighted N and unweighted n are presented for general informational purposes. As detailed in the previous chapter on methodology, all estimates, as well as all inferential statistical procedures, were obtained using the Panel weighting, to ensure that only those graduates who responded to the first three stages of data collection were included in the analyses. The unweighted frequencies are not given in this study, other than in Table 1 and in the ECBW variables detailed in Appendix B, both because the unweighted results are uninterpretable, and because of the potential for violations of confidentiality. Such violations could occur even with the weighted estimates if N is small enough, and for this reason statistics for American Indians or Alaska Natives are presented only in this discussion of demographics (as their numbers were too small to safely report when the groups were analyzed on the variables included in Family Environment, Academic Path, and Academic Achievement).

Of those who received the bachelor's degree sometime during the school year 1992-93 (referred to as "graduates"), 1.43% taught mathematics sometime within the study period, which was from 1993 to the time of the 1997 follow-up survey. During that same period 1.19% taught science, 9.36% taught some other K-12 field, and 88.01% never taught. Note that these figures recur throughout all the overall-population tables of this study, but the DAS system used to produce the tables usually round the proportions to 1.4%, 1.2%, 9.4%, and 88%, respectively.

The gender breakdown is: 1.0% of male graduates taught math, 1.2% taught science, 4.3% taught some other K-12 field, and 93.5% never taught during the study period. Of female graduates, 1.8% taught mathematics some time during the period, while 1.2% taught science, 13.5% taught some other field, and 83.5% never taught.

The breakdown of the graduates into teaching group according to race/ethnicity is: Of American Indian, Alaskan Native, or other graduates, 2.4% taught mathematics, 0.7% taught science, 7.9% taught some other K-12 field, and 88.9% didn't teach. Of Asian or Pacific Islander graduates, 1.0% taught mathematics, none taught science, 2.1% taught some other K-12 field, and 96.9% never taught. Of black, non-Hispanic graduates, 0.4% taught mathematics, 0.6% taught science, 9.4% taught in some other field, and 89.6% never taught. Of Hispanic graduates, 2.3% taught mathematics, 0.9% taught science, 11.6% taught something else, and 85.2% never taught. Of white, non-Hispanic graduates, 1.5% taught mathematics, 1.3% taught science, 9.6% taught some other K-12 field, and 87.6% never taught.

Table 2 presents the demographic information on gender and race/ethnicity by teaching group (mathematics teachers, science teachers, etc.). Of those graduates who taught mathematics during the study period, 33% were male and 67% female; as a point of comparison, of all graduates 43% were male, and 57% were female. Science teachers followed the mathematics pattern more closely than they did that of the teachers of non-mathematics and non-science, with 44% of science teachers being male and 56% being female. Other-field teachers were heavily weighted towards female at 79%, with only 21% of them being male.

Table 2

Of 1992-93 bachelor's degree recipients, percentage distribution of graduates having selected demographic characteristics, by teaching group: 1997

	Male (%)	Female (%)	Am.Indian/Alaska Native/Other (%)	Asian/Pacific Islander (%)	Black, non-Hispanic (%)	Hispanic (%)	White, non-Hispanic (%)
Total	43.2	56.7	0.5	4.8	6.0	5.1	83.6
Main field taught in:							
Mathematics	32.8	67.2	0.9	3.3	1.5	8.5	85.8
Science	44.2	55.8	0.3	0.0	2.8	3.6	93.2
Other teachers	20.6	79.4	0.5	1.1	6.0	6.4	86.1
Non-teachers	47.8	52.2	0.6	5.3	6.1	4.9	83.1

Source: NCES, B&B:93/97 Baccalaureate and Beyond Longitudinal Study; computation by DAS-T Online Version 4.0, and by ECBW via SPSS; 2005. All inferences and estimates are based on the Panel-weighted Ns. Percentages may not sum to 100 because of rounding and/or missing values.

The breakdown of the group of mathematics teachers by ethnicity was: 0.9% of them were American Indian or Alaska Native, 3.3% of them were Asian or Pacific Islander, 1.5% were black, non-Hispanic; 8.5% were Hispanic, and 85.8% of those who taught mathematics were white, non-Hispanic. The comparison with all graduates is: 0.5% American Indian/Alaska

Native, 4.8% Asian/Pacific Islander, 6.0% black, 5.1% Hispanic, and 83.6% white, non-Hispanic.

Family Environment

Graduates in the B&B study were classified by whether they were financially dependent on their parents or independent, and by income levels within each of those classifications. As can be seen in Table 3, when graduates are considered overall, the outcome of becoming a mathematics teacher was not much affected by the family income level for those graduates classed as having been dependents: 1.3% of those from families at the lowest income level became mathematics teachers, 1.2% of those at the middle level, and 1.5% of those at the highest level. Similarly, that outcome was little affected by dependent versus independent status, at the same income level. The choice of becoming a teacher as compared with not becoming a teacher was also not much affected by either dependency, or income level, when graduates were considered overall.

Table 3

Of 1992-93 bachelor's degree recipients, percentage distribution of groups by income and dependency level: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Total	1.4	1.2	9.4	88.0
Income and dependency level (categorical)				
Dependent, less than $20,000	1.3	2.9	8.8	87.0
Dependent, $20,000 to $99,000	1.2	1.2	9.6	88.1
Dependent $100,000 or more	1.5	0.6	8.7	89.3
Independent, less than $20,000	2.3	1.3	9.7	86.8
Independent, $20,000 or more	1.0	1.1	8.9	89.1

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005. Computation by DAS-T Online Version 4.0 on 02/23/2006. For "dependent", income given is that of the graduates' parents. For "independent", income given is that of the graduate.

Some significant differences were found, however, when the graduates were considered by gender, as can be seen in Table 4. Being classed as "dependent" made a difference in the likelihood of males versus females to teach mathematics, with the strongest effect for the middle income level. At all three income levels, dependent females were much more likely to teach mathematics than were dependent males.

Table 4

Of 1992-93 bachelor's degree recipients, percentage distribution of groups by income and dependency level, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Total	1.0	1.2	4.3	93.5
Income and dependency level (categorical)				
Dependent, less than $20,000	0.3	3.3	3.8	92.6
Dependent, $20,000 to $99,000	0.5	1.3	4.9	93.3
Dependent, $100,000 or more	0.6	0.3	1.8	97.3
Independent, less than $20,000	2.4	1.3	4.3	92.1
Independent, $20,000 or more	0.8	0.6	3.7	95.0
--------- Gender of student = Female ----------				
Total	1.8	1.2	13.5	83.5
Income and dependency level (categorical)				
Dependent, less than $20,000	2.0	2.7	11.8	83.6
Dependent, $20,000 to $99,000	1.8	1.1	13.4	83.8
Dependent, $100,000 or more	2.3	0.8	14.9	82.0
Independent, less than $20,000	2.2	1.3	15.1	81.5
Independent, $20,000 or more	1.1	1.3	12.3	85.4

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005. Computation by DAS-T Online Version 4.0 on 02/23/2006. For "dependent", income given is that of the graduates' parents. For "independent", income given is that of the graduate.

For both males and females classified as independent, income level did not make a significant difference in likelihood of teaching mathematics. And there was little difference by gender among those classed as independent: altogether, 3.2% of independent males chose to teach mathematics, while the corresponding figure for females was 3.3%.

The outcome of choosing not to teach at all, according to dependent/independent status and income level, did not show any clear trend when examined by gender, other than the familiar one of females being more likely than males to teach at all levels. Percentages of those choosing not to teach do not differ very much by status and income level for either gender.

Those who received no financial help from their parents, in the form of either loans or direct contributions to the costs of undergraduate education, were about as likely to become teachers as were those who did receive such help (with about 11.2% of those with no help having taught, and 12.5% of those who did get help having taught, as shown in Table 5). The same was true for the outcome of having been a mathematics teacher (1.5% of those who received no parental financial help had taught mathematics, as compared with 1.3% of those who did get help) or a science teacher (1.2% of those who had no parental help had taught science, while 1.3% of those who got help did so). Neither the difference between help and no help for the outcome of teaching mathematics, nor that for the outcome of teaching science, was found to be statistically significant.

However, a difference by gender in likelihood to teach by whether parents helped financially was found. Males were less likely to teach at all, or to teach math, if they received parental assistance (6% of males who got help taught, and 0.6% taught math, if they received help, while 7.3% who received no parental help taught, with 1.6% teaching mathematics.) Females were more likely both to teach in general, and specifically to teach math, if they received financial help from their parents, with the figures for those who got help being 18% and 14.2% for having taught, and 1.9% and 1.5% for having taught mathematics, by getting help or not getting help, respectively. Both these differences were found to be significant at the $p<0.05$ level.

Table 5

Of 1992-93 bachelor's degree recipients, percentage distribution by Group, by gender, according to whether parents provided financial help: 1997

	Main field taught in:			
	Mathematics %	Science %	Other %	Non-teacher %
--------- Parents helped with loan or direct contribution = **No help** ----------				
Estimates				
Total	1.5	1.2	8.6	88.8
Gender of student				
Male	1.6	1.0	4.8	92.7
Female	1.5	1.3	11.4	85.8
--------- Parents helped with loan or direct contribution = **Provided help** ----------				
Estimates				
Total	1.3	1.3	9.9	87.5
Gender of student				
Male	0.6	1.3	4.0	94.0
Female	1.9	1.2	14.9	82.0

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/19/2006.

The effect of parent's level of education on likelihood to teach was examined by means of the variable "highest education level of either parent". Differences which were not statistically significant at the $p<0.05$ level, but would have been if p were chosen to be slightly higher, were found in the likelihood to teach mathematics for the difference between the proportion of mathematics teachers whose parents had no education beyond high school, and those who had at least one parent with a bachelor's degree; and for the difference between the proportion of mathematics teachers whose parents were at the lowest educational level (high school or less) and the highest (with at least one parent holding a doctorate); Table 6 shows these proportions.

As shown in Table 6, 11.99% of 1992-93 bachelor’s degree recipients had taught by 1997; those whose parents had attained the highest level of education noted (with at least one parent holding a doctorate) were about as likely to have taught (13.3%) as were those for whom neither parent had any education beyond high school (13.41%).

Table 6

Of 1992-93 bachelor’s degree recipients, percentage distribution by Group, by highest education level of either parent: 1997

	Main field taught in:			
	Mathematics %	Science %	Other %	Non-teachers %
Estimates				
Total	1.43	1.19	9.36	88.01
Highest education level by either parent				
High School or less	1.82	1.64	9.95	86.59
Some college, no bachelors	1.32	0.76	9.86	88.06
Bachelor's degree	1.16	0.82	8.59	89.43
Masters or other advanced	1.38	1.5	8.91	88.22
Doctorate	1.05	0.93	11.32	86.7
Missing Value	1.32	0.73	7.75	90.21

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005

The results point up a pattern of difference between mathematics and science teachers on the one hand, and non-mathematics, non-science teachers. Those whose parents were most highly educated were found to be less likely to teach either mathematics (1.05%) or science (0.93%) than were those whose parents had no education beyond high school; of those in the latter category, 1.82% had taught mathematics, while 1.64% had taught science. The percentage distribution for teachers of something other than mathematics or science shows the opposite trend, with those having more highly educated parents being more likely to teach (in their non-mathematics or non-science fields); 11.32% of those who taught non-math, non-science had highly-educated parents, versus 9.95% for those whose parents did not have any beyond-high school education. This difference was not statistically significant at the $p<0.05$ level.

Academic Path

The category Academic Path was examined by analyzing the variables high school type, type of post-secondary institution first attended, field of major of that bachelor's degree, whether the degree recipient's age was considered typical, and the time taken from high school graduation to receipt of the bachelor's degree.

When the graduates were considered as a whole, as shown in Table 7, those who graduated from a public high school were found most likely to teach at all (with 12.8% choosing to do so) and second most likely to teach mathematics (with 1.5% making that choice). A slightly higher percentage (1.6) of those who graduated from private, non-religious high schools chose to teach mathematics. The only real difference by type of high school in the choice to teach mathematics is that having graduated from a Catholic high school made it somewhat less likely that a graduate would choose to teach in that field: as seen in the lower percentage, 0.4, of those who graduated from a Catholic school.

Table 7

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of high school graduated from: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Total	1.4	1.2	9.4	88.0
Type of high school graduated from				
Public	1.5	1.2	9.4	87.8
Catholic	0.4	0.9	9.8	88.9
Private, religious, non-catholic	1.2	1.0	8.5	89.2
Private, non-religious	1.6	1.2	9.7	87.4

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

As Table 8 shows, when the graduates are examined by gender, the pattern of choice of whether to teach and what to teach is different for males than it is for females. Across the board for males, those who graduated from public high schools were more likely to make the choice to teach, with 1.2% of public school graduates choosing to teach mathematics, and 1.3% choosing science, and 4.5% of such graduates making the choice to teach something other than mathematics or science. The highest proportion of all males who chose to teach at all is found among the graduates of public high schools, with 7% making that choice.

For females, by contrast, the highest proportions of those choosing to teach are always found outside the ranks of public high school graduates. These highest figures are: 2.2% of graduates of private, non-religious high schools chose to teach mathematics, and 2.4% of such graduates chose to teach science; while 16.3% of female graduates of Catholic schools chose to teach in non-mathematics, non-science fields. The highest proportion of all females who chose to teach anything comes from the graduates of private, non-religious high schools (19.6%).

Table 8

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of high school graduated from, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Type of high school graduated from				
Public	1.2	1.3	4.5	93.0
Catholic	0.1	0.9	3.3	95.7
Private, religious, non-catholic	0.6	0.6	3.0	95.8
Private, non-religious	1.0	0.0	3.9	95.1
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Type of high school graduated from				
Public	1.8	1.2	13.4	83.7
Catholic	0.6	0.9	16.3	82.2
Private, religious, non-catholic	1.9	1.4	13.4	83.4
Private, non-religious	2.2	2.4	15.0	80.4

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

When the graduates are examined by race/ethnicity, it is found that for all the groups (Asian/Pacific Islander, Black, non-Hispanic, Hispanic, and White, non-Hispanic) graduates of public high schools are more likely than graduates of other types of high schools, to choose to teach mathematics. (No teachers of mathematics were found among the groups American Indian/Alaska Native or Other.)

As shown in Table 9, the type of post-secondary institution that graduates attended first after high school graduation did have an affect on the choice to teach mathematics, or to teach at all. The highest proportion of those teaching mathematics, when graduates are divided by type of institution first attended, comes from those who attended public two-year colleges: 2.1% of those who first attended such a college went on to teach mathematics. Such colleges produced the second highest proportion among those who chose to teach at all, 14.4%. Those most likely to teach at all came from those who first attended private two-year colleges (with 16% of them making that choice).

Table 9

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of post-secondary institution first attended: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Estimates				
Total	1.4	1.2	9.4	88.0
First postsecondary institution attended				
Public 4-year	1.6	1.2	9.7	87.6
Private 4-year	1.0	1.1	8.3	89.6
Public 2-year	2.1	1.5	10.9	85.6
Private 2-year	0.0	1.0	15.0	84.0
Public or private, <2yr	low n	low n	low n	low n

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

However, though those who first attended a private two-year college were most likely to teach at all, they were least likely to teach either mathematics (with no such graduates teaching math) or science (with 1% of such graduates teaching science). This fact underlies the only statistically significant difference found on the question of the effect of first institution attended on the outcome of teaching: a graduate who first attended a public two-year college was significantly more likely to teach mathematics than was one who first attended a private two-year college.

In contrast with the results often found when previous variables were examined, there was no outstanding difference in the effect of first type of institution attended on the outcome of teaching when the genders were analyzed separately. As can be seen in Table 10, the pattern of proportions was the same for males as for females (though the actual numbers differed): for both, neither males nor females who first attended either private two-year colleges or public or private less-than-two-year schools became mathematics teachers. And for both genders the pattern continued: the type of institution of first attendance that was most likely to produce mathematics teachers was the public two-year colleges, the next most likely was the public four-year colleges, and the third type most likely to produce mathematics teachers was the private four-year colleges.

When graduates were examined by ethnicity on the variable of type of post-secondary institution first attended, it was found that the type of institution most likely to produce a mathematics teacher differed. For Asian or Pacific Islander graduates, private four-year colleges produced the highest proportion, with 2% of such graduates teaching mathematics. Black graduates who first attended public four-year colleges were those most likely to teach mathematics (0.6% did so); for Hispanic graduates it was public two-year colleges that produced the largest proportion (4.6%) and for white graduates it was public two-year schools (with 2.1% of those who first attended such a school choosing to teach mathematics).

Table 10

Of 1993-97 bachelor's degree recipients, percentage distribution of Groups by type of post-secondary institution first attended, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
First postsecondary institution attended				
Public 4-year	1.3	1.1	4.1	93.5
Private 4-year	0.7	1.0	4.9	93.4
Public 2-year	1.4	1.9	4.7	92.1
Private 2-year	low n	low n	low n	low n
Public or private, <2yr	low n	low n	low n	low n
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
First postsecondary institution attended				
Public 4-year	1.8	1.3	14.6	82.4
Private 4-year	1.3	1.2	11.0	86.5
Public 2-year	2.7	1.2	15.7	80.5
Private 2-year	0.0	0.0	19.2	80.8
Public or private, <2yr	low n	low n	low n	low n

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

When graduates were classified as being older than the "typical" college age—defined as being 20 or older at the beginning of their freshman year—or as typical, a slight difference in both the outcomes of teaching mathematics, and of teaching at all, was found; these differences were not statistically significant. In both cases, graduates of typical age were slightly more likely to teach than were older students, with 1.6% of the typical-age graduates choosing to teach mathematics, as opposed to 1.3% of the older than typical graduates. These results can be seen in Table 11. It might be noted that about 51.1% of all the graduates were classed as being of typical age, with 46.7% of them classed as older (and 2.2% missing).

Table 11

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups, by typical age/older classification: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Estimates				
Total	1.4	1.2	9.4	88.0
Age, typical/older classification				
Typical age	1.6	1.3	10.1	87.1
Older	1.3	1.1	8.8	88.8

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Graduates did differ by gender on the outcome of becoming both teachers of mathematics, and teachers in general, by the variable of being of typical age versus being older. As shown in Table 12, being older made it more likely that a male graduate would teach both mathematics (with 1.2% of older males doing so, versus 0.9% of typical-age males teaching math), and at all (with 6.8% of older males teaching, as compared with 6.4% of typical-age males). Neither of these differences was statistically significant, however.

For females, the opposite was true. Females of typical age were more likely to teach both mathematics and in general. Of typical-age females, 2.1% taught mathematics and 17.6% taught at all, while 1.4% of older females taught mathematics and 15.4% taught anything.

So, for males, having been of typical age or not didn't make much difference to the outcome of choosing to teach, mathematics or at all. For females, having been typical or not was more likely to make a difference.

Table 12

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by typical age/older classification, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Age, typical/older classification				
Typical age	0.9	1.3	4.2	93.6
Older	1.2	1.1	4.4	93.2
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Age, typical/older classification				
Typical age	2.1	1.4	14.2	82.4
Older	1.4	1.1	12.9	84.6

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

The variable "time from high school to bachelor's degree", examined in Table 13, has the potential to divide graduates by many possible life choices. This variable, expressed in months but divided for the purposes of this study into classifications of number of years (from the "typical" period of four years or less from high school graduation to degree, to a highest category of "more than seven years") would catch graduates who took time off between high school in college, who took time off between a two-year degree and the resumption of work on a bachelor's degree, who changed majors, and those who attended part-time and so took longer to achieve the bachelor's. Any combination of these stopping-out behaviors would also be caught by the variable.

Somewhat surprisingly, there was virtually no difference in the likelihood of becoming a mathematics teacher by time from high school graduation to bachelor's degree receipt. Slightly more graduates who took longer than the typical four years became mathematics teachers; but this breakdown into years since high school found about the same proportions becoming mathematics teachers, by year, as was true for graduates as a whole (1.4%).

The outcome of teaching at all was somewhat affected by the time elapsed since high school graduation, with the largest proportion (13.4%) occurring for those who attained the bachelor's degree between four and five years after the end of high school.

Table 13

Of 1992-93 bachelor's degree recipients, percentage distribution by Groups, by time from high school graduation to bachelor's degree: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Estimates				
Total	1.4	1.2	9.4	88.0
Number of months from HS grad to BA receipt				
Typical (4 yrs or less)	1.4	1.1	8.9	88.6
between 4 & 5	1.4	1.5	10.5	86.6
between 5 & 6	1.6	0.8	7.6	90.1
between 6 & 7	1.6	0.8	8.5	89.1
more than 7 yrs	1.6	1.0	9.0	88.4

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

The same variable examined by gender, as seen in Table 14, shows a higher likelihood for "traditional" program females—that is, those who earn the bachelor's degree within four years of high school graduation—than for "traditional" program males, to choose to teach mathematics, with the t value for that difference (1.8% of females versus 0.7% of males) being 2.02 (k=2, cv=1.96). Females who took between five and six years to get the bachelor's degree were the most likely (at 2.3%) to teach mathematics, while males who took between six and seven years were the most likely among males (at 2.9%) to make that same career choice.

Table 14

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by time from high school graduation to bachelor's degree, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Number of months from HS grad to BA receipt				
Typical (4 yrs)	0.7	0.9	4.3	94.1
between 4 & 5	1.1	1.5	3.9	93.5
between 5 & 6	1.0	0.9	4.6	93.6
between 6 & 7	2.9	0.1	4.4	92.6
more than 7 yrs	1.1	0.9	3.6	94.4
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Number of months from HS grad to BA receipt				
Typical (4 yrs)	1.8	1.2	11.9	85.1
between 4 & 5	1.7	1.4	16.6	80.3
between 5 & 6	2.3	0.7	11.3	85.7
between 6 & 7	0.0	1.7	13.4	85.0
more than 7 yrs	2.0	1.1	13.2	83.7

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table 15 shows the career choices of the graduates by the field they majored in. Interestingly, while 54.2% of Education majors taught at all and only 11.1% of Mathematics majors did so, the proportions of those two majors choosing to teach mathematics is not significantly different: 4.9% of those with an Education major taught mathematics, while 6.9% of those majoring in Mathematics taught that subject.

The top three majors for those choosing to teach mathematics were the aforementioned Mathematics and Education, with Psychology coming in third: 1.7% of those who majored in Psychology taught mathematics. Mathematics majors figure in the top three majors of those choosing to teach science: 5.4% of those who majored in Biological sciences taught science, and 4.2% of Education majors and 2.9% of Mathematics majors also making this career choice.

Engineering majors were the least likely to have ever taught, with the proportion of such majors teaching anything being only 0.3%. They were followed in order of decreasing likelihood to teach by Business and Management majors, Public Affairs/Social Services majors, Health Professions majors, Social Science majors, Psychology majors, Biological Sciences majors, other assorted majors, Mathematics and other sciences majors, Humanities majors, and History majors, with Education majors being the most likely to have taught.

Table 15

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by major: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
Estimates				
Total	1.4	1.2	9.4	88.0
Bachelors degree field recoded				
Business and management	0.4	0.1	0.8	98.7
Education	4.9	4.2	45.0	45.8
Engineering	0.2	0.0	0.1	99.7
Health professions	0.0	0.2	1.8	98.0
Public affairs/social services	0.0	0.4	1.4	98.3
Biological sciences	1.2	5.4	0.9	92.6
Mathematics and other sciences	6.9	2.9	1.4	88.9
Social science	0.4	0.5	4.2	95.0
History	0.0	0.7	28.5	70.8
Humanities	0.4	0.5	11.4	87.7
Psychology	1.7	0.3	5.2	92.9
Other	0.8	0.5	6.6	92.1

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

When the graduates are examined by gender, as seen in Table 16, the pattern of choice of whether to teach and what to teach is found to differ for males and for females. For males choosing to teach mathematics, the pattern of the three highest proportions is found to be: 6.5% of Education majors, then 5% of Psychology majors, and then 2.9% of Mathematics and other sciences majors, having taught mathematics. For females, by contrast, the three highest proportions are: 13.4% of Mathematics and other sciences majors taught mathematics, followed by 4.5% of Education majors, and then 1.8% of Biological science majors. Clearly, males who attain a bachelor's degree in mathematics were making the choice to do something other than teach (with only 6.6% teaching at all). And if they did teach, they were more likely to choose to teach science than to teach mathematics, with 3.4% choosing science teaching over 2.9% choosing mathematics teaching.

Table 16

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups, by major, by gender: 1997

	Main field taught in:			
	Mathematics (%)	Science (%)	Other (%)	Non-teachers (%)
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Bachelors degree field recoded				
Business and management	0.6	0.2	0.6	98.6
Education	6.5	5.5	31.8	56.2
Engineering	0.3	0.0	0.2	99.6
Health professions	0.0	0.0	1.6	98.4
Public affairs/social services	0.0	0.0	0.0	100.0
Biological sciences	0.7	7.1	0.4	91.9
Mathematics and other sciences	2.9	3.4	0.3	93.4
Social science	0.3	0.8	2.7	96.2
History	0.0	0.8	35.1	64.1
Humanities	0.2	0.4	8.3	91.2
Psychology	5.0	0.0	3.9	91.1
Other	0.4	0.2	2.3	97.1
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Bachelors degree field recoded				
Business and management	0.2	0.0	1.1	98.7
Education	4.5	3.9	48.4	43.1
Engineering	0.0	0.0	0.0	100.0
Health professions	0.0	0.3	1.9	97.8
Public affairs/social services	0.0	0.6	2.4	97.0
Biological sciences	1.8	3.4	1.5	93.4
Mathematics and other sciences	13.4	2.0	3.1	81.5
Social science	0.4	0.2	5.6	93.8
History	0.0	0.6	18.7	80.7
Humanities	0.5	0.6	13.4	85.5
Psychology	0.4	0.4	5.7	93.5
Other	1.1	0.7	9.7	88.5

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

The male graduates with Mathematics majors were significantly more likely to choose not to teach at all, than were the female Mathematics majors. Among male Mathematics majors, 93.4% did not teach and 6.6% did; for their female peers, the figures were 81.5% choosing not to teach versus 18.5% choosing to teach.

Academic Achievement

Questioning the academic ability and achievement of those who enter teaching is so clichéd a part of American culture as to have been turned into an aphorism (the familiar "those who can, do; those who can't, teach). Though the sentiment expressed may be somewhat exaggerated for comic (or malicious) effect, the underlying reality has received some empirical support:

> In the last decade or so, this issue has been studied from several vantage points. Studies have compared the achievement test scores and grade point averages of college students who were interested in teaching with those of other students, education majors with noneducation majors, teachers with nonteachers, and those who continued to teach with those who left the profession. The findings have been fairly consistent: college students interested in teaching, teacher education students, teachers, and those who remain in teaching tend to have somewhat lower scores on standardized tests—including the ACT or SAT, the NTE, and the High School and Beyond (HS&B) achievement tests—than their counterparts who were less inclined towards teaching. On the other hand, studies that employ high school or college grade point averages as the measure of achievement consistently report that those more inclined toward teaching achieve at levels equal to or higher than those less inclined…..earlier findings regarding the academic achievement of those who were considering teaching, had prepared to teach, or had taught were not contradicted by B&B:93/94 data. (US DOE, NCES, 1996)

But do these patterns—lower college entrance examination (CEE) scores and higher grade point averages (GPA) for teachers as compared with nonteachers—hold for teachers of mathematics? Do the answers to these questions vary by gender or by ethnicity?

When CEE scores were examined by quartile (as shown in Table 17), overall, no significant difference was found in the likelihood those having scores in a particular quartile becoming teachers of mathematics. A slightly higher proportion of those with midrange CEE scores became mathematics teachers, as compared with those with scores in either the highest or lowest quartiles.

However, a significant difference was found for likelihood of becoming a teacher of something other than mathematics or science by bottom quartile of the CEE versus by top quartile, with 12.9% of those bachelor's degree recipients in the bottom quartile choosing to teach something other than mathematics or science, as compared with 5.8% of those in the top quartile.

Table 17

Of 1992-93 bachelor's degree recipients, percentage distribution of Group, by CEE quartile: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
	%	%	%	%
Estimates				
Total	1.4	1.2	9.4	88.0
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	1.2	1.1	12.9	84.9
Second quartile SAT (or ACT if no SAT)	1.6	1.6	10.8	86.1
Third quartile SAT (or ACT if no SAT)	1.6	1.6	8.8	87.9
Top quartile SAT (or ACT if no SAT)	1.4	1.1	5.8	91.8

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/23/2006

When the groups were analyzed by gender (as shown in Table 18), gender was found to affect the outcome of becoming a mathematics teacher for those in the top quartile, but not for those in the bottom. A statistically significant difference was found among those in the top quartile of CEE scores, but was not found for those in the bottom quartile. Specifically, of male graduates in the top quartile, 0.4% taught mathematics, while 2.6% of such females did so. (The bottom quartile figures were 0.7% for the males and 1.4% of the females.)

Interestingly, which of the four quartiles a graduate was in did not affect the outcome of becoming a mathematics teacher; no significant difference in the likelihood of teaching mathematics by being in the bottom CEE quartile, as compared to being in the top, was found for either gender. However, such differences did exist for non-mathematics & non-science teachers.

Table 18

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by CEE score and gender: 1997

	Main field taught in:			
	Mathematics %	Science %	Other %	Non-teachers %
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	0.7	0.8	5.8	92.7
Second quartile SAT (or ACT if no SAT)	1.9	1.4	3.7	93.1
Third quartile SAT (or ACT if no SAT)	1.1	2.0	5.3	91.6
Top quartile SAT (or ACT if no SAT)	0.4	0.8	3.7	95.1
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	1.4	1.2	17.2	80.2
Second quartile SAT (or ACT if no SAT)	1.3	1.7	16.2	80.8
Third quartile SAT (or ACT if no SAT)	2.2	1.3	12.6	84.0
Top quartile SAT (or ACT if no SAT)	2.6	1.4	8.4	87.6

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

When the groups were examined by race/ethnicity, a similar pattern was observed, as shown in Table 19. For all the ethnicities for which sufficient numbers were sampled to give results (Asian/Pacific Islander; Black, non-Hispanic; Hispanic; and White, non-Hispanic), the outcome of becoming a mathematics teacher was not significantly affected by which quartile the participant's CEE score fell in. And as with gender, the outcome of becoming a teacher of something other than mathematics or science was significantly different for those with top quartile scores, versus those with bottom quartile scores (for all ethnicities except Asian/Pacific Islander, for whom the difference was not significant). For the ethnicities other than Asian/Pacific Islander, having scores in the top quartile made the outcome "having taught something other than mathematics or science" significantly less likely.

Table 19

Of 1992-93 bachelor's degree recipients, percentage distribution by Group by CEE quartile, by ethnicity: 1997

		Main field taught in:		
	Math %	Science %	Other %	Non-teacher %
--------- Merged SAT and ACT score quartile = Bottom quartile SAT (or ACT if no SAT) ----------				
Total	1.2	1.1	12.9	84.9
Respondent ethnicity				
Asian or Pacific Islander	0.0	0.0	1.9	98.1
Black, non-Hispanic	0.0	0.5	9.9	89.5
Hispanic	3.9	0.0	9.9	86.3
White, non-Hispanic	1.2	1.3	14.1	83.4
--------- Merged SAT and ACT score quartile = Second quartile SAT (or ACT if no SAT) ----------				
Total	1.6	1.6	10.8	86.1
Respondent ethnicity				
Asian or Pacific Islander	0.0	0.0	2.8	97.2
Black, non-Hispanic	0.8	0.0	11.2	88.0
Hispanic	0.0	3.9	19.2	76.9
White, non-Hispanic	1.8	1.6	10.7	86.0
--------- Merged SAT and ACT score quartile = Third quartile SAT (or ACT if no SAT) ----------				
Total	1.6	1.6	8.8	87.9
Respondent ethnicity				
Asian or Pacific Islander	3.3	0.0	0.7	96.0
Black, non-Hispanic	0.0	1.5	5.3	93.3
Hispanic	1.5	0.0	3.5	95.0
White, non-Hispanic	1.6	1.8	9.5	87.1
--------- Merged SAT and ACT score quartile = Top quartile SAT (or ACT if no SAT) ----------				
Total	1.4	1.1	5.8	91.8
Respondent ethnicity				
Asian or Pacific Islander	0.0	0.0	0.0	100.0
Black, non-Hispanic	low n	low n	low n	low n
Hispanic	2.8	1.5	1.7	94.0
White, non-Hispanic	1.3	1.2	6.2	91.3

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005

Differences in the outcome of becoming a mathematics teacher were analyzed using the variable “GPA in major”. As with previous variables examined, stronger differences were found when participants were grouped by gender and by ethnicity, than when looked at as a whole.

As shown in Table 20, having a low GPA in the major made it more likely that a graduate would teach mathematics, though this difference was not statistically significant. Of those with a major GPA of less than 2.24, 4.7% taught mathematics, versus 1.2% of those with a major GPA of 3.74 or higher. The same pattern was observed in science teachers, with 2.3% of those graduates with the lowest GPA teaching science, as compared with 1.4% of those with the highest GPA.

The opposite was true of teachers of something other than mathematics or science, with only 8% of those graduates with the lowest GPA in the major choosing to teach, versus 12.1% of those with the highest GPA. These varying results for the different groups of teachers appears to have evened out the results for teachers versus non-teachers, with 85% of those with the lowest major GPA choosing not to teach at all, as compared with 85.4% of those with the highest GPA making such a choice.

As none of these differences were significant, it would appear that when all graduates are considered, GPA in the major did not greatly affect the likelihood of choosing to teach, and of whether to teach mathematics, science, or something else. But significant differences do appear when the graduates are compared by gender.

Table 20

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
	%	%	%	%
Estimates				
Total	1.4	1.2	9.4	88.0
Overall grades in undergrad major				
3.74 and above	1.2	1.4	12.1	85.4
Between 3.24 and 3.74	1.7	1.2	9.0	88.1
Between 2.24 and 3.24	0.5	0.6	4.8	94.2
Less than 2.24	4.7	2.3	8.0	85.0

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

As can be seen in Table 21, male graduates with the highest GPAs in their major were significantly less likely to teach mathematics than were their female peers, with only 0.5% of the males teaching mathematics as compared with 1.5% of such females. There were too few males or females in the category "having the lowest GPA (less than 2.24) and teaching mathematics" for analysis (which must be considered as a positive for the profession).

Females with the highest major GPA were significantly more likely to teach topics other than mathematics or science than were similar males, with 4.9% of the males teaching versus 16.0% of the females. Also, such males were significantly more likely to choose not to teach at all, with 94% making that choice, as compared with 80.6% of the highest GPA females.

Table 21

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major and by gender: 1997

	Main field taught in:			
	Mathematics %	Science %	Other %	Non-teachers %
--------- Gender of student = Male ----------				
Estimates				
Total	1.0	1.2	4.3	93.5
Overall grades in undergrad major				
3.74 and above	0.5	0.6	4.9	94.0
Between 3.24 and 3.74	1.3	1.5	4.6	92.6
Between 2.24 and 3.24	0.7	0.2	1.1	98.1
Less than 2.24	low n	low n	low n	low n
--------- Gender of student = Female ----------				
Estimates				
Total	1.8	1.2	13.5	83.5
Overall grades in undergrad major				
3.74 and above	1.5	1.8	16.0	80.6
Between 3.24 and 3.74	2.0	1.0	12.9	84.1
Between 2.24 and 3.24	0.2	1.2	9.6	89.0
Less than 2.24	low n	low n	low n	low n

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table 22 gives the results by GPA in the major for graduates as classed by ethnicity. Of Asian/Pacific Islanders with the highest GPA, none became teachers of mathematics; 0.7% of such black graduates, 1.3% of Hispanics, and 1.2% of such white graduates taught mathematics. Percentages of the various ethnic groups who chose to teach at all (regardless of field) follow a similar pattern: of those with the highest GPA in the major, 0.8% of Asian/Pacific Islanders, 16.8% of blacks, 10.8% of Hispanics, and 15.4% of highest-GPA whites taught (in any field). The only pairwise comparison that was found to be statistically significant when k was adjusted to reflect the number of family comparisons possible was that of Asian/Pacific Islander versus White, with the Asian/Pacific Islander highest-GPA graduates much less likely to teach at all.

Table 22

Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major, by ethnicity: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
	%	%	%	%
--------- Respondent ethnicity = Asian or Pacific Islander ----------				
Total	1.0	0.0	2.1	96.9
Overall grades in undergrad major				
3.74 and above	0.0	0.0	0.8	99.2
Between 3.24 and 3.74	1.0	0.0	3.0	96.0
Between 2.24 and 3.24	2.4	0.0	0.0	97.6
Less than 2.24	low n	low n	low n	low n
--------- Respondent ethnicity = Black, non-Hispanic ----------				
Total	0.4	0.6	9.4	89.6
Overall grades in undergrad major				
3.74 and above	0.7	0.0	16.1	83.2
Between 3.24 and 3.74	0.4	0.4	8.9	90.4
Between 2.24 and 3.24	0.0	1.8	7.5	90.7
Less than 2.24	low n	low n	low n	low n
--------- Respondent ethnicity = Hispanic ----------				
Total	2.3	0.9	11.6	85.2
Overall grades in undergrad major				
3.74 and above	1.3	0.0	9.6	89.2
Between 3.24 and 3.74	3.1	1.2	9.6	86.1
Between 2.24 and 3.24	0.0	0.0	15.0	85.0
Less than 2.24	low n	low n	low n	low n
--------- Respondent ethnicity = White, non-Hispanic ----------				
Total	1.5	1.3	9.6	87.6
Overall grades in undergrad major				
3.74 and above	1.2	1.5	12.7	84.6
Between 3.24 and 3.74	1.7	1.4	9.2	87.8
Between 2.24 and 3.24	0.4	0.5	3.8	95.3
Less than 2.24	5.5	2.6	5.1	86.8

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006 Note: all results for "other" were "low n".

The last area of academic achievement examined was that of number of credits in mathematics earned by graduates. This continuous variable was broken into the categories shown in Table 23, as this breakdown best distinguished between teachers of mathematics and science on one hand, and teachers of other fields on the other.

As might be expected, those with the highest number of mathematics credits (13 or more) were most likely to teach both mathematics (7.4%) and science (2.1% of those with that many credits chose to teach science). By contrast, those with only one to three mathematics credits were the most likely to teach a non-mathematics and non-science field with 12.9% making that choice. The trend for mathematics and science is the reverse of that for other fields: the smaller the number of mathematics credits, the more likely the graduate was to have taught something other than mathematics or science.

Of particular interest were the differences at the high end of the number of mathematics credits earned. These results might shed light on the question of just how many credits in mathematics make a person more likely to teach mathematics. The difference between having 10 to 12 credits, and 13 or more, was found to significantly impact the outcome of becoming a mathematics teacher, with those having 13 or more much more likely to teach math. The same was true in the opposite direction for the outcome of becoming a teacher of something other than mathematics or science; with 9% of those with 10 to12 credits making such a career choice, versus 3.2% of those with 13 or more mathematics credits.

As with GPA in major, these results appear to even out when considering the groups teachers versus non-teachers: number of credits earned in mathematics did not significantly impact the outcome of choosing not to teach.

Table 23

Of 1992-93 bachelor's degree recipients, percentage distribution according to number of mathematics credits earned: 1997

	Main field taught in:			
	Mathematics %	Science %	Other %	Non-teachers %
Estimates				
Total	1.4	1.2	9.4	88.0
Credits for all mathematics:				
no mathematics credits	0.6	1.1	9.9	88.4
1-3 mathematics credits	0.8	1.2	12.9	85.2
4-6 mathematics credits	0.8	0.8	9.6	88.8
7-9 mathematics credits	1.4	1.7	7.1	89.8
10-12 mathematics credits	0.8	0.9	9.0	89.4
13 or more mathematics credits	7.4	2.1	3.2	87.3

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/23/2006

When graduates are examined by gender, greater differences are found on the outcomes of becoming a teacher, and of becoming a mathematics teacher, by the number of mathematics credits earned. As Table 24 shows, having a lot of mathematics credits made a female significantly more likely than a male to teach mathematics, with 13.7% of such females making that choice, versus 4.1% of such males.

Males and females differed, too, on likelihood of making the career choice not to teach at all, by number of mathematics credits earned. For males, number of mathematics credits made little difference: 91.8% of those with no mathematics credits did not teach, as compared with 92.4% of those with 13 or more credits. For females, this same comparison did produce a statistically significant difference; 86.3% of those with no mathematics credits did not teach, versus 77.5% of those with 13 or more credits.

Table 24

Of 1992-93 bachelor's degree recipients, percentage distribution by number of mathematics credits earned, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
	%	%	%	%
--------- Gender of student = Male ----------				
Total	1.0	1.2	4.3	93.5
Credits for all mathematics:				
no mathematics credits	0.6	1.3	6.4	91.8
1-3 mathematics credits	0.4	0.9	6.9	91.9
4-6 mathematics credits	1.0	0.9	3.2	95.0
7-9 mathematics credits	0.6	1.4	2.0	96.1
10-12 mathematics credits	0.3	0.5	1.8	97.4
13 or more mathematics credits	4.1	2.1	1.4	92.4
--------- Gender of student = Female ----------				
Total	1.8	1.2	13.5	83.5
Credits for all mathematics:				
no mathematics credits	0.7	1.0	12.0	86.3
1-3 mathematics credits	1.1	1.3	16.5	81.0
4-6 mathematics credits	0.6	0.8	15.2	83.4
7-9 mathematics credits	2.4	2.0	13.3	82.3
10-12 mathematics credits	1.4	1.3	18.0	79.3
13 or more mathematics credits	13.7	2.0	6.8	77.5

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/23/2006

Multivariate Analysis

Upon entry of the ten predictor variables (nine continuous and one categorical but dummy-coded), with the dependent variable Group (comprising the mathematics teachers, science teachers, other teachers, and non-teachers) three discriminant functions were obtained. It may be recalled from the Methodology chapter that the predictor variables were:

- ACT score
- SAT score
- Age at college entry
- Credits for all mathematics

- Cumulative undergrad GPA
- GPA in undergraduate major
- Number of months from HS graduation to receipt of BA
- Total income (of parents for dependent students, and of the students themselves if independent)
- Total direct financial contribution from the parent
- Dummy-coded gender (0=female, 1=male)

All variables were entered simultaneously, and missing data were dealt with according to SPSS's listwise method. Listwise treatment, in which "a case that has a missing value for any variable in the analysis is dropped from the analysis" (Norusis, 2003, p. 213) was chosen because relationships between pairs of variables may be different for those cases with missing values, as compared to those without missing values. Thus pairwise treatment, which allows cases with missing values on one variable to remain in the analysis of other variables, can result in a correlation matrix having coefficients whose relationships may not make sense and can't be reliably interpreted.

The Wilks' Lambda test (the oldest and most widely used criterion according to Huberty, 1994) was significant for all three. Wilks' Lambda gives the ratio of the within-groups sum of squares to the total sum of squares, and can be understood as the proportion of the variance not explained by the differences between the groups. It follows that the smaller the lambda statistic, the more desirable for the purposes of separating the groups by means of the predictor variables; when most of the observed variability can be attributed to differences between groups, small values of Wilks' Lambda will be found (Norusis, 2003). For the first function, lambda = .93, with chi-square = 85,541.75, with 30 degrees of freedom. For the second function, lambda=.97, chi-square=35,444.48, with 18 degrees of freedom. For the third function, lambda=.99, chi-square=2,471.41, and there were 8 degrees of freedom. All three were significant at $p < .05$.

This indicates that the model including the ten predictor variables was able to significantly discriminate the four groups.

The tests of equality of group means, giving comparisons between the groups on each of the predictor variables, showed that each of the ten predictor variables is a significant predictor by itself; on each measure there was a statistically significant difference between being a mathematics teacher, science teacher, other teacher, and non-teacher. Therefore the null hypothesis that the population means (for each predictor variable) are equal for each of the groups, is rejected.

The value of Wilks' Lambda for functions 1 through 3, 0.930, was smaller than each of the ten Wilks' Lambda statistics for the ten predictor variables. This indicates that the discriminant functions, which use all the information from all the ten predictors, do a better job of separating the groups than does any one predictor considered separately.

Table 25 presents the standardized function coefficients, showing how heavily each predictor variable was weighted in order to maximize discrimination of the groups, and allowing comparison of the relative contributions of a predictor while taking into account all the other predictors in the model.

Table 25

Standardized Canonical Discriminant Function Coefficients

	Standardized function coefficients			Correlations between variables & discriminant functions		
	1	**2**	**3**	**1**	**2**	**3**
ACT score	-.02	-.14	.75	.09	-.14	.77(*)
SAT score	-.11	.14	.16	-.06	.27(*)	-.11
Age at college entry	-.01	.03	.11	.00	.02	.04(*)
Credits for all mathematics	1.00	.15	-.10	.95(*)	.27	.05
Cumulative undergrad GPA	.02	-.14	.21	.03	-.15	.16(*)
GPA in undergraduate major	.07	-.04	-.13	.06	-.08(*)	-.04
Number of months from HS grad to BA	.02	.14	-.17	-.01	.02	-.22(*)
Total income (parents, or independent students)	-.05	.10	-.48	-.09	.15	-.51(*)
Total direct contribution from parent	-.05	.17	-.18	-.08	.20	-.28(*)
Dummy-coded gender	-.24	.90	.24	-.11	.92(*)	.29

Last three columns represent the pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions. * Largest absolute correlation between each variable and any discriminant function.

The results shown in Table 25 are obtained when all predictor variables are standardized to have a mean of 0 and a within-groups standard deviation equal to 1, permitting comparison of the magnitude of the coefficients for each of the predictors. These suggest that for the first function, number of mathematics course credits contributes most to group separation; for the second function, gender contributes most; and for the third function, ACT score and total income (of parents for dependent students, and of the students themselves if they were independent) contribute most to distinguishing the groups from one another.

Table 25 also contains the Pearson correlations between the values of the functions and the values of the variables; these provide another method of assessing what contribution the particular predictor variables made to the discriminant scores, but by means of showing the association of each predictor with the functions, while ignoring the other predictors. For the first function, the number of credits for all mathematics courses had the highest correlation with the discriminant score; gender was most highly associated with the second function and showed the highest correlation with the discriminant score; and for the third, ACT score showed the highest correlation. The smallest correlations were age at college entry for the first and second functions, and grade point average in undergraduate major for the third.

The classification results "quantify the strength of the association between the observed and the predicted groups… [and] compare the predictions to chance criteria" (Norusis, p.296). They indicate that the model correctly predicts 53.3% of those who taught K-12 mathematics in the test period, 25.6% of the science teachers, 63.5% of the other teachers, and 32.4% of those who did not teach at all. Of the original grouped cases, 35.5% were correctly classified overall. This success rate for predicting membership in Group by using the discriminant functions is not high, but as the Wilks' Lambda results show, the functions do significantly discriminate the four groups.

The canonical correlations were 0.204, 0.166, and 0.046 for functions 1, 2, and 3, respectively. As Norusis notes, "values close to 1 indicate that most of the observed variability in the discriminant scores is explained by differences between the groups" (2003, p. 291). Thus, the present results do not indicate as strongly delineated a group separation as might be desired.

As described in the Methods chapter, the assumptions underlying the analysis (that the sample derives from a population with a normal distribution on all the predictors, and that the variance-covariance matrix of the predictors is equivalent for all populations) were tested and not found to be upheld to the extent that is optimal. However, as Norusis points out:

> Discriminant analysis is robust to violations of the assumption of multivariate normality; dichotomous predictors work reasonably well. Violation of the assumption of equality of variance-covariance matrices can affect both hypothesis testing and classification. The linear discriminant function is statistically optimal only if the assumptions about the distribution of data values are met. However, linear discriminant analysis (LDA) works well, even when the assumptions that make it the best classification rule are violated. (p. 293)

The cross-validation results, using the leave-one-out procedure, resulted in percentages of correctly-classified cases that were smaller than or equal to the classification results of the discriminant analysis. The overall correct classification rate went from 35.5% in the original to 35.2% in the cross-validated procedure. The percentage of mathematics teachers classified correctly held steady at 53.3%; the result for science teachers fell from 25.6% to 20.4%; for other teachers fell from 63.5% classified correctly in the original analysis to 62.4% in the cross-validated results; and while 32.4% of non-teachers were correctly classified by the original discriminant analysis, 32.3% were so classified when the cross-validation procedure was applied.

Table 26 presents the means and standard deviations, as well as size of each group, for the ten variables (it should be recalled that the categorical variable GENDER was dummy-coded with 0=female and 1=male). Unsurprisingly, the same general trends can be seen in the table as were found in the descriptive analysis portion of this study. In general, teachers of mathematics and of science had more in common with non-teachers than they did with teachers of other K-12 fields, as reflected in college entrance examination scores (the ACT and SAT, here), number of credits for undergraduate mathematics courses, and gender distribution (with the other-teachers category the most heavily female of the four groups).

Table 26
Group statistics from discriminant analysis; Source: SPSS analysis of ECBW data from B&B:93/97

		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
math. teachers	ACT score	8.17	12.56	140	15,540
	SAT score	502.78	516.23	140	15,540
	Age at college entry	18.34	4.28	140	15,540
	Credits for all mathematics	15.48	13.52	140	15,540
	Cumulative undergrad GPA	3.14	1.09	140	15,540
	GPA in undergraduate major	3.14	1.54	140	15,540
	No. mos., HS grad to BA	84.02	71.89	140	15,540
	Total income (parents;ind stds)	40267.30	45914.55	140	15,540
	Total direct contribution, parent	2112.23	4359.97	140	15,540
	Dummy-coded gender	.35	.48	140	15,540
science teachers	ACT score	10.84	12.94	147	16,003
	SAT score	508.50	517.67	147	16,003
	Age at college entry	18.40	4.01	147	16,003
	Credits for all mathematics	6.07	7.69	147	16,003
	Cumulative undergrad GPA	3.21	.38	147	16,003
	GPA in undergraduate major	2.87	2.31	147	16,003
	No. mos., HS grad to BA	77.29	70.90	147	16,003
	Total income (parents; ind.stds)	34906.72	29174.24	147	16,003
	Total direct contribution, parent	2016.44	4469.17	147	16,003
	Dummy-coded gender	.44	.50	147	16,003
other teachers	ACT score	7.51	11.87	1027	109,042
	SAT score	485.10	490.81	1027	109,042
	Age at college entry	18.32	3.71	1027	109,042
	Credits for all mathematics	3.73	4.58	1027	109,042
	Cumulative undergrad GPA	3.19	1.05	1027	109,042
	GPA in undergraduate major	2.96	2.33	1027	109,042
	No. mos., HS grad to BA	83.99	77.04	1027	109,042
	Total income (parents; ind.stds)	44155.30	44463.36	1027	109,042
	Total direct contribution, parent	2315.38	4231.42	1027	109,042
	Dummy-coded gender	.22	.41	1027	109,042
non-teachers	ACT score	6.66	12.07	7941	1,038,391
	SAT score	564.64	519.45	7941	1,038,391
	Age at college entry	18.35	3.62	7941	1,038,391
	Credits for all mathematics	4.78	6.21	7941	1,038,391
	Cumulative undergrad GPA	3.01	2.16	7941	1,038,391
	GPA in undergraduate major	2.83	2.96	7941	1,038,391
	No. mos.,HS grad to BA	84.75	79.09	7941	1,038,391
	Total income (parents; ind.stds)	48416.75	55576.79	7941	1,038,391
	Total direct contribution, parent	2871.78	5256.73	7941	1,038,391
	Dummy-coded gender	.48	.50	7941	1,038,391
Total	ACT score	6.81	12.08	9255	1,178,976
	SAT score	555.70	517.38	9255	1,178,976
	Age at college entry	18.35	3.64	9255	1,178,976
	Credits for all mathematics	4.84	6.39	9255	1,178,976
	Cumulative undergrad GPA	3.03	2.06	9255	1,178,976
	GPA in undergraduate major	2.84	2.88	9255	1,178,976
	No. mos.,HS grad to BA	84.57	78.71	9255	1,178,976
	Total income (parents;ind. stds)	47731.81	54288.22	9255	1,178,976
	Total direct contribution, parent	2798.70	5153.30	9255	1,178,976
	Dummy-coded gender	.45	.50	9255	1,178,976

The three discriminant functions derived (which as with all SPSS output, go from best to worst on the criterion of F values and amount of variability explained by group membership) were found to explain 58.8%, 38.4%, and 2.8% of the total between-groups sum of squares or variance, respectively.

Thus the discriminant analysis did successfully separate the groups. Furthermore, each of the predictor variables chosen was shown by the analysis to measure a significant difference between being a mathematics teacher, science teacher, other teacher, or non-teacher.

CHAPTER FIVE: CONCLUSION

A pattern of differences between teachers of mathematics and science, and other kinds of K-12 teachers, was found to exist on most variables examined. However, no differences were of startling size or direction.

Because teachers of fields other than mathematics and science are so large a percentage of the category teachers as a whole—about 78% for the Baccalaureate & Beyond dataset—the differences present for that 22% of teachers who taught mathematics and science tend to disappear in analyses of the effect of variables on “all teachers”. Thus, most results reported here differ in many respects from the results found in those major B&B studies of teachers, *Out of the Lecture Hall and Into the Classroom* (US DOE, NCES, 1996), and *Progress Through the Teacher Pipeline* (US DOE, NCES, 2000).

For the category Family Environment, the outcome of being a teacher of mathematics was not much affected by either income level of the graduate’s family, or the graduate’s dependency status, when all graduates were considered together. When considered by gender, an effect was found: being classed as dependent increased the likelihood that a female would teach mathematics. Level of income did not change the likelihood of teaching mathematics, across gender.

Whether a graduate’s family had provided financial help or not, the overall likelihood for graduates of becoming a mathematics teacher was about the same. But as with income/dependency, a difference was found by gender: males were less likely to teach if they received parental assistance, while females were more likely to teach.

The highest level of education attained by either parent had an effect on the likelihood of teaching mathematics, with those graduates whose parents had the lowest attainment (high school or less) being more likely to teach mathematics than graduates whose parents had a higher level of educational attainment. Those who had at least one parent with a doctorate were the least likely to teach mathematics; by contrast, they were the most likely to teach in other K-12 fields. This result was somewhat surprising.

The category Academic Path yielded some further differences. On the variable "type of high school graduated from", graduates from non-religious private high schools, public high schools, and non-Catholic but religious private high schools were all found to be about equally likely to teach mathematics. Those who graduated from a Catholic high school were substantially less likely to teach mathematics. When the graduates were examined by gender, males who graduated from public high schools were most likely to teach mathematics, while for females, the highest proportion was for graduates who had attended private high schools, whether religious or not (but not Catholic).

An outcome on the result of becoming a mathematics teacher was found by the type of institution first attended after high school, with public two-year colleges yielding the largest proportion of mathematics teachers. For both males and females the result was the same, with those first attending public two-year colleges being most likely to teach mathematics, compared with those who first attended some other type of institution.

The effect of being older than typical age (that is, being 20 or older at the beginning of the freshman year) was slight: overall, typical age graduates were somewhat more likely to teach mathematics, and the same was true of females. For males, being older than typical age made it slightly more likely that a graduate would teach mathematics.

The amount of time taken between high school graduation and receipt of the bachelor's degree was not found to have much effect on the outcome of becoming a mathematics teacher, overall. Females who took the "traditional" four years or less to accomplish this were somewhat more likely than similar males to teach mathematics. Taking between five and six years made it more likely that a female would teach mathematics than any other timing; for males, taking between six and seven years made them more likely to become mathematics teachers, than did any other length of time from high school to bachelor's degree receipt.

The subject in which a graduate majored was not found to have a large effect on the outcome of becoming a mathematics teacher, with nearly the same proportion of Mathematics majors as Education majors (6.9% and 4.9% respectively) choosing to teach math. (In the group of mathematics teachers in the 1992-93 cohort, 44.9% held bachelor's degrees in Education, while only 27.5% had Mathematics bachelor's degrees.) A significant difference was found by gender, however, with 13.4% of females holding Mathematics degrees choosing to teach math, as compared with 2.9% of such males. Only 6.6% of males with Mathematics degrees chose to teach at all, while nearly three times that proportion of female holders of Mathematics degrees taught.

The first variable considered in the category Academic Achievement was college entrance examination (CEE) score; no significant differences in the likelihood of teaching mathematics was found by quartile of that score. Top quartile females were much more likely to teach mathematics than were top quartile males, however. By ethnicity, the greatest likelihood of becoming a mathematics teacher was found in the bottom quartile for Hispanic graduates, in the next-to-bottom quartile for both black and white graduates, and in the second-from-top quartile for Asian or Pacific Islander graduates.

Graduates with GPAs in their major in the lowest category (less than 2.24) were more likely to teach mathematics than were graduates with higher GPAs. A greater proportion of females with the highest GPA chose to teach mathematics than did their male peers.

Unsurprisingly, graduates with at least 13 credits in mathematics were more likely to teach mathematics than were graduates with fewer credits. A gender difference shows up here, too: having a lot of mathematics credits made a female much more likely than a male to teach math.

The group of people who chose to teach mathematics during the period of study was significantly different from the other three groups on the predictor variables examined, as shown by the discriminant analysis. The predictors that contributed most strongly to the separation of the groups were the number of mathematics course credits, gender, and ACT score.

Limitations of the Study and Recommendations for Future Research

A limitation of this study that future research could potentially overcome concerns the type of variables available for analysis. While the availability of more than five thousand variables is not to be disdained, there is no escaping the suspicion that some of the strongest predictors of the outcome of becoming a mathematics teacher may not exist in the dataset used here. This is not intended as a criticism of the majestically well-designed Baccalaureate & Beyond; rather, it is the recognition that the aims of the present study were not identical to the aims of the designers of the dataset. If future researchers had access to information on such questions that might influence the decision to teach as: experience with one's own past teachers;

the effect of a lifetime of media representations of teaching; or attitudes formed by the lack of professional status that many associate with teaching—then a more incisive depiction of the paths to becoming a mathematics teacher might be within reach.

A dataset which incorporates more variables on high school academic experiences could also prove to contribute to a better description of the outcome of becoming a mathematics teacher. The Baccalaureate and Beyond survey, while exhaustively comprehensive about life decisions during and after the undergraduate period, gives less attention to the high school years (a period covered by another NCES survey, the High School and Beyond). Information on specific mathematics courses taken in high school might well yield variables that would be predictive of the outcome "choosing to teach mathematics".

Further research might (even in the absence of the hypothetical dataset described above) examine in detail the experiences and characteristics of those who enter and leave mathematics teaching. This aspect of the examination of the choice to teach has been addressed for the group of teachers as a whole, by the 2000 NCES Statistical Analysis Report *Progress Through the Teacher Pipeline.* However, a separate report for mathematics and science teachers, especially employing the 2003 follow-up information, could be valuable to policy makers.

When looked at with a view to generalizing, the results of the present study seem to underscore the conventional wisdom that those with more options are less likely to choose to teach mathematics, just as they are less likely to choose to teach at all. People with higher CEE scores and people with degrees that are more specialized and technical are less likely to teach mathematics. When males and females are equally qualified, males are less likely to teach than are females. People who attended private colleges (which presumably points toward higher family socio-economic status) are less likely to teach mathematics, or anything.

The rationale behind this study was to provide information which could aid in efforts to recruit greater numbers of mathematics teachers. If the results are examined at face value, it seems clear that recruitment efforts should target those that our society considers to have fewer options: the female, the less prosperous, and the lower-achieving—as these are the people who are more likely to be staffing mathematics classrooms now. People who would seem to have more options are presently more likely to choose careers other than teaching, presumably because they find greater rewards (material and otherwise) in such careers.

This would assume that the present system of rewards remains in place. The problem of recruiting mathematics teachers has two aspects, of course: what has worked in the past (as reflected in this study) and what might work in the future. The future of recruitment success can be affected by changes in the perceived rewards of becoming a mathematics teacher. These changes might take the form of making the job itself more rewarding, or of making the process of qualifying for the job more attractive.

This last aspect of recruitment efforts has been addressed in recent years by numerous national programs for alternative certification of teachers, and by changes in existing university-based teacher education. By making the process of becoming a teacher less time-consuming, less structured, or less expensive for the candidate (through some form of subsidizing the education, or some provision of part-time work), greater numbers of future teachers of all kinds can be trained and certified.

Recruitment efforts have a logical “quality” component; we need more mathematics teachers, but we want them to be the most effective possible teachers we can find. The results of the present study cast a somewhat dismal shadow over this goal, given the findings that the most academically-talented students are not the type of students most likely to enter mathematics teaching. This situation is unlikely to change while academically-talented graduates find greater rewards in careers other than K-12 education. But it should be remembered that a high college entrance examination score is not all that goes into making an effective teacher. The distinguished University of Wisconsin education professor Martin Haberman has provided the concept of "Star" Teacher; these teachers are identified by qualities such as:

- are persistent and problem solvers;
- are protective of learners and learning;
- translate theory and research into practice;
- use successful approaches for at-risk students;
- respond professionally to students' needs;
- understand and anticipate burnout; and
- are willing to admit mistakes (Haberman Educational Foundation, 2004).

Though the standards of excellence in subject matter knowledge should never be relaxed, it is possible that the most effective teachers of mathematics might not always be those with the highest test scores, or with degrees in particular major areas of study. Such a theory was advanced in a 1999 paper by UK researchers Relf and Hobbs, who found:

> If it is really the case that personal qualities and attitudes predominate over subject knowledge and pedagogical expertise at the recruitment stage, then perhaps the same hierarchy of criteria should be applied to the design of courses and the selection of students prior to training. One of us has past experience of a 2-year PGCE [Post Graduate Certificate in Education] programme, designed to allow graduates in subjects other than mathematics to prepare to be mathematics teachers. Such courses permit the recruitment of candidates with high achievement motivation but limited mathematical qualifications. Students then spend significant amounts of time upgrading their personal mathematical expertise… (p.177)

Certainly, teachers of mathematics must have mastery of the subject matter. But perhaps there is more than one path in this case, too.

The success of recruitment efforts in the future will depend, in part, on the perceived rewards that a career in mathematics teaching might bring. That perception depends to some substantial extent on what actions policymakers take to make such a career more attractive, whether these actions affect the material rewards and work conditions teachers will face, or the costs (of money, time, and other resources) of undergoing the process of becoming a teacher. When policymakers have information on who might respond in particular ways to particular actions, their decisions can be made more efficiently and effectively.

APPENDIX A: TABLES OF STANDARD ERRORS

Table A3—Standard errors for Table 3: Of 1992-93 bachelor's degree recipients, percentage distribution of groups by income and dependency level: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Income and dependency level (categorical)				
Dependent, less than $20,000	0.54	1.20	1.18	1.52
Dependent, $20,000 to $99,000	0.16	0.18	0.57	0.57
Dependent, $100,000 or more	0.43	0.29	1.21	1.25
Independent, less than $20,000	0.45	0.29	0.88	1.03
Independent, $20,000 or more	0.21	0.29	0.90	0.98
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Income and dependency level (categorical)				
Dependent, less than $20,000	58.2			
Dependent, $20,000 to $99,000	563.5			
Dependent, $100,000 or more	86.7			
Independent, less than $20,000	258.6			
Independent, $20,000 or more	201.9			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A4—Standard errors for Table 4: Of 1992-93 bachelor's degree recipients, percentage distribution of groups by income and dependency level, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Income and dependency level (categorical)				
Dependent, less than $20,000	0.31	2.00	1.36	2.33
Dependent, $20,000 to $99,000	0.19	0.31	0.69	0.66
Dependent, $100,000 or more	0.45	0.34	0.81	0.87
Independent, less than $20,000	0.73	0.47	0.71	1.06
Independent, $20,000 or more	0.34	0.39	1.39	1.43
Weighted sample sizes (n/1,000s)				
Total	528.8			
Income and dependency level (categorical)				
Dependent, less than $20,000	21.9			
Dependent, $20,000 to $99,000	254.7			
Dependent, $100,000 or more	41.3			
Independent, less than $20,000	129.1			
Independent, $20,000 or more	78.8			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Income and dependency level (categorical)				
Dependent, less than $20,000	0.85	1.54	1.83	2.32
Dependent, $20,000 to $99,000	0.27	0.21	0.90	0.90
Dependent, $100,000 or more	0.84	0.47	2.03	2.04
Independent, less than $20,000	0.53	0.39	1.66	1.72
Weighted sample sizes (n/1,000s)				
Total	645.6			
Income and dependency level (categorical)				
Dependent, less than $20,000	36.3			
Dependent, $20,000 to $99,000	308.3			
Dependent, $100,000 or more	45.4			
Independent, less than $20,000	129.5			
Independent, $20,000 or more	123.1			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A5—Standard errors for Table 5: Of 1992-93 bachelor's degree recipients, percentage distribution by Group, by gender, according to whether parents provided financial help: 1997

	Main field taught in:			
	Math.	Science	Other	Non-teacher
--------- Parents helped with loan or direct contribution = **No help** ----------				
Standard Errors (BRR)				
Total	0.29	0.25	0.73	0.90
Gender of student				
Male	0.52	0.33	1.01	1.42
Female	0.31	0.35	0.99	1.08
Weighted sample sizes (n/1,000s)				
Total	409.3			
Gender of student				
Male	174.8			
Female	234.5			
--------- Parents helped with loan or direct contribution = **Provided help** ----------				
Standard Errors (BRR)				
Total	0.17	0.16	0.43	0.48
Gender of student				
Male	0.18	0.27	0.55	0.56
Female	0.30	0.22	0.75	0.79
Weighted sample sizes (n/1,000s)				
Total	733.8			
Gender of student				
Male	339.1			
Female	394.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/19/2006

Table A6--Standard errors for Table 6: Of 1992-93 bachelor's degree recipients, percentage distribution by Group, by highest education level of either parent: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors				
Total	0.16	0.13	0.43	0.5
Highest education level by either parent				
High School or less	0.34	0.34	0.73	0.94
Some college, no bachelors	0.4	0.22	0.81	0.9
Bachelor's degree	0.3	0.21	0.68	0.81
Masters or other advanced	0.29	0.34	0.81	0.95
Doctorate	0.52	0.58	1.93	2.04
Missing Value	0.8	0.45	1.57	1.85
Weighted sample sizes (n/1,000s)				
Total	1174.9			
Highest education level by either parent				
High School or less	349.72			
Some college, no bachelors	209.32			
Bachelor's degree	272.62			
Masters or other advanced	244.63			
Doctorate	47.83			
Missing Value	50.79			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005

Table A7—Standard errors for Table 7: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of high school graduated from: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Type of high school graduated from				
Public	0.18	0.15	0.49	0.57
Catholic	0.22	0.38	1.92	1.94
Private, religious, non-catholic	0.56	0.29	1.46	1.69
Private, non-religious	0.65	0.58	2.58	2.71
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Type of high school graduated from				
Public	972.3			
Catholic	70.1			
Private, religious, non-catholic	86.2			
Private, non-religious	39.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

Table A8—Standard errors for Table 8: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of high school graduated from, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Type of high school graduated from				
Public	0.27	0.26	0.54	0.64
Catholic	0.14	0.59	1.12	1.25
Private, religious, non-catholic	0.34	0.43	1.46	1.59
Private, non-religious	0.81	0.00	1.71	2.02
Weighted sample sizes (n/1,000s)				
Total	528.8			
Type of high school graduated from				
Public	431.5			
Catholic	34.9			
Private, religious, non-catholic	40.6			
Private, non-religious	19.0			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Type of high school graduated from				
Public	0.21	0.18	0.76	0.84
Catholic	0.43	0.51	3.98	3.94
Private, religious, non-catholic	1.08	0.58	1.92	2.34
Private, non-religious	1.25	1.11	4.11	4.19
Weighted sample sizes (n/1,000s)				
Total	645.6			
Type of high school graduated from				
Public	540.4			
Catholic	35.3			
Private, religious, non-catholic	45.6			
Private, non-religious	20.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

Table A9—Standard errors for Table 9: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by type of post-secondary institution first attended: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
First postsecondary institution attended				
Public 4-year	0.24	0.21	0.58	0.72
Private 4-year	0.25	0.26	0.72	0.89
Public 2-year	0.38	0.51	0.94	1.32
Private 2-year	0.00	1.10	3.18	3.11
Public or private, <2yr	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
First postsecondary institution attended				
Public 4-year	568.4			
Private 4-year	290.3			
Public 2-year	175.3			
Private 2-year	9.8			
Public or private, <2yr	low n			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A10—Standard errors for Table 10: Of 1993-97 bachelor's degree recipients, percentage distribution of Groups by type of post-secondary institution first attended, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
First postsecondary institution attended				
Public 4-year	0.37	0.33	0.77	0.90
Private 4-year	0.26	0.35	0.88	0.98
Public 2-year	0.42	0.90	0.92	1.46
Private 2-year	low n	low n	low n	low n
Public or private, <2yr	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	528.8			
First postsecondary institution attended				
Public 4-year	264.5			
Private 4-year	130.1			
Public 2-year	77.1			
Private 2-year	low n			
Public or private, <2yr	low n			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
First postsecondary institution attended				
Public 4-year	0.28	0.26	0.93	1.02
Private 4-year	0.46	0.42	0.98	1.14
Public 2-year	0.53	0.55	1.36	1.65
Private 2-year	0.00	0.00	4.84	4.84
Public or private, <2yr	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	645.6			
First postsecondary institution attended				
Public 4-year	303.5			
Private 4-year	160.1			
Public 2-year	98.2			
Private 2-year	7.7			
Public or private, <2yr	low n			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A11—Standard errors for Table 11: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups, by typical age/older classification: 1997

	Main field taught in: Mathematics	Science	Other	Non-teachers
Standard Errors(BRR)				
Total	0.16	0.13	0.43	0.50
Age, typical/older classification				
Typical age	0.24	0.23	0.52	0.70
Older	0.21	0.15	0.70	0.79
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Age, typical/older classification				
Typical age	606.0			
Older	546.8			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A12—Standard errors for Table 12: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by typical age/older classification, by gender: 1997

	Main field taught in: Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Age, typical/older classification				
Typical age	0.34	0.36	0.59	0.75
Older	0.32	0.30	0.70	0.86
Weighted sample sizes (n/1,000s)				
Total	528.8			
Age, typical/older classification				
Typical age	250.0			
Older	268.9			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Age, typical/older classification				
Typical age	0.34	0.31	0.79	0.90
Older	0.33	0.16	1.15	1.24
Weighted sample sizes (n/1,000s)				
Total	645.6			
Age, typical/older classification				
Typical age	355.5			
Older	278.0			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A13—Standard errors for Table 13: Of 1992-93 bachelor's degree recipients, percentage distribution by Groups, by time from high school graduation to bachelor's degree: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Number of months from HS grad to BA receipt				
Typical (4 yrs or less)	0.24	0.22	0.73	0.88
between 4 & 5	0.29	0.32	0.76	0.89
between 5 & 6	0.54	0.32	1.49	1.60
between 6 & 7	1.13	0.36	1.86	2.15
more than 7 yrs	0.33	0.26	0.81	0.96
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Number of months from HS grad to BA receipt				
Typical (4 yrs or less)	336.9			
between 4 & 5	300.9			
between 5 & 6	121.9			
between 6 & 7	59.5			
more than 7 yrs	272.5			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A14—Standard errors for Table 14: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by time from high school graduation to bachelor's degree, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Number of months from HS grad to BA receipt				
Typical (4 yrs)	0.37	0.34	0.82	0.96
between 4 & 5	0.49	0.55	0.75	1.09
between 5 & 6	0.37	0.48	1.97	2.05
between 6 & 7	2.07	0.13	1.35	2.48
more than 7 yrs	0.35	0.35	0.95	1.10
Weighted sample sizes (n/1,000s)				
Total	528.8			
Number of months from HS grad to BA receipt				
Typical (4 yrs)	132.0			
between 4 & 5	143.1			
between 5 & 6	68.2			
between 6 & 7	32.5			
more than 7 yrs	118.7			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Number of months from HS grad to BA receipt				
Typical (4 yrs)	0.40	0.31	1.05	1.22
between 4 & 5	0.34	0.39	1.25	1.22
between 5 & 6	0.98	0.42	2.00	2.18
between 6 & 7	0.00	0.82	3.53	3.55
more than 7 yrs	0.53	0.37	1.14	1.41
Weighted sample sizes (n/1,000s)				
Total	645.6			
Number of months from HS grad to BA receipt				
Typical (4 yrs)	204.9			
between 4 & 5	157.3			
between 5 & 6	53.7			
between 6 & 7	27.0			
more than 7 yrs	153.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/27/2006

Table A15—Standard errors for Table 15: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by major: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Bachelor's degree field recoded				
Business and management	0.23	0.10	0.26	0.41
Education	0.78	0.71	1.79	2.04
Engineering	0.21	0.00	0.14	0.26
Health professions	0.00	0.23	0.53	0.58
Public affairs/social services	0.00	0.37	1.00	1.01
Biological sciences	0.92	1.49	0.39	1.45
Mathematics and other sciences	1.36	1.00	0.67	1.71
Social science	0.19	0.24	0.61	0.72
History	0.00	0.56	7.06	7.04
Humanities	0.17	0.24	1.34	1.36
Psychology	1.37	0.30	1.55	2.00
Other	0.24	0.23	0.83	0.95
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Bachelor's degree field recoded				
Business and management	257.9			
Education	152.8			
Engineering	75.5			
Health professions	86.4			
Public affairs/social services	38.7			
Biological sciences	51.4			
Mathematics and other sciences	67.2			
Social science	112.4			
History	20.5			
Humanities	104.7			
Psychology	40.8			
Other	166.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

Table A16—Standard errors for Table 16: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups, by major, by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Bachelor's degree field recoded				
Business and management	0.39	0.18	0.30	0.56
Education	1.70	1.58	3.65	4.38
Engineering	0.25	0.00	0.17	0.30
Health professions	0.00	0.00	0.77	0.77
Public affairs/social services	0.00	0.00	0.00	0.00
Biological sciences	0.51	2.54	0.36	2.49
Mathematics and other sciences	1.45	1.62	0.31	2.21
Social science	0.24	0.40	0.79	0.89
History	0.00	0.83	11.04	10.99
Humanities	0.20	0.35	1.93	1.95
Psychology	4.70	0.00	2.56	5.28
Other	0.31	0.22	0.80	0.94
Weighted sample sizes (n/1,000s)				
Total	528.8			
Bachelor's degree field recoded				
Business and management	136.3			
Education	31.4			
Engineering	64.1			
Health professions	22.9			
Public affairs/social services	16.5			
Biological sciences	27.7			
Mathematics and other sciences	41.5			
Social science	54.9			
History	12.2			
Humanities	41.1			
Psychology	11.2			
Other	69.0			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Bachelor's degree field recoded				
Business and management	0.22	0.00	0.44	0.49
Education	0.73	0.83	2.22	2.21
Engineering	0.00	0.00	0.00	0.00
Health professions	0.00	0.31	0.61	0.70
Public affairs/social services	0.00	0.63	1.73	1.72
Biological sciences	1.89	1.25	0.70	2.23
Mathematics and other sciences	2.20	0.92	1.66	2.95
Social science	0.28	0.23	1.08	1.14
History	0.00	0.66	5.01	4.99
Humanities	0.26	0.34	1.88	1.87
Psychology	0.44	0.41	2.05	2.16
Other	0.36	0.30	1.30	1.38

Weighted sample sizes (n/1,000s)	
Total	645.6
Bachelor's degree field recoded	
Business and management	121.4
Education	121.5
Engineering	11.4
Health professions	63.5
Public affairs/social services	22.2
Biological sciences	23.7
Mathematics and other sciences	25.7
Social science	57.5
History	8.2
Humanities	63.7
Psychology	29.6
Other	97.3

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/26/2006

Table A17—Standard errors for Table 17: Of 1992-93 bachelor's degree recipients, percentage distribution of Group, by CEE quartile: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	0.22	0.32	0.87	0.88
Second quartile SAT (or ACT if no SAT)	0.39	0.41	0.90	1.10
Third quartile SAT (or ACT if no SAT)	0.38	0.30	0.89	1.09
Top quartile SAT (or ACT if no SAT)	0.37	0.23	0.75	0.88
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	219.1			
Second quartile SAT (or ACT if no SAT)	256.4			
Third quartile SAT (or ACT if no SAT)	242.6			
Top quartile SAT (or ACT if no SAT)	217.0			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A18—Standard errors for table 18: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by CEE score and gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	0.30	0.40	0.97	1.12
Second quartile SAT (or ACT if no SAT)	0.71	0.59	0.90	1.56
Third quartile SAT (or ACT if no SAT)	0.40	0.56	1.19	1.34
Top quartile SAT (or ACT if no SAT)	0.18	0.29	0.92	0.92
Weighted sample sizes (n/1,000s)				
Total	528.8			
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	82.9			
Second quartile SAT (or ACT if no SAT)	111.5			
Third quartile SAT (or ACT if no SAT)	125.6			
Top quartile SAT (or ACT if no SAT)	119.8			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	0.35	0.45	1.26	1.40
Second quartile SAT (or ACT if no SAT)	0.33	0.56	1.50	1.52
Third quartile SAT (or ACT if no SAT)	0.60	0.35	1.23	1.67
Top quartile SAT (or ACT if no SAT)	0.81	0.37	1.00	1.30
Weighted sample sizes (n/1,000s)				
Total	645.6			
Merged SAT and ACT score quartile				
Bottom quartile SAT (or ACT if no SAT)	136.2			
Second quartile SAT (or ACT if no SAT)	144.9			
Third quartile SAT (or ACT if no SAT)	117.0			
Top quartile SAT (or ACT if no SAT)	97.0			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A19—Standard errors for Table 19: Of 1992-93 bachelor's degree recipients, percentage distribution by Group, by ethnicity, according to CEE quartile: 1997

	Main field taught in:			
	Math	Science	Other	Non-teacher
--------- Merged SAT and ACT score quartile = Bottom quartile SAT (or ACT if no SAT) ----------				
Standard Errors (BRR)				
Total	0.22	0.32	0.87	0.88
Respondent ethnicity				
Asian or Pacific Islander	0.00	0.00	2.12	2.12
Black, non-Hispanic	0.00	0.38	2.22	2.20
Hispanic	1.55	0.00	2.32	2.52
White, non-Hispanic	0.25	0.42	1.03	1.05
Weighted sample sizes (n/1,000s)				
Total	219.1			
Respondent ethnicity				
Asian or Pacific Islander	7.1			
Black, non-Hispanic	31.6			
Hispanic	15.8			
White, non-Hispanic	163.4			
--------- Merged SAT and ACT score quartile = Second quartile SAT (or ACT if no SAT) ----------				
Standard Errors (BRR)				
Total	0.39	0.41	0.90	1.10
Respondent ethnicity				
Asian or Pacific Islander	0.00	0.00	0.99	0.99
Black, non-Hispanic	0.77	0.00	3.82	4.05
Hispanic	0.00	4.16	7.49	8.08
White, non-Hispanic	0.45	0.43	0.99	1.12
Weighted sample sizes (n/1,000s)				
Total	256.4			
Respondent ethnicity				
Asian or Pacific Islander	9.1			
Black, non-Hispanic	13.5			
Hispanic	10.2			
White, non-Hispanic	221.9			
--------- Merged SAT and ACT score quartile = Third quartile SAT (or ACT if no SAT) ----------				
Standard Errors (BRR)				
Total	0.38	0.30	0.89	1.09
Respondent ethnicity				
Asian or Pacific Islander	2.75	0.00	0.78	2.90
Black, non-Hispanic	0.00	1.42	3.85	4.00
Hispanic	1.59	0.00	2.06	2.52
White, non-Hispanic	0.38	0.34	0.98	1.15
Weighted sample sizes (n/1,000s)				
Total	242.6			
Respondent ethnicity				
Asian or Pacific Islander	12.9			
Black, non-Hispanic	5.9			
Hispanic	7.7			
White, non-Hispanic	213.7			

	Main field taught in:			
	Math	Science	Other	Non-teacher
--------- Merged SAT and ACT score quartile = Top quartile SAT (or ACT if no SAT) ----------				
Standard Errors (BRR)				
Total	0.37	0.23	0.75	0.88
Respondent ethnicity				
Asian or Pacific Islander	0.00	0.00	0.00	0.00
Black, non-Hispanic	low n	low n	low n	low n
Hispanic	2.20	1.58	1.79	3.37
White, non-Hispanic	0.39	0.26	0.82	0.95
other	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	217.0			
Respondent ethnicity				
Asian or Pacific Islander	14.8			
Black, non-Hispanic	low n			
Hispanic	7.2			
White, non-Hispanic	189.3			
other	low n			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
(all categories had “other: low n”, as has been left in the Top quartile)

Table A20—Standard errors for Table 20: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Overall grades in undergrad major				
3.74 and above	0.31	0.25	0.98	1.08
between 3.24 and 3.74	0.22	0.18	0.46	0.56
between 2.24 and 3.24	0.24	0.29	1.10	1.20
less than 2.24	3.46	2.41	4.79	6.94
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Overall grades in undergrad major				
3.74 and above	267.8			
between 3.24 and 3.74	779.5			
between 2.24 and 3.24	91.4			
less than 2.24	4.6			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A21—Standard errors for Table 21: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major and by gender: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors(BRR)				
Total	0.22	0.21	0.46	0.55
Overall grades in undergrad major				
3.74 and above	0.25	0.23	0.93	1.02
between 3.24 and 3.74	0.32	0.32	0.58	0.70
between 2.24 and 3.24	0.40	0.16	0.50	0.67
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	528.8			
Overall grades in undergrad major				
3.74 and above	94.7			
between 3.24 and 3.74	368.2			
between 2.24 and 3.24	52.0			
less than 2.24	low n			
--------- Gender of student = Female ----------				
Standard Errors(BRR)				
Total	0.21	0.17	0.68	0.75
Overall grades in undergrad major				
3.74 and above	0.42	0.35	1.39	1.59
between 3.24 and 3.74	0.31	0.18	0.75	0.87
between 2.24 and 3.24	0.24	0.62	2.37	2.38
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	645.6			
Overall grades in undergrad major				
3.74 and above	172.8			
between 3.24 and 3.74	411.1			
between 2.24 and 3.24	39.4			
less than 2.24	low n			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A22—Standard errors for Table 22: Of 1992-93 bachelor's degree recipients, percentage distribution of Groups by GPA in major, by ethnicity: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
--------- Respondent ethnicity = Asian or Pacific Islander ----------				
Standard Errors (BRR)				
Total	0.65	0.00	1.06	1.35
Overall grades in undergrad major				
3.74 and above	0.00	0.00	0.81	0.81
between 3.24 and 3.74	0.84	0.00	1.66	1.99
between 2.24 and 3.24	2.82	0.00	0.00	2.82
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	56.4			
Overall grades in undergrad major				
3.74 and above	10.1			
between 3.24 and 3.74	37.4			
between 2.24 and 3.24	6.5			
less than 2.24	low n			
--------- Respondent ethnicity = Black, non-Hispanic ----------				
Standard Errors (BRR)				
Total	0.21	0.28	1.53	1.58
Overall grades in undergrad major				
3.74 and above	0.94	0.00	6.33	6.53
between 3.24 and 3.74	0.29	0.25	1.77	1.71
between 2.24 and 3.24	0.00	1.26	2.95	3.44
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	69.7			
Overall grades in undergrad major				
3.74 and above	6.7			
between 3.24 and 3.74	48.8			
between 2.24 and 3.24	12.9			
less than 2.24	low n			
--------- Respondent ethnicity = Hispanic ----------				
Standard Errors (BRR)				
Total	0.84	0.70	2.11	2.44
Overall grades in undergrad major				
3.74 and above	1.31	0.00	3.95	4.27
between 3.24 and 3.74	1.42	0.99	2.53	3.48
between 2.24 and 3.24	0.00	0.00	9.00	9.00
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	59.5			
Overall grades in undergrad major				
3.74 and above	9.6			
between 3.24 and 3.74	41.7			
between 2.24 and 3.24	6.0			
less than 2.24	low n			

--------- Respondent ethnicity = White, non-Hispanic ----------				
Standard Errors (BRR)				
Total	0.18	0.15	0.48	0.59
Overall grades in undergrad major				
3.74 and above	0.30	0.28	1.08	1.18
between 3.24 and 3.74	0.24	0.20	0.50	0.63
between 2.24 and 3.24	0.25	0.30	0.93	0.99
less than 2.24	4.10	2.80	3.67	7.30
Weighted sample sizes (n/1,000s)				
Total	975.6			
Overall grades in undergrad major				
3.74 and above	238.1			
between 3.24 and 3.74	642.4			
between 2.24 and 3.24	65.3			
less than 2.24	4.0			
--------- Respondent ethnicity = other ----------				
Standard Errors (BRR)				
Total	1.69	0.75	3.78	4.02
Overall grades in undergrad major				
3.74 and above	low n	low n	low n	low n
between 3.24 and 3.74	1.53	1.33	5.40	5.54
between 2.24 and 3.24	low n	low n	low n	low n
less than 2.24	low n	low n	low n	low n
Weighted sample sizes (n/1,000s)				
Total	6.3			
Overall grades in undergrad major				
3.74 and above	low n			
between 3.24 and 3.74	3.7			
between 2.24 and 3.24	low n			
less than 2.24 low n				

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005
Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A23—Standard errors for Table 23: Of 1992-93 bachelor's degree recipients, percentage distribution according to number of mathematics credits earned: 1997

	Main field taught in:			
	Mathematics	Science	Other	Non-teachers
Standard Errors (BRR)				
Total	0.16	0.13	0.43	0.50
Credits for all mathematics				
no mathematics credits	0.16	0.24	0.67	0.77
1-3 mathematics credits	0.22	0.25	1.11	1.23
4-6 mathematics credits	0.32	0.20	0.93	1.02
7-9 mathematics credits	0.44	0.64	0.89	1.36
10-12 mathematics credits	0.32	0.45	1.36	1.49
13 or more mathematics credits	1.27	0.67	0.76	1.32
Weighted sample sizes (n/1,000s)				
Total	1,174.9			
Credits for all mathematics				
no mathematics credits	387.6			
1-3 mathematics credits	230.1			
4-6 mathematics credits	228.8			
7-9 mathematics credits	129.6			
10-12 mathematics credits	64.2			
13 or more mathematics credits	106.5			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/23/2006

Table A24—Standard errors for Table 24**:** Of 1992-93 bachelor's degree recipients, percentage distribution by number of mathematics credits earned, by gender: 1997

		Main field taught in:		
	Mathematics	Science	Other	Non-teachers
--------- Gender of student = Male ----------				
Standard Errors (BRR)				
Total	0.22	0.21	0.46	0.55
Credits for all mathematics				
no mathematics credits	0.32	0.48	0.77	0.95
1-3 mathematics credits	0.25	0.44	1.25	1.32
4-6 mathematics credits	0.53	0.35	0.83	1.06
7-9 mathematics credits	0.30	0.76	0.67	1.12
10-12 mathematics credits	0.28	0.55	0.73	0.95
13 or more mathematics credits	1.35	0.96	0.90	1.44
Weighted sample sizes (n/1,000s)				
Total	528.8			
Credits for all mathematics				
no mathematics credits	146.8			
1-3 mathematics credits	87.6			
4-6 mathematics credits	106.4			
7-9 mathematics credits	70.0			
10-12 mathematics credits	35.6			
13 or more mathematics credits	69.7			
--------- Gender of student = Female ----------				
Standard Errors (BRR)				
Total	0.21	0.17	0.68	0.75
Credits for all mathematics				
no mathematics credits	0.17	0.26	0.95	1.03
1-3 mathematics credits	0.34	0.36	1.64	1.85
4-6 mathematics credits	0.25	0.21	1.57	1.60
7-9 mathematics credits	1.03	1.18	1.93	2.90
10-12 mathematics credits	1.00	0.69	3.15	3.28
13 or more mathematics credits	2.22	0.67	1.28	2.53
Weighted sample sizes (n/1,000s)				
Total	645.6			
Credits for all mathematics				
no mathematics credits	240.7			
1-3 mathematics credits	142.6			
4-6 mathematics credits	122.4			
7-9 mathematics credits	59.3			
10-12 mathematics credits	28.6			
13 or more mathematics credits	36.7			

Source: NCES, B&B:93/03 Baccalaureate and Beyond Longitudinal Study 07/11/2005 Computation by DAS-T Online Version 4.0 on 02/23/2006

APPENDIX B: GLOSSARY OF VARIABLES

DAS variables—descriptions and frequencies from the DAS
http://nces.ed.gov/das/

Name: **WTC00**
Label: Panel weight for resp to all surveys

Type: Weight
Description:
Panel weight for respondents to all surveys - NPSAS:93, B&B:94, B&B:97, B&B:2003
Weight for longitudinal analysis of respondents to B&B:93/2003 who were also respondents to NPSAS:93, B&B:93/94 &B:93/97. Applies to: All respondents to all of NPSAS:93, B&B:94, B&B:97, B&B:2003

Name: **B2FLD**
Label: Main field taught in B97 recoded

Type: Categorical
Description:
B2FIELD recoded with the following code:
recode b2field
(48 thru 51=1)(2,4=2)(1=3)(41,42,43=4)(20,40=5) (21 thru 26=6)(52=7)(16,18=8)(12,13,14,15,17,19=9) (27 thru 39=10)(44 thru 47=11)(5 thru 11=12)(3,53=13)(-1=-1)(-2=-2)(-8=-8)(-9=-9) into b2fld.

Statistics

Value	%	Label
1	0.5	Art, drama, music
2	0.2	Business
3	4	Elementary, early childhood educatn
4	1	English, journalism, reading, writing
5	0.2	ESL, bilingual
6	0.5	Foreign languages
7	0.4	Health, physical education
8	1.2	Mathematics
9	1.1	Science
10	0.7	Special education
11	0.5	Social studies/sci, history, civics
12	0.3	Vocational, occupational
13	0.3	Other
-1	89.2	Missing Value

Source: B&B93/97 student CATI

Name: **GENDER**

Label: Gender of student

Type: Categorical
Description:
Gender of student
What is the student's gender?
Case [CADE->M_STGEN = 1 or 2] CADE->M_STGEN = DERIVED->GENDER
Case [CADE->M_STGEN<>1 or 2] and [CATI->G001=1 or 2 or -7 or -8]
CATI->G001 = DERIVED->GENDER Otherwise GENDER = -9
Key to variable(s) used in the construction of derived variable: G001 - Student: Sex of the respondent M_STGEN - Student: Gender

Statistics

Value	%	Label
1	44.9	Male
2	54.7	Female
-1	0.3	Missing Value

Source: NPSAS, B&B93/94, B&B93/97 student CATI

Name: **B2ETHNIC**
Label: Respondent ethnicity

Type: Categorical
Description:
This variable provides the race and ethnicity of the respondent. Data for RETHNIC were merged here for B&B93/94 respondents. pseudo-SAS code:
If rhispor=1 then rethnic=4;
else if rrace=1 and rhispor^=1 then rethnic=5; else if rrace=2 and rhispor^=1 then rethnic=3;
else if rrace=3 and rhispor^=1 then rethnic=1; else if rrace=4 and rhispor^=1 then rethnic=2;
else if rrace=5 and rhispor^=1 then rethnic=6; else rethnic=-2;

Statistics

Value	%	Label
1	0.6	American Indian/Alaska Native
2	5	Asian or Pacific Islander
3	5.9	Black, non-Hispanic
4	5.4	Hispanic
5	81.9	White, non-Hispanic
6	0.3	Other
-1	0.9	Missing Value

Source: NPSAS, B&B93/94, B&B93/97 student CATI

Name: **BBPART**
Label: B&B panel participation

Type: Categorical
Description:
Indicates which components of the B&B study respondent participated in:
1993 Base year survey (NPSAS:93)
1994 First follow-up survey (B&B:94)
1997 Second follow-up survey (B&B:97)
Refers to survey participation only, not CADE or transcripts.

Statistics

Value	%	Label
1	85.2	1993, 1994, 1997
2	4.5	1993, 1994
3	4.6	1993, 1997
4	5.8	1993

Source: B&B:93/97 derived

Name: **DISABLED**
Label: Does respondent have a disability

Type: Categorical
Description:
DISABLED flags respondents who have a hearing, speech, orthopedic, vision, learning, or other disability.
SAS Code:
If (HEARDIS=1)| (SPEACHD=1) | (ORTHDIS=1)| (VISIOND=1) |
(OTHDISB=1)| (LEARNDS=1) then DISABLED = 1;
Else if (HEARDIS<0)| (SPEACHD<0) | (ORTHDIS<0)| (VISIOND<0) |
(OTHDISB<0)| (LEARNDS<0) then DISABLED = -2;
Else DISABLED=0;
Related Variables:
HEARDIS
SPEACHD
ORTHDIS
VISIOND
OTHDISB
LEARNDS

Statistics

Value % Label

1	3	Yes
0	85.5	{No}
-1	11.5	Missing Value

Source: B&B93/94 student CATI

Name: **PAREDUC**

Label: Highest education level by either parent

Type: Categorical

Description:

Highest education level completed by either parent

What is the highest grade or level of education completed by either of your parents?

PAREDUC=FATHEDUC

If (MOTHEDUC > PAREDUC) then PAREDUC=MOTHEDUC

Key to variable(s) used in the construction of derived variable:

PAREDUC - Parents: Highest level of education completed by either parent

FATHEDUC - Parent: Highest level of education completed by father

MOTHEDUC - Parents: Highest level of education mother ever completed

Statistics

Value	%	Label
1	4.5	Less than high school
2	0.5	GED
3	24.3	High school graduation
4	1	Less than 1 year
5	2.3	1 year but less than 2 years
6	3.7	2 years or more
7	2.4	Less than 2 years of college
8	5.7	Associate's degree
9	2.7	2 or more years of college
10	21.9	Bachelor's degree (4-5 year degree)
11	14.9	Master's degree or equivalent
12	3.9	First professional degree
13	1	Other advanced professional degree
14	4	Doctorate (PhD, EdD)
-1	7.2	Missing Value

Source: N93 Student CATI

Name: **PARHELP**

Label: Parents helped with loan or direct contribution

Type: Continuous
Description:
Parents helped with loan or direct contribution
Parent help flag. Equal to 1 if either student or parent reported that parent had given student money, either as a direct contribution (PPARSPRT, SPARSPRT) or as a loan (PPARLOAN, SPARLOAN).

Statistics

Value	%	Label
1	60.4	{Yes}
0	34.6	{No}
-1	5	Missing Value

Source: N93 Student/parent CATI

Name: **INCOME**
Label: Income and dependency level (categorical)

Type: Categorical
Description:
Income and dependency level (categorical) Dependency status and categorical income level. Equal to DEPINC for dependent students and INDEPINC for independent students. See component variables for more information.

Statistics

Value	percentage	Label
1	1.9	Dependent: Less than $10,000
2	3.1	Dependent: $10,000-$19,999
3	5	Dependent: $20,000-$29,999
4	5.8	Dependent: $30,000-$39,999
5	7	Dependent: $40,000-$49,999
6	11.1	Dependent: $50,000-$59,999
7	7.7	Dependent: $60,000-$69,999
8	4.5	Dependent: $70,000-$79,999
9	5.2	Dependent: $80,000-$99,999
10	7.3	Dependent: $100,000 or more
11	7.1	Independent: Less than $5,000
12	6.7	Independent: $5,000-$9,999
13	8.3	Independent: $10,000-$19,999

14	5.4	Independent: $20,000-$29,999
15	7.7	Independent: $30,000-$49,999
16	4.3	Independent: $50,000 or more
-1	2	Missing Value

Source: N93 CADE, N93 Student/parent CATI, Pell file, Student loan

Name: **HSTYPE**
Label: Type of high school graduated from

Type: Categorical
Description: Type of high school graduated from; Did you graduate from a public or private high school? If private, was it a Catholic, other religious, or non-religious high school?
HSTYPE=A009
Key to variable(s) used in the construction of derived variable:
A009 - High school: Type of high school graduated from (public, private, religious)

Statistics

Value	percentage	Label
1	79.5	Public
2	5.6	Catholic
3	7.1	Private, religious, non-catholic
4	3.3	Private, non-religious
-1	4.5	Missing Value

Source: N93 Student CATI

Name: **B2BAMAJR**
Label: Bachelors degree field recoded

Type: Categorical
Description:
B2BAMAJR identifies a respondent's undergraduate major field of study. The major codes were collapsed into categories equivalent to RCG codes using the following rules:
if in (10-16) then = 1;
if in (25-30) then = 2;
if in (31-36) then = 3;
if in (40-54) then = 4;
if in (89-91) then = 5;
if in (66-70) then = 6;

if in (71, 72, 20-22, 84-87) then = 7;
if in (92-94, 96-98) then = 8;
if in (95) then = 9;
if in (37-39, 61-63, 81-83, 108-113) then = 10;
if in (88) then = 11;
if in (0-9, 17-19, 23, 24, 55-60, 64, 65, 73-80, 99-107, 114) then =
12;
Humanities: English, liberal arts, philosophy, theology, art, music, speech/drama, history/fine arts, area studies, African-American studies, ethnic studies, foreign languages, liberal studies, women's studies.

Social/behavioral sciences: Psychology, economics, political science, American civilization, clinical pastoral care, social work, anthropology/archaeology, history, sociology.

Life sciences: Natural resources, forestry, biological science (including zoology), biophysics, geography, interdisciplinary studies, including biopsychology environmental studies.

Physical sciences: Physical sciences including chemistry, physics.

Math: Mathematics, statistics.

Computer/information science: Computer/information science, computer programming.

Engineering: Electrical, chemical, mechanical, civil, or other engineering; engineeing technology; electronics.

Education: Early childhood, elementary, secondary, special, or physical education; leisure studies; library/archival sciences.

Business management: Accounting, finance, secretarial, data processing, business/management, public administration, marketing/distribution, business support, intern relations.

Health: Nursing, nurse assisting, community/mental health, medicine, physical education/recreation, audiology, clinical health, dentistry, veterinary medicine, health/hospital, publdietetics, other/general health.

Vocational/technical: Mechanic technology including transportation, protective services, con air/other transportation, precision production.

Other professional or technical: Agriculture, agricultural science, architecture, professional city planning, journalism, communications, communications technology, cosmetology, military science, dental/medical technology, home economics, vocational home economics including child care, law, pbasic/personal skills.

The main source used to create B2BAMAJR was BAMAJOR from the B&B93/94 student survey; if that was missing, MAJCODE1 from B&B93/94 student transcripts was used. If still missing, then MAJORS from NPSAS was used.
Related Variables:
B2HDGMAJ
B2HENMAJ
B2RCNMAJ

Statistics

Value	percentage	Label
1	20.6	Business and management
2	11.9	Education
3	5.9	Engineering
4	7	Health professions
5	3.1	Public affairs/social services
6	4.2	Biological sciences
7	5.4	Mathematics and other sciences
8	9.1	Social science
9	1.8	History
10	8.8	Humanities
11	3.5	Psychology
12	13.1	Other
-1	5.8	Missing Value

Source: NPSAS, B&B93/94, B&B93/97 student CATI

Name: **SATACTQ2**
Label: Merged SAT and ACT score quartile

Type: Categorical
Description:
This composite variable replaces SATACTQ, which was included in the DAS's for B&B:93/94. It categorizes graduates into quartiles based on SATQTR2 and ACTQTR2. If graduates had a value > 0 on SATQTR2, that value was assigned to SATACTQ2. If graduates did not have a value > 0 on SATQTR2, but did have a value > 0 on ACTQTR2, the value on ACTQTR2 was assigned to SATACTQ2. Graduates who did not have a valid value on either variable were assigned -2 (missing) on SATACTQ2. See code below.

Statistics

Value	percentage	Label
1	18.9	Bottom quartile SAT (or ACT if no SAT)
2	21.3	Second quartile SAT (or ACT if no SAT)
3	19.7	Third quartile SAT (or ACT if no SAT)
4	18	Top quartile SAT (or ACT if no SAT)
0	22.2	{Did not take SAT or ACT}

Source: B&B93/94 student CATI

Name: **GRADEMAJ**
Label: Overall grades in undergrad major

Type: Categorical
Description:
Overall grades in undergraduate major
Combines student-reported grade average in the major (GPAMAJ) with categorical responses to the CATI item asked only of students who were unable to supply an exact GPA (GRDSMAJ).
Exact GPAs were mapped to categories as follows:
GPACUM / GPAMAJ GRADECUM / GRADEMAJ
============== ==================
>374 1 Mostly As
325-374 2 As & Bs
275-324 3 Mostly Bs
225-274 4 Bs and Cs
175-224 5 Mostly Cs
125-174 6 Cs and Ds
<125 7 Mostly Ds or below

Statistics

Value	percentage	Label
1	20.3	Mostly As
2	24.4	As & Bs
3	34.8	Mostly Bs
4	6.2	Bs and Cs
5	1	Mostly Cs
6	0.1	Cs and Ds
7	0.2	Mostly Ds or below
-1	12.9	Missing Value

Source: B&B93/94 student CATI

Name: **TCRED11Z**
Label: Credits for all mathematics

Type: Continuous
Description:
Total number of normalized credits taken at the sample school in all math. Courses in All Mathematics are sample school courses with the following course codes: 270100-270299, 270600-270799, 270801, 270901-270902, 271001, 272001, 279999 [i.e., (08)+(09)+(10)+279999]
Identical to TCRED11 except legitimate skips were recoded to zero.
Related variables:
TCRED11 on transcript student master file.

Statistics

Value	percentage	Label
continuous	57.3	{1-70;7.64/6.49}
0	30.1	{zero}
-1	12.5	Missing Value

Minimum: 1
Maximum: 70
Mean: 7.64
Standard Deviation: 6.49

Source: Student undergraduate transcripts

Name: **SECTOR_B**
Label: Institutional type

Type: Categorical
Description:
Institutional type (level and control)
Institution type by level and control, combined. Institution level concerns the institution's highest offering (length of program and type of certificate, degree or award), and control concerns the source of revenue and control of operations. See descriptions for LEVEL6 and CONTROL for more complete information. Related variables:
SECTOR_A is a more detailed version of SECTOR_B.
Source variables:
POSTSTR

Statistics

Value	%	Label
1	0.4	Public, less-than-2-year
2	1.6	Public, 2-year
3	23	Public, non-PhD granting
4	41.9	Public, PhD granting
5	0.2	Private, nfp, less-than-4-year
6	17.8	Private, nfp, 4-year, non-PhD granting
7	13.4	Private, nfp, 4-year, PhD granting
8	0	Private, for-profit, less-than-2-year
9	1.5	Private, for-profit, 2-years-or-more
-1	0.2	Missing Value

Source: IPEDS-IC (1992)

Name**: BATIME1**
Label: Number of months from HS grad to BA receipt

Type: Continuous
Description:
This composite calculates the number of months between the date a respondent graduated from high school and the date of BA receipt. If a respondent was missing either date, BATIME1 was set to missing (-2). In some cases, the value for BATIME1 was lower than 30 months; these cases were set to -3 (out of range). BATIME1 was calculated only for those students receiving their first bachelor's degree at the sample school; those students not meeting this criterion were coded as legitimate skip.

Statistics

Value	percentage	Label
c	83.6	{30-683;89.89/76.91}
-1	16.4	Missing Value

Minimum	Maximum	Mean	Standard Deviation
30	683	89.89	76.91

Source: B&B93/94 student CATI

Name: **FSCTYPE**
Label: First postsecondary institution attended

Type: Categorical
Description:
This variable gives the type of school the student first attended. It was created by looking for the earliest enrollment date from the sample school and any other school attended (before receiving the bachelor's degree at the sample school).

Statistics

Value	Percentage	Label
1	43.7	Public 4-year
2	21.8	Private not-for-profit 4-year
3	0.4	Private for-profit 4-year
4	13	Public 2-year
5	0.6	Private not-for-profit 2-year
6	0.2	Private for-profit 2-year
7	0	Public less than 2-year
8	0	Private not-for-profit less than 2-year
9	0.1	Private for-profit less than 2-year
-1	20	Missing Value

Source: B&B93/94 student CATI
Name: **TYPAGE2**
Label: Age, typical/older classification

Type: Continuous
Description:
Age, typical/older classification. Derived based on student classification and age. Freshman 20 or older, sophomores who were 21 or older, juniors who were 22 or older, and sen who were 23 or older were classified assigned a value of 1, older. All others were assigned a value of 0. Following code will create this variable. compute typage2=typage recode typage2 (3,6,9,12=1) (sysmis, -1=-1) (else=0).
RELATED VARIABLES: TYPAGE, AGE, YEAR_R

Statistics

Value	percentage	Label
1	46.7	{Older student}
0	51.1	{Typical age}
-1	2.2	Missing Value

Source: N93CADE, N93CATI, derived

ECBW variables—descriptions and frequencies

Please note: frequencies are given only as general information; no content in this report provides any context for identification of respondents, in accordance with the LICENSE FOR THE USE OF INDIVIDUALLY IDENTIFIABLE INFORMATION, PROTECTED UNDER THE NATIONAL EDUCATION STATISTICS ACT OF 1994, AS AMENDED, AND THE PRIVACY ACT OF 1974. All analyses which employed this data were weighted to correct for nonresponse, and for the unequal probability of selection into the sample.

B2BAMAJR Bachelors degree field recoded
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 3/11 389-390

Section: Education B2
+ +
B2BAMAJR identifies a respondent's undergraduate major field of study. The major codes were collapsed into categories equivalent to RCG codes using the following rules:
if in (10-16) then = 1; if in (25-30) then = 2; if in (31-36) then = 3;
if in (40-54) then = 4; if in (89-91) then = 5; if in (66-70) then = 6;
if in (71, 72, 20-22, 84-87) then = 7; if in (92-94, 96-98) then = 8; if in (95) then = 9;
if in (37-39, 61-63, 81-83, 108-113) then = 10; if in (88) then = 11;
if in (0-9, 17-19, 23, 24, 55-60, 64, 65, 73-80, 99-107, 114) then = 12;
The main source used to create B2BAMAJR was BAMAJOR from the B&B93/94 student survey; if that was missing, MAJCODE1 from B&B93/94 student transcripts was used. If still missing, then MAJORS from NPSAS was used.
Related Variables: B2HDGMAJ B2HENMAJ B2RCNMAJ
Sources: NPSAS, B&B93/94, B&B93/97 student CATI

Code	Freq	%	Label
1	1353	12.1	Business and management
2	1626	14.5	Education
3	732	6.5	Engineering
4	888	7.9	Health professions
5	391	3.5	Public affairs/social services
6	568	5.1	Biological sciences
7	665	5.9	Mathematics and other sciences
8	1108	9.9	Social science
9	217	1.9	History
10	1086	9.7	Humanities
11	429	3.8	Psychology
12	1518	13.6	Other
-9	611	5.5	{Missing, blank}

ACTSCOR2 ACT score
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 4/11 401-402

Section: UG admission test
\+ +
This composite variable replaces ACT and ACTSCORR, which were included in the DAS's for B&B:93/94. It combines information from graduates' records at the NPSAS institution and self-reported scores. If the NPSAS institution provided an ACT score for the graduate, that score was assigned to ACTSCOR2. If there was no institution-reported score but there was a self- reported score, that was assigned to ACTSCOR2. Otherwise, the case was declared missing (assigned a value of -2). See code below. {continuous}
Sources: B&B93/94 student CATI

Code	Freq	%	Label
{cont.}	3957	35.4	{1-36;22.29/5.07}
-2	7235	64.6	{Missing, unavailable}

SATSCOR2 SAT score
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 4/11 407-410

Section: UG admission test
\+ +
SATSCOR2: This composite variable replaces SATTOTAL and SATSCORR, which were included in the DAS's for B&B:93/94. It combines information from ETS, the company that administers the SAT; graduates' records at the NPSAS institution; and self-reported scores. If ETS provided a score for the graduate, that score was assigned to SATSCOR2. If ETS did not provide a score but the NPSAS institution did, that score was assigned to SATSCOR2. If there was neither an ETS-reported nor an institution-reported score but there was a self-reported score, the self-reported score was assigned to SATSCOR2. Otherwise, the case was declared missing (assigned a value of -2). See code below.
Sources: NPSAS93, B&B93/94 student CATI

Code	Freq	%	Label
{cont}	6430	57.5	{400-1600;996.04/198.91}
-2	4762	42.5	{Missing, unavailable}

B2FIELD Main field taught in B97
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 5/11 635-636

Section: Teach
+ +
B2FIELD identifies a teacher's main teaching field in B&B93/97. Respondents who had no teaching jobs were coded as -1. This variable was derived using the following rules:
1. If a teacher taught in only one field, that field will be the main field.
2. If a teacher taught in more than one field, their main field is the one taught for the most number of periods.
3. If a teacher taught two or more fields for an equal number of periods, the main field was the field certified in.
4. One rare occasions, if applying rule 3 was not sufficient to select a main field (i.e., teacher was either certified in all the fields or not certified in any), the main field was set to the first field taught.

NOTE: In the B&B93/97 interview, teachers who reported teaching general elementary were not asked how many periods they taught that field. If a teacher was teaching general elementary and one or more other fields, the main teaching field is set to one of the other fields which fit the criteria above. Sources: B&B93/97 student CATI

Code	Freq	%	Label
1	528	4.7	General elementary
2	3	0.0	Accounting
3	2	0.0	Agriculture
4	12	0.1	Business, marketing
5	3	0.0	Health occupations
6	4	0.0	Home economics
7	8	0.1	Industrial arts
9	1	0.0	Technical
10	2	0.0	Trade and industry
11	17	0.2	Other vocational education
12	39	0.3	Biology/life science
13	9	0.1	Chemistry
14	28	0.3	Geology/earth/space science
15	5	0.0	Physics
16	15	0.1	Computer science
17	14	0.1	Physical science
18	146	1.3	Mathematics
19	45	0.4	General and all other science
21	6	0.1	French
22	2	0.0	German
23	1	0.0	Latin
25	39	0.3	Spanish
26	7	0.1	Other foreign languages
27	18	0.2	Special ed-Basic skills/remedial educ

28	3	0.0	Special ed for deaf and hard of hearing
29	13	0.1	Special ed for emotionally disturbed
31	5	0.0	Special ed for mentally retarded
32	4	0.0	Special ed for mildly handicapped
34	3	0.0	Special ed for severely handicapped
35	10	0.1	Special ed for specific learning disabil
36	8	0.1	Special ed for speech/language impaired
37	1	0.0	Special ed for visually handicapped
38	26	0.2	Special ed-general
39	13	0.1	Other special education
40	26	0.2	English as a second language
41	131	1.2	English language arts
42	1	0.0	Journalism
43	18	0.2	Reading
44	6	0.1	American Indian studies
46	8	0.1	Religion
47	60	0.5	Social studies/social science
48	26	0.2	Art
49	1	0.0	Dance
50	3	0.0	Drama/theater
51	34	0.3	Music
52	55	0.5	Physical education/health
53	36	0.3	All other educ.
-1	8638	77.2	{Missing, legitimate skip}
-2	10	0.1	{Missing, unavailable}
-8	488	4.4	{Don^t know}
-9	611	5.5	{Missing, blank}

B2ETHNIC Respondent ethnicity
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 10/11 963-964

Section: Student
+ +
This variable provides the race and ethnicity of the respondent. Data for RETHNIC were merged here for B&B93/94 respondents.
pseudo-SAS code:
If rhispor=1 then rethnic=4; else if rrace=1 and rhispor^=1 then rethnic=5;
else if rrace=2 and rhispor^=1 then rethnic=3; else if rrace=3 and rhispor^=1 then rethnic=1;
else if rrace=4 and rhispor^=1 then rethnic=2; else if rrace=5 and rhispor^=1 then rethnic=6;
else rethnic=-2;
Sources: NPSAS, B&B93/94, B&B93/97 student CATI

Code	Freq	%	Label
1	73	0.7	American Indian/Alaskan native
2	487	4.4	Asian or Pacific Islander
3	665	5.9	Black, non-Hispanic
4	600	5.4	Hispanic
5	9230	82.5	White, non-Hispanic
6	33	0.3	Other
-2	104	0.9	{Missing, unavailable}

BNBPANEL Panel weight for NPSAS and B&B
Module[1]: ECBW\B97\DATA\B97ECB7.DAT Position: # 11/11 467-474

Section: Weight
+ +
Panel weight for NPSAS, B&B93/94, and B&B93/97 response. This is the panel weight for B&B:93/97, which is B0 adjusted for nonresponse (nonrespondents have PANEL2=0). Panel respondents are those who responded to all three surveys: NPSAS:93, B&B:93/94, and B&B:93/97. Therefore, this is greater than 0 for only those persons who responded to all three surveys.
Sources: Sample file

Code	Freq	%	Label
0	1918	17.1	{zero}
{cont}	9274	82.9	{1.7693-3357.6700;127.39/102.15}

AGECOLL Age at college entry
Module[2]: ECBW\B97\DATA\BB94ECB6.DAT Position: # 2/ 7 868-869

Section: Student
+ +
Age at college entry
This composite calculates a respondent's age when he/she entered college. The age was calculated by subtracting date of birth in months from date of college entry in months and dividing by 12 to obtain years. If a respondent was missing either date of birth or a date began college, AGECOLL was set to missing (-2). If the calculated age was less then 14, AGECOLL was recoded to missing (-2).
NOTE RE: date of entry into postsecondary education In most cases, date of postsecondary entry was based on FSCDATE. In certain circumstances, however, other dates were used:
- if FSCDATE was missing, DTBEGCOL was used if valid;
- if DTBEGCOL was more than 1 month earlier than FSCDATE but not earlier than HSGRADDT, DTBEGCOL was used;
- if FSCDATE was earlier than HSGRADDT, DTBEGCOL was used if not earlier than HSGRADDT;
-if both FSCDATE and DTBEGCOL were earlier than HSGRADDT, HSGRADDT+1 was used.
Related variables: RDOB DTBEGCOL FSCDATE
Sources: B&B93/94 student CATI

Code	Freq	%	Label
{cont}	9957	98.8	{14-57;18.54/2.91}
-2	123	1.2	{Missing, unavailable}

TCRED11Z Credits for all math
Module[2]: ECBW\B97\DATA\BB94ECB6.DAT Position: # 3/ 7 63-68

Section: Subject level Credit
+ +
Credits for all mathematics Total number of normalized credits taken at the sample school in all mathematics. Courses in All Mathematics are sample school courses with the following course codes: 270100-270299, 270600-270799, 270801, 270901- 270902, 271001, 272001, 279999 [i.e., (08)+(09)+(10)+279999] Identical to TCRED11 except legitimate skips were recoded to zero.
Related variables: TCRED11 on transcript student master file.
Sources: Student undergraduate transcripts

Code	Freq	%	Label
0	3455	34.3	{zero}
{cont}	6428	63.8	{1-70;7.70/6.77}
-2	197	2.0	{Missing, unavailable}

CUMULGPA Cumulative undergrad GPA
Module[2]: ECBW\B97\DATA\BB94ECB6.DAT Position: # 4/ 7 82-86

Section: UG education grades
+ +
Cumulative undergraduate GPA Original value: AX16, Q156 What was your cumulative grade point average (GPA) at "SAMPLE SCHOOL"? This variable created by merging NPSAS preload and B&B data. Special code for pass/fail was indicated in GPASCAL and recoded to legitimate skip.
Sources: NPSAS93, B&B93/94 student CATI

Code	Freq	%	Label
{cont}	9817	97.4	{1-93;3.26/2.34}
-1	121	1.2	{Missing, legitimate skip}
-7	13	0.1	{Refused}
-8	112	1.1	{Don^t know}
-9	17	0.2	{Missing, blank}

GPAMAJOR GPA in undergraduate major
Module[2]: ECBW\B97\DATA\BB94ECB6.DAT Position: # 4/ 7 87-91

Section: UG education grades
+ +
GPA in undergraduate major Original value: AX17, Q154 What was your grade point average (GPA) in your major data. Special code for pass/fail was indicated in GPASCAL and recoded to legitimate skip.
Sources: NPSAS93, B&B93/94 student CATI

Code	Freq	%	Label
{cont}	9492	94.2	{1-95;3.40/2.26}
-1	136	1.3	{Missing, legitimate skip}
-7	17	0.2	{Refused}
-8	382	3.8	{Don^t know}
-9	53	0.5	{Missing, blank}

BATIME1 Number of months from HS grad to BA
Module[2]: ECBW\B97\DATA\BB94ECB6.DAT Position: # 4/ 7 146-148

Section: UG ed info
+ +
Number of months from HS grad to BA receipt This composite calculates the number of months between the date a respondent graduated from high school and the date of BA receipt.
If a respondent was missing either date, BATIME1 was set to missing (-2). In some cases, the value for BATIME1 was lower than 30 months; these cases were set to -3 (out of range).
BATIME1 was calculated only for those students receiving their first bachelor's degree at the sample school; those students not meeting this criterion were coded as legitimate skip.
Sources: B&B93/94 student CATI

Code	Freq	%	Label
{cont}	9374	93.0	{30-683;87.49/74.66}
-1	675	6.7	{Missing, blank}
-2	26	0.3	{Missing, unavailable}
-3	5	0.0	{Missing, out of range}

CINCOME Total income (parents and independent students)
Module[3]: ECBW\B97\DATA\N93B94.DAT Position: # 1/ 3 911-916

Section: Family income
+ +
Total income (continuous) parents and independent students. Total family income from the 1991 calendar year (continuous). Equal to DEPINC if the student was dependent and INDEPINC if the student was independent. See component variables for more details. Sources: N93 CADE, N93 Student/parent CATI, Pell file, Student loan

Code	Freq	%	Label
{cont}	10968	98.0	{100-800000.0;45554.29/50825.53}
-1	196	1.8	{Missing, legitimate skip}
-3	23	0.2	{CATI 94 Non-Respondents}
-9	5	0.0	{Missing, blank}

PAREDUC Highest level by either parent
Module[3]: ECBW\B97\DATA\N93B94.DAT Position: # 3/ 3 65-66

Section: Parent, education
Highest education level completed by either parent
What is the highest grade or level of education completed by either of your parents?
PAREDUC=FATHEDUC
If (MOTHEDUC > PAREDUC) then PAREDUC=MOTHEDUC
Key to variable(s) used in the construction of derived variable:
PAREDUC - Parents: Highest level of education completed by either parent
FATHEDUC - Parent: Highest level of education completed by father
MOTHEDUC - Parents: Highest level of education mother ever completed
Sources: N93 Student CATI

Code	Freq	%	Label
1	495	4.4	Less than high school
2	56	0.5	GED
3	2672	23.9	High school graduation
4	116	1.0	Less than 1 year
5	277	2.5	1 year but less than 2 years
6	415	3.7	2 years or more
7	281	2.5	Less than 2 years of college
8	599	5.4	Associate^s degree
9	313	2.8	2 or more years of college
10	2480	22.2	Bachelor^s degree (4-5 year degree)
11	1669	14.9	Master^s degree or equivalent
12	452	4.0	First professional degree
13	108	1.0	Other advanced professional degree
14	442	3.9	Doctorate (Ph.D, Ed.D)
-1	794	7.1	{Missing, legitimate skip}
-3	23	0.2	{CATI 94 Non-Respondents}

SPARSPRT Total direct contribution from parent
Module[3]: ECBW\B97\DATA\N93B94.DAT Position: # 3/ 3 88-92

Section: Parental support
Total direct contribution from parents
Student-reported amount of direct monetary contribution from both parents together for AY 1992-93 school expenses. Does not include loans or income-in-kind. Students whose parents were married or who had guardians were asked questions about both parents together, while students whose parents were not married were asked about each parent separately. Students were given a value on SPARSPRT regardless of parent's marital status. For students who were asked the combined parent question, SPARSPRT is equal to the amount reported on that question. For students who were asked separate questions, SPARSPRT is equal to the sum of the amount reported for each parent.
Related variables: RPAR (referent parent)
SPARSPRT Parental support: Total direct contribution from parents (student report)
SPARLOAN Parental support: Amount of both parent's loans to student (student report)
PPARLOAN Parental support: Amount of referent parent's loans to (parent report)
INKIND Parental support: Value of referent parent's income in kind contributions (parent report)
Sources: N93 Student CATI

Code	Freq	%	Label
0	3818	34.1	{zero}
{cont}	5020	44.9	{100-40000;5932.67/6335.71}
-1	2312	20.7	{Missing, legitimate skip}
-3	23	0.2	{CATI 94 Non-Respondents}
-8	11	0.1	{Dont know}
-9	8	0.1	{Missing, blank}

GENDER Gender of student
Module[3]: ECBW\B97\DATA\N93B94.DAT Position: # 3/ 3 288-289

Section: Student
+ +
Gender of student What is the student's gender? Case [CADE->M_STGEN = 1 or 2]
CADE->M_STGEN = DERIVED->GENDER Case [CADE->M_STGEN<>1 or 2] and [CATI->G001=1 or 2 or -7 or -8] CATI->G001 = DERIVED->GENDER
Otherwise GENDER = -9 Key to variable(s) used in the construction of derived variable:
G001 - Student: Sex of the respondent M_STGEN - Student: Gender
Sources: N93 CADE, N93 Student CATI

Code	Freq	%	Label
1	4821	43.1	Male
2	6331	56.6	Female
-1	17	0.2	{Missing, legitimate skip}

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