

Map of Existing Data Terrain

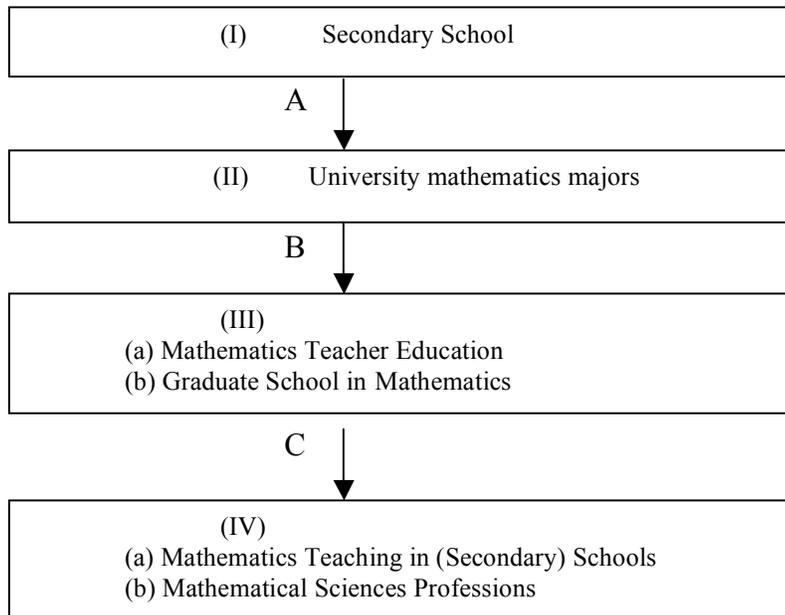
Draft conception of the project

This project studies the supply of students majoring in mathematics at universities, and their career trajectories, with particular emphasis on two domains –

- (a) Mathematics teaching, and
- (b) Mathematical sciences professions

It also looks at the undergraduate mathematics programs at universities and (a) the mathematics education programs at teacher education institutions, and (b) graduate mathematics programs. The project encompasses three transitions:

- A From (I): secondary school, to (II): university
- B From (II): university, to (III): (a) Teacher education schools; or (b) Graduate school in mathematics.
- C And thence to (IV): (a) Teaching in (secondary) schools; or (b) Mathematical sciences professions.



(I) Secondary School

The only source of survey-based data on secondary schools is the National Center for Education Statistics (NCES), an arm of the U.S. Department of Education. I have only worked with NCES survey data for postsecondary schools so the items listed below, while they appear as possible sources of relevant information, will require further investigation to confirm just how useful they are.

An overview of the survey series from NCES is available at <http://nces.ed.gov/surveys/> The tabs for “Elementary/Secondary” and “Postsecondary” lead to the surveys relevant to this study. One can also see the myriad types of information drawn from the NCES survey series by perusing *Digest of Education Statistics Tables and Figures, 2005* at http://nces.ed.gov/programs/digest/d05_tf.asp

The following are specific NCES studies that appear most likely to provide useful information.

Education Longitudinal Study of 2002 (ELS:2002) – something relatively new that might be useful

<http://nces.ed.gov/surveys/els2002/>

Abstract from NCES:

The Education Longitudinal Study of 2002 (ELS:2002) is a longitudinal survey that will monitor the transitions of a national sample of young people as they progress from tenth grade to, eventually, the world of work. ELS:2002 will obtain information not just from students and their school records, but also from students' parents, their teachers, their librarians and the administrators of their schools.

High School Transcript Studies (HST) – another survey that might be useful, but is highly likely to require a commitment of time to obtain useful results, e.g. by obtaining customized datasets.

<http://nces.ed.gov/surveys/hst/>

Abstract from NCES:

High school transcript studies have been conducted by NCES as part of the Longitudinal Studies Program and the National Assessment of Educational Progress (NAEP) High School Transcript (HSTS) Studies program since 1982. Each transcript study is associated with a major NCES data collection.

A: The Transition from Secondary School to University

Both of the NCES surveys listed above may provide insight into high school seniors transitioning to college study, but it remains to be seen if the information provided will allow specific focus on plans for mathematical study. The following is another NCES study of potential value, though the sample size may be too small to provide useful information specific to mathematics study plans.

Beginning Postsecondary Students Longitudinal Study - BPS

<http://nces.ed.gov/surveys/bps/>

Abstract from NCES:

BPS studies follow students who first begin their postsecondary education. Initially, students in the NPSAS surveys are identified as being first time beginners of undergraduate studies. These students are asked questions about their experiences during, and transitions through postsecondary education and into the labor force, as well as family formation. Transfers, persisters, stopouts/dropouts, and vocational completers are among those included in the studies. In the first BPS study, about 10,600 students were identified in NPSAS:90 as being first time beginning postsecondary students during the academic year 1989-90. These students were followed in 1992 (BPS:90/92) and in 1994 (BPS:90/94). A second cohort of first time, beginning students was identified in NPSAS:96, with follow-ups performed in 1998 (BPS:96/98) and in 2001 (BPS:96/2001). The third cohort was identified in NPSAS:04, and will be followed in 2006 and 2009.

The NCES reports on fall term enrollments and also provides projections of future enrollments through its Intergrated Postsecondary Education Data Systems (IPEDS). This is a system built around several large surveys, some of which may be useful. The best starting point for viewing the information within this system of surveys is Chapter 3 of the *Digest of Education Statistics Tables and Figures, 2005* at

http://nces.ed.gov/programs/digest/d05_tf.asp

NCES IPEDS EF – Enrollment

<http://nces.ed.gov/surveys/bps/>

Abstract from NCES:

This component collects data annually on the number of full- and part-time students enrolled in the fall in postsecondary institutions, by level (undergraduate, first-professional, and graduate) and by race/ethnicity and gender of student. Institutions report on students enrolled in courses creditable toward a degree or other formal award; students enrolled in courses that are part of a vocational or occupational program, including those enrolled in off-campus centers; and high school students taking regular college courses for credit. An item that requests the total number of undergraduates in the entering class (including first-time, transfer, and nondegree students) was added in 2001, to put into context the Graduation Rates data. Institutions began reporting first-year retention rates for undergraduate students by attendance status in fall 2003.

Racial/ethnic data on enrollment have been collected annually since 1990 (biennially in even-numbered years prior to then) for the Office for Civil Rights as part of its Compliance Report. Age distributions are collected in odd-numbered years by student level. Data on state of residence of first-time freshmen (first-time, first-year students) and the number who graduated high school in the past 12 months are collected in even-numbered years. Four-year institutions are also required to complete enrollment data by level, race/ethnicity, and gender for nine selected fields of study in even-numbered years for OCR. [* Need to determine if mathematics is one of these nine. *]

(II) University Mathematics Majors

The immediately preceding two NCES surveys may provide background information relevant to the undergraduate experiences of mathematics majors.

In addition, there are survey series conducted by the American Mathematical Society (AMS) and by the Conference Board of the Mathematical Sciences (CBMS) that provide information directly relevant to undergraduate math majors.

Annual Survey of the Mathematical Sciences: This survey is conducted annually by the AMS and gathers information from mathematical sciences departments at four-year institutions and additional information from each year's new doctoral recipients in the mathematical sciences. Information available includes counts of junior and senior mathematics majors through fall 2002. This data was discontinued after fall 2002 in favor of counts of individuals graduating with a bachelors degree from the institution with a major in a mathematical science. Since 2004, the reports include separate counts for bachelors with a departmental major only in statistics or only in computer science.

Links to further information:

An overview of what's in the Annual Survey is available at <http://www.ams.org/employment/about-the-survey.html> The relevant data on majors and bachelors degree recipients is provided in the *Third Report of the Annual Survey*, readily accessible from <http://www.ams.org/employment/surveyreports.html>

Conference Board of the Mathematical Sciences (CBMS) series of surveys. Under the sponsorship of CBMS and with the support of AMS and funding from NSF, this survey of mathematics departments at both two-year and four-year institutions provides the most detailed breakout of types of majors among bachelors degree recipients. It has been conducted every five years since 1965. Each of these surveys provides detailed enrollment information and additional information on special topics selected at the time of each survey. For example, the 2000 CBMS survey gathered information on the pre-service education of K-8 teachers in the mathematical sciences, and the 2005 CBMS survey gathered information on the mathematical education of pre-college teachers.

Links to further information:

The entire report of the 2000 CBMS survey is available from the AMS website at <http://www.ams.org/cbms/> The report of the 2005 survey will be available from this same page before the end of June.

The NCES provides comprehensive data on the number of individuals completing degrees at U.S. institutions, from bachelors through doctoral degrees. The data are gathered from the central institutional administrative offices, not from individual departments, and as a result, the NCES counts of bachelors degrees do not match those reported by the mathematics departments on the Annual Survey, though the two data series correlate closely. One possible advantage of the NCES data is that they permit one to compare degrees awarded in the various disciplinary areas.

NCES IPEDS Completions Survey

<http://nces.ed.gov/surveys/bps/>

Abstract from NCES:

This component collects data annually (for the prior academic year) on recognized degree completions in postsecondary education programs by level (associate's, bachelor's, master's, doctor's, and first-professional) and on other formal awards by length of program. These data are collected by race/ethnicity and gender of recipient and by field of study, which is identified by 6-digit Classification of Instructional Programs (CIP) codes. Completions data by race/ethnicity at the 2-digit CIP level became an annual collection in 1990; beginning in 1995, race/ethnicity data were collected at the 6-digit CIP level. Beginning with the 2001 collection, institutions were able to report the number of students with double majors by level of degree and 6-digit CIP code of the second major. Racial/ethnic data on completers are collected in odd-numbered years for the Office for Civil Rights as part of its biennial Compliance Report.

B: The Transition from Undergraduate to Graduate School

Annual Survey of the Mathematical Sciences: In addition to information on bachelor's recipients mentioned above, the Annual Survey reports counts of first-year graduate students, by gender and citizenship. First-year means the first year enrolled in the reporting department; hence, one cannot distinguish between those who changed graduate school after completing their masters degree and those just beginning their graduate education. The relevant data on graduate students is provided in the third reports of each year's Annual Survey. These reports are readily accessible from <http://www.ams.org/employment/surveyreports.html>

NSF's Graduate Student and Postdoctoral in Science and Engineering: This report also provides first-year enrollment figures across all science and engineering disciplines. <http://www.nsf.gov/statistics/gradpostdoc/>

Abstract from NSF:

The Survey of Graduate Students and Postdoctorates in Science and Engineering (also known as the graduate student survey or GSS) provides data on the number and characteristics of students in graduate science and engineering (S&E) and health-related fields enrolled[1] in U.S. institutions. NSF uses the results of this annual survey to assess trends in financial support patterns and shifts in graduate enrollment and postdoctoral appointments. The graduate student survey collects data from all U.S. institutions offering graduate programs in all science and engineering fields and specific health-related fields of interest to NIH. This annual survey collects data items at the academic department level. Data include counts of full-time graduate students by source and mechanism of support, by total and by women; part-time[2] graduate students by sex; and citizenship and racial/ethnic background of all graduate students, including first-time students. In addition, the survey requests count data on postdoctorates by source of support, sex, and citizenship, with separate data on those holding first-professional doctorates in the health fields; and summary information on other doctorate nonfaculty research personnel.

(III) Programs in (a) Mathematics Teacher Education or (b) Graduate School in Mathematics

The two immediately preceding surveys provide (independent) counts of total numbers of graduate students. The most recent counts of graduate students in mathematical sciences departments can be found in the *Third Report of the 2005 Annual Survey* accessible from

<http://www.ams.org/employment/surveyreports.html>

Recent data on degrees awarded in mathematics teacher education at the bachelors, masters and doctoral level are available in *Digest of Education Statistics Tables and Figures, 2005*, mentioned earlier, in Table 252 of this report

http://nces.ed.gov/programs/digest/d05/tables/dt05_252.asp

C The Transition into the Profession

The **Annual Survey of the Mathematical Sciences** reports on initial employment of each annual cycle of new doctorates from mathematical sciences departments at four-year colleges and universities in the U.S. Information gathered includes starting salaries. The relevant data on graduate students is provided in the *First Report of the Annual Survey* and the *Second Report of the Annual Survey*, accessible from

<http://www.ams.org/employment/surveyreports.html>

S&E Doctorate Awards This series of NSF reports presents data and trends on doctorates awarded in science and engineering. Information is also available on characteristics of doctorate recipients, institutions awarding doctorates, and postgraduation plans of doctorate recipients.

<http://www.nsf.gov/statistics/doctorates/>

Abstract from NSF:

This series presents data and trends on doctorates awarded in science and engineering. Information is also available on characteristics of doctorate recipients, institutions awarding doctorates, and postgraduation plans of doctorate recipients.

Also available is the special report *U.S. Doctorates in the 20th Century*, <http://www.nsf.gov/statistics/nsf06319/> which documents the history of U.S. doctoral education from its beginnings in 1861 through 1999. Detailed tables and figures in the report provide historical trend data for 20th century periods.

The most recent edition of these reports is *Science and Engineering Doctorate Awards: 2005*

<http://www.nsf.gov/statistics/nsf07305/>

(IV) The Profession

The **Annual Survey of the Mathematical Sciences** reports on various aspects of the U.S. mathematics profession in academia. A profile of annual salaries of the tenured and tenure-eligible faculty is reported in the first report of each Annual Survey. A detailed profile of the number of faculty by gender and tenure-status is reported in the third report of each Annual Survey, along with details of each year's academic recruiting cycle. The relevant reports are accessible from <http://www.ams.org/employment/surveyreports.html>

NSF's Survey of Doctoral Recipients.

http://www.nsf.gov/statistics/showsrvy.cfm?srvy_CatID=3&srvy_Seri=5

Abstract from NSF:

The Survey of Doctorate Recipients (SDR) gathers information from individuals who have obtained a doctoral degree in a science, engineering or health field. The SDR is conducted every 2 years and is a longitudinal survey that follows recipients of research doctorates from U.S. institutions until age 76. This group is of special interest to many decision makers, because it represents some of the highest educated individuals in the U.S. workforce. The SDR results are used by employers in the education, industry, and government sectors to understand and to predict trends in employment opportunities and salaries in science and engineering (S&E) fields for graduates with doctoral degrees. The results are also used to evaluate the effectiveness of equal opportunity efforts. NSF also finds the results important for internal planning, because most NSF grants go to individuals with doctoral degrees. The data from this survey are combined with that from two other NSF surveys of scientists and engineers, the National Survey of College Graduates (NSCG) and National Survey of Recent College Graduates (NSRCG). The three surveys are closely coordinated and share the same reference date and nearly identical instruments. The data base developed from the three surveys, the Scientists and Engineers Statistical Data System (SESTAT), provides a comprehensive picture of the number and characteristics of individuals with training and/or employment in science and engineering in the United States.

Respondents were individuals:

- * with a research doctorate in an S&E or health field from a U.S. institution,
- * living in the U.S. during the survey reference week, and
- * under age 76.

NCES's National Survey of Postsecondary Faculty:

<http://nces.ed.gov/surveys/nsopf/>

Abstract from NCES:

The National Study of Postsecondary Faculty (NSOPF) was developed in response to a continuing need for data on faculty and instructional staff. NSOPF includes a nationally representative sample of full-and part-time faculty and instructional staff at public and private not-for-profit 2- and 4-year institutions in the United States. The NSOPF was designed to provide data about faculty and instructional staff to postsecondary education researchers, planners, and policymakers. The study was initially conducted during the 1987-88 school year and was repeated in 1992-93, 1998-99, and 2003-04.

More details at <http://nces.ed.gov/surveys/nsopf/components.asp>