

A Major Trend: The Rise of Undergraduate Programs in Statistics



Statistics majors in a class on statistical programming taught by Rebecca Ottesen in the department of statistics at Cal Poly San Luis Obispo

Photo courtesy of Rebecca Ottesen

During August, college students will flock to campus for the start of the academic year. You might be surprised to know that record numbers are registering as statistics majors. This column explains why—and what it means for these students and our profession.

What Has Changed?

Most statisticians of my vintage learned about statistics as graduate students, having earned an undergraduate degree in another field, such as mathematics. Although bachelor's degree programs in statistics existed as early as the 1940s, the number of degrees granted remained small for decades.

A landmark in the evolution of undergraduate statistics programs was a 1983 article in *The American Statistician* by Paul

Minton, who pointed out that the lack of such programs diminished the recognition of statistics as a discipline. However, it was not until 15 years ago, when more high-school students began taking Advanced Placement (AP) Statistics, that the numbers of college majors and minors in statistics began to climb. Today, that number is at an all-time high.

In 2001, our association endorsed a set of curriculum guidelines for BS degrees in statistics (www.amstat.org/education/pdfs/BS-curriculum.pdf). These guidelines make up one of many ways the ASA statistical education community has strengthened the teaching of statistics at the undergraduate level.

What Trends Are Departments Seeing?

To learn more, I contacted statistics departments with large

numbers of majors. Although their programs vary in emphasis, their stories paint an exciting picture for our profession. I'll start with two departments that have historically focused on training undergraduate majors.

At Cal Poly San Luis Obispo, Bob Smidt has seen a dramatic increase in the caliber and number of students applying as statistics majors—from five in the late 1990s to 60 in the last two years. Smidt credits this to AP Statistics, noting that “high-school students who have had a good experience in this class are more likely to apply.”

In response to this increase, the Cal Poly program has evolved. It now emphasizes writing and communication skills, statistical programming, senior projects, and a capstone class that exposes students to working with clients. Graduates are highly employable, often receiving multiple offers



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from companies that value the statistical contributions they make as analysts and programmers. Of these graduates, 30% to 50% go to graduate school and 20% to 30% earn a PhD.

At Brigham Young University, Del Scott reports an increase from 139 majors six years ago to 240 this year. To accommodate freshmen who have taken AP Statistics, his department developed a new introductory course that focuses on experimental design and is taken concurrently with calculus. A strong background in mathematics is essential for majors considering graduate school in statistics or biostatistics.

The department now offers three undergraduate degrees with distinct goals: statistical science as preparation for graduate work, actuarial science as preparation for an actuarial career, and applied statistics/analytics as preparation for corporate environments in which strong programming skills are in demand.

What About Majors in PhD-Granting Departments?

Growth is also the story in the department of statistics at Purdue, where the number of majors has doubled from 200 to 400 in the past five years. Rebecca Doerge notes that the undergraduate program in statistics emphasizes a strong theoretical foundation and computational skills. Most graduates either head to graduate school or work in pharmaceutical companies and other businesses with strong data-related needs.

At Purdue, another option for undergraduates is a program in actuarial science offered jointly by the departments of statistics and mathematics. An emerging career opportunity for these students is health care engineering, the specialization of Purdue's Regenstrief Center.

I found yet another example of rapid expansion at Carnegie Mellon University (CMU), where the department of statistics has 150 majors, up from 40 in 2006. Rebecca Nugent explains, "Exposure to statistics in AP courses is one reason why 17-year-olds now decide to major in statistics, along with a growing recognition that statistical skills are crucial in today's market." In addition to a major in statistics, CMU offers a major that combines economics and statistics.

The CMU program emphasizes working on research problems by using both classical methodology and newer, computationally intensive methods. Students participate in design competitions, work in groups, and are required to write reports and give presentations. Thirty to forty percent of students go to graduate school, and many find employment in banking, financial services, and insurance.

What Are Graduates Saying?

For a student perspective on these trends, I asked CMU graduates why they decided to major in statistics. Nora Albert, currently at the U.S. Census Bureau, answered with one word: versatility. She elaborated, "I knew that by majoring in statistics I would have a lens through which I could view any industry."

Daniel Frank, now a quantitative finance analyst at Bank of America, replied, "I decided that the possibilities with a solid statistics background are virtually limitless. Every field, from in-depth science to industry-focused jobs, requires statisticians in one way or another. The beauty of this degree is that you can move anywhere and do anything because your skills will always be in demand."

I also asked students what aspects of their undergraduate studies best prepared them for

success. Hon Ming Quek, who is entering graduate school this fall, cited practical applications, proficiency in statistical software, and practice in writing reports. For Hannah Pileggi, now in graduate school, "the opportunity to participate in research was invaluable."

Major and Minor Conclusions

There are three points to glean from these stories. First, the number of students majoring or minoring in statistics is soaring because of positive experiences in AP Statistics courses. The word is out that statistics is a "must."

Second, successful undergraduate programs anticipate and deliver the training their students will require when they move into employment or graduate studies, whether in statistics or another field. For business-minded students, graduate programs in analytics are an increasingly attractive option.

Third, the growing on-the-job contributions of majors and minors are making statistics more visible and more valued by employers, colleagues, and society.

In view of the strong demand for skills needed to analyze Big Data—in business, government, and scientific research—we should update the ASA curriculum guidelines for BS degrees to reflect these needs. Defining appropriate statistical training is one way our association can take a leading role in the arena of Big Data.

Wherever our majors and minors land after graduation, we should make sure they see themselves as members of our profession. The best place for this to begin is the classroom. "As a teacher," says Nugent, "the most fun is watching students get excited about what they are doing and turning into members of the statistics community."

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