The Sky Is Not Falling, It's Just Shifting

Two recent articles (*Notices*, January and April 2009) have addressed the question of whether "the sky is falling". This refers to the fact that mathematics enrollments in four-year colleges and universities have been flat or declining since 1985 and dropping sharply as a percentage of overall enrollments. It is noted in these articles that there is a very large and growing number of high school students studying calculus, including the 300,000 per year who now take the AP calculus exam. It is also noted that college statistics enrollments are growing rapidly (CBMS 2005, page 3).

Our experience in mathematics at the University of Nebraska at Omaha, a comprehensive university with about 15,000 students, is different. Statistics is included in the Mathematics Department but comprises less than 10% of enrollments. Our total departmental enrollments are growing rapidly:

Ten-year increase in student credit hour production in mathematics at UNO

Year	Mathematics	UNO
1999–2000	15,313	260, 020
2009–2010	22,235	310,785
percentage increase	45%	20%

We are very much aware of the growth trends in high school calculus and college statistics referred to above. We respond by embracing these trends. Seven years ago we started a dual enrollment program in calculus with area high schools which continues to grow every year. More and more of these DE calculus students are enrolling at UNO and successfully taking follow-up math courses. A secondary benefit is our growing relationship with high school calculus teachers in the Omaha area, with whom we now hold joint workshops. We use DE tuition funds to give scholarships to high school teachers to work on a master's degree in our department in order to qualify to teach AP and DE calculus. We employ many of these same high school teachers as part-time instructors.

At least one-third of our majors are following an actuarial or related statistical track. Only four of our seventeen Ph.D. faculty are statisticians and we need more. Our statisticians are in great demand to give independent studies to our majors. Of the new courses created in recent years, most are at least somewhat statistical in nature. Consider the following additional valuable contributions made by the small number of statistics faculty:

- For our most difficult required course for undergraduate majors, "Introduction to Analysis", two of the most popular and successful instructors are statisticians, who use analysis in their own research.

- Our newest, and pretenured, statistician has organized an undergraduate colloquium series with such talks as "The Use and Misuse of Statistics in the Real World", "How to Get a Good Night's Sleep (Cure for Mathematical Insomniacs)", and "Magic and Mathematics". These colloquia are attracting large audiences of students, especially from our calculus-level courses.

Here are some other recent outreach-related developments in our department:

- Our senior-level course in number theory has become "Number Theory and Cryptography" and has thereby increased its enrollments by appealing to more computer science majors.

- One of our graduate students is the vice president of risk management for a national energy development company. He wants to deepen his understanding of analysis, which he uses in his work. He recently gave a talk to our math club on financial mathematics. As a result of this talk two of our undergraduate majors now have internships at his company. His talk also generated interest in having a course in financial mathematics, which was offered for the first time in Spring 2010.

- A program in biomechanics on the UNO campus sends so many students to our graduate course "Dynamical Systems and Chaos" that we are able to justify offering this course every year. Our willingness to serve this student audience has now led to the development of a follow-up course in nonlinear time series.

- There is growing interest in online instruction in mathematics at UNO. Already we offer intermediate algebra, college algebra, trigonometry, calculus I, discrete mathematics, and applied linear algebra totally online. We are experimenting with operations research, numerical methods, and partial differential equations hybrid online.

Conclusion: national data suggest a growing interest in mathematics, broadly construed, among American high school and college students. There really are many opportunities for growth in the mathematics curriculum. Yes, we have favorable demographics at UNO. But many other schools and locations have their own natural advantages and could adopt similar strategies.

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