Know Your Wisconsin Mathematician

Interview with Professor Georgia Benkart, UW-Madison, by J. Sriskandarajah, Madison Area Technical College

This is our fifth interview for this section, and you are the first woman mathematician to be interviewed in this series. As an undergraduate and graduate student, were there a reasonable number of female students in your math classes?

In virtually all my mathematics classes, there were only one or two women.

During the my time as a graduate student at Yale, the entire graduate mathematics program had only four or five female students, and the undergraduate college at Yale was just in the process of becoming coed. Perhaps this sounds a little strange coming from a mathematician, but actual numbers are not so important. The atmosphere is the key, and I was fortunate to be surrounded by wonderful fellow students and encouraging professors who created a cooperative, supportive environment for learning mathematics.

The numbers of women studying mathematics have changed significantly. Nowadays over 40% of the mathematics majors are women, and about 28% of the Ph.D.s in mathematics are earned by women compared to the roughly 7% when I got my doctoral degree. The faces in mathematics classrooms are quite different now, but I hope that same spirit of cooperation and nurturing will always be present. In 2005, only 9% of the tenured mathematics faculty at four year colleges and universities were women. That is something that needs to change if the mathematical enterprise has a chance of continuing.

Let's start with your childhood. What impression did grade school make on you?

I always have loved science and mathematics and remember joining the science club as soon as I could.

Are there any teachers who had influenced you to become a mathematician?

The honors mathematics program at Ohio State University was the determining factor in my becoming a mathematics major. We were treated to small classes and excellent teachers who encouraged us to take graduate courses when they thought we could do well in them. Professors Joan and Jim Leitzel and Joe Ferrar stimulated my interest in abstract algebra with challenging courses, and I remember quite fondly a graduate p-adic analysis course I took when I was a junior from the famous number theorist Kurt Mahler.

As a graduate student, I took a course in Lie algebras from the group theorist Walter Feit. Even though there were experts in Lie theory on the faculty at Yale, he was teaching the course that term because he wanted to study the subject. So we all struggled to learn the topic together, and that is how I became interested in Lie algebras.

What town did you grow up in and how did you end up in UW-Madison?

I grew up in Youngstown, Ohio, and had never been in the state of Wisconsin before I accepted a two-year postdoctoral instructorship at UW-Madison. Somehow two years translated into a career at Madison.

Did your family influence your intellectual development in any particular directions? Tell me about growing up and becoming a mathematician?

My parents encouraged our educational activities but didn't try to influence the subjects we studied. I started out wanting to become a chemist but soon found I was allergic to most things in the lab including the work. My sister went in an entirely different direction and earned a Ph.D. in history.

You have received UW's highest prize award for distinguished teaching in 1987, and you were named the Polya Lecturer of the MAA in 2000. What is the best part of being a mathematician?

The two things that I have enjoyed most are the excitement of discovery and the people I have encountered along the way.

What is the worst part?

It is difficult to communicate to others, especially to non-mathematicians, what mathematics is and what it is we do. So many people have such negative impressions about the subject.

I want to talk about how you do mathematics and how you did it. Has it changed over the years? Did you do it differently at 30 than you did at 40, 50?

Mathematics is a rapidly changing field, and learning is really a lifetime process. The most successful mathematicians seem to be those who are willing and able to continue to learn. Probably the thought-processes remain pretty much the same throughout a career, but the actual problems one considers might be constantly evolving.

Technology plays a critical role in mathematics and what is your impression on that? Does it hurt the student in anyway?

Technology has expanded our capabilities immeasurably. With several clicks we can access information that used to take weeks to locate. An older colleague once told me about the days before Xerox machines when he would copy by hand an article that he needed in his research.

Technology has influenced how we approach some problems and has altered which problems we tackle. It has enabled us to collaborate with people we haven't even met. But we need to convey to students that they still need to think and create and not just push buttons.

Where do you think mathematics is going, and then closely allied to that, where do you think it should go?

The numbers of majors in what might be regarded as ivory tower subjects (such as philosophy, classics, and perhaps even mathematics) are declining while those in the more career-oriented majors of the health and biological sciences, business, and engineering are increasing. Mathematics plays an important role in these and other subjects (that's a message that should be communicated widely), and there will be a need to develop the relevant mathematics for these areas.

What do you think makes a mathematician successful?

Perseverance and perseverance and a healthy dose of enthusiasm for mathematics.

What of your mathematical work do you like best?

I have enjoyed working on the classification of simple Lie algebras of prime characteristic, on the classification of Lie algebras graded by finite root systems, and on combinatorial problems that arise in representation theory from considering commuting actions.

What have been some moments that have stood out for you in your career so far?

The times I have given invited addresses at the joint math meetings stand out but mostly for the sheer panic of speaking before such large audiences. Also mentoring graduate students and seeing them successfully complete their doctoral degrees has been one of the best aspects of the job.

I understand you have invented a new branch of Algebra called "down-up algebras." Can you elaborate on this in layman's language?

If a set of objects has a partial order where one object may be larger or smaller than another, or perhaps they are not related at all, then one can define an up operator that takes an object to the sum of the larger ones that lie directly over it and a down operator that takes an object to the sum of the smaller ones that lie immediately beneath it. Down-up algebras generalize the algebras generated by such operators. Often there is a beautiful combinatorics underlying the situation, and these operators can reveal much information about the combinatorics of the objects.

You have served as an editor of the Journal of Algebra since 1991. Are you continuing to serve in this capacity?

After almost 15 years as an editor of *Journal of Algebra*, I decided to resign from the board. About a year ago I joined the editorial board of a new journal, *Algebra and Number Theory*.

Who else in your family is good in mathematics?

My father was an engineer and was good in mathematics. My mother was a successful teacher at all levels from kindergarten through to college. She majored in English, biology, and education. My own career as a mathematics professor reflects their interests.

What is your advice to college students and new teachers?

Find something you enjoy and devote your energies to it, but don't be afraid to try new things. Challenge yourself.