Making Connections

Mother-daughter duo builds on math

"Making connections is my passion," says Dr. Bozenna Pasik-Duncan. To that end, it isn't hard for her—or for anyone—to see the clear connection between the professor of mathematics at the University of Kansas (KU) and her daughter, Dominique Duncan. In addition to teaching, Pasik-Duncan has dedicated her life to researching stochastic adaptive control and theories of randomness, while Dominique has long been fascinated by predictability, specifically the ability to predict seizures in epilepsy patients. Though one believes in randomness while the other searches for predictability, the mother/daughter pair share a strong bond, which is elevated by their common interests.

Pasik-Duncan has always been interested in mathematics, as well as science, engineering, economics, and other areas where the practical application of math can be utilized. As a young girl, "I would look around and see applications of math everywhere," she recalls. "What fascinated me most was the so-called randomness or uncertainty in the world."

To better make connections among these random events, she enrolled in the Warsaw School of Economics after attending Warsaw University, both in her native Poland. "I wanted to teach people to apply mathematics," she explains. Pasik-Duncan credits a close relationship with her own mother, who advised her that she was born to be a teacher and to help others. Following that advice, Pasik-Duncan doesn't just teach math but also serves as a courtesy professor of electrical engineering and computer science at KU as well as an investigator at the Information and Telecommunication Technology Center, where she is affiliated with three research labs. And it seems her mother was right about her natural talent for teaching—Pasik-Duncan was recently honored with an Outstanding Education Service Award in recognition of her "exemplary dedication and outstanding service in education" from The Institute of Interfaith Dialog.

She feels very much at home in the world of academia, because she says, "I never could separate teaching from research because I always like to learn to be a good teacher." By continuing her research and studies, Pasik-Duncan is proud to say that "I've been teaching for 42 years, and I've never taught a class in the same way. I'm always updating my knowledge and bringing what is new in research to class."

Yet her influence extends well beyond the classroom. She has published numerous articles, spoken on a variety of panels, and participates in many organizations. In fact, she was just reelected to a fourth term as the IEEE Control Systems Society (CSS) liaison to the IEEE Women in Engineering (WIE) Committee. She is also a member of the advisory board at the KU Spencer Museum of Art, which she references as an example of her passion for working across disciplines. "I really love art and music, but I'm not talented in those areas," she laughs. "I strongly believe it is important, especially for women, to make connections with these nontraditional fields. I'm currently involved with a project in cryptography, where we're bringing engineers and artists together."

One connection that Pasik-Duncan did not make? "I never thought Dominique would be an engineer!" she says. "She has so many passions and took so many courses, that I thought she would pursue classics or language." Dominique recalls always being interested in math and engineering, becoming inspired by growing up in a home with two math professors (her father teaches math at KU but is trained as an engineer). "They would talk about math at the dinner table," she says. "And ever

Dominique's graduation ceremony when she received her master's in philosophy from Yale.

Digital Object Identifier 10.1109/MWIE.2012.2215238
Date of publication: 1 November 2012

since I was little they would take me to conferences, so I grew up in that community."

Coming Into Focus

Dominique really began to focus on honing her math and science skills in the fourth grade, when her parents were on sabbatical in Poland and France. Enrolled in schools there, Dominique began to realize that her American education was not at the levels of the European students her age, who were practicing physics, biology, and advanced math. To get caught up, the Duncans had the idea that Bozenna would run an after-school program to teach Dominique and a group of her gifted peers more advanced math and problem solving. "We participated in a lot of math competitions," she says. "And in sixth grade, a group of us would walk over to the junior high school each day to take math with the older students." Additionally, Dominique began taking a math class at the University of Kansas.

From there, her passion and abilities grew. Dominique completed so many math courses at KU that she was practically a college graduate by her senior year of high school. Still, "I wanted to have the typical college experience," she explains. Enrolled at the University of Chicago, Dominique pursued a double major in mathematics and Polish literature. However, it was the classes she took in computational neuroscience that got her thinking about a future in engineering. Like her mother, Dominique realized, "I felt the math major was a really good foundation, but I wanted to apply it somehow. With engineering, there are so many options."

Then, the summer before her senior year of college, Dominique was in a program at the University of California, Berkeley, where she worked on projects with graduate students and professors and prepared for her own graduate school career. "I learned a lot that I hadn't learned in college, like MATLAB," she says. "That just convinced me that I wanted to study engineering in grad school."

Tyrone Duncan, Dominique Duncan, and Bozenna Pasik-Duncan at the IEEE Conference on Decision and Control in San Diego, California.

Dominique chose Yale University for her studies because, while it's a small engineering school, students are able to choose advisors from any graduate program, and this allows for cross-disciplinary study and perspective. She is currently working to earn her Ph.D. in electrical engineering, but she's been fortunate to have advisors in neurology and mathematics, too. "I think working together is a lot more productive," she explains. After completing the Ph.D. program, Dominique plans to do post-doctorate work and then become a professor, like both of her parents.

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But unlike her mother who has focused on randomness, Dominique's research and work has centered around predicting seizures in patients with epilepsy. "Some patients have hundreds of seizures a day," she says. "Using electrodes put directly on the brain, we collect data to see if we can come up with methods to predict when and why the seizures occur. If we can do that, we can stop them."

A Personal Connection

Pasik-Duncan remembers the moment when her daughter first became interested in predicting seizures. "In the sixth grade, a very good friend of hers was thrown from a horse and developed epileptic seizures," she tells. "Dominique was very disturbed that no one could predict the seizures and give her friend a warning so that she could leave the classroom and avoid having her schoolmates witness the episodes."

Pasik-Duncan put her daughter in touch with doctors at a medical school in Kansas City so that Dominique could ask questions and talk through her concerns, and the doctors even invited Dominique to observe a brain surgery. "I think that was the critical moment," says Pasik-Duncan. "It was when she began to make connections and started on the path of trying to solve problems." One of Dominique's earliest contributions to the field was around this same time, when she completed a

project on predicting seizures for her sixth-grade science fair. "She realized that for this kind of research, she needed not only math but neuroscience, engineering, and other disciplines as well," says her mother.

Dominique has been fortunate to have a live-in role model (or one just a phone call away, as she currently lives in Connecticut while her mother is in Kansas), especially one that doesn't believe in studying math or science within a vacuum. She relied on her mother's support in the ninth grade when she made the cheerleading squad, and the teacher for gifted students called her parents and told them that Dominique could not participate in both the gifted classes and cheerleading. "My parents were very disturbed by this," recalls Dominique. "They told the teacher that they would support me in doing both."

For Dominique, having the encouragement of her parents has been a key factor in her success. "There has been a lot of discouragement along the way," she says, "and unfortunately I've seen a lot of girls drop out of the field because they didn't fight hard enough for it. I think it's because they didn't have a strong support system. I have my parents and others always supporting me and telling me to keep going and focusing on what I love."

Mom and daughter both agree that their love for science, technology, engineering, and mathematics (STEM) comes from the ability of those skills to be used in so many ways. In her conversations with schools for her postdoctorate work, Dominique has seen a high demand for engineers within the medical world because "people like that engineers know how to think." Her mother agrees, noting that for skills in STEM, one has to be curious and always wonder why things happen or how something works. "I always say you can be a better lawyer if you know math or science," says Pasik-Duncan. "If I had to go to court and defend myself against a speeding ticket, STEM can help with the necessary logical thinking. And kids can do anything they dream of with training in math, science, and engineering, once they are made aware of how curious they are."

Pasik-Duncan certainly followed her own advice, helping build curiosity in her only daughter from a young age. Now, she watches her daughter's achievements and waits for a time when they can collaborate on something as a family. "We support her, but we also want to stay away until she finishes her degree," says Dr. Pasik-Duncan, proudly. "Then we'll do something together and everyone will say it is Dominique's contribution, with some help from others."

—Leslie Prives

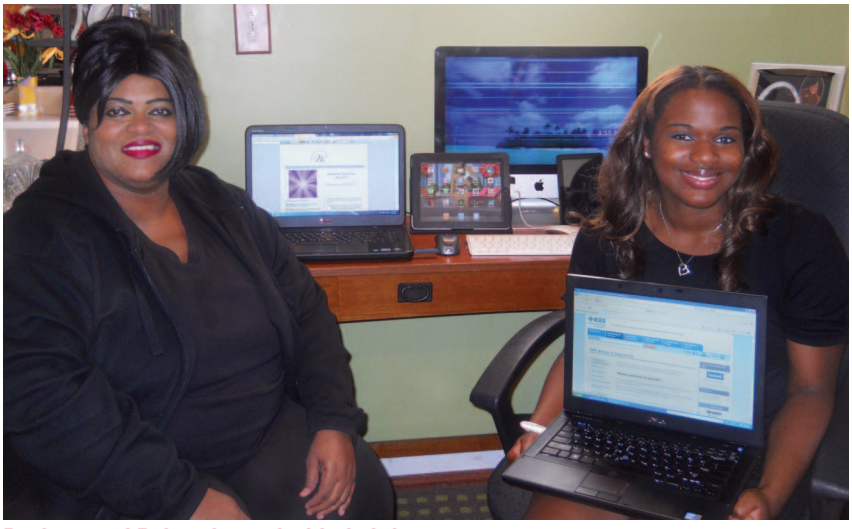
Like Mother, Like Daughter

Januarys share a love of computers

Paulette January and her daughter, Rainy, have a lot in common. Paulette is the editor of the international *Women in Engineering Newsletter*, while Rainy served as editor of the *EsCoHi News*, her high school's newspaper. Rainy spent six years in the high school marching band as a saxophone lead player and drum majorette, which Paulette supported by serving as president of the band booster association. They're already both members of the same sorority, Zeta Phi Beta Sorority, Inc.: Paulette as a national member and Rainy as a teen member of the Zeta Archonettes. Then there's the fact that Rainy just graduated from the same high school in Atmore, Alabama, that Paulette attended and, in the fall, Rainy is off to college at her mother's alma mater, Alabama A&M University, a historically black college located in Huntsville, Alabama.

But what brings them together most is a shared love for computers. Paulette, who studied computer science at Alabama A&M, became fascinated by the technology at the age of 12, when she saw a television commercial presenting what was a novel concept at the time: the personal computer. "Of course, being 12 years old, I thought working in computers was very basic," she says. Yet, as a software quality engineering manager for DRS Technologies, Inc., her job is quite complex. Paulette performs software quality engineering for the design and development of airborne instrumentation flight training systems. This system allows pilots to simulate air combat using airborne instrumentation pods to improve and enhance mission preparedness and performance. "I primarily work on air combat training systems as well as various engineering design products," she

Digital Object Identifier 10.1109/MWIE.2012.2215251
Date of publication: 1 November 2012



Paulette and Rainy pictured with their love: computers.