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Adding It Up

In his teaching and research, Math Professor Tian-Xiao He embraces the joy of exploring an oft-feared subject.

Story by KIM HILL

Professor of Mathematics Tian-Xiao He says reaching the number “100” is not significant. Colleagues and former students beg to differ.

It’s not the numeral following “99” under debate, but rather the number of papers published in peer-reviewed journals that He has written or co-authored. To be precise (after all, this is mathematics), He has published 111 papers and five books since his graduate school days in the 1980s.

“That’s a very, very heavy publication rate you don’t often find, even at major research institutions,” says Melvyn Jeter, chair of Illinois Wesleyan’s math department.



In his 22 years at Wesleyan, Professor He estimates he has taught more than 2,000 students. He's mathematical research has resulted in publication of 111 peer-reviewed papers and five books.

According to He, all that research has made him more effective in the classroom. “I think my research experience helps my teaching a lot. Although the pedagogy and methodology of teaching are very important, teaching math is basically teaching how to think about math creatively, such as raising questions, finding ways to solve them ... which is exactly what we need in research.”

It’s a message He often conveys in the classroom, where he cajoles his students, “Don’t use memory — use *understanding*.”

“A cornerstone idea for mathematics is taking a math problem to big and different spaces,” He says. “I am working in several fields, which allows me to consider a problem from different aspects. A hard problem in one space might be solved readily in another space by using a different view.”

He’s career has been ground-breaking as well as prolific. In his native China, at Dalian University of Technology, he was the first Ph.D. student in approximation theory. At the first joint U.S.–China conference on approximation theory, He was one of only 20 Chinese mathematicians invited to speak.

He’s abilities caught the attention of Charles K. Chui, an internationally renowned expert on approximation theory. A professor at Texas A&M, Chui invited He to come to the United States to work with him in his pioneering research on multivariate spline functions. He borrowed money for the airline ticket from China to America. Five years later, he had earned his second Ph.D. and was named Texas A&M’s Distinguished Doctor of the Year.

He ascribes to the philosophy of British mathematician Sir Michael Atiyah, who stated: “The length of the time you can go on being active within mathematics very much depends on the width of your coverage.” The Illinois Wesleyan professor agrees, noting that diversifying fields brings researchers more perspective and interaction.



He's talent for math, first recognized in China, led to an invitation to teach and do research at Texas A&M, where he earned a second Ph.D.

At a young age, He was encouraged to pursue a wide breadth of knowledge. Along with math, he loved literature, and could often be found exploring the bookshelves in his journalist father's study. He remembers winning a math contest in junior high. The prize, roughly the equivalent of five U.S. dollars, was enough to cover one semester's tuition at the time. Inspired by his success, He dedicated himself to self-study and by high school was poring through a college textbook on mathematical analysis, including calculus, differential equations and functional analysis. The text contained more than 4,000 problems —it took him years, but eventually he filled 11 answer books with the solutions to each problem.

It wasn't until his undergraduate study at Hefei University of Technology that He first embraced the challenge of teaching math, instructing classes with more than 100 students. Continuing his teaching at Texas A&M, He began to develop his energetic, cheerful classroom style that encourages students to see the fun side of a subject they may have previously feared or found dull.

"Dr. He is a brilliant professor who creates a warm, open environment where people are able to learn," says Kristin (Stankus) Kahn '97, who is now an account executive for Aon Risk Services in Chicago. "He even managed to make 'Differential Equations' at 8 a.m. one of my favorite classes!"

Once voted by IWU students as "Professor of the Year," He estimates he has taught more than 2,000 students over the last 22 years — many of them non-math majors. Learning math can and should be an exciting and non-intimidating process, says He, who decentralizes difficult points — breaking them into steps that are easier to digest.

For students up to the challenge, He encourages them to pursue independent study projects. One of He's recent students, Cindy Tagaris '12, was fascinated with approximating functions and undertook an extra-credit project to learn more about numerical analysis. "I learned about the research process and gained a 'bigger picture' view of mathematics," says Tagaris. "These are things one does not learn solving homework problems."

"Dr. He showed me what it means to be a mathematician," adds Tagaris, whose research area is number theory in her master's program at Clemson University. She is considering a career in either academia or the defense industry.

At times, the student projects align with He's own research interests. Such was the case for Nathan Mueggenburg '98, a math and physics major who participated in numerous research projects under He's supervision.

As a student, Mueggenburg often presented his research findings and remembers being approached afterwards by people who were "surprised that undergraduate students would do research in mathematics," he says. Now, as an assistant professor of physics at Lake Forest College in suburban Chicago, Mueggenburg says he understands why.

"Most mathematics professors and all of us in the natural sciences choose to either do significant research on our own without students, or choose to work with students and abandon the idea of doing a significant amount of research. Dr. He manages to do both, and this is what is so unusual."

Patrick Crowley '96 — a double major in math and computer science at Wesleyan — concurs. Understanding He's research "requires a degree of mathematics literacy most undergraduates do not have," says Crowley. "Dr. He was willing to take an advanced topic — wavelet analysis — and introduce me to it."

The benefit of his research experience with He was far-reaching, says Crowley, who is an associate professor of computer science at Washington University in St. Louis. “It was my first insight into what it might be to operate as an independent scholar, along with my first example of what it was to engage in research.”

In hindsight, both Crowley and Mueggenburg realize that He designed their undergraduate research with their benefit in mind. “If his goal was to advance his research,” says Mueggenburg, “he could do much more by working alone. Instead, his goal was educating and enriching his students, and he is able to achieve this while continuing his own research.”

It’s a trait that He shows for all his students, says Tagaris, who sensed her professor’s “immense care for their learning.”

Mueggenburg notes this same quality. “When he returned a test, he was always eager to say ‘good job’ or ‘great work,’ or some similar compliment. I knew these were not idle platitudes, but were heartfelt expressions of joy when students succeed. This was most evident when some tests were returned with a quiet ‘thank you.’”

Bringing joy to the study of math has become something of a mission for He. He feels it himself as he walks or jogs in the park, and an idea for some new avenue of research comes to mind. And he feels it in the classroom, when he sees understanding in a student’s eyes that was not there before.

For He, teaching and research are entwined: he needs one to excel at the other.

“In teaching, I most enjoy the immediate reaction — when I can’t make my sentence complete before the questions begin,” He explains. “In research, being stuck on a problem and then finding a simpler way to do the work, that is very enjoyable, too.”

Teaching awards and papers accepted for publication are high honors He appreciates, but they are not the highest for He.

“When I receive an email from a former student who says, ‘I used some things you taught me in my current work or to solve a problem’ — that is my best reward.”

TO READ WHAT PROFESSOR HE REGARDS AS AMONG THE MOST INTERESTING NUMBERS, [CLICK HERE](#).