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Strength in Numbers

Illinois Wesleyan's mathematics faculty open the minds of their students while relaxing fears about an often daunting subject.

Story by CANDACE SCHILLING
Photos by MARC FEATHERLY

For generations of students, the phrase “math class” has been synonymous with the squeak of chalk, the drowsy drone of a lecturer’s voice, and a blackboard dense with columns of numbers and bewildering, exotic symbols.

But over the past century, a shift has occurred as professors inject personality into their teaching patterns and classrooms. An interactive, Socratic style of instruction with its questions and answers has ventured beyond philosophical topics and back into the sciences — including mathematics.

Illinois Wesleyan mathematics faculty

Melvyn Jeter, Tian-Xiao He, and Zahia Drici are a few of the professors who stand on the front lines of this new teaching style, sharing their passion for their subject by engaging their classes in discovery. Rather than viewing students as sponges ready to soak up information from a lecture, their collaborative teaching techniques treat students as partners in the learning process.

This move away from the lecture style of instruction does not mean that teaching classical mathematical foundations has also been abandoned. According to He, the need to visit classic material before moving to modern concepts is, in fact, a pedagogical challenge that separates mathematics from other sciences. Math requires a foundation, a set of building blocks constructed from more than 2,000 years of accumulated mathematical knowledge.

At the same time, “math is exploding,” says Jeter, who chairs IWU Mathematics Department. “Thousands of mathematicians are working on problems, and the growth in math knowledge has been so extreme, there’s no way to keep up with it.”

For Jeter and his fellow professors, the challenge lies in building an initial foundation of comprehension, while conveying to students that mathematics is both ancient and alive.



Jeff Armstrong '07 (above) goes over the details of a proof he had written prior to class.



Drici (above) works with Josh Rundle '08 (at right), Quentin Brummet '08 (seated) and other students in a collaborative classroom setting. It took her time, she says, to let go of her role as lecturer and embrace a more open style of learning.

first, she felt “separate from the class” during her lectures. Feedback and introspection led her to try a new approach. She credits her colleagues in the Math Department with helping her understand the climate at IWU and the opportunities provided by smaller classes. “Slowly I realized I was putting the spotlight on the wrong thing. I should be in the background, facilitating and helping students find their own voice,” Drici says.

“I like to see students grab a marker in class, write, and then turn and ask their friends what they think,” she says. This exchange is vital to learning, Drici-style.

When a student hesitates during her answer to a review question, Drici begins to guide, then asks if the student is still struggling. An affirmative response causes Drici to scan the room with the question, “Help?” Other students, one by one, suggest their own ideas.

Such scans are frequent. When action moves to the white board at the front of the room, she asks the students, “Do you agree?” After a student answers a question, Drici searches the room for visual cues of agreement and understanding.

One important concept students take from Professor Zahia Drici’s classes won’t be found on any written test.

Drici tells students to ask themselves, “What is the purpose of this class, and why am I taking it?” According to Drici, a class should be more than a checkmark to satisfy an academic requirement. Considering why they are taking the class helps math majors and non-majors alike become more invested in the process of learning the language. “They have to see the value in what we are doing, for them to engage,” Drici says. Some non-majors are at the top of her 100-level Analysis classes.

Today Drici’s class is reviewing for an exam. Drici begins at the front of the room, but ignores the lectern. She walks among the rows of students, merging with the audience as she asks for answers from volunteers — selecting students to respond as needed. As the students provide a counterexample and explain why each is a good choice, Drici occasionally expands an answer with the opener: “Another way to do this could be ...”

For Drici, the shift from lecture to collaboration was a personal evolution. At

Drici works to create a supportive environment in her classes, where students can express emotions, including frustration. She cares about how they feel, and acknowledges what she notices, whether they are tired or alert, happy, or struggling. Drici accepts these changing emotions of the room, and she teaches her students to accept the ebb and flow of the learning experience. “Learning is a messy thing,” she says.

The next phase of the review session involves group work, and students scatter into clusters along the walls to work on their problems. Drici continues to float around the classroom, asking about their work rather than telling them what to change. Even when she focuses on one board, her ears remain open to the class. Hearing a quiet conversation across the room, she suddenly asks, “Is that analysis?” The social moment ends as Drici brings a chatting group back into the process.

The energy of the class is both analytical and creative. A student in one group suddenly raises his arms into a V with a quiet yell, “*That’s it!*”

Rebecca Carlton, an IWU junior with a minor in math, has taken all of her math courses with Drici and compliments her thoroughness.

“She makes sure that you understand the material very well and will change the schedule in the syllabus, slowing down if the class is struggling with the chapter,” Carlton says. “Dr. Drici often has one student or the whole class working in groups on problems at the white boards around the classroom. This way, we get personal feedback if we are stuck on a problem either from Dr. Drici or our classmates.”

Students matter to Drici. In her office, she frequently encourages students to develop ease, fluency, and confidence with math — to, as one of her professors used to say, “make it your own.”

On an upper shelf in her office, she points to a stack of papers — every student evaluation she has received since her arrival at IWU in 1995.

Drici already knows the power of teaching, and how it can awaken a soul. She hated math during her first year out of elementary school and wanted to be a history teacher. The next year, a different teacher made math fun and changed the direction of her life. Recently, the teacher’s son wrote to Drici on behalf of his father, who had seen her name on the Internet and wanted to know if she was “the same little girl he had taught.”

Drici’s approach is flexible. “Each class has a personality and individuals have personalities,” she says, and she adjusts to meet the unique blend of each new audience. For first-year courses, part of the journey includes finding out what backgrounds they have in mathematics.

“I no longer see students as having deficits,” she says. “I take a positive attitude — ‘You’ve learned this material in high school, and now we’re building on that.’ I point out they have a foundation, and acknowledge what they already know.”

IWU mathematics professor Tian-Xiao He is a math maestro, a conductor encouraging his students to interact with him at all points of his instruction. As the board fills with the language of calculus during the review portion of his Analysis class, He pauses to let students feed him the answers. Occasionally he performs an almost yogic twist as his right arm works the white board with a marker, while his left arm swings back from his torso and up into the air.



His voice grows quiet in a way that beckons the students to listen: “Can you prove that?” Later, he crescendos: “Very good!” or “Very important!”

In his classroom, He (above) uses humor to relax students. He believes that anyone can learn math “if they love it.”

He’s classes demonstrate his passion for frequent exchanges between students and the instructor. “I have more understanding of the material, so I can show it in different ways,” He says. “The instructor spent his whole life to get here, and can bring personal experiences to the students.”

His Analysis class is no exception. He begins by sharing quiet banter with the students before class, apologizing for the way a cold has turned his voice hoarse. The shift from casual conversation to classroom mode as He crosses the floor to the white board is a transformation that reflects He’s love of math and his love of teaching it. The classroom ignites him.

He uses a textbook, but he is not limited by it. “Next topic; this is beyond your textbook! Could you establish the formula for the expansion of...”

Greeted with hesitation when he asks the class a question, he responds, “Don’t use memory — use understanding.”

Not everyone in He’s classroom is a math major chasing a passion for numbers, formulas, and theorems, and he enjoys a mix of math majors and non-majors in his classes. If students are willing, he encourages them to apply mathematical principles to projects in their own major for extra credit.

Even in smaller classes like those offered by IWU, He finds a lot of differences from class to class and student to student. Any student who passes a course needs to handle at least “basic material.” But exceptional students should be exposed to more material. His goal is to “make all people feel challenged.”

He also sees the value research can bring to the classroom. He says, "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."

Ikenna Odinaka, an IWU physics major who may become a math major, says that He has shown that you can learn all the material in a class and get an "excellent grade" in the process. "I have even heard a lot of people in IWU say that 'Dr. He forces you to get a good grade even if you don't want to.'"

Odinaka characterizes He as a "smart and humble" person who has inspired Odinaka to work hard in his own studies. Although He has "written lots of papers in mathematics, he doesn't go around bragging about it."

Learning math can and should be a fun process, according to He, who decentralizes difficult points — breaking them into steps that are easier to digest. Odinaka enjoys how He is able to joke and make plays on words while still moving forward to cover all the relevant information. "He treats the material so well that you are guaranteed a thorough understanding of the course content and a completion of the entire course material for the semester."

Anyone can learn math, if they love it, He believes. How far they go depends on many factors, but whether a student is nervous at the board really depends on the instructor.

"You can make people relaxed," He says.



IWU Mathematics Professor Melvyn Jeter's Topology class is in pursuit of a "Shazaam moment."

As a student presents her proof on the overhead projector, Jeter joins the class, sitting in the front row. "Can you show what you're proving?" the presenter's classmates ask. As students begin to respond to the presenter's work, Jeter carefully watches faces and body language, encouraging the quiet or hesitant to voice their comments as well.

Jeter encourages his students to work together on unresolved problems, and acts as an "advisor or director," of his class, according to a student.

instructor, from the equation by allowing students to discover solutions for themselves. The

For Jeter, a "Shazaam moment" is the triumph of finding a solution, and the best learning experience for a student. In his classes, Jeter tries to free himself, the

magic of mathematics, he says, comes when a student can apply problem-solving skills that stretch beyond formulas, theorems, and proofs.

“We live in a world where things change rapidly,” Jeter says. “It’s important for them to be able to solve problems — and not just mathematical problems. It’s much more important to teach someone how to discover than to tell them what has already been discovered.”

Students in Jeter’s Topology course receive a spiral-bound booklet created by Jeter himself — and nothing more. The booklet contains definitions and exercises for the students, whose homework is to prove the theorems that interest them.

“At the beginning of each period students write down all the problems they have solved and are ready to present,” said Carol Ambrose, an Illinois Wesleyan junior with a double major in math and Spanish. “Professor Jeter selects students from the list to present one of their proofs.”

In today’s class, Jeter asks the presenter to explain what the difficulty was in her proof last time. Then the formal vote occurs: “Give me some hand action — how many vote to accept her proof?” Jeter asks the class. A sea of hands reflects their approval of the student’s work. “That isn’t the proof I expected to see, which is nice,” Jeter says, updating his score book to reflect the student’s success.

The students are responsible for making sure what they see is correct before accepting a classmate’s proof. Knowing that an incorrect theorem could be on the final exam “puts heat on the group,” Jeter says.

The student has used an indirect proof, and Jeter returns to the front of the classroom to show the class how to create a direct proof using the same ideas.

Jeter says he tries to free students from taking notes in class, and they bring their proofs already written on sheets of film for the overhead projector rather than writing on the board during presentations. He also prefers for the students to ask questions about the proof.

“In general, Professor Jeter’s teaching style makes him more like an advisor or director to the class,” Ambrose says. “Professor Jeter wants the class to feel like a group project where the class is trying to learn about the subject, say topology, together, by proving neat results, learning definitions, and discovering useful examples. Since the class is similar to a group project with a lot of individual work (solving the problems) then Professor Jeter teaches through direction and hints or advice instead of lecture. In my techniques class we even met without Professor Jeter once instead of canceling class.”

That’s exactly the kind of independence that Jeter and his fellow math professors are happy to promote among their students.

“You’re successful as a teacher,” Jeter says, “when your students don’t need you any more.”