Diane Jammula on a Mission to Make Physics Accessible to All

By Lawrence Lerner

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On a recent afternoon, Diane Jammula stood at the front of a large lecture hall packed with 150 students, wearing a humorous grin. It was Valentine's Day, and she was about to toss a nugget to her General Physics II class.

"Here's a special Valentine's Day physics problem for you: Are you attracted to or repelled by the person next to you?" she asked.

A wave of delight passed over the room, culminating in laughter, raised hands and more than a few jokes made in response. After the noise subsided, Jammula continued.

"Everyone has mass, right? We all have a gravitational field around us—you know that. And gravity is an attractive force. So, who among you are attracted to the person next to you?"

Everyone in the class raised their hand.

It was vintage Jammula. Since arriving at RU-N in fall 2015 on a new line called a NTT teaching instructor, it has been her mission to make physics accessible and engaging to students, using modern teaching methods and a healthy dose of humor to bring equity to a field long bereft of it.

"Physics is one of the least diverse fields in science. There are few people of color or women, "says Jammula. "We need to show students that physics can be fun and related to their everyday lives. Doing this takes changing our approach to teaching and creating a warm, welcoming classroom environment for all."

Jammula has done just that by taking the traditional lecture format and turning it on its head.

She starts with a warm-up exercise "to get the juices flowing," then presents new concepts via demos, videos or simulations while students jot notes and draw on Powerpoint printouts. Next, she gives them a problem to solve independently before they turn and discuss it with their neighbor. At other times, they break up into small groups to do hands-on work while Jammula and her undergraduate Learning Assistants circle the room, listening to conversations and chiming in to answer questions or offer help, before reconvening for large-group discussions.

Either way, students are engaged in "active learning," where knowledge isn't so much transferred from teacher to student as it is constructed by the students themselves.

"The research shows that actively involved students reap twice the learning gain over traditional teaching methods," says Jammula. "Students have to play with the material, make mistakes, work their brain to learn. Our classes get loud and fun."

Aside from her weekly lecture-hall classes, students attend a lab and recitation, which are even more hands-on. But according to Jammula, who teaches General Physics I and II at RU-N, the ideal setup would be to converge lecture, problem-solving and lab into one studio classroom.

In fall 2017, her wish will come true when a newly renovated state-of-the-art classroom comes online in Smith Hall. The space will feature movable tables accommodating eight students each, projector screens around the room, and laptop computers and lab equipment shared by smaller groups of two or three students at each table.

Jammula will be freed up to walk around and run what education specialists call a "decentered" classroom, where the teacher is no longer the focal point but is more of a teacher-coach facilitating students' learning, which they construct on their own.

The setup will enable her to control her Powerpoint presentations on multiple screens from anywhere in the room, while letting students engage in "authentic physics" by tackling a research question, designing an experiment and collecting and analyzing their data, then projecting that data onto the screens for large-group discussion.

"They'll work together and compare their findings to reach a consensus and build a model, arrive at math equations through their data collection, build graphs and represent data in different ways, then deploy the model they just built and apply it to different situations," says Jammula. "In other words, they'll work and create knowledge the way actual physicists do."

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All the while, Jammula and her Learning Assistants will help the students think about their experiment design and pose questions to push their data analysis. Their answers will come not from the teacher but from the data.

"They'll no longer depend on me to tell them the answer. They'll go and get it themselves, and in that way they're empowered," says Jammula.

She's doing her best version of this right now, working within the constraints of the traditional lecture-hall space and lecture, lab and recitation structure and applying her active-learning approach to the delight of the students, who are aware they're reaping the benefits of innovative instruction.

Henry Jimenez is a second-year biology major from Harrison, N.J., with a minor in chemistry and psychology. He says that because Jammula embraces active-learning in not just labs and recitations but also in her lectures, she presents alternative ways for students to understand the information, and is able to support nearly every learning style.

Christina Estremera, a fourth-year psychology major from East Brunswick, N.J., agrees. She says Jammula's approach works especially well for visual learners like herself, and the way Jammula relates physics to daily life helps her retain the material better and keep her engaged.

"There have been many times where I've been so interested and focused that I couldn't believe the class was over so quickly. That says a lot for a course as difficult as physics," she says.

Jammula is happy to hear that her methods are paying dividends, and that all of her students are comfortable and tuned in.

"When people imagine a physicist, they think of Sheldon from *Big Bang Theory*, a dorky, elitist, independent-minded male who doesn't connect with others," says Jammula. "And they imagine physics as only theoretical and abstract, and physics courses as weed-out exercises for med-school. But they don't have to be that way. My mission is to make sure they're much more engaging and inclusive."

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