

Effort makes quantum education more accessible

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port quantum education in U.S. science classes. Quantum for All is one of the Q-12 Partnership's many affiliates, which include other quantum education organizations and tech companies like Google and IBM.

Franklin and Singh say that, in order for quantum technologies to continue revolutionizing the world, quantum really does need to be for all.

"We ... have missed out on the lens of women and racial/ethnic minority students," said Singh, referring to the quantum revolution.

Franklin added: "Everyone needs to be at the design table so that the products can be designed in a way that's beneficial to everyone."

Approachable and fun

Both Q-12 and Quantum for All focus on breaking down quantum to be approachable and fun for teachers and students, rather than mysterious and scary. "When you start early, things are not spooky," said Singh, who also serves on the advisory board of Quantum for All.

Christina Tran, a rising junior at Martin High School, definitely isn't spooked. She attended Quantum for All's camp last summer, too. "They break it down so well that ... it doesn't discourage you from learning," she said.

In addition to learning, Tran and the other campers had fun with hands-on experiments at the Arlington summer camp in June.

Earlier in the day, students built model trains that levitated using magnets. While the trains moved quickly because they didn't have contact with the ground to slow them down,



Juan Figueroa/Staff Photographer

Pierce Nguyen (right) participated in a quantum levitation demonstration during the Quantum for All camp at Martin High School in Arlington. Quantum for All is an affiliate of the National Q-12 Education Partnership, a group that works with academic and industry leaders to support quantum education in U.S. science classes.

they were wobbly and some flipped over.

So the students tried out a different solution — quantum levitation.

Quantum levitation has two components — a strong magnet and a superconductor, which is a material that has special quantum properties when it is extremely cold.

When the magnet is moved on top of the cold superconductor, these special properties make the superconductor act as a second magnet.

The magnet-like superconductor repels the original magnet up and away from it. But gravity still pulls the magnet down. Trapped between two opposing forces, the magnet

levitates above the superconductor.

After this happens, the magnet and the superconductor are invisibly locked together as if they're connected by invisible strings. If either piece is moved carefully, so as not to break the lock, the other will move with it.

At one table, a teacher demonstrated this by dunking a superconductor in liquid nitrogen and moving it toward a large magnet, creating the quantum lock. Then, the teacher turned the magnet upside down and showed that the disk stayed attached, hovering just below.

Elsewhere, students gently tossed small magnets at a superconductor and watched

them bounce away, repelled.

Tran said she loved getting "to pick up the [superconductor] and work with the nitrogen." She added that while liquid nitrogen is "amazing," she's "over" liquid nitrogen ice cream.

After the experiments, the students agreed that quantum levitation was more stable than magnetic levitation. They thought that applying this technique to trains might provide a lot of the same pros as a magnetic levitation without some of the downsides.

Due in part to Matsler's efforts, Texas now requires quantum education as part of the core curriculum. Organizations like Quantum for All and

the Q-12 Partnership are connecting teachers to emerging quantum resources that they can incorporate into physics, chemistry, computer science and math classes.

Confidence boost

To help teachers feel more confident teaching quantum concepts, Quantum for All combines teacher training with practical experience.

This year, teachers came to Arlington from all over the country for a week of training, then immediately turned around and taught what they had learned to high school students at the camp.

This type of practice makes

Ashley Fiamengo, a chemistry teacher in the Irving Independent School District, feel more comfortable bringing the concepts back to the classroom. "[You're] a little more confident because you've done it again," she said.

Fiamengo has been attending Quantum for All teacher trainings since the organization started offering them in 2020. She said, "It is the best form of professional development I've ever had."

Fiamengo and the other teachers who attended the camp will continue to tweak the camp's curriculum based on their experiences with campers and their own students.

Interactive resources

Quantum for All will then collate this feedback to strengthen the curriculum before making it publicly available. Matsler hopes that starting next spring, teachers everywhere will be able to access these resources.

For young people who are excited about quantum science but missed Quantum for All's camp, there are lots of opportunities to learn more. The Q-12 Partnership has a number of interactive, free games on their website that help teach quantum concepts (and they come with teacher guides that don't require any background knowledge).

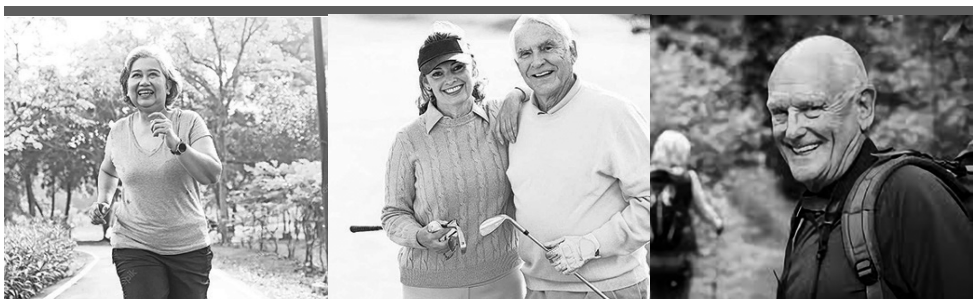
A new video series from the Chicago Quantum Exchange, a quantum research and outreach program, uses fun animations to break down complicated quantum ideas.

Lila Levinson reports on science for The Dallas Morning News as part of a fellowship with the American Association for the Advancement of Science.

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