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New approach is energizing physics

By Yamil Berard

DENTON -- Students at Denton High School have debunked the stereotype of the physics dweeb.

It's OK to hold a protractor, students say. The Bunsen burner? Outdated, dude.

Today, work in a physics laboratory means using a spectroscope to view the color-rich explosion of electrons and photons, the velocity of waves across a ripple tank.

"Physics isn't as dork-related anymore," said Elizabeth Boni, a sophomore at Denton High School who is enrolled in pre-advanced placement physics. "A lot of really cool people take this class."

The turn-on to science at the school can be attributed to the influential approach of teacher Gerald Cardwell, head of the science department.

A whopping 234 students--almost one-fifth of the approximately 1,300 students at Denton High--are enrolled in a science course, primarily because of Cardwell's push to make science more experimental and less regimental.

The nationwide number of secondary-level students who sign up for science courses is lower, averaging 10 percent to 12 percent, statistics show.

Cardwell, a master teacher, gets his ammo for jazzy classroom experiments from professors at the University of North Texas in Denton who sponsor a program called the Texas Regional Collaboratives for Excellence in Science Teaching.

Cardwell and about 30 other Metroplex junior high and high school teachers who are enrolled in the statewide program log up to 125 hours a year in the UNT physics lab.

The program is supported by federal Dwight D. Eisenhower Professional Development grants and by the Texas Education Agency. More than 1,000 teachers are involved in the program.

Primarily, the teachers set off chemical reactions and dabble with molecules, said UNT physics professor Jim Roberts, one of several instructors who conduct the classes.

"We're trying to capture the imagination of the kids, and we do that by capturing the imagination of the teachers," Roberts said. "Mark Twain once made the comment, 'I would never let my schooling get in the way of my education.' I never let the regimentation in the classroom get in the way of letting my intelligence fly free and learn to discover."

One popular experiment uses a "magic" pendulum that suspends a rod of magnets. Students study chaotic motion by watching the swinging rod and projecting the direction of the movement by using a special formula.

Cardwell "puts a lot into it," said Karen Rhodes, a 17-year-old junior at Denton High School. "In other science classes, we don't have as much lab. We have more in-depth stuff."

Sixty percent of Cardwell's class is lab driven. Students recently had calibrated spectroscopes for an experiment about atomic structure. Through the finely tuned instruments, they saw fan-shaped bands of color--bright yellows, aquamarines and reds. Measuring the color scatter with their protractors, the students speculated on the Rydberg constant, which reveals the relationship between wavelengths and electron transitions, Roberts said.

"This enables you to see a model of the unseen world, the structures of an atom," Roberts said. "It's a fundamental discovery of nature. We can understand the origin of light and the quantum mechanical behavior of systems."

UNT officials say they hope that more teachers will join the collaboratives. Their primary goal is to boost the number of

"Many people have the idea that it's all particles mechanism and the [Superconducting] Super Collider that failed," Cardwell said. "Physics isn't learned by writing formulas on the board. You learn physics by doing. The days of a lot of lecture time are gone."

students enrolled in the sciences.

Denton High, with its large numbers of students in science classes, would be an example for other high schools, said Kamil Jbeily, the collaboratives' director and a chemistry instructor at the University of Texas at Austin.

"The person who doesn't continue to learn is no better off than a person who cannot learn, so we as adults need to continue to learn, to improve the way we are doing our work," Jbeily said. "I tell the teachers that they are the key for improving science in the classroom and that's why we invest in them."

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