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A New Equation For Math Students

Schools Turn To Technology To Help Them Catch Up With The World. Connecting To Life More Efficiency 'The Bigger Picture'

By Suzanne Cassidy, Staff Writer

In teacher Jeremy Gwyn's geometry class at Hempfield High School, students are learning mathematics in a way their parents did not.

These students use laptop computers and graphing calculators. Their teacher uses an interactive whiteboard that can call up graphics, videos and Web pages with a touch of a finger.

Compared to this math class, the classrooms in which most parents learned might as well have been little one-room schoolhouses on the prairie.

Math class, like so much else in modern life, has gone high-tech.

There has been a great deal of hand-wringing over math in the United States in recent years.

According to one assessment, American 15-year-olds rank 25th in math compared to their peers in other countries. Math scores have improved in Pennsylvania, but educators say that more improvement is needed to prepare students for future success.

President Barack Obama has said he's determined to raise American students' performance in math and science. He believes American children should spend more time in the classroom, and wants to see the school day, or school year, extended.

His administration also is encouraging businesses and nonprofit organizations to get involved in improving math, science and technology education and launched a campaign to that end called Educate to Innovate. Obama recently announced that more than \$250 million in public and private funds would go toward training math and science teachers.

For years, parents and educators have warred over the best way to teach math.

Should math education be teacher-directed, with students being drilled in math facts? Or is a child-centered approach better, with students discovering and learning math concepts through inquiry?

The debate is ongoing, but one thing seems clear: Technology is changing the way math is being taught to American students.

The National Council of Teachers of Mathematics - a major player in the modern math wars - believes all schools should ensure that all math students have access to technology.

In 2006, the Pennsylvania Department of Education launched the Classrooms for the Future grant program to help high schools acquire high-tech equipment. Leah Harris, deputy press secretary for the department, said 453 of the commonwealth's 500 school districts received grants totaling \$196 million.

The technology only started to be installed in local schools in the past couple of years, so it's too soon to know what its true effect will be.

"These students today, they wake up to technology, they go to bed to technology," said Deb McKonly, a high school math teacher and math department supervisor in the Ephrata Area School District.

Using technology - computers, interactive whiteboards, graphing calculators - is a way of drawing students into math and keeping them engaged "rather than just staring at a chalkboard," McKonly said.

"One of the things we really stress now, more than we ever did, is making connections to real-life problems," McKonly said. "If you make the connection to real life, it makes it more interesting."

Christopher Adams, assistant superintendent for secondary education in the Hempfield School District, said technology can help teachers convey to students the importance of mathematics.

"More than ever, teachers are looking for creative solutions to get students where they need to be with regard to demonstrating what they know, understand, and are able to do relative to the math standards," Adams said.

In Barb Wagner's fifth-grade math class at Landisville Intermediate Center, a Hempfield school, students recently surfed the Web to collect data about roller coasters across the United States.

Wagner figured real-life coasters would make a compelling subject for her students as they absorbed lessons about median, mode, range and mean.

So she instructed her students to collect roller coaster data, enter it onto a spreadsheet on their laptops, and then use calculators to crunch certain numbers - the mean speed of the coasters, for instance, or ride time range.

Still, "it's not about the technology," Wagner said. "It's about using the technology to teach."

One recent day in Jeremy Gwyn's geometry class, students were learning about the area of polygons and circles.

Gwyn wrote a formula on the interactive whiteboard in his classroom with his finger. With another touch of the whiteboard, he called up the answers to the previous night's homework assignment. On that same board, Gwyn then showed a short film about pi and the ancient Greek mathematician, Archimedes.

The students opened up MacBook laptops, and went to "Mr. Gwyn's Discovering Geometry" page on Hempfield's Moodle site.

They answered questions about pi and posted their answers to a forum, so the whole class could see the answers and discuss them.

Luke Schwanger, a junior, said technology has made learning math much more efficient. "It takes us less time to figure things out - we can see it right in front of us," Schwanger said.

He said he particularly likes an application called Geometer's Sketchpad. Students can draw and manipulate shapes and the computer measures those shapes for them.

Gwyn, the geometry teacher, said that it's hard to teach kids about three-dimensional shapes by drawing those shapes in two dimensions on a chalkboard. Now, he said, he's able to display 3-D shapes on his whiteboard - and rotate them, too.

And thanks to the Internet, both teachers and students "have more information in front of you now than you can imagine," Gwyn said.

Kathleen McKinley, coordinator of secondary mathematics for the School District of Lancaster, said the city schools have interactive whiteboards in half of the math classrooms at the secondary level.

In the middle school, teachers can use something called a "classroom response system," in which students transmit answers to math questions via clickers. So the teachers instantly "can identify who's answering correctly and who's not," McKinley said.

Graphing calculators are available to students in both the middle and high schools. Students can use these to graph a function, and to compare functions. "It helps to bring the mathematics to life, make it visual," McKinley said, noting that teachers also can create study cards, and send them to the calculators.

"When children learn through inquiry and discovery, they retain the learning better," McKinley said.

In the Ephrata schools, secondary students use a Web-based learning system called ALEKS. The program "differentiates instruction for every student and requires the student to master a concept before moving on," explained Stephanie Gingrich, spokeswoman for the Ephrata Area School District.

"The use of this technology has created incredible opportunities for the students," Gingrich said in an e-mail. "Some students have used ALEKS to progress to a more advanced course the next year. For others, it helps them to regain a confidence in basic math concepts."

At McCaskey High School, students who struggle with math can work independently on a bilingual Web-based program called Apangea, which is meant to help remediate deficit skills.

Students can work on the program at school or from home. Students earn points from Apangea that they can redeem for prizes such as iTunes cards.

That program has an avatar, which gives students hints when they are struggling. If a student still struggles, the avatar will direct him to a live chat person. "And if the live chat person doesn't work, then a teacher will be connected to the student," McKinley said.

"Kids text all of the time - it's something they're very comfortable with," McKinley said. "They're on the computer all of the time. ... It's their world. They're also used to interacting with avatars."

Technology, she said, "engages them in a way that they're comfortable being engaged."

Janet White, associate professor of mathematics education at Millersville University, said technology has had a profound impact on the teaching of mathematics to students at all levels.

"When we were in school, in algebra, it was very unusual for the answer to be anything but a whole number," White said, adding, "We grew up thinking that life is a whole number - which is obviously not true."

Now, technology helps students to make sense of the "not-nice numbers," White said.

"It's very hard for students at any level to understand the concept of infinity," she said. "Technology has helped us to understand those very big, and very tiny, concepts."

Just about any middle-school student can sit down at a computer now, and using Microsoft Excel, can make a quick graph. In the past, that might have been a three-day activity, White said.

As for elementary students collecting data and entering it into spreadsheets - the activity that took place in Barb Wagner's fifth-grade class at Landisville Intermediate Center - "that was something I never did until college," White said.

White taught high school for 11 years, and now prepares Millersville students to teach math in secondary schools. She said that as math education has become more infused with technology, the focus increasingly is on "looking at the bigger picture," and on thinking about math "in an applied sense, rather than just in an arithmetic sort of fashion."

"I still believe people need to know their times table," White said. "It crushes me when I have college students, and they have simple operations, and they're paralyzed without their calculators."

Now, even fourth-graders are permitted to use calculators in some sections of the PSSA tests.

"Technology was opening up the doors to all of the exciting mathematics, and the applications, all of the neat things we could do, and letting kids see the different types of mathematics. ... You could start to show kids where math really worked," White said.

Unfortunately, high-stakes testing has drained some of the joy out of math, White said. She said that teachers often feel compelled to focus on what's going to be on the PSSA tests, so they may not spend time on fun math activities that might inspire kids to pursue math and science in the future, White said.

They may not spend a lot of time drilling students on math facts, either.

Technology "opens a lot of doors," and has a lot of potential, but "there's a lot of math you need to understand ... before you allow the technology to do it for you," White said.

Students, she said, "have to be taught how to interpret what the technology is telling them."