

Enhancing Mathematics

EDCompass newsletter

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Experiencing Exponential Growth in Math

By **Kim Hamill**

"Math is a beautiful and elegant way of understanding our natural and human-made world."

This sentiment from Dr. Cathy Bruce may explain why she has chosen a career that focuses on enhancing the teaching and learning of mathematics.

Bruce, who is an associate professor at the School of Education and Professional Learning at **Trent University** in Peterborough, Canada, says that one of the biggest issues in math education today is the divide between how experienced in-service teachers were taught mathematics as children and what current research confirms as effective practices for teaching math.

"The challenge is to not replicate the rote-learning strategies that we experienced as learners, but instead to forge into more inquiry-based teaching approaches that support all students as learning mathematicians," explains Bruce, who has spent most of her career focused on studying and guiding effective mathematics teaching.

She says interactive technology like **SMART Board™ interactive whiteboards** can enable educators to support inquiry-based learning in math, which is why these technology products are part of the curriculum in the teacher education program at Trent University.

"The interactive whiteboard is an incredibly dynamic learning tool for students," Bruce says. "It brings the world into the classroom, but what I find really interesting is this – the interactive whiteboard is a tool for gathering or consuming information, but it is also a tool for creating information. It is a productive tool that helps generate ideas and solutions to problems," she says.

Lynn Keith, the program and technology specialist at **Providence Spring Elementary** in Charlotte, North Carolina, has seen the effect that SMART products can have on math instruction in her school. She says SMART products have made teaching math so much more efficient, because teachers are able to clearly show the reasoning behind math.

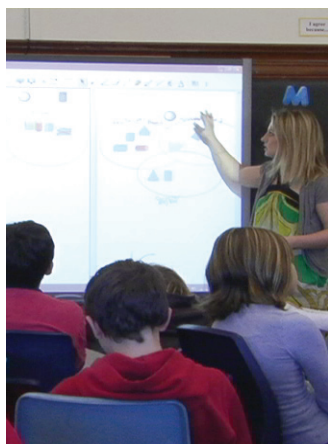
"It's amazing the quality of tools teachers now have at their fingertips to deliver instruction. Math was abstract, and now it's something real for the children that they can see and grasp and even touch," Keith says. "The SMART Board gives the teacher the tools to help the children understand the way math works."

The root of engagement

Keith believes by using SMART products to make math concepts tangible, educators are helping students build a foundation of knowledge that will ensure their success in later grades.

"I feel like our teachers provide our students with a really solid foundation because of the SMART products that they have in place. They are ready, they get it. And our test scores reflect that," Keith says.

Providence Spring has a SMART Board interactive whiteboard in every classroom, and educators at this K-5 school use many other SMART products, including **SMART Response™ PE interactive response systems**, the **SMART Document Camera™** and the **SMART Table™ interactive learning center**.



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Dr. Cathy Bruce

Associate Professor, School of
Education and Professional Learning
Trent University
Peterborough, Canada



Teachers find that the content and resources in [SMART Notebook™ collaborative learning software](#) not only make math more visual but also more understandable, Keith says, recalling how “gleeful” the fifth-grade teachers were upon first discovering the protractor tool in the Gallery of SMART Notebook software.

“Instead of holding up a six-inch protractor in front of a class of 25 children, they suddenly had a huge protractor,” she says. “The students understood the visuals, they could see the angles being measured, they were able to touch it, they were able to rotate it, and it just cut down on the amount of time it took for the children to grasp the concept.”

And while the SMART Board interactive whiteboard is frequently used for teaching and learning math, other products, like the SMART Table interactive learning center, are just as effective.

Recently, one of the school’s kindergarten teachers used the SMART Table for a one-to-one correspondence lesson. Because of its multitouch, multiuser capabilities, the students were able to count digital objects and move them together. Keith says the SMART Table not only helped the students understand the meaning behind numbers, but it also enabled cooperative learning.

Expressions of knowledge

For educators at Providence Spring Elementary, the [SMART Response PE interactive response system](#) is a key product that’s used throughout the curriculum, especially in math.

The school has organized its students into ability-grouped math classes, which means that students switch classrooms for math lessons. And when the students walk into their assigned classroom, a remote (or clicker) is already placed on each desk.

Keith says that during the first minutes of every math class, students use their remotes to key in answers to a quiz that they’ve already completed. The teacher immediately has a record of who turned in their math homework, what the grades are, what areas the students understand and what areas need to be reviewed or retaught.

“The teachers are able to use the math instructional time so efficiently, because they know what the kids know and what they don’t know. And they’ve gotten the information so quickly and they are ready to move along,” Keith says.

Immediate insight into her students’ understanding is one of the reasons why Kristen Stephens, the mathematics department chair at [Rocky River High School](#) in Rocky River, Ohio, values her SMART Response system.

Because Stephens teaches algebra 1, advanced placement calculus and introduction to calculus and statistics, she uses the only interactive response system that features a full QWERTY keyboard –

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Lynn Keith
Program and Technology Specialist
Providence Spring Elementary
Charlotte, North Carolina



SMART Response XE. With this system, Stephens can have students type in everything from fractions to polynomial division.

“The fact that students can give me things in mathematical notation means that I actually get to see, did they do the process right or not,” Stephens says.

According to Stephens, the SMART Response XE system has helped her increase student success. Her department quizzes students on all the benchmarks and standards required for a particular math course, and before she started using the SMART Response XE system, grading those quizzes was completely overwhelming.

“With SMART Response, every benchmark gets tested twice, and it does it in 10 minutes. If kids still need help on the second time around, within 10 seconds after they hit submit, I have the data and I know exactly what they need help on,” she says.

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Lessons in symmetry

In addition to the SMART Response XE system, Stephens has a **SMART Board 885ix interactive whiteboard system**, a **SMART Slate™ wireless slate**, a **SMART Document Camera** and **SMART Notebook Math Tools** software in her classroom. Stephens is a **SMART Exemplary Educator** and **SMART Certified Trainer**, who has used the SMART Board interactive whiteboard for over five years.

“I think the SMART Board allows you to do so much more,” she says. “In calculus, we can visualize volumes of revolution, where we used to try to describe it. In algebra, we can color code certain steps in equations and we can add sound to represent a certain move.”

Using technology products in high school math is a priority for Stephens, especially when she’s teaching math classes that are mandatory for all students.

“These students are not passionate about math – you have to find a way to make them feel good about it. For some of these kids, they hit high school and they have never been successful in math,” Stephens says. “It’s my job to make sure we can touch those kids and that they leave here feeling good about themselves because they’ve been successful.”

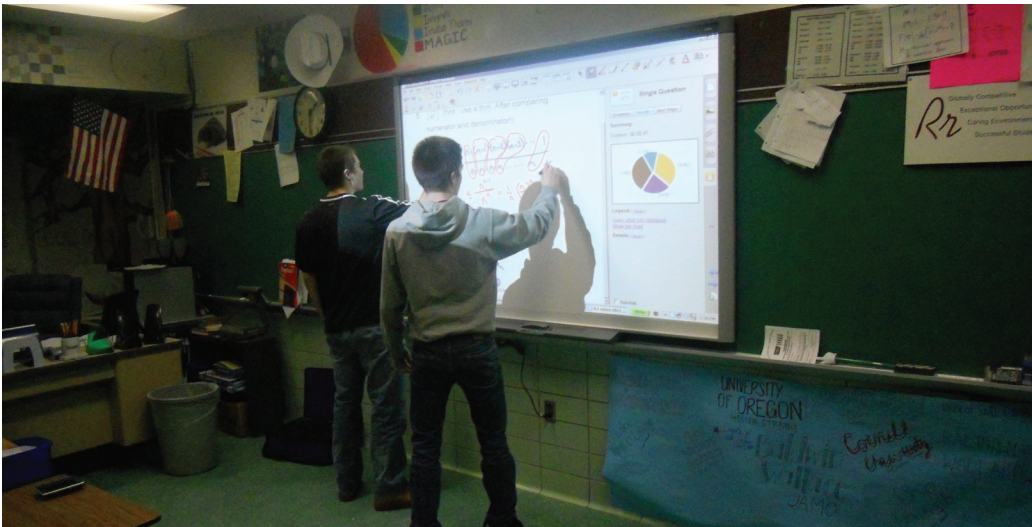
Stephens often uses SMART Notebook Math Tools software on her SMART Board interactive whiteboard because it offers a variety of visual tools that help her make complex math concepts understandable for students.

Because SMART Notebook Math Tools integrates with TI Smartview™ software, Stephens finds teaching differential equations so much easier – she can bring up the calculator right within SMART Notebook Math Tools software and show her students how to enter a formula step-by-step.

This is a big timesaver, she says, because she used to have to walk around the classroom to ensure her students were correctly entering the formulas into their graphing calculators.

Kristen Stephens

Mathematics Department Chair
Rocky River High School
Rocky River, Ohio



She can also instantly construct a slope field using the Graph Wizard or use the software’s advanced equation editor to create SMART Response XE question sets using proper notation.

“I don’t think I could teach the way I could without SMART Notebook Math Tools,” she says.

Stephens usually records her lessons using the SMART Recorder function and uploads the files to her online classroom site on Moodle™. She says this is valuable for students who are absent, but many of her students also use these files for review outside of class.

For Stephens, the flexibility of SMART products has had a positive impact on her and her students.

“SMART products have rejuvenated me and challenged me to make my lessons more differentiated and cohesive,” she says. “SMART products help motivate the kids and keep them interested, which, in turn, lead to a more positive experience in math class, and I believe it helps them remember the material better.”

The elevation of teaching and learning

For Keith, the value of using SMART products is in the ability to make lessons more student centered.

“I really think that’s where the power of the SMART Board truly lies – it’s when the children are actually involved and part of learning,” Keith says.

Bruce echoes that idea, saying that teachers need to find ways to maximize student use of the interactive whiteboard for learning. She feels that “interactive whiteboards have tremendous potential for building a mathematics learning community in the classroom, where discussion, healthy debate and alternate solutions are encouraged.”

And to support math teachers’ innovative use of interactive whiteboards, Bruce founded the [Trent Mathematics Education Research Collaborative](#), a website and collaborative research group focused on innovative practices in math education. It offers research, resources and a framework that describes the ways in which an interactive whiteboard can be used in the classroom. A revised version of the framework will be available this summer.

Recently, Bruce also conducted independent research on the effectiveness of SMART Board interactive whiteboards in math classrooms. Specifically, she and her colleagues wanted to determine how SMART Board interactive whiteboards support student learning, so they analyzed significant teaching and learning moments in math classrooms where these products were installed.

Some of the conclusions drawn from the research are that interactive whiteboards facilitate teacher-student communication of math processes and that students working in pairs at the SMART Board interactive whiteboard are more focused and more inclined to take risks with their mathematics thinking. Bruce will be presenting the study findings at an international research mathematics technology conference in June. **EC**

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