NCTM

NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

THE NATION'S PREMIER MATH EDUCATION EVENT

2015 NCTM ANNUAL MEETING & EXPOSITION

April 15–18 • Boston

EFFECTIVE TEACHING TO ENSURE MATHEMATICAL SUCCESS FOR ALL

PULLING TOGETHER

Join NCTM in Boston as we bring together thousands of education professionals for the nation's largest math education event.

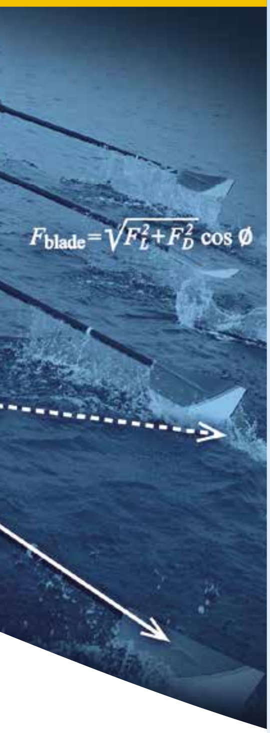
Go outside the classroom to examine the innovative ideas that can improve the quality of learning for every student.

- Gain insights into implementation and assessment of the **Common Core State Standards** for Mathematics.
- Learn about ***Principles to Actions: Ensuring Mathematical Success for All***, which describes what is essential for a high-quality mathematics education.
- Collaborate with peers on concepts that diversify instruction and **support student learners**.
- Explore **more than 700 sessions** that help you grow and develop as a teacher.
- Discover fresh ways to **integrate mathematics into other disciplines**.

WHO SHOULD ATTEND?

- Pre-K–12 teachers
- Math teacher educators
- New and soon-to-be-teachers
- Math coaches and specialists
- Math researchers
- School and district administrators

REGISTER TODAY! **Group discounts available.**



2015 Keynote Speakers

Register Early and SAVE up to $80!

OPENING KEYNOTE

Wednesday, April 15, 5:30pm - 7:00pm

ELIZABETH GREEN

Author and cofounder, CEO, and editor-in-chief of Chalkbeat

How can we make every teacher a "star" teacher? Elizabeth Green's *New York Times* best-selling book *Building a Better Teacher: How Teaching Works (and How to Teach It to Everyone)* presents teaching as a complex skill—one that requires infrastructure for support and training. *Chalkbeat* is a nonprofit news organization that covers educational change efforts across the country.

CLOSING KEYNOTE

Saturday, April 18, 12:30pm - 1:30pm

MIKE NORTH

Host / Producer, Discovery Channel

Dr. North is involved in all aspects of today's technological charge from inventing new materials and technologies in a cleanroom to creating cutting-edge prototypes on Discovery Channel's *Prototype This!* A master of the "nano" world, Mike earned a PhD and Masters in Materials Science and Engineering, as well as graduating summa cum laude in Mechanical Engineering, from UC Santa Barbara.

Learn more at **www.nctm.org/boston** and follow us on

#NCTMBOSTON

teaching children mathematics

NCTM NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

volume 21 + number 7

Mission Statement: The National Council of Teachers of Mathematics is the public voice of mathematics education, supporting teachers to ensure equitable mathematics learning of the highest quality for all students through vision, leadership, professional development, and research.

Teaching Children Mathematics (***TCM***), an official journal of the National Council of Teachers of Mathematics (NCTM), supports the improvement of pre-K–grade 6 mathematics education by serving as a resource for teachers so as to provide more and better mathematics for all students. It is a forum for the exchange of mathematics ideas, activities, and pedagogical strategies, and for sharing and interpreting research. NCTM publications present a variety of viewpoints. The views expressed or implied in *TCM*, unless otherwise noted, should not be interpreted as official positions of NCTM. The appearance of advertising in NCTM's publications and on its websites in no way implies endorsement or approval by NCTM of any advertising claims or of the advertiser, its product, or services. NCTM disclaims any liability whatsoever in connection with advertising appearing in NCTM's publications and on its websites.

All correspondence should be addressed to *Teaching Children Mathematics*, 1906 Association Drive, Reston, VA 20191-1502. Manuscripts should be prepared according to the *Chicago Manual of Style* and the United States Metric Association's *Guide to the Use of the Metric System*. No author identification should appear on the manuscript; the journal uses a blind-review process. To send submissions, access **tcm.msubmit.net**. Send letters to the editor to **tcm@nctm.org**.

For information on **article photocopies** or **back issues**, contact the Customer Care Department in the headquarters office.

The **index** for each volume appears online with the May issue. A cumulative index appears on the NCTM Web site at **www.nctm.org**. *Teaching Children Mathematics* is indexed in *Academic Index*, *Biography Index*, *Contents Pages in Education*, *Current Index to Journals in Education*, *Education Index*, *Exceptional Child Education Resources*, *Literature Analysis of Microcomputer Publications*, *Media Review Digest*, and *Zentralblatt für Didaktik der Mathematik*.

Information is available from the Headquarters Office regarding the three **other official journals**, the *Mathematics Teacher*, *Mathematics Teaching in the Middle School*, and the *Journal for Research in Mathematics Education*. Dues support development, coordination, and delivery of NCTM's services. Dues for individual membership are $81 (U.S.) and include $37 for a *Teaching Children Mathematics* subscription. Each additional school journal (*Mathematics Teacher* and *Mathematics Teaching in the Middle School*) subscription is $37. Each additional subscription to the *Journal for Research in Mathematics Education* is $61. **Foreign subscribers**, add $18 (U.S.) postage for the first journal and $4 (U.S.) postage for each additional journal. Special rates for students, institutions, bulk subscribers, and emeritus members are available from the Headquarters Office.

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news* & views

Special pi day ahead: 3.14.15

BEVERLY L. WOOD AND ROBERT Q. BERRY III

IN MY OPINION

Every year since the first Pi Day celebration in 1988, some opportunity arises to marvel anew at the "mystery" of π—the ratio of the circumference to the diameter of a circle, approximated as 3.141592653. . . . This ratio remains the same no matter the size of the circle, which makes it interesting to people across time and culture. The fact that it is irrational also intrigues people of all ages and backgrounds because its decimals continue forever without repeating a sequence, so it can never be written as a fraction. This taste of infinity is hard to resist.

Ancient mathematicians knew that this number existed, and they knew that it was a little more than the number 3. For all practical purposes, calculating with 3 then adding a pinch more was sufficient. For example, if I baked a cake in a circular pan with an eight-inch diameter, I would need a ribbon that's a little more than twenty-four inches to wrap around the outside of the cake. The geometer Archimedes came up with a brilliant estimating technique that allowed for better precision. He proved that this special ratio that we call *pi* must have a value between 3 1/7 and 3 10/71. In fact, 22/7 was the accepted approximation for many centuries.

Although Archimedes was Greek, he was not the first to name this fascinating number with the Greek letter π. William Jones, an English mathematics tutor used it in his introductory text that was published in 1706. It is presumed that he chose this particular designation because it began the word *periphery* in Greek and the *circumference* of a circle marks its periphery. However, the symbol was not common practice until the prolific mathematician Leonhard Euler used it in his texts several decades later in 1748.

An interesting pastime for π admirers is to memorize many digits and recite them in competitions locally or globally, sometimes earning pie (or pizza pie) as a reward. Calculating by hand in the late 1500s, Ludolph van Ceulen found thirty-five digits. One hundred digits were known by the time William Jones gave it its name. Computers have allowed calculation of more than a trillion digits—with still no end or repetition.

Pi Day was first celebrated in 1988 at San Francisco's Exploratorium Science Museum. Larry Shaw began the tradition with a small gathering of mostly museum staff. Now, the Museum's Pi Day celebration includes a public "pi procession" in which attendees line up in the order of pi's digits. The museum has a "pi shrine," with digits spiraling around it embedded in the sidewalk. The museum's Pi Day website, http://www.exploratorium.edu/pi/, describes a history of π and a schedule of events, activities, and links.

In 2009, the U.S. House of Representatives declared March 14 to be National Pi Day. Members passed House Resolution 224, which supports the designation of Pi Day and encourages schools and educators to observe the day with appropriate activities that teach students about π and engage them in the study of mathematics. Even before this legislative encouragement, commemorations of Pi Day took place in schools at all levels as well as at community events and museums.

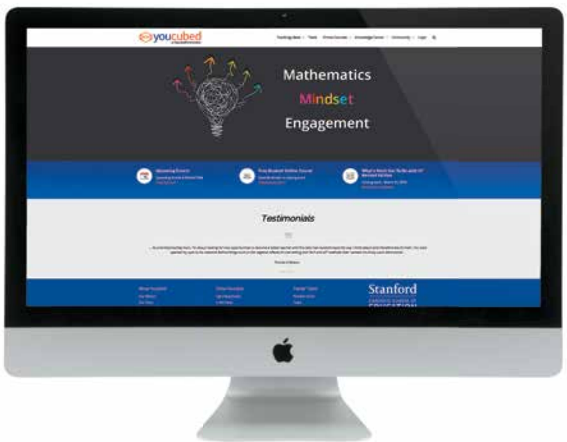
The entire community of Princeton, New Jersey, celebrates Pi Day because it is also Albert Einstein's birthday. Einstein was born in 1879 and lived his last two decades in Princeton. The city holds a pie-eating and a pie-judging contest. Connections to science and history—even to music because Einstein was an accomplished violinist—abound because of the pleasing coincidence of this unforgettable scientist's birthday.

March 14, 2015, is not only Pi Day but also a special Pi Day—3.1415. What do you notice when you compare the date March 14, 2015, to 3.1415? To make this Pi Day even more interesting, try capturing your perfect π moment on 3/14/15 at 9:26 and 53 seconds. If you do, then you will have captured *the* 3.141592653 moment. Why do you think that 3.141592653 is the "perfect" pi moment?

Beverly Wood, bwood@irsc.edu, is an assistant professor of mathematics at Indian River State College in Fort Pierce, Florida. She teaches preservice teachers and particularly loves teaching the history of mathematics. **Robert Q. Berry III, robertberry@virginia.edu**, is an associate professor at the University of Virginia in Charlottesville who teaches elementary and special education mathematics methods courses. His research focuses on equity issues in mathematics teaching and learning.

YouCubed: Broadening the conversation for supporting student success in mathematics

HOLLY HENDERSON PINTER



YouCubed is a new, nonprofit organization with a mission to revolutionize the way mathematics is taught. Spearheaded by Stanford professor of Mathematics Education Jo Boaler, YouCubed provides free and affordable K–grade 12 math resources and professional development for educators and parents.

Drawing on current research and best practices, YouCubed is a collaborative effort to empower learners to find the joy of mathematics through engaging in challenging tasks. The website offers short videos appropriate for a broad audience of students, parents, and teachers. Examples include short interviews with Boaler describing current research about mathematics education in the United States, including innovations in brain research and how it relates to student understanding; other video clips capture research proven pedagogical practices in action such as the use of math talks (Richardson 2011), allowing parents to see in practice what students may be experiencing in classrooms. These videos focus on the big ideas of teaching and learning mathematics and provide support for the kinds of tasks and instructional strategies used in standards-based classrooms.

Beyond laying the foundation of information, YouCubed offers challenging mathematical tasks spanning the entire K–grade 12 curriculum. For example, at the elementary school level, a series of activities and tasks related to geometric reasoning and patterns is posed as an engaging, challenging, and yet accessible sequence to help elementary school students grapple with mathematical concepts aligned to Common Core State Standards (CCSSM) (CCSSI 2010). The tasks offered in this section are constructed with classroom implementation in mind and provide pacing and necessary materials.

YouCubed's next section targets engagement in mathematics beyond the classroom through contextual real-life examples. Providing contexts where mathematics is used in the real world has been found to be effective in terms of motivating students as well as allowing them to make important mathematical connections (Hand 2012). This section of YouCubed will provide a context for conversation about real-life mathematical connections for elementary school students.

YouCubed's last component is a resource section where parents can find ideas for working with students at home as well as Boaler's twelve steps for helping students learn mathematics, a document that includes tips on how to appropriately encourage students to stay motivated in mathematics as well as simple pedagogical strategies to use at home in helping students work through math homework.

Potentially its most significant attribute, YouCubed focuses on broadening the conversation about mathematical understanding beyond the walls of the classroom. The implementation of CCSSM across much of the nation has forced a shift in the way parents and teachers converse about mathematics and how to help students succeed. Such resources as YouCubed can be instrumental in fostering the ongoing conversation by laying a foundation of knowledge to help parents understand the how and why of CCSSM objectives.

Knowledge is power. By building the knowledge base, *all* stakeholders can be successful in this continuing journey.

REFERENCES

Common Core State Standards Initiative (CCSSI). 2010. Common Core State Standards for Mathematics (CCSSM).

Standards for Mathematical Practice: A three-step implementation approach

BY ROBYN SILBEY, PD AND CAMPUS CONSULTANT

The Common Core's Standards for Mathematical Practice (SMPs) have been the subject of many professional development workshops and seminars around the country. How might you, as a coach, convey the depth of understanding of these standards among your teachers? This three-step approach ensures deep understanding and ease of implementation.

Teachers work with a partner. Each pair creates a student-friendly, bullet-point summary of one standard. All bullet-point summaries are posted around the room. Teachers identify the matching bullet-point summary with the original standard. Allow time for discussion, justification of choices, and editing if needed. Teachers may use the bullet-point summaries to introduce the standards to their students.

Student-friendly
Standards for Mathematical Practice (SMPs)

6: Attend to precision

- I will use math words when I talk about what I am thinking.
- I will be careful with units of measure.
- I will label carefully.
- I will make sure that everyone can understand my thinking and answers.

Emphasize that each standard begins with "Mathematically proficient students. . . ." Student expectations are clear. To assist teachers in helping students meet those expectations, invite teachers to complete the sentence, "Teachers will. . . ," for each standard. Allow time for teachers to explain their reasoning and describe how their "Teachers will. . . ." statements actually look in the classroom.

Teachers' version
Standards for Mathematical Practice (SMPs)

1: Make sense of problems and persevere in solving them.

Teachers will ______________________________

____

____.

Teachers create posters that embed visual representations suitable for each standard. Laura Hunovice, a coach in Carroll County, Maryland, created and executed this activity on her campus. She found that—

> teachers made sense of the practices themselves, but they valued the importance of the practices enough to take them back to their students and have students make sense of them, too.

Teachers will learn to live by the Standards for Mathematical Practice when they are given opportunities to deeply understand and value their meaning.

Direct questions and comments about this article to **robyn@robynsilbey.com**.

Washington, DC: National Governors Association Center for Best Practices and the Council of Chief State School Officers. http://www.corestandards.org/wp-content/uploads/Math_Standards.pdf

Hand, Victoria. 2012. "Seeing Culture and Power in Mathematical Learning: Toward a Model of Equitable Instruction." *Educational Studies in Mathematics* 80 (1–2): 233–47.

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readers exchange

In the August 2013 issue of *Teaching Children Mathematics*, an article appears titled “Fractions Instruction: Linking Concepts and Procedures.” With respect to Michelle’s solution in **figure 5**, the authors comment that Michelle—

> made the error of adding across both the numerators and denominators to get her answer of $\frac{5}{12}$.

They went on to say,

> Her explanation and her symbolic procedure point to a lack of understanding of both fraction concepts and procedures used to add fractions. (p. 23)

Michelle’s equation does indeed read

$$\frac{2}{6} + \frac{3}{6} = \frac{5}{12},$$

which, had it appeared by itself, might be justification for the authors’ conclusion. However, the accompanying diagram clearly shows that the first two cakes were equal to each other in size and smaller than the third cake. Furthermore, in her explanation, she clearly states that she “combined the cakes” to get the third cake. Hence, her equation now looks like this:

$$\frac{2}{6}\left(\frac{1}{2}\right) + \frac{3}{6}\left(\frac{1}{2}\right) = \frac{5}{12}(1).$$

This is clearly a true statement because

$$\frac{2}{12} + \frac{3}{12} = \frac{5}{12}.$$

From this perspective, we are no longer able to view Michelle’s solution and infer that she lacks an understanding of fraction concepts and procedures. In fact, we can draw the opposite conclusion. Based on her understanding that the problem was asking how much of the combined cake was eaten, her solution shows a strong grasp of basic fraction concepts.

I elaborate further about this problem and the concept of a “composite whole” in my article, “Recognizing the Whole in Fractions Problems,” which appears in the Spring 2014 issue of *OnCore*, published online by the Arizona Association of Teachers of Mathematics.

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