

Nano News in the Classroom

by *Catherlyne Draper*

What would the conversations have sounded like if Thales, Greek philosopher and mathematician from seventh-century BCE, had the chance to meet seventeenth-century German philosopher and mathematician Gottfried Wilhelm Leibniz? My middle school students imaginatively improvised this interaction during a Spirit of Mathematicians Day at The Phoenix School in Salem, Massachusetts, during the school's Halloween events. We celebrated mathematicians from several eras with both upper-grade and lower-grade sections of students.

The upper-grades students were encouraged to come dressed appropriately for the culture and times of the mathematicians that they studied. Each student portrayed a historical figure and presented his or her mathematician's ideas to their fellow mathematician-colleagues. The lower-grade students drew portraits of their mathematicians. I facilitated the mathematicians' programs in the guise of Admiral Grace Hopper (1906–1996) acting as Editor of the *Nano News*, so named in honor of Grace Hopper's [foot-long wire](#) used during her lectures illustrating a nanosecond.*

Who says mathematics needs to be only about numbers and formulas? Mathematicians grow up just like the rest of us, but often we know solely about their resulting contributions, not the life challenges that they faced as kids. The students learned that Ramanujan (India, 1887–1920) had difficulty passing his school tests; the father of Albert Einstein (Germany, 1879–1955) was told his little Albert was a dullard; Benjamin Banneker (America, 1731–1806) was a child of former slaves in Maryland, and Emmy Noether (Germany, 1882–1935) was not allowed as a girl to attend a college prep school. Despite these circumstances, all became outstanding contributors to the mathematics that we currently study in our schools and use in today's world.

Making them Real

The students in both grade sections made their mathematicians come alive and seemed to enjoy the idea that mathematicians were actually *real* people. We listened to Leibniz and Sir Isaac Newton (England, 1643–1727) argue over who was first to use calculus, and asked Mary Sommerville (Scotland 1780–1872) to describe her theories to Ramanujan (India 1887–1920) and Hypatia (Greece ca. 350–415 AD).

The students selected their mathematician from a deck of cards compiled from AIMS' *Historical Connections Vol. II*, plus some extra cards that I developed using the same AIMS format. I added cards in order to include more current mathematicians as well as different cultures and genders so that students would recognize that new mathematics is currently being developed by a diverse group of people.

In both the upper-level and lower-level sections, the students followed the day's schedule and an outline for asking questions and writing their interview article or drawing their



CATHERLYNE DRAPER

Thales presents his ideas to the rest of the mathematicians using a twentieth-century portable whiteboard to assist the explanation.

Each student portrayed a historical figure...

* The [teaching tool](#) got its name from the foot-long lengths of telephone wire that Admiral Grace Hopper used to illustrate how in one billionth of a second (a nanosecond) an electronic signal can travel almost twelve inches.

Middle School or Upper Elementary sample interview assignment schedule	
The Interview Schedule	
Interviewer	Interviewed
Ramanujan	Gauss
Euler	Hypatia
Gauss	Banneker
Germain	Fermat
Banneker	Ramanujan
Fermat	Wiles
Wiles	Germain
Newton	Thales

portrait. I let each mathematician use an improvised microphone during his or her presentation to enhance the drama of the moment and to provide a mechanism to focus attention to the speakers—only the person holding the mic could speak.

For the first year, the school administration approved this project in mid-September so that a date was set that did not interfere with the usual school Halloween activities. After the successful results of the first year, we had a built-in schedule support for subsequent years. Although I allowed students the choice for participation and dress compatible with time and culture, I was delighted that each one was eager to become another personality if only for a day. Even though not all students wished to wear their mathematician’s period costume, all were outstanding mathematician-actors. In subsequent years the energy actually mushroomed due to an air of competition or “out-mathematicizing” each other. Maybe it was the math arguments or maybe, just maybe, the kids got into the theatrics of it all!

At the Upper Level

A week before the event, I distributed a packet of materials to upper-grade students:

- Assessment rubric;
- *Nano News* questions that Grace Hopper would ask;
- Outline of the kind of information that the students needed to research and bring to the event.

The brief but clear rubric specified the extent of the content expected with associated allocation of points for cross-century arguments, dress in the appropriate time period, mathematics presentation, and mathematical quality of mathematician’s responses. All students had to be prepared to answer the interview questions because they did not know which “mathematician” would get which question. I gauged the questions based on the students’ interactions as the day’s event progressed and controlled the interaction by using the *Nano News* microphone for each speaker.

Each year all students wore a name tag on the day of the event and they were seated according to my prearranged assignments identified with nameplates. As is true with most projects, our event preparation became easier with each subsequent year and the actual implementation improved significantly with the shared involvement of more people. For example, in the second year I provided a schedule for mathematicians to interview each other instead of Admiral Grace Hopper doing all of the interviewing. Each interviewer was assigned the task of writing a three-paragraph article for the *Nano News* addressing the Who, What, Where, When, and How information about their interviewee and the language teacher assisted in the editing process.

The lower-level students were provided a similar but less rigorous Mathematician Day schedule. The objective was to introduce the children to mathematicians and provide an interdisciplinary experience for research, drawing, writing, and sharing. They chose their mathematician from the same enhanced AIMS deck, but had an opportunity to ask questions during the class about the person they had chosen before researching the mathematician using the library or Internet connection at school. On the following day, the children were given the materials for drawing their portraits and then allowed to present their mathematician to the class. The portraits were displayed in a Mathematician’s Gallery during the next two days.

The true beauty of this event was the way in which we could humanize mathematicians while learning about the contributions that each provided the world. Students were exposed to mathematics as an interesting topic and learned that topics are still explored, expanded on, and created. An example of “new” mathematics could be represented in the work of Benoit Mandelbrot (1924–2010) with fractals and the Mandelbrot Set. Mathemat-



The mic is made of a cutoff paper roll wrapped in black plastic and topped off with a styrofoam ball.

The Spirit of Mathematics Is Alive and Well

The twentieth Century welcomes mathematician giants of history event. The mathematical giants of the new millennium will take on the persona of one of these mathematical giants of yore and talk about their work, life as a mathematician during their historical times, and their mathematical contributions to the world of mathematics. Your son/daughter has already selected a mathematician to study and dress in the period garb of their century.

Interview questions:

What was it like to be a gifted mathematician during your lifetime?

What was going on in history when you lived?

Did historical events make it difficult to study math?

Where did you go to school? (Or did you go to school?)

Did you have any math friends who could understand what you were talking about? Who were they?

What was your contribution to mathematics? Why did you like it?

Note to Students: Improvise your conversation with how you think your mathematician would talk. Use information from the Internet, math history books, and historical references from the library.



STUDENT WORK COURTESY OF CATHERINE DRAPER

"Self" portrait of Sophy Germain (1776–1831), French mathematician, physicist, and philosopher

ics developed over time with several contributions. An example of this can be seen in Pythagorean Theorem, with three presentations from Pythagoras, Fermat, and Wiles.

Pythagoras (Greece, 500 BC) has a namesake theorem, the Pythagorean Theorem. This theorem is an integral part of most middle school classrooms. It states that the relationship of $a^2 + b^2 = c^2$ for three sides of a triangle generates a right triangle. Another seventeenth-century French mathematician, Pierre Fermat, expanded that relationship of numbers to consider all positive integers but stated that *no three positive integers a, b, and c* can satisfy

Name: _____

Date: _____

Name of my mathematician: _____

When born: _____

When died: _____

Where spent most of life: _____

Important things about his/her life: _____

- _____
- _____
- _____
- _____

Things my mathematician was famous for: _____

- _____
- _____
- _____
- _____

Flip this corner to see a sample of *Nano News*



"Self" portrait of Sir Isaac Newton (1642–1727), English physicist, mathematician, astronomer, natural philosopher, alchemist, and theologian

Math can be an exploration, a discovery, and a challenge leading to success and accomplishment.

the equation $a^n + b^n = c^n$ for any integer value of n greater than two. That extension needs a proof, just as all mathematical relationships do, much to the chagrin of many mathematics students! Even though this theorem appears to be a repetition of the Pythagorean Theorem, Fermat stated that the relationship would *only* work for 2 as an exponent. He wrote a proof in the margins of a book somewhere but no one could find it. The theorem was named "Fermat's Last Theorem" and left unproven and open to mathematical proof efforts. Three hundred years later, a British twentieth-century mathematician, Sir Andrew Wiles, devoted his life to solving this theorem.

Wiles decided at the early age of ten years that he wanted to solve it. He did and was later knighted in 2000 for this significant contribution. As the Eugene Higgins Professor of Mathematics at Princeton, he publicly presented a proof in 1993 that contained a subtle error (and we worry about our test scores; imagine what it felt like to have your results *with error* published throughout the world!). Undaunted, Wiles persevered and completed the correct proof in 1994. The new proof was published in 1995 in a special volume of the prestigious *Annals of Mathematics*.

So, you see, mathematics study isn't just a matter of formulas to remember and grades on tests. Students can learn that math can be an exploration, a discovery, and a challenge leading to success and accomplishment. Who knows who the next person will be to earn the title of Sir or Dame as a member of the Royal Society of London for their work in mathematics! ✍️

*Catheryne Draper has more than forty years experience in math education, starting as a high school teacher, then district supervisor, state level advisor, tutor, professional development consultant, and as an adjunct math professor for several colleges. She has also worked as a math textbook editor. She started *The Math Studio* in Salem, Massachusetts, in the early 80's and published "The Algebra Game" and "Solving with Pythagoras" for cooperative learning groups. Visit mathstudio.com to learn about other math and algebra connections.*

... largely responsible for the present interest in Fractal Geometry.



Benoit Mandelbrot
1924–2010

Showed how Fractals can occur in many different places in both Mathematics and Nature.

Was born in Warsaw into a Jewish family from Lithuania.

... wrote software for NASA.



Evelyn Boyd Granville
1924–

... math must not be taught as a series of disconnected, meaningless technical procedures from dull and empty textbooks.

This interest in mathematical education led to her involvement with Miller Mathematics Improvement Program in Los Angeles.

... was unable to accept the highly restrictive terms under which black women could hold academic posts in the early 50s.

Cards asses to the AIMS deck, made by author.