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Dr. Ton Dieker is the Fouts Family Assistant Professor of Industrial and Systems Engineering at Georgia Institute of Technology in Atlanta, GA 30332. He works on a variety of topics in the areas of applied probability and operations research.

Marsha Shrago is a retired mathematics teacher with more than 25 years experience in teaching high school students and facilitating workshops for their teachers. She enjoys developing activities that promote active learning.

Hilary Rogers is a 9th grade math teacher at Woodland High School in Henry County. She teaches all levels of Coordinate Algebra including honors, regular, co-taught, and support. She is currently finishing up her second year of teaching, and she graduated from Georgia College and State University with her bachelor's degree in mathematics and MAT in math education in 2011 and 2012 respectively.

For the past 18 years, Dennis Wilson has been teaching at Landmark Christian School. An active member of GA2PMT, he enjoys using technology to help students explore mathematics.

Michael Pershan teaches math to both high school and elementary school students at Saint Ann's School in New York City. He also organizes sessions for the Global Math Department, runs the Math Mistakes website, and writes about teaching and learning math at http://rationalexpressions.blogspot.com.
I hope and pray that each of you has weathered February’s storms without suffering too much damage. The disruption it caused has certainly leaked into classrooms across Georgia: missed days, disrupted curriculum and school activities, not to mention the added time and energy you have had to muster to deal with circumstances on the home front.

In spite of all this, GCTM volunteers have had a busy couple of months working on your behalf to foster mathematics and its teaching and learning across the state. Let me give you a run down.

The twenty-six member GCTM Executive Committee spent a soggy weekend in Augusta during January working to develop strategic goals and a 5-year plan. See photos here. The work was facilitated by the Cunningham Center for Leadership Development from Columbus State University. Executive Director Tom Ottinger said that the time “was well spent” and helped us focus on “important issues.” Vice-president for Advocacy Shelly Allen commented, “I worked so hard, that I thought I was at my regular job.”

The ice storm trumped our original Math Day at the Capitol, but it was rescheduled for the first week in March and was a tremendous success. Check the GCTM website for a report and photos."

At its February meeting the Executive Committee approved a joint letter with the Supervisors (GCSM) in support of the CCGPS. The text of the letter can be found on our web site, www.gctm.org. The letter has been mailed to each Georgia Senator and Representative.

Plans are shaping up for the 2014 Georgia Mathematics Conference at Rock Eagle, Oct 16-17, 2014. The Conference Board is also beginning to think about 2015, and they will be well represented at the upcoming NCTM national meeting to recruit major speakers.

GCTM continues to work with GaDOE to provide Summer Academy professional development opportunities to our membership. This year GaDOE will shoulder the lion’s share of the preparation, registration, and facilitation with support from GCTM. GaDOE has agreed to set aside five (5) seats at each Academy session which will be available to GCTM members who are not employed in the public sector or who are not otherwise able to register through their local systems. Complete details about this and other Academy issues will be available on our website.

The Competitions Committee under the leadership of Vice President for Competitions, Chuck Garner, is hard at work preparing for the GCTM sponsored state high school and middle school tournaments.

GCTM is moving forward to establish relationships with education groups that foster access for all students and work to remove barriers to their efforts to learn mathematics. The Executive Committee recently approved a motion to maintain an ongoing Sustaining Member relationship with TODOS (http://www.todos-math.org/) and directed me to investigate partnering with other similar organizations.

All of the above, along with many other things at the Georgia Council of Teachers of Mathematics, are done by your completely volunteer staff. These services and opportunities are not being provided to you by an
impersonal organization, but by individual educators who devote a portion of their time and energy to further the goals and objectives of GCTM. We are an organization of teachers supporting and encouraging each other. Please consider increasing your service to fellow mathematics teachers by volunteering. Drop me an email and I’ll get you plugged in.

**From the President’s Pen cont.**

**NEWS FLASH!**

Middle School Teachers of Mathematics, Bring a team of students to the

Middle School Math Tournament
April 19, 2014

For More Information and to Register Visit www.gctm.org!
The Georgia Department of Education will host the 2014 Summer Academies "Sowing the Seeds: Growing Mathematical Content Understanding" at seven locations across the state. There will be 15 grade level/course sessions at each site: Kindergarten, Grade 1, Grade 2, Grade 3, Grade 4, Grade 5, Grade 6, Grade 7, Grade 8, Coordinate Algebra, Analytic Geometry, Advanced Algebra, Pre-Calculus, Statistical Reasoning, and AMDM. Each session will be the same at each of the seven locations.

Public school teachers interested in attending should contact their district to become registered. Teachers from private schools, home schools, pre-service teachers, and teachers unable to register through their school districts will have an opportunity to register for a limited number of seats through GCTM's website under "Academies" in April.

Visit our website for up-to-date information on the academies.

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<td>Tucker High School, Dekalb County</td>
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<td>June 10 &amp; 11</td>
<td>Lee County Middle School - West Campus, Lee County</td>
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<td>July 22 &amp; 23</td>
<td>Chestatee High School, Hall County</td>
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Probability and statistics are among the most feared topics in today's mathematics curriculum, by students as well as teachers. Many students find it difficult to invest in a new way of thinking without seeing why it is immediately useful, and many teachers find it hard to motivate their students with examples such as rolling dice. This could leave students with the impression that probability and statistics is only useful in Las Vegas.

This impression couldn't be further from the truth, and we believe it is important to give students of probability and statistics a broader perspective. Particularly in recent years, data has enabled or improved decision-making across different domains such as healthcare (patient monitoring), manufacturing (product reliability), and retail (inventory levels). As a result of the increasing use of computers, the ability to transform data into meaningful insight is often needed for careers where such skills were much less needed in the recent past, such as for instance in a car repair shop.

Analytics is a relatively new, fast-growing STEM field for college-bound students. It spans the areas of computing, statistics, operations research, and business. Analytics students are typically hired as analysts or consultants. The need for data-driven skills has outpaced the supply of these students, and will continue to do so for the foreseeable future. For instance, McKinsey Global Institute (2011) predicts that by 2018, the United States could face a shortage of 140,000-190,000 people with deep analytical skills, as well as 1.5 million analytics-trained managers and analysts with the know-how to use "big data" to make effective decisions.

There are many information sources* available on the web on various aspects of data-driven decision-making. In this paper, we describe a resource we have developed to give students a broader perspective for learning probability and statistics in the context of decision-making.

An activity to engage students
We have designed a free web-based computer game called Theme Park for grade levels 9-12. The game places tools from probability and statistics in a real-world context with an eye towards the Common Core State Standards. Students manage a theme park in which their customers visit rides randomly. As students analyze, maneuver, construct, and synthesize information throughout the game, they gain a deeper
Studying Probability and Statistics cont.

understanding of a variety of difficult topics in probability and statistics while applying these concepts to a real-world situation. At the heart of the computer program lies a simulation game, where students are challenged to make decisions to improve the customer experience in their theme park.

Introducing "Theme Park" to students
Introduce the Theme Park program to the students through a discussion on the role of probability and statistics in our daily lives. Review the concept of randomness and its role in making predictions from samples. Consider the following initial talking points:

- Demand for a product (such as the latest computer gadget) is random.
- Stock prices are random, and being able to predict them would make you very rich!
- Machines in manufacturing and airplanes break down at random times.
- Insurance premiums are based on likelihoods and sizes of claims.
- There is a lot of randomness in the weather, which impacts airport delays and traffic.

Playing the game
The game consists of four interactive sections. The first section introduces the theme park and asks questions related to data collection and statistics. The second section focuses on questions related to probability and counting. The questions in these two sections focus on Common Core GPS standards MCC9-12.S.CP 1-7. In the third section, students are asked to assign cars to rides in the park, which vary in popularity. More cars reduce waiting times and therefore improve the service level of the customers, but they also cost money. Students are given twelve cars and three attempts to distribute these cars in a 'smart' way, and after each attempt the program runs a simulation that can guide students to improve their allocation. Students are also able to compare their customer service levels with other students.

The fourth section asks about key insights obtained through the simulation.

The program is available free of charge through http://themepark.gatech.edu. Teachers can get a quick impression of how it works by glancing at the teacher’s guide: http://themepark.gatech.edu/teacherguide.html. This guide contains all the solutions to the questions in the game, and connects different parts of the game to specific Common Core standards.

We suggest that this activity be used as a review of the probability standards through Analytic Geometry and an application of data driven decision-making. We recommend the following three steps: (1) introducing the game to the students through a classroom discussion, (2) playing the game, and (3) having further classroom discussions about the findings of the students.
Classroom discussion after the game
Students now have a better understanding of the use of statistics and probability. In particular, the game has built and solidified a better understanding of how probability and statistics can be applied and used in the everyday operations of a theme park.

To conclude the activity, we suggest having a class discussion on the decision problems facing the managers of a theme park. Students should be able to discuss various decisions facing a theme park, and recognize that mathematics is a powerful tool for decision making. Some examples are:

- Reducing waiting times (this is the subject of the computer program),
- Maximizing concessions revenue by cleverly positioning stands and having the right products available in the right places,
- Logistics and inventory management of foods sold at the park,
- Personnel scheduling to ensure that appropriate and sufficient performers and crew are present for each show, and that last-minute changes are addressed,
- Revenue management: pricing discount packages and specials to fill up seats or hotel rooms that would otherwise be empty.

Further resources can be found on the web through a search engine. The field of industrial engineering uses mathematics, including probability and statistics, to make processes more efficient.

Our classroom experiences
We have introduced this game to various classrooms and teacher workshops over the past several years. We have had enough computers for individual students, but it is also possible to work through the program in pairs.

Students are able to work through the theme park program during a traditional class period (50 - 60 minutes), and many students finish the game twice. We have implemented some randomness in the questions that are asked, so a second run is likely to have several new questions. Moreover, if the student did not receive the best possible score in the simulation game in the first run, he or she has a chance to improve this score in the second run.

Some questions in the game have a relatively high level of difficulty. Some students are inclined not to think deeply about questions on a computer screen, therefore some encouragement from the teacher is desirable. Students are allowed one hint on the questions, and may make a few mistakes without hindering their progress in the game. They can also review and correct their answers.

We run a student survey every time we expose the game to new students (this survey is also available from the program’s website). This has been an invaluable tool to continuously improve the game. Two questions we asked are "Taking everything into account, did you enjoy this game? (5 = very much, 1 = not at all)", where we report an average of 3.96, and "To what extent do you think this game could motivate you to learn more about mathematics and engineering? (5 = very much, 1 = not at all)", where we report an average of 3.45. (For the statistics junkies among us: the standard deviations are 0.72 and 0.96, respectively.)

References and Acknowledgments
QR Codes in Education
By Hilary Rogers

Have you ever had those days where you know just by looking at your students’ faces that you have lost them? Do you battle with students who misinterpret the meaning of BYOT in the classroom? One way to engage the students in math class is by creating lessons where they are using familiar devices like cell phones and tablets to enhance their learning. One tool that I have found successful is the QR code. Here are some websites that create free QR codes for you. All you do is input what you want imbedded in the code.

http://qrcode.kaywa.com
http://www.qrstuff.com

Once you make them, the codes can be posted online or displayed in the classroom. You can embed a variety of content with QR codes:

• Do you want students to watch video tutorials to remediate a certain topic? Copy and paste the URL into the code generator. The QR code will direct them straight to that site without going through search engines or typing in long web addresses.

• Do you want to get the students up and moving around the room with a station activity? Post various problems around the room that are aligned to your current standards. Include the solutions embedded in QR codes for the students to check their work as they go. You can also quickly turn the stations into a scavenger hunt by allowing students to hide problems and/or solutions around the room. With the QR codes, answers can be posted in plain sight yet hidden inside the code.

• Does the math vocabulary provide a point of confusion? Embed these words in a QR code, print them on address labels (or any other type of sticker). Place one sticker on the back of each student but do not tell them what word they have been given. While the students walk around the room, they scan each other’s QR code and use clues to try to get the other student to guess the word that

Students can freely use their technology to visit websites that I have navigated for them and to complete activities that may have otherwise been just worksheets to complete. They are also using the Standards for Mathematical Practice to help them make sense of the content.

All you need to make this work in your classroom are devices with a free QR scanner app, access to a free online QR code generator, and a little creativity. Making the codes takes very little effort and time.
QR Codes in Education cont.

was placed on their back.

- Do you need to leave plans for the substitute? Display problems with their solutions embedded in QR codes around the room. Give them full credit for explaining why the solution works or showing how they got the solution accurately. The written explanations will hold the students accountable for more than copying the solution from the key and eliminate the excuse that "the sub couldn't help me so I didn't get it done".

Once you are comfortable with generating QR code activities, encourage your students to start creating them for you. Have fun with it and, of course, share what works or doesn't work for you.

Please also check out my school webpage where I have attached resources from my presentation at Rock Eagle this year on using QR codes.

https://sites.google.com/site/carogers1314/home/gctm-conference-material

There are many other uses for QR codes in the classroom, including record keeping and surveying your students about any topic you desire. Scan the QR code below to take a short survey on how QR-savvy you are. The results of the survey will be emailed to you along with information about how to create Google docs.

With technology available why not try QR codes! You will create a class full of learners that are persevering, problem solving, discussing math with each other, and looking for patterns. Also, students are finding math more fun and approachable through movement and using technology they already love and are attached to!
Introducing Series with Taylor Polynomials
By Dennis Wilson

If you will kindly pardon the pun, I have always been displeased by the discontinuity of my AP Calculus BC course. Upon finishing the unit on Differential equations, the course seemingly steps away from the concepts of calculus to explore infinite series and tests for their convergence. I always promise my students that we will be returning to the calculus they have grown to love after we learn these convergence tests.

Following conversations at the Georgia Mathematics Conference at Rock Eagle with Nurfatimah Merchant of Westminster and Marshall Ransom of Georgia Southern, I decided to escape this sequence dictated by my textbook, and introduce Taylor polynomials before discussing convergence tests. My students finish our unit on differential equations by approximating the base of the natural logarithm using Euler’s Method. Moving from the "broken lines" of Euler’s method to the curves of Taylor polynomials seems a logical next step to my students.

Starting cautiously with the linear approximation to \( f(x) = e^x \) at \( x = 0 \), we next build a quadratic approximation and then proceed to polynomials of higher degrees. As these polynomials provide a higher degree of accuracy for \( e \), my students become convinced of the validity of this method for our chosen function. The question then becomes, is the method valid for all functions.

We continue to explore other functions using the Taylor polynomial, namely \( f(x) = \sin x \) and \( f(x) = \cos x \). The Taylor polynomials for these functions continue to produce highly accurate approximations. Opportunities to connect these polynomials with differentiation and trigonometric identities are then explored. Students are now satisfied with the utility of Taylor polynomials and their ability to provide higher degrees of approximations for various tasks. The next function we explore though, creates significant challenges to their satisfaction.

Finding a Taylor Polynomial for the natural logarithmic function seems a logical next step, but it presents some difficulties previously not encountered. First, all the Taylor polynomials studied thus far were centered at \( x = 0 \). The fact that \( f(x) = \ln x \) is undefined at \( x = 0 \) obviously makes this center impossible. After finding a Taylor polynomial for a known value of the natural logarithm at \( x = 1 \), the difficulty of the domain restrictions must again be considered. While \( f(x) = \ln x \) is defined only for \( x > 0 \), our newly created polynomial is defined for all values of \( x \).

\[
\ln(x) = (x - 1) - \frac{(x - 1)^2}{2} + \frac{(x - 1)^3}{3} - \frac{(x - 1)^4}{4} + \ldots
\]

By exploring the approximations generated by higher degrees of polynomials at selected values of \( x \), students are able to discover the idea of divergence and convergence for Taylor series.

Using diagrams like those shown in the given figures, students are able to visualize Taylor series by seeing each term and its effect on the partial sum. The lengths of the arrows in the diagrams represent the magnitude of the individual terms, while the tip of the arrow ends at the partial sum. The first value outside the domain of \( f(x) = \ln x \) that we explore is \( x = -1 \).

\[
-2 - 2^2 \cdot 2 - 2^3 \cdot 3 - 2^4 \cdot 4 - 2^5 \cdot 5 - 2^6 \cdot 6 - 2^7 \cdot 7 - 2^8 \cdot 8 - 2^9 \cdot 9 - 2^{10} \cdot 10 - \ldots
\]

By calculating successive terms, students can see that each one is larger in magnitude than the previous. The ever increasing magnitude of the terms leads to an ever increasing magnitude of our Taylor polynomial’s
Introducing Series with Taylor Polynomials cont.

approximation, which is easily seen in the diagram 1. This series provides the basis for my introduction of the Divergence Test to students.

The next value we explore is \( x = 0 \). The series of term generated by our polynomial approximation is the harmonic series itself.

\[
\frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} + \frac{1}{6} - \frac{1}{7} + \frac{1}{8} - \frac{1}{9} + \frac{1}{10} - \cdots
\]

Although this series passes the Divergence Test, students are shown using various methods why it diverges. This series provides the basis for my introduction of the Integral Test and the p-series test.

The question now arises that if these values outside the domain of our original function diverge, what about values of \( x \) that are inside the domain. The first value we explore from inside the domain is \( x = \frac{1}{2} \).

A careful term by term analysis of this series presents two opportunities.

\[
-\left(\frac{1}{1 + \frac{1}{2}}\right) - \left(\frac{1}{2 + \frac{1}{2}}\right) - \left(\frac{1}{3 + \frac{1}{2}}\right) - \left(\frac{1}{4 + \frac{1}{2}}\right) - \left(\frac{1}{5 + \frac{1}{2}}\right) - \cdots
\]

The first is a reintroduction of the geometric series. As you can see from the expanded form of the series, each term is just a fraction of the series the students first learn in Zeno's paradox. Students know that the geometric series has a limiting value, and therefore our series should have a limiting value as well since each term is less than its counterpart in the geometric series. This series provides the basis for my introduction of the comparison test.

The series for \( x = \frac{1}{2} \) provides two points of emphasis for continued discussion of the Taylor polynomial for \( f(x) = \ln x \).

\[
\left(\frac{1}{1 + \frac{1}{2}}\right) - \left(\frac{1}{2 + \frac{1}{2}}\right) + \left(\frac{1}{3 + \frac{1}{2}}\right) - \left(\frac{1}{4 + \frac{1}{2}}\right) + \left(\frac{1}{5 + \frac{1}{2}}\right) - \cdots
\]

This series has the same terms as the series for \( x = \frac{1}{2} \), except that the signs alternate. The Comparison Test can be reapplied to show that a limiting value exists for this series as well. Also, the nature of the alternating series can be seen in the diagram 4. Students are able to visualize how adding successive terms alternate the partial sums above and below the limiting value of the series. This is important as we consider the value of \( x = 2 \).

\[
1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \frac{1}{5} - \frac{1}{6} + \frac{1}{7} - \frac{1}{8} + \frac{1}{9} - \cdots
\]

The alternating behavior of the partial sum in this series is even more apparent in diagram 5. The values can be seen converging on to some limiting value. This series provides the basis for my introduction to the Alternating Series Test.

The last value we explore for with our Taylor polynomial probably provides students with their greatest consternation. The value of \( x = 3 \) is easily in the domain of \( f(x) = \ln x \), but as student consider the terms, they see that the series of values fails to pass the Divergence Test.

\[
2 - \frac{2^2}{2} + \frac{2^3}{3} - \frac{2^4}{4} + \frac{2^5}{5} - \frac{2^6}{6} + \frac{2^7}{7} - \frac{2^8}{8} + \frac{2^9}{9} - \frac{2^{10}}{10} - \cdots
\]

Using diagram 6, students once again see that no limiting value exists for the series. The fact that the Taylor Polynomial fails to provide an approximation for values inside the domain of our function makes students question our previous results with \( f(x) = e^x \), \( f(x) = \sin x \), and \( f(x) = \cos x \). The dilemma of knowing when a Taylor Polynomial will approximate a function must be considered. This motivates the
Introducing Series with Taylor Polynomials cont.

introduction of the Ratio Test and the Radius of Convergence.

While this new sequence of topics has led to hopscotching among the sections of my text for appropriate exercises, the benefits are quite clear. The first benefit is that it has eliminated what students considered an apparently meaningless break in the presentation of material. The continuity of the course is now preserved. The primary benefit though is that it gives students a concrete example of the use of each convergence test and its importance. Students are no longer blindly learning convergence test, but they are now empowered with visual confirmation for each series convergence. The diagrams in this article were made using TI-Nspire Technology. The document for Visualizing Series can be downloaded at the website for the Georgia Association of Advanced Placement Math Teachers.

Diagram 1
Series for $x = -1$

Diagram 2
Series for $x = 0$

Diagram 3
Series for $x = \frac{1}{2}$

Diagram 4
Series for $x = \frac{3}{2}$

Diagram 5
Series for $x = 2$

Diagram 6
Series for $x = 3$

eREFLECTIONS is designed by The Digital Pen, Rome, GA
www.thedigitalpen.com - 706-346-8731
One of the goals of GCTM is to promote and reward excellence in the teaching of mathematics in the state of Georgia, which means that we want to celebrate Georgia Teachers and their accomplishments.

In this column we would like to highlight excellent Georgia teachers. If you know of a Georgia teacher who wins an award or receives a grant (other than from GCTM), email me and we will celebrate them in the next issue.

Kudos to Dr. Jeanne Rast who teaches math and science at St. John the Evangelist Catholic School in Hapeville, Georgia. Jeanne is a winner of the Presidential Award for Excellence in Math and Science Teaching for 2012.

From the website it is described as "The Presidential Awards for Excellence in Mathematics and Science Teaching (PAEMST) are the nation's highest honors for teachers of mathematics and science (including computer science). Awardees serve as models for their colleagues, inspiration to their communities, and leaders in the improvement of mathematics and science education.

Since 1983, more than 4,200 teachers have been recognized for their contributions in the classroom and to their profession."

Dr. Jeanne Rast
2012 Presidential Award for Excellence in Math and Science Teaching

Nominated by her principal, Karen Vogtner, Jeanne submitted the detailed application about herself and her school, made the required video of herself teaching, and wrote a lengthy paper explaining the video and the pedagogy involved. This process took approximately 18 months, but the results are certainly worth it.

She submitted her application in May of 2012, and was soon informed that she was a member of the top 3 in our state. In December of 2013 she was informed that she has won the award! There are 51 math winners and 51 science winners, with only 7 from private schools.

She wins $10,000 to spend any way she wishes, and a trip to Washington to receive her actual award from the President. At the writing of this article the final plans for the trip to Washington and the celebration were not complete.

From the PAEMST website, "the award recognizes those teachers who develop and implement a high-quality instructional program that is informed by content knowledge and enhances student learning. Since the program’s inception, more than 4,200 teachers have been recognized for their contributions in the classroom and to their profession.

Awardees serve as models for their colleagues, inspiration to their communities, and leaders in the improvement of mathematics and science (including computer science) education. The National Science Foundation administers PAEMST on behalf of The White House Office of Science and Technology Policy."

Congratulations to St. John the Evangelist Catholic School and Dr. Jeanne Rast for this award. This is a great accomplishment and honor.

Many Georgia teachers have received this honor in the past, as we anticipate that many will also in the future. As this occurs, please inform the editor so that the awardee may be recognized.

By Cheryl Hughes
Editor
Why Kids Mess Up Exponents
By Michael Pershan

One thing that you need to know about me: I'm really into math mistakes. I love discovering a new math mistake the way some teachers love hearing a kid say something funny, which is to say that I have a sort of antenna in the back of my head, constantly awaiting precious signal. In fact, I love math mistakes so much that I started taking pictures of them and collecting them on the internet at (you guessed it) www.mathmistakes.org.

This is a story about helping kids who make mistakes with exponents.

My first group of algebra students messed up exponents in every way possible, but there was a sort of order and pattern to their mistakes. They'd say that anything to the zeroth power was zero, that something to the negative first was negative something, and that a number to the half power was half of whatever you started with. All of these exponent mistakes have something in common: they multiply when they should be exponentiating.

Why do high school students confuse exponents for multiplication? One theory is that the kids are just guessing. They don't know what to do with negative powers, so they just do whatever they can with the numbers involved.

Another view is that it's because high school students still don't have the basics of exponents down. They don't really understand what "two cubed" means, so of course they make mistakes while working with more advanced powers.

Were my kids guessing? Were they confused about the basics? Here's what I did: I asked my students a series of questions about exponents, starting with pretty basic stuff and moving to questions that were computationally difficult. I also asked students to rate their confidence in each answer. If the kids were guessing, they would express low confidence in their answers. If the kids were confused about the basics, they'd get the basic questions wrong.

Neither of these things happened. Overall, my kids got the basic questions right, and they expressed high confidence in their wrong answers to the more difficult questions. Moments after correctly solving a problem involving exponents, they would revert to multiplying the base and the power just several lines later!

What did I learn from this experiment? First, my students carry a silent, lurking impulse to treat exponents like multiplication. Second, this impulse is so strong that I have to explicitly address it with my high school students. Third, we need to change the way that we introduce exponents to students so that we avoid creating this strong drive to multiply the base and the power.

Finally, this experiment confirmed that my love for math mistakes isn't (just) some crazy obsession. Taking a close look at the mistakes our kids make can teach us a ton about the way we're showing math to our students.
Ev'ry time I circle, I see you, I feel you
That is how I know you go on:
Trillions of digits, no pattern to show us,
You have come to show you go on.

Find.... pi.... however we try,
We will see that pi does go on.
Be.....fore..... one guy called it "four",
But I know in my heart that pi does go on and on.

Twenty-two sevenths might seem more pleasant,
But pi never ends or repeats.
Pi is a ratio, but never a fraction:
This number really is neat!

Find..... pi..... however we try,
We will see that pi does go on.
Arc....tan.... however you can,
But Lambert showed that pi will go on and on....

(lyrics by Lawrence Mark Lesser; may be sung to the tune of Celine Dion's #1 hit "My Heart Will Go On" from Titanic)
Mini-Grant Awards

The Mini-Grant program has been implemented to provide funding for creative teaching projects. Proposals will be judged anonymously, and grants will be awarded in any amount up to $300.00. Each winner should be willing to either write an article for Reflections, the GCTM publication, or participate on a panel with other Mini-Grant winners at the following Georgia Math Conference.

The criteria upon which applications will be evaluated are:
• Creativity, innovation
• Potential impact upon student achievement
• Potential for replication by and dissemination to other teachers
• Advancement of NCTM's Principles and Standards for School Mathematics
• Unavailability of funding from local sources

The following is a list of those who have been awarded mini-grants for this year. If you are interested in applying, please check our website for more information, or email Ned Colley.

<table>
<thead>
<tr>
<th>Name</th>
<th>District</th>
<th>Grade</th>
<th>Project Title</th>
<th>Award Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Melisa Hendricks</td>
<td>Griffin-Spalding</td>
<td>K-2</td>
<td>Let's Shape Up!</td>
<td>$300.00</td>
</tr>
<tr>
<td>Sarah Griffis</td>
<td>Henry</td>
<td>3-5</td>
<td>Mobil Math Lab</td>
<td>$300.00</td>
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<td>Ed Griffis</td>
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<td>3-5</td>
<td>Mobile Math Lab</td>
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<td>Kimberly White</td>
<td>Richmond</td>
<td>6-8</td>
<td>We know how to VersaTile</td>
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<td>Lauren Kilmark</td>
<td>Waycross</td>
<td>6-8</td>
<td>Keep Calm &amp; Organize your Math</td>
<td>$300.00</td>
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<td>Erica Crawford</td>
<td>Augusta</td>
<td>6-8</td>
<td>OMG books</td>
<td>$300.00</td>
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Greetings from Central West Region!

Cathy Franklin and Amanda Foiles are your representatives! We have so many activities for mathematics in our great part of the state! First of all we have so much going on for UTeach! This is a program that will produce the next generation of great mathematics and science teachers. Both Columbus State and West Georgia have programs. This is a program from University of Texas, Austin! One of the Master Teachers from CSU is our own Kenneth Jones! He often presents sessions at the Georgia Mathematics Conference. This past year he was presented the John Neff Award for outstanding leadership given by Georgia Council of Teachers of Mathematics! You can see him at Rock Eagle either presenting or sitting with these fine young future mathematics teachers. Kenneth is third from the left.

Another active award winner from our region is Peter Anderson from Troup County High who won the Secondary Mathematics Teaching award given by Georgia Council of Teachers of Mathematics. Peter is an excellent teacher and in the picture below, he is sharing great ideas on teaching to other teachers.

The Mathematics Collaborative at CSU had a great Middle School Problem Solving Tournament in January. CSU sponsored the regional Science Fair February 5 and 6. West Georgia RESA will host a STEM Conference on March 6 and 7. The Mathematics Department at CSU will have a mathematics high school tournament in March and the winners will be invited to the GCTM Mathematics Tournament in April. As you can see there are a lot of wonderful happenings in our Central West Region!

For more information or to let Cathy and Amanda know of other great happenings, slip Cathy or Amanda a note so we can let all our mathematics teachers who are members of GCTM in this region know.
Keynote Speakers

Wednesday, October 15, 2014
Cindy Moss - Discovery Learning

Cindy Moss, Director of Global STEM Initiatives for Discovery Education, is charged with supporting school districts in their work to develop and deploy student initiatives to drive science, technology, engineering and math achievement nationwide.

Prior to joining Discovery Education, Dr. Moss served as Director of PreK-12 STEM Education for the Charlotte Mecklenburg School system, the 17th largest district in the US. Dr. Moss moved into this role after 21 years as a classroom teacher, where she received numerous awards for excellence including RadioShack's National Teaching Award and the Milken National Educator Award.

Dr. Moss has a BS in Zoology from UNC-Chapel Hill where she was a Morehead Scholar, a Masters in Science Teaching from Syracuse University and a Ph.D. in Science Curriculum and Instruction from Curtin Institute of Technology in Perth, Western Australia.

Thursday, October 16, 2014
David Dockterman - Harvard University, Scholastic

David Dockterman is chief architect, learning sciences at Scholastic Education where he provides guidance on turning research into practice and programs. He was one of the founders of Tom Snyder Productions, a leading educational software developer and publisher that was acquired by Scholastic in 2001. Over his 25-plus years in the industry, Dockterman has led the development of scores of award-winning instructional technology programs, including Decisions, Decisions; Thinking Reader; FASTT Math; and TimeLiner. Most recently he served as a key adviser for the creation of Scholastic's MATH 180. Dockterman authored the books Great Teaching in the One Computer Classroom and Weaving Technology into Your Teaching. He also co-created and co-wrote Science Court, the highly acclaimed animated TV show that ran for three years on ABC's Saturday Morning. Before joining Tom Snyder Productions, Dockterman taught high school social studies. He has dedicated himself to supporting classroom teaching and the successful integration of technology into schools.

Friday, October 17, 2014
Kati Haycock - EdTrust, President

Kati Haycock, one of the nation's leading child advocates in the field of education, is President of The Education Trust. The organization was founded to promote high academic achievement for all students at all levels - pre-kindergarten through college. Although many organizations speak up for the adults employed by schools and colleges, Ed Trust speaks up for students, especially those whose needs and potential are often overlooked, by evaluating every policy, every practice, and every dollar spent through a single lens: what is right for students.

Haycock previously served as Executive Vice President of Children's Defense Fund, the nation's largest child advocacy organization.

A native Californian, Haycock founded and served as president of The Achievement Council, a statewide organization that provides assistance to teachers and principals in predominately minority schools in improving student achievement. Before that, she was director of the Outreach and Student Affirmative Action programs for the nine-campus University of California system.
NCTM has entered the blogosphere!

Blogs have been created for elementary teachers, middle school teachers, and high school teachers, with guest bloggers chosen from our peers.

Check them out!

April is Mathematics Awareness Month and the theme for the April 2014 celebration is "Mathematics, Magic, and Mystery." Order a free copy of the official poster, available while supplies last. Then, throughout April, look for 30 days of magical, mysterious, mathematical phenomena, conveyed through video, articles, and other materials.

Special Features at Rock Eagle 2014
State School Superintendent Panel Discussion

All candidates running for State School Superintendent of Georgia have been invited to participate in a panel where they will be welcome to share their views on Georgia education priorities, especially those specific to mathematics.

In addition to the keynote speakers above, the following are Featured Speakers who will present workshops throughout the conference:

Kenneth Jones with Tim Howard
Cindy Moss
Christine Franklin
Brian Newsome
Claire Pierce
Kevin Moore

Miriam Leiva
Eric Milou
Tom Rearden
Sherry Parrish
Jan Scott

Continue to check our web page for more information on the Conference.
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