UETCTM NEWS

Pi Day π

March 14 (3/14) is celebrated around the world as Pi Day. Pi (π) is the symbol used in mathematics which represents a constant, ratio of a circle's circumference to its diameter, approximately equal to 3.14159.

The number Pi is an irrational and transcendental number which continues infinitely without pattern or repetition. It had been calculated to over one trillion digits past the decimal point.

Fun fact: If you hold a mirror to a circle, it looks like a circle. If you hold a mirror up to Pi, it spells PIE!

Geometry formulas using pi:

The area of a circle:

$$A = \pi r^2$$

The volume of a cylinder:

$$V = \pi r^2 h$$

http://www.piday.org/learn-about-pi/

Math Anxiety: A Self-Fulfilling Prophecy

By Amy Duncan

> "I get it; there is only one correct answer, but sometimes the effort and dedication and reasoning that goes into a child's work to solve a math problem is just as much a victory as coming up with the right answer"

Amy Duncan teaches for Johnson City Schools

When one considers the importance of Reading/Language Arts and Mathematics in our educational system, it should seem disturbing that so many students still find it acceptable to declare, "I'm not good at math" or "I can't do math." They will tell anyone who will listen including the math teacher. I never hear students say, "I can't read," although I know that there are plenty of students who struggle with reading on grade level. What is it about math that has students feeling like they are going to fail before they start?

I'm not sure there is one answer to this question but a few ideas have crossed my mind. Of these ideas, all could and will hopefully be alleviated through our new "task" approach to teaching. First, I believe a huge part of math education is built around memorizing algorithms. I'm certainly not suggesting that students shouldn't have the knowledge of standard algorithms, but they should be able to use an algorithm that makes sense to them not the *one* approach the teacher is modeling in class that day. Teaching by way of tasks allows students the opportunity to understand the problem in their own brain and then communicate their understanding by way of a diagram or an algorithm that makes the best sense to them. Mastering a problem through their

own hard work and effort will pay dividends in way of the student's math confidence.

Secondly, the pressure applied by the teacher and/or students to always have the right answer can put a lot of stress on a student who isn't as confident in their math abilities. I get it; there is only one correct answer, but sometimes the effort and dedication and reasoning that goes into a child's work to solve a math problem is just as much a victory as coming up with the right answer. Celebrating a student who has worked extremely hard on a problem and just come up short on the correct answer will encourage him/her to work hard on the next problem. Also, not ignoring a student who doesn't have the correct answer but asking very specific questions about their reasoning and work and speaking directly with them about ways they can improve their performance will validate them. The student will begin to believe "the effort is worth it and my teacher wants to help me succeed."

The task lesson plan model empowers teachers to slow down and have good discussions with his/her students about "their thinking." A math class with these types of activities and with a student empowering environment will help reduce math anxieties in students.

Lastly, and this one doesn't have as much to do with the student as much as with the teacher who teaches math, teachers can impose their own fears of math on to their students. Teachers certainly don't do this on purpose, but they can and I believe do communicate with their students as subtly as through their sagging shoulders and sighs that, "math is not my favorite subject and I can't wait for it to be over." Okay, so maybe it isn't that loud, but teachers can say and do things that tell students reading a story is much more entertaining, working on a science experiment is way cooler, and history is just plain old fun. Where does that leave math? Studying for a math lesson might take more work and effort for teachers than other subjects they teach. However, I think they should put the effort into the lesson *and then* require their students to work just as hard during the lesson.

Problem solving isn't easy work. If teachers shy away from it, their students will too. How can a teacher ask his/her students to preserver when working through the problems when they themselves can't preserver to adequately prepare for the lesson? I believe the old adage, "what a child sees he does" and this includes in the math class. When we model perseverance and dedication in our math classes, students will have an example to look up to and possible try to replicate.

Allowing students autonomy in solving math problems, praising them when they give great effort, even if the outcome isn't the correct answer, and speaking directly and honestly about their performance in math class, and lastly having a teacher who works hard on the lesson preparation and comes to class with an, "I love math," attitude, will go a long way in reducing math anxieties or just low math confidence among students.
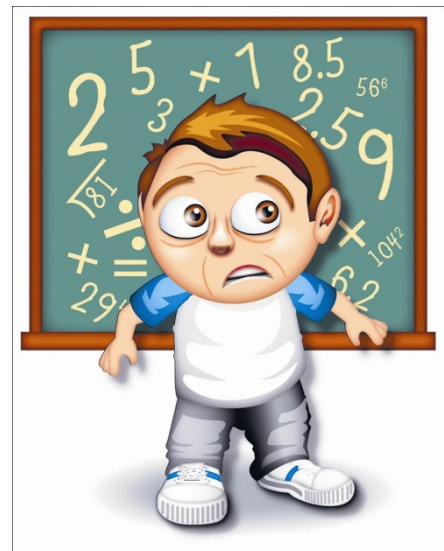
Even Miracles Take a Little Time

By Kristen Galloway

> "I always begin by asking myself, "what do I want students to learn?" and "how can I weave one concept into the tapestry of the day?"

Kristen Galloway teaches for Kingsport City Schools

What is the one thing that teachers cannot get enough of other than RESPECT? The answer is **_time!_** Teachers have so much subject content area to cover, including curricula that is federal, state, or locally mandated.   A teachers' normal day is a linear progression of disconnected subjects with specific time allotments per discipline, connected only by short transition periods. What this translates into is frustration on the part of teachers as they often struggle to fit everything into these allotted time periods. It is my experience that there are ways to meet these challenges by integrating content across disciplines and thereby maximizing student learning.
In my ideal world, I would have three hours for math instruction. However, I live in a real world where ninety minute periods to teach math are the rule. My solution would be to link math instruction to science instruction. I could also visualize incorporating literacy, music, physical education, and other subjects into math instruction.

There are a number of ways that I have been able to integrate math into other disciplines. I always begin by asking myself, "what do I want students to learn?" and "how can I weave one concept into the tapestry of the day?" In literacy, I can read books that involve math and math concepts, such as One Grain of Rice. My students can also read a readers theater about subjects such as division. In science my students can compile and interpret data, compare numbers, and measure different units such as temperature and time. In music my students can learn about fractions using music notes and learn their "math facts" through singing. My students can add and subtract on a chalk number line in physical education class where I can also use that same number line to teach about positive and negative numbers.

How else does literacy relate to math? With Common Core and Constructed Response Assessment, students are expected to be able to read through math word problems and explain their thinking in a coherent fashion. I believe this translates into the need to practice comprehension skills and the ability to write math sentences that can be understood.

I believe that student learning and engagement will improve when students are able to see the big picture and apply knowledge they can transfer from one subject area into another. I know that I am not the first to suggest this approach; I know others who have tried integration successfully. Integration will allow teachers to stop focusing on how to frantically fit everything in the day, but free teachers to design a rich approach to student learning that integrates content areas and facilitates authentic and sensible learning.

March Puzzle

This month's math challenge comes from www.mathisfun.com, a great website where you can find many fun puzzles and brain teasers.

5 digit puzzle number:

What 5-digit number has the following features:

If you put the numeral 1 at the beginning, you get a number three times smaller than if you put the numeral 1 at the end of the number.

(Answer: 42857 (142857 is three times smaller than 428571)

Games, Games, Games

By Brett Herron

This past year was my first year teaching 4th grade. The move was a big transition from kindergarten which I had taught for the past three years. The most overwhelming transition that I had moving from the two grades was the idea of teaching math. By teaching three consecutive years in kindergarten, I was feeling comfortable with the curriculum and the most effective strategies to use with students. The summer before I moved to 4th grade, I read and studied the 4th grade curriculum as much as I could. I asked colleagues, read journals, and even experimented on family members to see if certain math strategies would work or fail. I wanted my students to experience a love of math, like I did when I was in school. When reflecting on the past year, one math strategy stood out above others. I felt that the use of games in teaching math was the most effective strategy that I used in teaching my students concepts or new mathematical ideas. Below are a few of the games I used in my classroom as I taught multiplication, division, decimals and fractions.

Multiplication Games

Double, Halve or Stay: This game is intended for two to four players, with the use of two dice. One dice will represent the tens and the other dice will represent the ones. Players will agree on a target number between 5 and 122. The players take turns to roll the dice. Once the dice are rolled a number is formed. The player then makes a decision to produce a number that is as close as possible to the target number. The player can choose to: double, halve, or keep the number as is. The player closest to the target number is the winner.

Multiplication War: This game is intended for two players, with the use of a deck of playing cards (with or without face cards – assign number value for face cards). One player shuffles and divides the cards between both players (placing the cards face down between them). Each player turns over a card at the same time. The first player to say the product of both of the cards wins and takes the cards. Play continues until one player has most (or all) of the cards.

Double Dice: The materials used for this game include (per person): 1 pair of double dice (dice inside dice), paper & pencil. The object of the game is to have the highest total score after five turns. On their team's turn, both players on Team A roll his/her pair of double dice. Each die will produce a total number between 1-12. Players will use their digits to create a two digit number. Both members of the team record the problem on their paper and solve the multiplication problem. Team B now takes their turn. After 5 turns, all players total their points. The team with the largest sum wins.

Division Games

Division with Dice: In this activity/game, the teacher will give the students centimeter grid paper and a regular die. The students will roll the die. The number on the die tells the student how many rows there will be in their array. The students will use X's to make the number of rows. The students will then roll the die again. This is the number of X's they will draw in each row. For example: If a student rolled a 6 and a 5, there will be six rows of five X's on the grid paper. After they draw the array, the students will write one division fact that is related to the array.

Decimal Games:

Adding Decimals with Playing Cards: This game is intended for students in groups of two or more. The teacher will give out a deck of cards to each group of students (face cards and tens are removed and the Ace is worth 1). The players split a deck of cards and deal out three cards each, placing them face down. Each player turns over the first and third cards and leaves the second card face down to represent the decimal point. Together, players line up the decimals and add both numbers together to get the sum. This is not a competitive game, but a chance for students to work at adding and working with decimals.

Fraction Games:

Fraction War: Much like Multiplication War, the object of Fraction War is to win all of the playing cards from your partner. In the deck of cards, the Ace is worth 11, the Jack is worth 12, the Queen is worth 13, and the King is worth 14.   The players split a deck of cards and simultaneously flip over their top two cards, using the smaller card as the numerator. The greatest fraction wins the cards. If the cards are equivalent fractions, the cards are placed in a center pile. The next hand is played normally and the winner of the next fraction.

Fraction Addition: This game is intended for students in groups of two. The teacher will distribute a deck of cards (faces are worth ten, Ace is worth 1 or 11). The two players work as a team as they add fractions. Deal four cards and place them face up. Use the four cards to create two fractions. Once they add the fractions on scratch paper, they can check their answer using a calculator.

Fun Math Facts! http://www.makemegenius.com/

- *The number 5 is pronounced as 'Ha' in Thai language. 555 is also used by some as slang for 'HaHaHa'*

- *Have you ever noticed that the opposite sides of a die always add up to seven (7).*

- *An icosagon is a shape with 20 sides.*

- *From 0 to 1,000, the letter "A" only appears in 1,000 ("one thousand").*

The Benefits of Differentiated Instruction

By Tonya Warner

> "Differentiated instruction is teaching using various methods and activities to meet each individual's needs."

Tonya Warner teaches for Hawkins County Schools

Being an educator is not a simple task. Before a teacher ever enters a classroom full of eager students, he or she must think about how to get the students to learn and accomplish their learning goals. Educators have studied various methods and strategies written by well-known psychologists. What ideas actually work for the students in the classroom? If every student learns differently and each student reaches his or her personal goal at different times, then how do teachers teach every student in the class? The technique that works is using differentiated instruction.

What exactly is differentiated instruction and how do teachers know it really works? Differentiated instruction is teaching using various methods and activities to meet each individual's needs. All students are provided materials that relate to the same content. Students vary when approaching learning. Some students are visual learners while others can listen to lecture or read to understand the material. So how does a teacher implement this kind of instruction into the classroom?

First the teacher must know the levels of all of the students. A teacher will do this by giving pre assessments on various subjects before the beginning of the lesson. Then students will be taught using manipulatives, direct instruction, and through common core tasks. The teacher can also group the students in centers when content is taught. Each group will be assigned to a different area of the room. The areas may be with IPads, class computers, graphic organizers, or learning games.

Each group will work on the same content; however, one student may understand it better on the IPad versus a graphic organizer. The multiple stations will have different activities for the students to complete. This shows the teacher that each student had the opportunity to learn the content and had a chance to learn in the way that works for them.

Another way to differentiate the instruction is to work with students who may get behind. When most students understand the content but a few seem confused, the teacher can work with the students who need help. For example, a teacher will teach a lesson and give some type of assessment to the students whether it is formal or informal. The teacher can leave the students who understand alone and allow them to have time to work on enrichment activities while working individually with the students who do not grasp the content immediately. This allows extra time to implement the content to reach students comprehension.

Differentiated Instruction is a method that works in the classroom. It allows all students to have a chance to learn what is being taught. Every student feels comfortable in the classroom knowing they have various opportunities to reach their academic goals. Differentiated Instruction allows the teacher to keep the students motivated at school. It also supports the teacher's knowledge of his or her students and what type of learning works best for which student. This type of instruction is an exceptional approach to education.

Over the Hill by Ellan Kitzmiller

"Over the Hill" is one of the many challenging tasks that Dr. Nivens gave our Mathletes class. Like most tasks that he provided us to work on over that last two weeks, this activity had multiple ways to be approached. We had five groups working on this task at the same time. Over an hour later, when everyone finished, each group made a poster showing the steps they took to get to their answer. It is always amusing to see how others get the same result using a totally different method. The first part of the lesson started off with a picture and a few broad questions to get our though process going.

Part 1: Preliminary Probing
1. What information is needed to solve the problem? What information is not important to know?

A cell phone tower will be built somewhere on the west side of the hill pictured in figure 1. How far up the hill must the tower be placed to provide a signal to anyone on the east side of the lake?
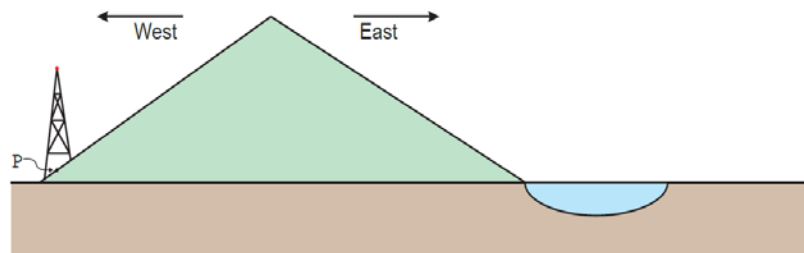
(Not drawn to scale)

2. Thinking algebraically or geometrically, how can you mathematize the problem?

This is a real-world problem that deals with trying to find the best placement for a cell tower on the west side of the hill that would allow the signal to reach people living on the east side of the lake. All we had at the time was a picture of the situation, not drawn to scale, and these very broad questions. There was quite a bit of discussion about how cell phone signals are dispersed, such as, at an angle, horizontally, into space and back to earth, etc. After much discussion, we were told that the signal could reach the east side of the lake at an angle from the top of the tower. Some began drawing a line on the picture using a ruler from the point where the top of the tower could be located down to the edge of the lake in order to visualize the problem better.

At this point, we were given part 2 of the activity.

Part 2: Down to Details
3. Use the following information to draw an accurate model:
• The cell tower is 200 feet tall.
• The hill is 800 feet tall and 2800 feet wide from west to east at the base.
• The hill has vertical symmetry.
• The lake starts at the base of the hill and is 600 feet wide.

4. First, predict how far up the hillside the tower must be built so that the tower can provide a signal to all points on the other side of the lake. Then determine the exact location on the hillside for the base of the tower. Explain your thinking completely.

5. How close was your prediction to your actual solution? Is your solution reasonable? Explain.

When we got to the second part of the activity, we were given a grid and some very important information. We found out that the hill had vertical symmetry. We also found out the height and width of the hill and height of the cell tower. Our group plotted the picture on the grid and labeled our vertical and horizontal axis. The horizontal distance of the hill was 2800 feet and the lake extended 600 feet beyond that point, so the east side of the lake was positioned at (3400, 0) on the x-axis. We then used a ruler to connect this point to the top of the hill which was positioned at (1400, 800). We extended the line to allow for the top of the cell tower to touch this line.   We then found the slope of this line and developed an equation for the line using the coordinates that we came up with on the grid. The equation is y=-2/5x + 1360.

This equation represents the top of the tower to the east edge of the lake. Next, we decided to draw a line parallel to west side of the hill that would intersect the top of the cell tower.   The slope of the west side of the hill was found by using the coordinates (0,200) which was the base of the hill and (1200,900) which represented the top of the hill. Using the slope 4/7 that we found and the fact that we would have to raise the parallel line up 200 feet, we got the equation y=4/7x + 200. Members in our group used either substitution or elimination to find the exact point of intersection of these two lines to the top of the cell tower. This point was (1195,882). I then subtracted 200 from the y-coordinate to find the coordinates that would represent the base of the tower (1195,682). At this point, the distance formula was used to find how far up from the base of the west side of the hill to where the base of the cell tower would be which 1376 feet. Dr. Nivens provided us with many thought-provoking, interesting, and fun problems. This problem may have been my favorite.
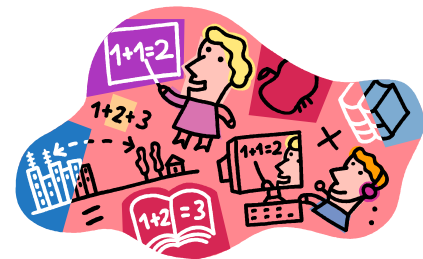
What Would You Like to Eat?

By Rachel Norris

The entire basis of Common Core is to allow students to look at and solve math problems in multiple ways. Even though I have always encouraged students to see problems from their own perspective and work them out with a method of their choice, I never realized I was still so much in control of their thinking and problem solving skills. My students could pick from different methods used to solve the given problem, but I was still orchestrating the choices and their thought process. It is like asking a child, "Would you like an apple or a banana?" As adults we think we are allowing the child an opportunity to make an independent choice. In reality the child wanted a candy bar, but we have the power and control to ensure the child's choice is acceptable to us. In essence, we are still making the decision.

Experiencing Common Core tasks in a classroom setting has forced me to think about math problems in a different way. As an experienced math teacher, it is natural for me to go into a problem looking for a pattern, an equation, or possibly a formula. I look at the problem in its entirety to find order and meaning. For most problems, I can write an equation from a table in less than 30 seconds because it is second nature to find a solution and I pride myself in the ability to do it quickly. How quickly I forget that I have been working these problems longer than any of my students have been alive.

The original toothpick problem assigned in class focused on the relationship between the total number of toothpicks and how that related to the perimeter of the figure. Because this was a perimeter problem, it was solved easily with repeated addition. Even though the fact that the perimeter could be found by simply multiplying the figure number by 4, it took a bit of thought to break the problem down in a way that could explain it with simple arithmetic.
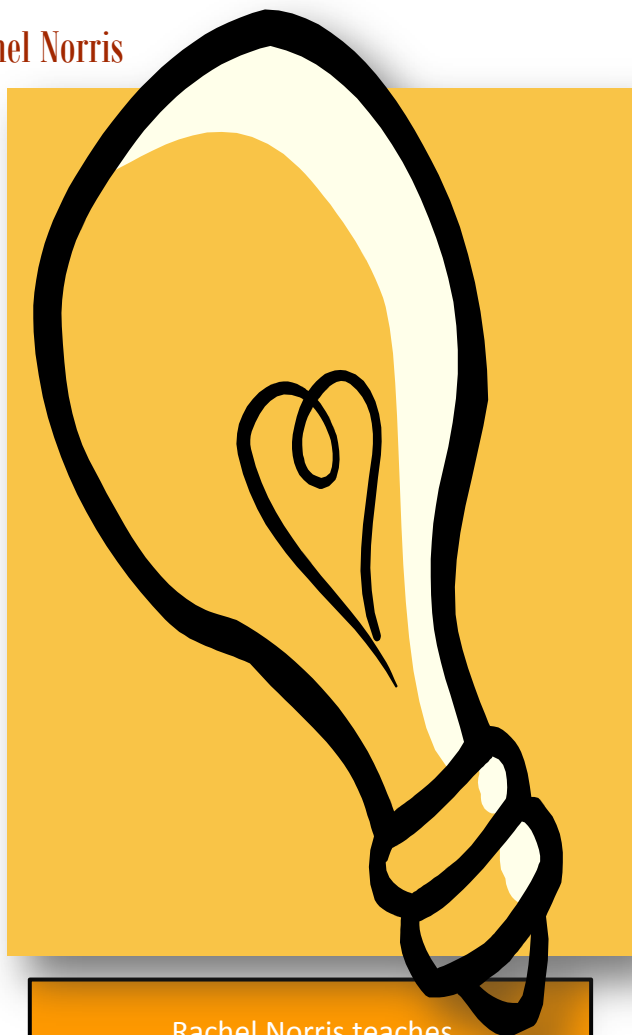
Rachel Norris teaches for Sullivan County Schools

The challenge came when we were asked to find a formula that could be used to determine the total number of toothpicks in the figure. I forced myself to use only simple arithmetic and my solution path follows:

Fig #	# of toothpicks added	total # of toothpicks
1	4	4
2	6	10
3	8	18
4	10	28
5	12	40

Fig #		# of toothpicks added
1	$4+0 = 4+2(1-1)$	4
2	$4+2 = 4+2(2-1)$	6
3	$4+4 = 4+2(3-1)$	8
4	$4+6 = 4+2(4-1)$	10
5	$4+8 = 4+2(5-1)$	12
	$4+2(n-1) = 4+2n-2$	
n		$2n+2$

$2n+2$ (where n is the figure #) is the amount of toothpicks being added in each figure

As teachers, we have to loosen the reigns when it comes to thinking. I want my students to think, but I have to understand and accept the fact that they will probably not think the way I expect them to think. As they say, sometimes less really is more. The less we impose our own thought processes on our students, the more likely they are to find their own and with that will come ownership, meaning and learning. Instead of asking, "Would you like an apple or a banana?" we could actually get the independent thoughts we desire by simply asking, "What would you like to eat?"

This created a lot more work than what was really required to develop the formula. I knew that I wanted to break this problem down into basic mathematical operations; however, most of my students have not had much experience with higher degree equations and expressions. It was important for me to mimic their possible thought patterns and solving strategies. I always tell students to use what they know, but I forget that they do not know what I know. I
realize that in order for me to change the way my students think, I have to change the way I think first.

Fig #	# of toothpicks already present	+ (2n+2)	=	Total # of Toothpicks
1	0	+ 4		4
2	4	+ 6		10
3	10	+ 8		18
4	18	+ 10		28
5	28	+ 12		40

Fig #			# of toothpicks already present
1	$2-2 = 1 \cdot 2 - 2$	=	0
2	$6-2 = 2 \cdot 3 - 2$	=	4
3	$12-2 = 3 \cdot 4 - 2$	=	10
4	$20-2 = 4 \cdot 5 - 2$	=	18
5	$30-2 = 5 \cdot 6 - 2$	=	28
n	$n(n+1) - 2$	=	$n^2 + n - 2$

$$\underset{\text{already present}}{\text{# of toothpicks}} + \underset{\text{added to the figure}}{\text{# of toothpicks}} = \underset{\text{of toothpicks}}{\text{Total #}}$$

$$(n^2 + n - 2) + (2n+2) = n^2 + 3n$$

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The Upper East Tennessee Council of Teachers of Mathematics is an organization for anyone involved in mathematics education from preschool through college in the greater Tri-Cities region. This year we will have a single-day conference in the spring at a day and location yet to be announced. The purpose of UETCTM is to promote excellence in teaching mathematics and to share best practices among mathematics educators.