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Super Bowl Coin Toss – A look at the numbers

Posted on February 8, 2012 by jisommer

In 46 Super Bowls the opening coin toss has come up heads 23 times and tails 23 times. The NFC has won the toss 31 times out of 45 with their streak of 14 straight years broken this year by the New England Patriots who were the last AFC team to win the coin toss in 1997.
The team that wins the coin toss is 21-25 all-time and the coin toss winner lost Super Bowls 35 to 41. All but three teams that have won the coin toss have elected to receive the opening kickoff. The Arizona Cardinals became the first team to defer to the second half in Super Bowl XLIII and lost to the Pittsburgh Steelers, 27-23. The Green Bay Packers deferred after winning the toss in last year's Super Bowl en route to a 31-25 win and this year the Patriots deferred and lost to the Giants.

The coin flip result has had several streaks of 3 or 4 in a row. Streaks of 4 in a row are 24-27 4 heads; 32-35 4 tails; 37-40 4 tails; 43-46 4 heads. So if you want to bet on the coin toss next year I would say go with Tails since we have never had 5 in a row; but then again it is random.

Raw data from: docsports.com

Posted in All Categories, News |

Number trick 1089

Posted on August 29, 2011 by jisommer

The Trick

I have used this number trick many times with beginning Algebra classes. I take a dictionary to class and before had write a word on a piece of paper then place it in an envelope. At the beginning of class I select a student at random and give them the envelope then have each student pick a 3 digit number without any zeroes or repeating numbers, such as 389. Next have them perform the following calculations:

389 reverse the digits in the number to get 983.
Take the larger and subtract the smaller.
983 – 389 = 594
Reverse the digits of 594 and get 495.
Add them, 594 + 495 = 1089

Next I give the dictionary to a random student and have them take the result of their calculation (I check to ensure no arithmetic errors), use the first 3 numbers for the page and the last number for the word on the page.

Ask them to say the word aloud then have the first student open the envelope and say the word. The class is always amazed and soon realize they all got the same result in their calculation and wonder why – which is the segway to discussing some algebra.

The Proof

Call initial number abc = a*100 + b*10 + c
after reversing cda = c*100 b*10 + a

we will assume a>c (does not matter which one is larger).
A = abc – cba = (a – c)*100 + (b – b)*10 + (c – a)
since c<a we will need to borrow to do the subtraction (in our example above we had to take 3 – 9 for the units digits).
to borrow we take 1 from the 10s unit and 1 from 100s unit and get (since middle term of both numbers are the same we need to borrow from 10s and 100s units:
A = abc – cba = (a – c – 1)*100 + (b – b – 1 + 10)*10 + (c – a) + 10
A = (a – c – 1)*100 + (9)*10 + (c – a) + 10

now reverse A to get
B = (c – a + 10)*100 + 9*10 + (a – c- 1)

Next add them
A + B = (a – c – 1)*100 + (9)*10 + (c – a) + 10 + (c – a + 10)*100 + 9*10 + (a – c- 1)
= (a – c – 1 + c – a + 10)*100 + (9 + 9)*10 + (c – a + 10) + (a – c – 1)
= 9*100 + (10 + 8)*10 + 9
= 9*100 + 100 + 8*10 + 9
= 10*100 + 8*10 + 9
= 1000 + 80 + 9
= 1089
same answer regardless of values of a,b,c keeping the all different and non-zero.

Also check this page http://mathandmultimedia.com/2011/08/29/the-kaprekar-constant-6174/
for another set of calculations, Kaprekar constant, which will eventually end up with the same number.

Posted in All Categories, Tidbits |

Mathematicians are People Too

Posted on November 1, 2010 by jisommer

Just purchased this book for our neighbor's daughter whose birthday is around Thanksgiving. It is a great book for elementary through junior high with short stories about each of the 15 mathematician and their contribution to mathematics and three of the featured mathematicians are female which helps to raise the awareness of some of the very good yet unknown female mathematicians. The mathematicians featured run from Thales to Srinivasa Ramanujan.

Here is a link to someone who has done a nice job using the book for home schooling activities.
Mathematician Are People Too activities

http://www.squidoo.com/printables-mathematicians-are-people-too

Posted in All Categories, History, Mathematicians |

Fermat Last Theorem Video

Posted on September 10, 2010 by jisommer

I read Simon Singh's first book Fremat's Last Theorem and thoroughly enjoyed the story. My youngest son sent me a link to this video and said he had not watched it but thought a math nut like me would enjoy the video. Well he was right, it was very good – and not just for a math nut.

It is produced by Dr. Singh and starts with Dr. Wiles talking about his excitement and the fulfillment of a childhood dream; he is so taken as he talks about it he has to turn away to gain his composure.

The video is well done and depicts well the struggles, effort and how he needed to bring together many existing mathematics in a very creative manner. Creativity is sometimes described as the ability to make unexpected connections. Dr. Wiles demonstrates this in many ways in his quest to prove the theorem and shows how his study of a branch of mathematics, elliptic curves, while at the time he thought it would not ever be of any help in proving the theorem (a period in his career when he had to put his interest in the theorem on hold) ended up being a major piece of his proof.

Take some time and enjoy, I think you will find it time well spent.
http://www.youtube.com/watch?v=7FnXgprKgSE

Posted in All Categories, History, Mathematicians |

Euler on a Prime Time Crime show

Posted on August 29, 2010 by jisommer
Rizzoli & Isles (2010–) is a TNT television series starring Angie Harmon as police detective Jane Rizzoli and Sasha Alexander as medical examiner Dr. Maura Isles. The one-hour drama is based on the Rizzoli/Isles series of novels by Tess Gerritsen.

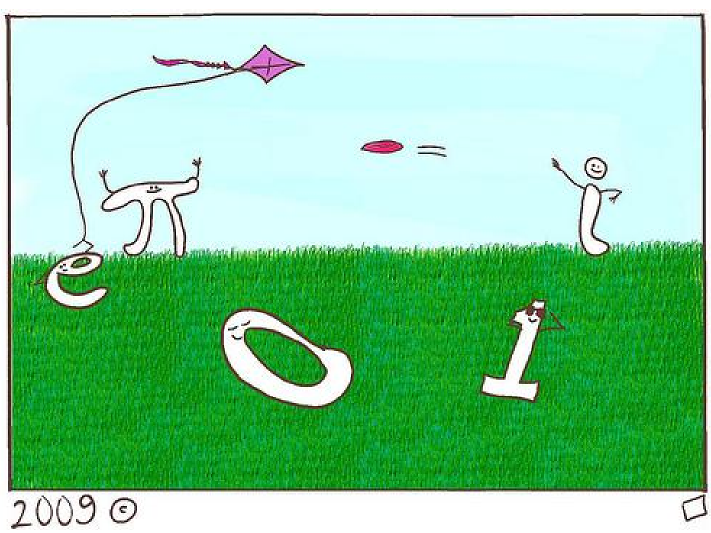
In a recent episode I was surprised by her reference to one of Leonard Euler's (1707-1783) most famous equations (actually called Euler's identity). He was one of the most prolific mathematicians of all time and definitely in the top 5 of all mathematicians.

Isles: Have you ever tried to appreciate Euler's number e? You know, the beautiful equation that connects three constants of mathematics? Have you?

Rizzoli: Yeah, I tried it once.
Unfortunately Dr. Isles mispronounced his name. She pronounced like the name looks but actually it is pronounced as 'oiler'. (There are some who do pronounce it closer to the way it looks but it seems the accepted pronunciation is oiler.
Check this site for pronunciation guide of mathematicians.
http://nsm1.nsm.iup.edu/gsstoudt/pronounce.html

$$e^{1\pi} + 1 = 0$$

From Brown Sharpie's mathematical comic site.



Euler's formula on spring break

Dangerous Knowledge

Posted on August 29, 2010 by jisommer

Always in awe of great mathematicians, this two part documentary by BBC Four in 2008 gives a very good look into four famous mathematicians (one is actually a physicist) who delve into new knowledge so different those around them want nothing to do with it yet so compelling to each of them they cannot leave it alone even if it drives them insane.

"In this one-off documentary, David Malone looks at four brilliant mathematicians – Georg Cantor, Ludwig Boltzmann, Kurt Gödel and Alan Turing – whose genius has profoundly affected us, but which tragically drove them insane and eventually led to them all committing suicide.

The film begins with Georg Cantor, the great mathematician whose work proved to be the foundation for much of the 20th-century mathematics. He believed he was God's messenger and was eventually driven insane trying to prove his theories of infinity."

Below is the link, very well done and well worth the time.
http://topdocumentaryfilms.com/dangerous-knowledge/

Posted in All Categories, History, Mathematicians |

Golden Rectangle and 8.5 x 11 paper

Posted on July 27, 2010 by jisommer

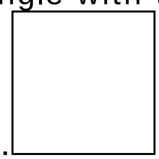
Thanks for your question about the Golden Rectangle, “Can you please explain- How many Golden Rectangles can be made from a sheet of 8.5 x 11inches? Also, please explain how to draw as well.”

Drawing the Golden Rectangle

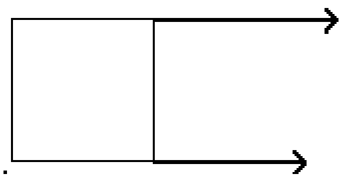
To answer your question would like to first start with your question about how to draw/create a Golden Rectangle.

To create a rectangle with this golden ratio:

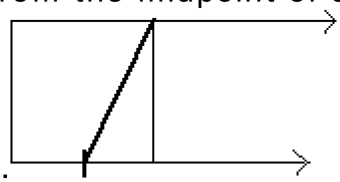
1. Draw a square.



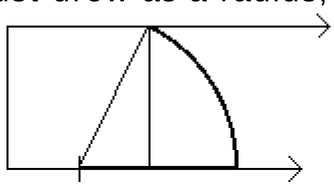
2. Extend two parallel sides.



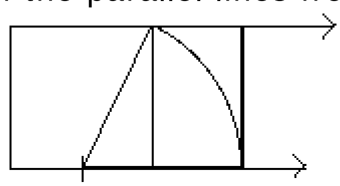
3. Draw a line from the midpoint of one side of the square to the opposite corner.

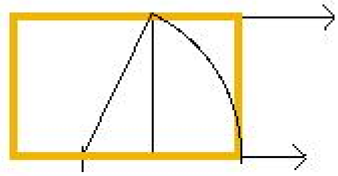


4. Using the line you just drew as a radius, draw an arc between the two parallel lines.



5. Draw a perpendicular line from between the parallel lines from the intersection of the arc on the bottom line.





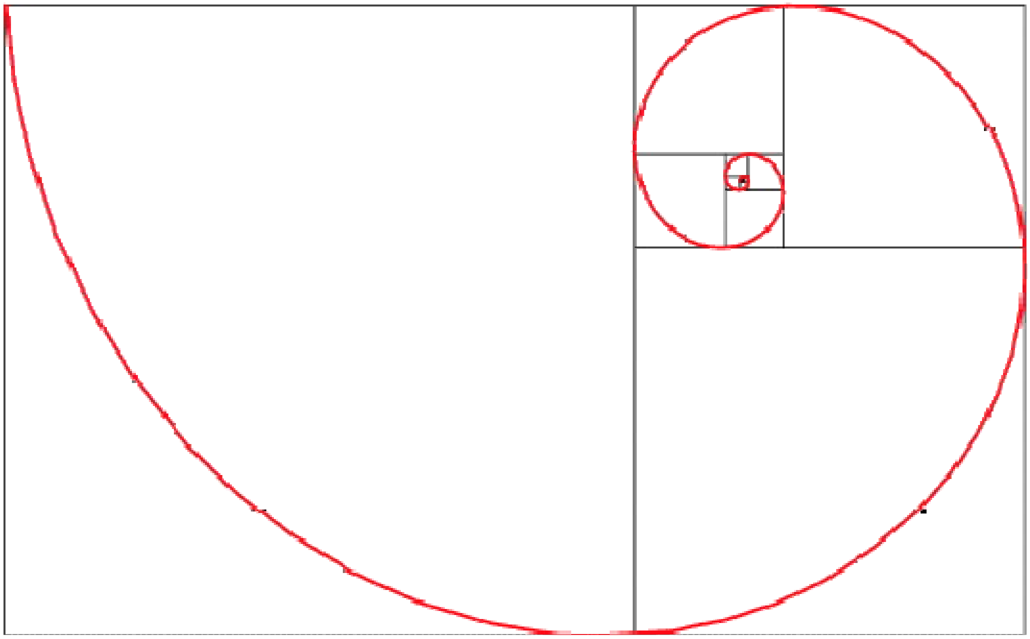
6. You now have a golden rectangle.
If the side of the Golden rectangle is A (thus we started with a square A by A) and the length is B then $\frac{A}{B} = \frac{(A+B)}{A}$
This fraction, $\frac{(A+B)}{A}$, is called the golden ratio (or golden section or golden mean).
The ratio is $\frac{1+\sqrt{5}}{2}$which is about 1.618304…

The ratio is so important it has its own special Greek character (Phi). If you have ever heard of Fibonacci numbers, reference in the book and movie DaVinci Code, you may know they are directly related to the Golden Ratio. Fibonacci numbers are defined as the sequence 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, … where the next term is the sum of the previous two terms. If you take the ratio of two sequential terms continually as you get further out in the Fibonacci numbers the ratio approaches Phi.

Golden Spiral and Fibonacci Numbers

Once you have drawn your Golden Rectangle you can continue on to create more Golden Rectangle and create a very interesting spiral – sometimes called the Fibonacci Spiral.

In geometry, a golden/Fibonacci spiral is a logarithmic spiral whose growth factor b is related to j, the golden ratio. Specifically, a golden spiral gets wider (or further from its origin) by a factor of j for every quarter turn it makes.



Successive points dividing a golden rectangle into squares lie on a logarithmic spiral which is sometimes known as the golden spiral.

Image Source: http://mathworld.wolfram.com/GoldenRatio.html

How Many on an 8.5 x 11 sheet of paper?

Now to address your question about how many Golden Rectangles can you put on an 8.5 x 11 piece of paper.

When you look at the construction of a Golden Rectangle you can see you can start with any size square. So the answer to your question is technically an very large number depending upon the size of the initial square.

If we look at the opposite of your question, what is the largest Golden Rectangle you can draw on a standard piece of paper. Using the construction method we need to start with a square, take half the side of the square and extend the side of the square to get the end point of the rectangle. We extend the square by:

Let say the side of our square is S. The length of the diagonal from the mid point of the side of the square to the opposite corner by the Pythagorean Theorem is: $\sqrt{(\frac{S^2}{4}) + S^2} = S * \frac{\sqrt{5}}{2}$. Thus the length of our rectangle is half the side of the square plus the length of the diagonal: $\frac{S}{2} + S * \frac{\sqrt{5}}{2} = S * \frac{(1+\sqrt{5})}{2}$ which is = 1.618034…

For standard paper the length is 11 so we set the previous equation equal to 11 to find value for S to us as much of paper as possible.
$S * \frac{1+\sqrt{5}}{2} = 11$
Solving this equation for S we get $S = \frac{22}{1+\sqrt{5}} = 6.79837$
So we the largest Golden Rectangle on an 8.5 x 11 sheet of paper is width of about 6.8 by 11 inches.

Another way to look at answering your question about how many Golden Rectangles we can fit on a standard sheet of paper is to assume we are using a 'unit' Golden Rectangle which means the rectangle would have dimensions of side 1" and length $\frac{1+\sqrt{5}}{2}$ which is about 1.618304…

If our side is 1 then would could have 8 rectangles high if we look at the paper in landscape mode. This will cover 8" of the paper from top to bottom. To see how many rectangles will fit across the paper we divide 11" by : 11/1.618034 = 6.798373828 so we could fit 6 rectangles across the paper. This gives us a total 6 * 8 = 48 rectangles to cover the paper.

If you use the same logic placing the rectangles with the paper in portrait mode you can fit 11 from top to bottom and 8.5 / 1.6.8034 = 5.2532888678 which rounds down to 5 so we can fit 55 rectangles in the portrait mode – a larger number than landscape.

There are many fascinating characteristics of the Golden Rectangle and would suggest you look at:
http://goldennumber.net/
http://www.mathsisfun.com/numbers/golden-ratio.html
http://www.maths.surrey.ac.uk/hosted-sites/R.Knott/Fibonacci/

Posted in All Categories, Questions |

Sir Michael Atiyah

Posted on June 30, 2010 by jisommer

What is mathematics? A question which is hard to answer especially for most people who have never had the opportunity to experience 'real' mathematics. I ran across this paragraph by Michael Atiyah express his thoughts on mathematics and those we delve into its inner beauty.

Dreams

In the broad daylight of mathematicians they check their equations and proof, leaving no stone unturned in their search for rigor. But at night under the full moon they dream; they float among the stars and wonder at the miracle of the heavens, they are inspired. Without dreams there is no art, no mathematics to life.

He is a British-Lebanese mathematician (born 1929), and widely considered one of the greatest geometers of the 20th century and 2004 Abel prize winner. Read his Wikipedia page for more details. While looking at the web for more information on him I found this additional quotation from him on the Go Geometry site: http://www.gogeometry.com/math_geometry_quotes/michael_atiyah_importance_geometry.html

Visual Learning

Our brains have been constructed in such a way that they are extremely concerned with vision. Vision, I understand from friends who work in neurophysiology, uses up something like 80 or 90 percent of the cortex of the brain…

Understanding, and making sense of, the world that we see is a very important part of our evolution.

Therefore spatial intuition or spatial perception is an enormously powerful tool and that is why geometry is actually such a powerful part of mathematics – not only for things that are obviously geometrical, but even for things that are not. We try to put them into geometrical form because that enables us to use our intuition. Our intuition is our most powerful tool…

I think it is very fundamental that the human mind has evolved with this enormous capacity to absorb a vast amount of information, by instantaneous visual action, and mathematics takes that and perfects it.

Possibly his most famous quote is this one – keep in mind his passion for geometry:
Closing thought

Algebra is the offer made by the devil to the mathematician...All you need to do, is give me your soul: give up geometry –Michael Atiyah

Posted in All Categories, Tidbits |

The Value of Teaching Concepts

Posted on April 10, 2009 by jisommer
I saw this article in Science Digest about some research done at Vanderbilt on the value of teaching concepts – something I have strongly believed in for many years.

You Do The Math: Explaining Basic Concepts Behind Math Problems Improves Children's Learning

ScienceDaily (Apr. 10, 2009) New research from Vanderbilt University has found students benefit more from being taught the concepts behind math problems rather than the exact procedures to solve the problems. The findings offer teachers new insights on how best to shape math instruction to have the greatest impact on student learning.

The research by Bethany Rittle-Johnson, assistant professor of psychology and human development at Vanderbilt University's Peabody College and Percival Mathews, a Peabody doctoral candidate, is in press at the Journal of Experimental Child Psychology.

Teaching children the basic concept behind math problems was more useful than teaching children a procedure for solving the problems " these children gave better explanations and learned more", Rittle-Johnson said. "This adds to a growing body of research illustrating the importance of teaching children concepts as well as having them practice solving problems."

In math class, teachers typically demonstrate a procedure for solving a problem and then have children practice solving related problems, often with minimal explanation for why things work.

With conceptual instruction, teachers explain a problems underlying structure. That type of instruction enables kids to solve the problems without having been taught specific procedures and also to understand more about how problems work. Matthews said. "When you just show them how to do the problem they can solve it, but not necessarily understand what it is about. With conceptual instruction, they are able to come up with the procedure on their own."

The study also examined whether having the students explain their solution to problems helped improve their learning. To test this, the researchers used the conceptual teaching approach with all students, and had one group explain their solution while the other did not. They found no discernible difference in performance between the two groups.

While self explanation has been found to be beneficial in previous studies, Rittle-Johnson and Matthews found that when the students were given a limited time to solve the problem, the benefit disappeared. This led them to suggest that part of the benefit of self explanation may come from the extra time a student spends thinking about that particular problem.

Self explanation took more time, which left less time for practice solving the problems. Matthews said. “When time is unlimited, self-explanation gives students more time to repair faulty mental models.

We found conceptual explanation may do the same thing and make self-explanation less useful.”
Rittle-Johnson is an investigator in the Vanderbilt Kennedy Center for Research on Human Development and in the Vanderbilt Learning Sciences Institute. The research was funded by the U.S. Department of Education.

Vanderbilt University (2009, April 10). You Do The Math: Explaining Basic Concepts Behind
Math Problems Improves Children’s Learning. ScienceDaily. Retrieved April 10, 2009, from http://www.sciencedaily.comÂ/releases/2009/04/090410143809.htm

Posted in All Categories, Methods |

Teaching Ideas from Professor Wildberger

Posted on April 5, 2009 by jisommer

Professor N J Wildberger is a mathematics professor at the University of South Wales and in his web site present some very helpful ideas on teaching. http://web.maths.unsw.edu.au/~norman/

Teaching ideas from Dr. Wildberger:
In my opinion here are the keys to successful mathematics teaching at the university level, in order of importance. These might be useful to young lecturers who are starting out on their teaching careers.

- Content
  The fundamental requirement for succesful teaching (actually at any level) is to have something to teach. In mathematics, this means content that is accessible, useful and interesting. Material should be aimed at the appropriate level for students, it should be seen to be useful by them, and it should stimulate them at the same time. All three aspects are necessary, and getting the balance right is not easy. Well chosen examples are particularly important for mathematics teaching.
- Preparation
  The second most important factor for successful mathematics teaching is careful preparation. You must know the material, have your examples worked out beforehand, and have thought about how best to structure the content, both at the global and local levels.
- Delivery
  The third most important factor is effective delivery. Without distorting your natural self, you should strive to be enthusiastic, friendly, and to talk and write clearly. There are many specific skills to be learned in this direction.
- Action
  Mathematics is an active subject. Students learn not only by reading and listening, but also by writing and more crucially by doing. It is thus valuable to structure mathematics learning so as to provide opportunities for students to take lecture notes, work actively in solving problems, and to write up and discuss solutions.
- Resources
  The right tools make any job easier. A well-designed book is an important aid in successful long term learning, particularly if written by an expert who has thought deeply about how to best

structure the subject. Be skeptical about the merit of quickly put together notes, especially common on the web.

Every Child Matters

Posted on February 25, 2007 by jisommer

"There was a lack of excitement about learning and some almost had a fear of creativity – they'd been told not to get dirty. We felt we had to move to a more personal, more creative curriculum."

While vacationing in London I read an article in the newspaper The Guardian about the United Kingdom's version of No Child Left Behind.

http://www.guardian.co.uk/everychildmatters/story/0,,1891127,00.html

They are also concerned about the effectiveness of their school and have developed a program for their school system named Every Child Matters.

The main objective of the USA and UK programs look to be very similar but I as I read the article I was struck by what I believe are some distinct differences. In the USA many people, including the government, have concluded we have serious issues in our education of the children and seem to have taken an approach widely used in business: You can't control what you can't measure or if you can't measure it you can't manage it. To encourage changes to take place a measuring stick of end of grade tests have been put in place to define the facts/skills which must be learned and how the success of a school/student will be measured. It is hoped with the installation of a measurement tool and punishment for not meeting measurement standards, we will improve our education of students.

What is missing from the strategy is a full understanding of the real reasons for declining learning for which productive solutions could be developed. I believe the UK approach addresses some of the root cause problems in education and have created a strategy and programs to address them. At the end of this article is a diagram which appeared with the article which illustrates the purpose and components of the program.

Here are some quotes from the articles which highlight key points of the UK approach.

- You can't take education in isolation and expect children to perform at their best without considering all the other factors they bring with them when they come in the door.
  They recognize factors outside of school can be inhibitors to a child's learning environment.

- ECM is designed to free up schools from the burden of providing services outside their central remit of teaching and learning "services that other agencies such as health, social care and law enforcement are equipped to do far better.
  It is also recognized the school is not the best place to address the outside factors but the program does need to provide alternatives.
- Teachers are now free to concentrate on teaching and learning.
  When a business works to improve a process, one thing it does it determine what is adding value and tries to eliminate or reduce non-value activities. The UK program wants the teacher's efforts focused on teaching and learning so as to utilize their talents and improve their effectiveness.
- Adult education classes have allowed poorly educated parents to learn basic skills.
  One of the other factors affecting the learning of children, especially those in the primary grades, is the influence and assistance of the parents. The UK program attempts to create learning opportunities for parents to better help their children, gain an appreciation of education and in many cases the parent has been able to improve and find new opportunities for themselves.
- There should be wide spread acceptance that responsibility for delivering the five outcomes, including safety and attainment is a shared one. If you bring kids into the world, you have a responsibility for them.
  The parents must realize and acceptance responsibility for the education of their children. The schools and teachers are a resource for them not their replacement.
- The clubs we put on offer children the chance to do things that middle class families do for their children automatically. A child can attend for £5 per club per term and charging gives parents a sense of ownership and improves attendance.
  An important part of a learning experience is exposure to new ideas, experiences, investigation and learning with others. By giving children access to opportunities and expecting the involvement of parents, children have more options than hanging around or watching TV.
- Tens of thousands of students who leave school every year with few or no qualifications. Changes to the 14-19 curriculums, which include plans for improved vocational qualifications, will be introduced with diplomas in 14 broad sector areas.
  Recently I read an article in our local paper which voiced concern about students leaving high school before graduating.

> The focus of the article, proposed solution, was consideration to raise the age when a student would be allowed to leave school. It seemed a bit odd there was no mention of why they were leaving and what changes could be made to encourage them to stay. The UK program saw that one program of study meets everyone needs and is working to develop a variety of programs to interest students and attain the aims of the strategy to enable all children to reach their potential, contribute to society and be equipped for the workplace in safety and in good health, at school and at home

And back in the USA we are still struggling with how to improve our educational programs. From the 2006 national test score report by Nancy Zuckerbrod – Associated Press Writer on Friday, February 23, 2007

Two federal reports out Thursday offer conflicting messages about how well high schoolers are doing academically.

One showed that seniors did poorly on national math and reading tests. The other, a review of high school transcripts from 2005 graduates, showed students earning more credits, taking more challenging courses and getting better grades.

The reality is that the results don't square said Darvin Winick, chairman of the independent National Assessment Governing Board, which oversees the tests.

Nearly 40 percent of high school seniors scored below the basic level on the math test. More than a quarter of seniors failed to reach the basic level on the reading test. Most educators think students ought to be able to work at the basic level.

I think that we are sleeping through a crisis said Massachusetts Commissioner of Education David Driscoll, a governing board member. He said the low test scores should push lawmakers and educators to enact school reforms.

The approach to fixing education reminds me of a story about the monkey and the banana – Drop the Banana.
http://www.foundationsmag.com/banana.html

You have probably heard about a rather interesting method they sometimes use when trying to catch a monkey for the zoo. It seems that trappers take a small cage out into the jungle. Inside the cage they place a bunch of bananas and then they close it, locking the bananas inside.

Now a monkey coming along and spotting the bananas will reach through the narrow rungs of the cage and grab a banana. But he can't get it out. And no matter how hard he tries twisting his hand back and forth he can't pull his hand through the rungs while hanging on to the banana. And even with the approaching trappers he won't let go of the banana. For the trappers, it's simply a matter then, of coming up and grabbing the monkey. Now if you were standing there in the jungle, watching all of this happen, and wanted to save the monkey, you might yell in exasperation, "Drop the Banana!"

Why are we continually plagued by long outstanding problems? Could it quite possibly be that that is the way we want it? We can get so comfortable doing what we have always done that we don't want to overcome the inertia of continuing on as we are. We don't want to drop the banana in our life because we really enjoy just doing what we have always done even if that behavior is not serving us well. There is a saying that "when you're in a hole, stop digging." Sometimes we just have to bring everything to a complete halt. Make an assessment of what is going on and make the appropriate correction. Self-examination is necessary for change. But it can be uncomfortable. Comfort is one of the most de-motivating forces on earth. It stops us from growing.

Is there too much comfort in the educational system? Is there a fear of making a change, a fear of self-examination? The current approach has serious flaws and the solutions are not out of reach but they do require getting out of a comfort zone and looking at education in a holistic manner and realizing the same approach does not work for

all.

Posted in All Categories, Methods |

A Crutch is Thrown Away

Posted on January 24, 2007 by jisommer

A favorite team building activity is based on simulated adventures. One example is where a group of people are involved in a plane crash in a remote area where all survive the crash but they now must survive the elements until they are rescued. The team is given a list of articles on the plane and asked to rate each of the items by importance. They rate them individually then as a group and finally the rankings from each rating are compared to the expert's ranking. The vast majority of the time the team's ranking is better than the individual rankings.

Based on my teaching and tutoring experience I think most students if faced with any situation which requires them to do any math would put a calculator high on the list. I have seen students grab a calculator to divide by 10, multiply by two, etc. Recently I was in a used bookstore to buy a couple of books and wanted to use a credit I had from previously selling some books back to the store. The store was crowded and the sales person was waiting to check me out. I was not sure why since the cash register was available. Soon I realized why, he was waiting to use the calculator to subtract the total book sale from my credit. Soon, to my delight, he turned to me smiling, "I just realized I don't need the calculator, I have a college education – I can subtract $5.65 from $8.00″. Which he then did correctly and was proud he did.

Posted in All Categories, Tidbits |

Spaces of Silence

Posted on October 1, 2006 by jisommer

'Silence' does not equate 'nothingness'. Get it? Au contraire, it is in silence that cogito slowly and slowly reveals itself. – Mitha Budhyarto

Introduction

The theme of one of our priest's homily was the need to pause, collect your thoughts, silence your attention to the rest of the world and seek a deeper understanding of yourself and God. He used the phrase "Spaces of Silence". The phrase caught my attention immediately. It is so simple, concise and yet powerful. It is very appropriate for the subject of his homily and the more I thought about the phrase the more I thought of extensions of its usage.

Silence of Learning

One such extension is in learning. How can we use silence to learn? Most likely the first thought for parents is to tell their children to turn off the music or television. This can be good advice for many children, but spaces of silence means much more and it does not always mean a reduction in sound.

The phrase is two words – spaces and silence. They are a team and have more meaning and power when used together. Michael Michalko has identified four steps in the learning process:

1. Investigation
2. Incubation
3. Illumination
4. Illustration

Incubation and Illumination are key steps in the learning, problem solving or creative process in which spaces of silence play a major role. Let's first look at what may appear to be unrelated examples but from which we may gain a better understanding of spaces of silence.

Spaces of Silence – Timeout

First let's consider a sporting event which is also a learning event. Most team sports are divided into quarters, periods, halves, etc. and also allow teams to request a defined number of short time out periods. What is the purpose of this down time? Part of the purpose is rest for the players, but a good coach use this time for themselves and the players to reflect on what they have learned about themselves and the other team that can be used to make adjustments and improve their performance. The space of silence is from the event and not a period of absence of sound.

I enjoy reading but have a pet peeve about the way some authors organize their books. Some authors go on and on with long paragraphs and even longer chapters. Ever notice how much easier it is to read an article or section of a book if it has some white space to help you break up the reading and thoughts? The section or chapter breaks give you a chance to stop for a moment, think about what you have read, reflect on how ideas in the book are developing and then move on. A skillful author provides well timed breaks (spaces of silence) to increase the enjoyment and understand of their writing.

A Pregnant Pause

Do you remember your formal days of education where you sat through lectures trying to take copious notes while still listening to the teacher and other student's questions? With some teachers this task went very well, with others it was almost impossible and you missed important topics or explanations. A good teacher or speaker is going to provide appropriate pauses for their audience to reflect, collect and organize the ideas which have been presented. Another phrase, very similar to spaces of silence comes to mind with this example. It is a pregnant pause. The original meaning of pregnant was full of significance. A good teacher uses a pregnant pause to alert the learner something of significance is coming or now is the time to collect what has been said and link it together two ideas from a previous learning experience.

A correctly placed space of silence from a speaker can make the difference between just a lot of talk or an enlightening experience for the audience.

Arthur Schnabel made this point well with this comment:

> "The notes I handle no better than many pianists;
> but the pauses between the notes – ah,
> that is where the art resides!"

Types of Spaces of Silence

At this point let's take our own pause and identify the different types of Spaces of Silence.

1. Regroup
   A pause from activities, stepping back and review where you are, reassess and adjust (feedback process). This is what we are doing at this time, a team does during the half time of a game or a good speaker practices.
2. Shield
   Creating a protective shield about yourself to shut out disturbances and silence the surroundings to allow you complete focus. An attribute my oldest son seemed to master.
3. Disengage
   Putting the current activity on hold and move on to another unrelated activity. Many times this will lead to an illuminating idea related to a previously shelved activity.
4. Cleansing
   This is similar to #3 but instead of pursuing an alternative activity youÂ clean the mind of current thoughts using day dreaming, meditation, etc.

Put up a Shield or Disengage

My oldest son has the ability to completely tune out everything around him when he becomes absorbed in something. It took us a few times but we eventually learned we had to get his attention first, and then talk to him. He was able to create a space of silence for himself, where space is not temporal but a zone around him with his own form of a force field to keep the rest of the world out of his thought process. Silence does not mean there is absolute quiet, but the ability to use the sounds around him to create a silence of interruption of thought. At times he would assist himself with a background of music which in reality was one of the components of his space of silence force shield. Not many people have the ability to focus so intently to create their own zone and each may have different methods. Most people struggle greatly to create a small and short lived space and others are more in tune with the distractions and appear to be looking for interruption. If you can create this space of silence, you will find the effort to be worthwhile. This is a form of meditation which is defined as: a state that is experienced when the mind dissolves and is free of all thoughts or focused on a single object [Wikipedia Encyclopedia].

Cleansing and Inspiration

For the incubation-illumination process to fully develop we sometimes need to silence the current thinking process, at least consciously.

Better said by Grant Wood: “All the really good ideas I ever had came to me while I was milking a cow”.

Hard work and more hard work sometimes just do not get the results and you reach a point where your effort has diminishing returns and may even eventually slow down or prevent you from solving the problem. Just as Grant Wood experienced, after an intense effort which seems to leave you at a roadblock, the best thing is to completely put the current problem out of mind.

Some people go to work on a completely different problem, some change to a different subject, some go the physical route and others may use a form of meditation. The objective is to silence the conscious mind from the current problem for a period of time. Your mind will unconsciously not forget about the problem and miraculously help you to make the unexpected connection (creative touch) needed to solve the problem. When you may least expect it, an inspiration presents you the answer you were working so hard to obtain.

Inspiration is critical to creative thought. Without sudden flashes of inspiration, we might never arrive at creative solutions to difficult problems. Without the fresh insight that intuition grants us, we might never see the forest through the trees. Flashes of inspirational thought can be stimulated in various ways. The Enchanted Mind

http://www.enchantedmind.com/html/creativity/inspiration/inspiration.html

web site has some good ideas regarding the process of inspiration.

For those who have experienced it they have found it to be a very satisfying experience. The moment of illumination occurs, it engages the emotions in such a way that it’s impossible to remain passive or indifferent. On those rare occasions when I’ve actually experienced it, I couldn’t keep tears from coming to my eyes – The Music of Primes by Marcus du Sautoy.

Senior Moments

Ever forget something? I mean something you just thought of a few moments ago. This experience is many times referred to as a senior moment, but anyone can experience it. One example is with people’s names. You see someone and know you know them and definitely know their name and while it is on the tip of our tongue, you just cannot remember it. You move on and then some time later it comes to you as clear as it can be and you wonder how it could have been forgotten. Many names, at that moment, you will also recall many other pieces of information about the person.

Otto Loewi, a scientist and Nobel prize winner, shared an experience of this type in his autobiography (here with additional comments from his nephew, Renate G Justin). "The night before Easter Sunday of that year [1920] I awoke, turned on the light, and jotted down a few notes on a tiny slip of thin paper. Then I fell asleep again. It occurred to me at six o'clock in the morning that during the night I had written down something most important, but I was unable to decipher the scrawl."

He would pause at this point and tell me how he had tried all day, unsuccessfully, to remember his dream and to interpret the scribbled note. He said that he went to bed early Sunday night and read for a while before turning out the light. Then, Onkel Otto continued, in an animated tone, he woke up at two or three in the morning, most unusual for him, and, yes, he knew what his dream had been about the previous night. He got up immediately and went to the laboratory. Dr. Justin includes a very appropriate poem from Agi Mishol:

for a thousandth of a second
I knew for certain
the secret of life
even if forgetting descended on me
and I forgot the moment I remembered
and not a word remained
except the taste of knowledge
– The Dream Notebook, Agi Mishol

Creativity and Spaces of Silence

Creating a space of silence for the mind to fertilize the mind for illumination is akin to creative thinking. Kathleen Fackelmann, in an USA Today article (August 28, 2006), interviewed Nancy Andreasen who gave advice on How to Give Your Mind A Workout. She advocates spending 30 minutes a day on creative work. Why wait for a difficult problem? Maybe an exercise regime for the mind will be as beneficial as physical exercise is for the body by reducing the number of times or the duration of spaces of silences.

Ms. Andreasen suggests:

Explore an unfamiliar area of knowledge. For example, people who use a lot of math on the job should sign up for a painting class.

Spend time each day thinking. Don’t censor your thoughts, but allow your mind to go freely to a problem and see what kinds of solutions or ideas surface.

Practice the art of paying attention. Look for and really observe a person, an object or something in your daily commute that you hadn’t really noticed before. Try describing or drawing that object in a journal or sketchbook.

Use your imagination. Spend time each day imagining a different world. What would it look like? What would you do there?

To nurture creativity in children

Read with your child every day. Make sure reading becomes an active experience in which you ask questions and point out new concepts to your child.

Emphasize diverse topics of study. Make sure your child is exposed to both the arts and sciences.

Encourage curiosity. Ask children interesting questions and get them to look around and think about the world in novel ways.

Get children interested in music. Studies have shown that musicians have more gray matter than non-musicians. Children can listen to music while doing another activity, such as playing.

Conclusion

Imagination is a shaping power that dissolves, diffuses, dissipates in order to re-create, extending our consciousness by providing a new unity to our perceptions; it is an echo. Samuel Taylor Coleridge wrote this about the imagination of God himself in his eternal creation. For me it is also a beautiful way to describe the power and benefits when we utilize spaces of silence.
Listen to the silence; it may be the most important thing you hear.

Posted in All Categories, Methods |

Value of Competition?

Posted on July 19, 2006 by jisommer

The Cubic Equation Competition
I recently finished reading Mario Livio's very interesting book The Equation That Couldn't Be Solved. In the book two different types of duels are presented, the famous pistol duel involving 20-year-old Evariste Galois and a lesser know duel involving Scipione dal Ferro, the first person ever to solve a cubic equation. The duel involving Nicolo Tartaglia and Scipione dal Ferro (and later a duel between Cardano's student and Tartaglia)Â is a mathematical duel of the mind in a day and age, where if you wanted to show how clever you were in math, science, the arts, theology or any subject you would challenge someone to a public debate – a duel. For some details on the duels and cubic equation go to an interview of Mario Livio.
http://www.mariolivio.com/symmetry-q-and-a/

My first reaction to the story was wow, what interest and enthusiasm there must have been in mathematics and science for people to consider such a public format and the fact it would generate enough interest to declare a winner of the duel. It then led me to think about competition in education.

Competition in Education?
I have seen a lot written condemning competition in schools, Alfie Kohn in particular. Scipione dal Ferro duel is just the type of competition Mr. Kohn abhors because it was vindictive in nature where his intent was to defeat and demean his opponent.
After reading several of his articles it is obvious he would like to remove competition completely from a child's experience. Claims it is only evil and does not have any beneficial effect. Competition, he says, is an obstacle to success and healthy competition is a contradiction in terms. He cites several studies to support his claims and yet does admit there is no problem with comparing ones achievement to an objective standard. With this last statement would deduce he is against competition where the competitor is another person.

Competition is a part of being human a natural (maybe even instinctive) response and means of development. We are doing our children a disservice to ignore it or shelter them from it. It will hit them in the face eventually, whether in college or trying to make a living. Mr. Kohn would like to replace cooperation and teams for competition. Both are important and valuable part of the learning experience but not mutually exclusive to competition. Anyone part of a team soon realizes each person is expected to contribute, you are valued by your contribution and within a team there are leaders and followers where each person assumes a role and certain responsibilities. Whether or not you have formal competition, it soon become obvious some people are better at some things than others.

“Every man in the world is better than someone else and not as good as someone else” – William Saroyan. You are not going to be the best or win everything (based on the common definition of a win) and it is wrong to approach a competition with the assumption that you will. If we use competition to identify and gloat the differences in people then I do agree we have a problem. But because we are all different competition (the comparison to others) is always going to exist. We need to teach our children how to compete because when done incorrectly it can be self destructive to oneself and others. Done correctly it can be very beneficial.

What is Competition?
According to Wikipedia, “Competition is the act of striving against another force for the purpose of achieving dominance or attaining a reward or goal, or out of a biological imperative such as survival. When you put it that way it does sound like something that does not have a place in an educational environment.

An old proverb defines competition this way: Competition is the whetstone of talent. Whetstone is an interesting choice of words to define competition. A whetstone is a stone used to sharpen a tool so it may perform to it up most capabilities and a whetstone is also a benchmark used to evaluate the performance of computers. This old proverb may provide us with better insight.

Why do I think it is worth spending time on the evil called competition? Because, as previously mentioned, I believe it is part of the human spirit and I believe there are benefits. Let me illustrate with a very simple example. I am a runner and running long distances is a mostly an individual experience. Most of my runs are done alone with many of them in the darkness of early morning. I started running distance late in life and at my age, late fifties, you are not running to beat the world. For the most part I run against time and distance and monitor my mile pace against my own standard. Normally my standard is set by my own assessment of my effort and dedication to a regular schedule.

Several times a year I run in competitive races against others from all ages and yes I do get a great thrill when I pass someone younger than me. When I run a race I have a pace in mind and also hope to finish in the top third of my age group. Thus I compete against a self made standard and others (who I do not know or probably will never meet again).

When I compete in a race I am competing against a non-person person. It is a generic person of a certain age and ability to which I compare and assess myself. Recently my pace got a little slower, most probably I thought from just getting a bit older. Seemed reasonable and I adjusted my standard. A good friend of ours also runs and she told me about her recent 5K time, which was really very good. I was very happy for her and decided just maybe I could improve my pace a bit she inspired me to improve. Within a couple of weeks I was back to my previous pace, dropped 10 seconds of my mile pace on my 10 mile runs and felt better about myself. Contrary to Mr. Kohn's conclusion that there is no such thing as healthy competition, I found this bout with competitive spirit to be very healthy.

John Bingham is also a runner and has written several wonderful books about running. He loves running but is not the fastest, not even in the top half of most running events, but he loves the competitive runs. His love of running has combined with his writing talent to write articles for Runner's World magazine and this link to Survival of the Slowest http://www.johnbingham.com/cc_survival_slowest.html

offers some great insight into how to compete. I would like to pull some particularly relevant comments from the article. "But my limited talent doesn't mean I can't, or shouldn't run. More importantly, it doesn't mean that I'm not a runner." We need to make sure our students understand the result or ranking of a competition does not automatically tell them they are not good at that type of competition and should give up and never try it again. "Some runners, and even well meaning non-runners, interpret our position in the pack as a measure of our effort.

Nothing could be further from the truth. We – the few, the proud, the plodding – very often train as much as, or more than, fast runners." Not finishing at the top does not always mean lack of effort or dedication. "It's not a matter of trying. It's not a matter of motivation. It's just a matter of speed." Innate ability is an important factor. But you are not totally limited by your innate ability. Those who know how to compete and how to reap the benefits can achieve more than others with more talent. “I am the best runner I know how to be. Every day is an opportunity to improve. Every time I run, I try to be better.”

Let’s build a better definition of competition. First remove the notion in competition there is only one winner and any loser must feel badly after the competition. Secondly understand there is not just one opponent and the opponent is not always a person. If you ask someone who is their competition they will normally answer quickly and identify another person, team, another company or a standard.

This is how most people will measure the win or loss as the comparison of how well you or your team did against the competition. While this is not incorrect, there is really more to the question and if a student is going to compete in a beneficial manner they must understand all of the opponents in a competition. The most important opponent is you.

Principles Questions of Competition:
In order to benefit and understand competition we need to help the student to understand themselves. This means they must know how to answer the Principles Questions of Competition:

- What are my areas of strengths and weakness, What am I capable of doing
- What are my goals and dreams, what are my plans to achieve them
- How do I measure myself
- How will I handle my wins and losses

Competition can play an important role in developing answers to these questions.

When I was teaching in a seminary where we had students from many areas of the country I coached the basketball team. This was in the heart of high school basketball in Indiana where the high school gyms are larger than many college gyms. The team was not blessed with a lot of talent but it was a good group of kids. We had a tough season as far as wins and losses. I remember one game in particular which told a lot about this team. We were playing one of the better teams in the area at home and like most games were outmatched in talent. The game ended with us losing by around twelve points but at the end of the game the crowd gave our team a standing ovation and the other team came over to congratulate us. Our team played very well, more than achieved our goals and for us it was a win and the players felt very good about themselves, as well they should.

I taught a pre-algebra mathematics course at a technical college and one semester had a young lady who came in and told me the first night she did not like math, was not good at math but needed to pass this course and was going to work as hard as she could. She set a stretch goal for herself and her competition was the other students, the tests and mathematics. Everyone came into the class with the at least an implied goal to pass the course otherwise why take the class. But not everyone came into the class to compete, she did. What was the difference – Her attitude, plan, understanding of the opponents, goals, and keep her focus on the goal and make adjustments to the interim wins and losses. As I am sure you have guessed, she passed the course, actually received a B. She did not win top grade in the class, several finished ahead of her but as far as she was concerned (and me) she won.

Base Requirement of Competition

Now back to improving the definition of competition. From Wikipedia, Continuous Improvement is defined using the Japanese word Kaizen. An important component of Kaizen is critically important to defining competition: kaizen must be practiced in tandem with the Respect for People principle. Without Respect for People, there can be no continuous improvement. Instead, the usual result is one-time gains that quickly fade. The Base Requirement of Competition is respect for people involved which includes you, teammates, support people and opponents. Competition earns its evil reputation when this component is missing. If we can instill in our students that this must be a part of any competition, we will have had a positive influence on them and improved competition for all involved.

Mr. Kohn states there is a fundamental confusion between excellence and competitiveness. He considers them diametrically opposite. He also is inclined to believe quality learning and competition are mutually exclusive. He gives several studies which he says support his claims and while I don’t have the facts of the studies, my own experience suggest there can be a positive correlation between quality learning and competition as a tool. I believe he misunderstands how to compete by using a very limited definition of competition. This is especially evident by his belief that a competitor’s single brain often shuts off when given no reason to learn except to triumph over his or her classmates. All of his beliefs and statements are based on competing badly. Almost anything done badly will have poor results. There is plenty of evidence of top quality competitors and coaches/teachers who guide them and instruct them in how to compete. College football, especially at the Division 1 level, is very competitive and you do see a lot of win at all cost coaches and schools.

But you also see some top notch competitors and coaches who teach their players much more than how the beat the competition.
The University of Notre Dame is a high profile school in college football. They hired a new coach who of course is under a great deal of pressure to win. He is very good at his profession and stated he would bring a nasty attitude to Notre Dame Football. Sounds just like the competition Mr. Kohn dislikes so much. Here are a couple of examples illustrating how some very positive learning can come from a highly competitive environment.

The new coach, Charlie Weis, went to visit a very ill child the week before Notre Dame played Washington who just happens to be coached by the man who was just fired from Notre Dame. The boy has a brain tumor and the prognosis is not very good. Weis talked with him, joked with him and asked him if Weis could do anything for him. The boy, Montana (name after Joe Montana), asked Weis to call pass right for Notre Dame's first play of the game. Montana died the Friday before the game and Weis called the mother to tell her the request will still be honored, the game is for Montana. Well ND first play was from their one yard line (after a fumble) and Montana's mother was sure the play would not be called, it would be foolish. The ND quarterback had the same thought but Weis said we have no choice, we throw right. The pass was thrown to the tight end and he caught the pass and started to run up field and with his large frame leaped over a defender for a 13 yard gain. Montana's Mom was overwhelmed and Weis took a signed game ball to her.

Later in the season ND was playing Navy. Navy was not a ranked team but always give them a good game. The game was close early but then ND took control and won the game. Weis has a great respect for Navy as a team and as a source of people to defend our country. After the game he and the team walked from one end of the field to the other passing by a field of reporters wanting interviews to the Navy corner and joined in with the cadet's fans in honoring the Navy team.

Summary
We do more harm to our students by discouraging it and not helping them to be quality competitors. We strive to prepare them to benefit themselves, their families and society and competition is a part of their lives no matter how some try to ignore it in hope it will go away. Competition can be done well if we teach our students how they can

develop answers to the Principle Questions of Competition and ensure they understand the Base Requirement of Competition then more will be achieved in school and each will be better prepared learn from their experience and teach themselves.

Here are two quotes which help to summarize an appropriate attitude and approach to competition:

"Competition is easier to accept if you realize it is not an act of oppression or abrasion – I've worked with my best friends in direct competition" – Diane Sawyer.
Learn and grow from competition – not to destroy (your opponent or yourself) or degrade.

"Mountains should be climbed with as little effort as possible and without desire. The reality of your own nature should determine the speed. If you become restless, speed up. If you become winded, slow down. You climb the mountain in equilibrium between restlessness and exhaustion. Then, when you're no longer thinking ahead, each footstep isn't just a means to an end but a unique event in itself." – Robert Pirsig.

It is a personal endeavor – motivated internally. Each competitive event has meaning for you and is evaluated for its current value and enjoyment from which you can learn and be an aid to your next and long term goal.

Posted in All Categories, Methods |

Favorite Mathematics History Books

Posted on July 4, 2006 by jisommer

Quality use of mathematics history in the teaching of mathematics is important to improve understanding, appreciation and opens up more learning options in mathematics for a wider group of students.

Here is a list of many of my favorite books related to mathematics and science history.

For a current list check www.jsommer.com/booklist/

1	A Beautiful Mind: The Life of Mathematical Genius and Nobel Laureate John Nash	Nasar, Sylvia	743224574
2	A Mathematician's Apology (Canto)	Hardy, G. H.	521427061
3	A Pirate of Exquisite Mind : The Life of William Dampier: Explorer, Naturalist, and Buccaneer	Preston, Diana	042520037X
4	Codebreaker's Victory: How the Allied Cryptographers Won World War II	Haufler, Hervie	451209796
5	COMPLEXITY: THE EMERGING SCIENCE AT THE EDGE OF ORDER AND CHAOS	Waldrop, Mitchell M.	671872346
6	Cuckoo's Egg: Tracking a Spy Through the Maze of Computer Espionage	Stoll, Clifford	743411463
7	Descartes's Secret Notebook : A True Tale of Mathematics, Mysticism, and the Quest to Understand the	Amir D. Aczel	767920333
8	e: The Story of a Number	Maor, Eli	691058547
9	Euclid's Window : The Story of Geometry from Parallel Lines to Hyperspace	Mlodinow, Leonard	684865246
10	Fermat's Enigma : The Epic Quest to Solve the World's Greatest Mathematical Problem	SINGH, SIMON	385493622
11	Fermat's Last Theorem : Unlocking the Secret of an Ancient Mathematical Problem	Amir D. Aczel	385319460
12	FUZZY LOGIC: THE REVOLUTIONARY COMPUTER TECHNOLOGY THAT IS CHANGING OUR WORLD	Mcneill, Daniel	671875353
13	Gamma : Exploring Euler's Constant	Julian Havil	691099839
14	Hitler's Scientists: Science, War, and the Devil's Pact	Cornwell, John	670030759
15	In Code: A Mathematical Journey	Flannery, Sarah	761123849
16	Journey Through Genius: The Great Theorems of Mathematics	Dunham, William	014014739X
17	Longitude : The True Story Lone Genius Who Solved Greatest Scientific Problem his Time	Dava Sobel	140258795
18	Mauve: How One Man Invented a Color That Changed the World	Garfield, Simon	393323137
19	Meta Math! : The Quest for Omega	Gregory Chaitin	375423133
20	Pendulum : Leon Foucault and the Triumph of Science	Amir D. Aczel	743464788

21	Prime Obsession: Bernhard Riemann and the Greatest Unsolved Problem in Mathematics	Derbyshire, John	309085497
22	Prisoner's Dilemma/John Von Neumann, Game Theory and the Puzzle of the Bomb	Poundstone, William	038541580X
23	Socrates Cafe: A Fresh Taste of Philosophy	Phillips, Christopher	039332298X
24	Surely You're Joking, Mr. Feynman!	Feynman, Richard P.	393316041
25	Takedown: The Pursuit and Capture of Kevin Mitnick, America's Most Wanted Computer Outlaw-By the Man	Shimomura, Tsutomu	786862106
26	The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography	Singh, Simon	385495323
27	The Equation That Couldn't Be Solved: How Mathematical Genius Discovered the Language of Symmetry	Mario Livio	743258207
28	The Lady Tasting Tea: How Statistics Revolutionized Science in the Twentieth Century	Salsburg, David	805071342
29	The Man Who Knew Infinity: A Life of the Genius Ramanujan	Kanigel, Robert	671750615
30	The Man Who Loved Only Numbers : The Story of Paul Erdos and the Search for Mathematical Truth	Hoffman, Paul	786884061
31	The Measure of All Things : The Seven-Year Odyssey and Hidden Error That Transformed the World	Ken Alder	743216768
32	The Music of the Primes : Searching to Solve the Greatest Mystery in Mathematics	Marcus du Sautoy	60935588
33	The Mystery of the Aleph : Mathematics, the Kabbalah, and the Search for Infinity	Amir D. Aczel	743422996
34	The Pleasure of Finding Things Out: The Best Short Works of Richard P. Feynman	Feynman, Richard P.	738203491
35	The Riemann Hypothesis: The Greatest Unsolved Problem in Mathematics	Sabbagh, Karl	374250073
36	The Victorian Internet	Tom Standage	802713424
37	Tuxedo Park: A Wall Street Tycoon and the Secret Palace of Science That Changed the Course of World	Conant, Jennet	684872889

Posted in All Categories, Tidbits |

The USE of Calculators

Posted on April 7, 2006 by jisommer
I read an article recently which listed the proponent and critic's arguments regarding the use of calculators in the classroom. The emphasis of the discussion should be on the word USE.

Calculators and computers are tools for the mathematics student and teacher. Just like any tool, one needs to understand how to use it and when to use. I am reminded of the quote from Abraham Maslow (also used by one of my college professors): "If the only tool you have is a hammer, you tend to see every problem as a nail."

As an educator we do not want to lose focus on the particular objectives of a lesson. The question then becomes, how may the calculator aid in meeting the objectives? Let's first look at ways we can utilize the calculator.

- Lookup tables
  In the 'old days' many textbooks carried tables in the back of the book with information such as trigonometric and logarithm functions. The standard for books of mathematics' information was the CRC Standard Math Tables book. The calculator can be a very good portable source for look up tables. Although one does lose the practice of interpolation of 'in between' entries.
- Tedious Calculations
  The calculator can be great at perform 'nasty' calculations in which the process of doing so no longer reaps any educational benefit. Sometimes the word Rote is used to describe this activity.
  We need to understand that the definition of Rote is:
  A memorizing process using routine or repetition, often without full attention or comprehension. In most cases the value of the calculator comes after comprehension of the calculation process.

  I also caution against overuse (the hammer analogy again). I have seen many students pull out the calculator to do 2 + 2 or 10 times a number. One young lady I was tutoring for SAT exam panicked the first night because she forgot her calculator. By the end of the evening I think I convinced her it wasn't really needed except for a small number of problems she never worried about it again and rarely used it when is was right at hand.
- Graphing
  This is very similar to the Tedious Calculations usage. The new

graphing calculators can be of great benefit checking one's work or quickly seeing a graph of a function. If used correctly, the graphing calculator is a great tool to teach about graphing by hand since it is easy to show the effect of changes in an equation's parameters/coefficients to aid in understanding the characteristics of a function.

- Simulation
  A more general extension of what I described in Graphing. In many situations it is helpful to see multiple examples or carryout multiple calculations with carefully designed changes to parameters. Seeing the effects of the changes can enhance one's understanding. Similar to a science class where the running of several experiments with appropriately changed variables give the student data to make inductive or deductive conclusions.
- Numerical Analysis
  I marvel at the patience and skills of mathematicians of earlier centuries when they had to calculate by hand series or other iterative calculations. The calculator and computer are a great tool to the student to perform the same type of analysis in much less time and effort.
- Programming
  Most educators seem to never address this topic with students. It is an extension of the calculator tool. The TI83, TI92 calculators have quite a bit of programming power in them and yet I see very few students or teachers taking advantage. When I left teaching, I started a career as a programmer. I learned when teaching, a great way to learn a topic is to teach it to some one.
  Also, a great way to understand a process is to be able to teach (program) a calculator/computer to do the process. The programming languages of calculators are not complex or abstract and many students would find programming very interesting and useful.

As with any tool, one's skill and understanding of the tool enhances it effectiveness. And, as expressed by Charles Babbage, we do not want to imply more from the tool than it can deliver.
On two occasions I have been asked [by members of Parliament], 'Pray, Mr. Babbage, if you put into the machine wrong figures, will the right answers come out?' I am not able rightly to apprehend the kind of confusion of ideas that could provoke such a question.

Posted in All Categories, Methods |

May I Ask a Question?

Posted on March 28, 2006 by jisommer

What shapes our lives are the questions we ask, refuse to ask, or never think to ask. – Sam Keen

I recently finished reading two books, A Pirate of Exquisite Mind and Socrates Cafe. The first was about pirate William Dampier and the second about a professor reviving Socrates methods in an informal cafe setting. A pirate is defined as "A ruthless speculator or adventurer". What could a pirate and a great philosopher possibly have in common? I would suggest Nichtwissen.

I came across this word in an article by Harrison Owen named "Opening Space for Nichtwissen. He states: the German word Nichtwissen dictionary supplied translation is Ignorance. So what English word might communicate the essence of Nichtwissen (which literally means no knowledge, state of not knowing)? Something positive and useful; the condition precedent to knowledge? I think the word might be question.

For most people, the word question and Socrates have a strong correlation. From Socrates Cafe, Socrates method is described as: "Socrates did not teach in the regular way. He held no classes and gave no lectures and wrote no books. He simply asked questions. When he got his answer he asked more. Socrates asked his questions in order to make people think." The more questions you have, the firmer the footing you are on. The more you know yourself. The more you can map out and set a meaningful path for your future.

If you asked people to think of words to describe a pirate, most likely the word question would be low on the list – if at all. And yet, the more I read about pirates the more I learn the typical stereotype is not completely correct. Pirates, within their group, created and practiced one of the first forms of democracy. On board ship a set of articles (rules of conduct) governed the ship. The rules included: creation of a council to delegate duties of the crew, workman's compensation program for injuries sustained during the voyage, voting by the crew determined the level of punishment for offensives, voting on major decisions regarding attacks and course, and strict rules on association with women. Most likely they created this democracy because many faced injustice from society (over one third of the pirates were former slaves and many others experienced the rule of cruel monarchy). How could we set up a better system they probably asked?

Pirates were also a very literate group with over 70% level of literacy (a literate person at this time was also one who could sign their name). Diana & Michael Preston in A Pirate of Exquisite Mind surmised the relatively high level among sailors is reflected partly due to the intelligence of those sufficiently curious to want to see the world and partly the requirement to read charts.

William Dampier is considered to have been an explorer, naturalist, author and buccaneer. He became a model for writing travel books. Jonathan Swift and Daniel Defoe used Dampier's writings as a source for their books. His detailed account of his journeys and astute observations of the environment, geography, maps, weather and animal life became the bible for many current and future explores. Dampier can claim more than 1000 entries in the Oxford English Dictionary. Inscription on his memorial: Thrice he circumnavigated the globe. An exact observer of all things in Earth, Sea and Air he recorded the knowledge won by years of dangers and hardships in Books of Voyages and a Discourse of Winds, Tides and Currents

Dampier's last trip was made while he was in his 50s. The journeys were filled with hardship and many dangers. What drove him? In part it was the chance of a fortune from a well laden ship. His initial objective was to pursue the bounty of other ships but his curiosity, atypical pirate interests and powers of observation provided him with real satisfaction. He asked why, how, related in what ways, what deductions could be made? He was then able to understand the weather, nature, navigation, etc. better than anyone at this time.

The book Socrates Cafe shares the author's experience in coffee houses, book stores and other small gatherings to share ideas and experience. In the book about Dampier, the author describes the atmosphere of a coffee house in the Seventeenth-century. It was an era of intellectual and political ferment where ideas could transcend status. London's lively coffeehouses, where Dampier probably pursued his contacts, exemplified this. England's first coffee house had been opened by a Jewish immigrant in Oxford in 1650. The first in London had followed two years later and proved so popular that by 1700 there were more than 2,000 in the city. They were convivial, democratic establishments where men of all pursuits and backgrounds rubbed shoulders. Entrance cost a mere penny, and a man could spend much of the day drinking a dish of coffee costing about one and a half pence and debating the state of the world with other drinkers.

I tutor mathematics to high school and college students. Many times my students will look at a problem and remark they have no idea how to solve it, nor where to start. I start by asking them a few questions; no answers from me just questions. Almost all of the time, after a few directed questions, they have figured out how to solve the problem. James Krenov is a wonderful cabinetmaker and teacher. Ellis Walentine made this comment about his teaching style (a modern version of the Socratic method): In his quick, self-effacing and sometimes impish way, he delivers his critiques in the form of questions and oblique suggestions, which convey his point without becoming too didactic. My experience in working with students has taught me one of the most important skills a student needs to learn is what questions to ask.

George Polya's problem solving process in his famous book, How to Solve It, can be summarized as these steps and typical a questions: Understand (what do I know, what do I need to solve, how can it be restated?, related to another problem?), Plan (organize, write/draw what I know, create an approach/path), Carry Out the Plan (give it a try, adjust), Look Back (will this be useful later, how else can it be applied?).

Stephan Shapiro 24/7 Innovation made the following observation. When a good detective sets out to analyze a crime scene or investigate a case, he never starts by asking what evidence can I gather? He's much smarter that that. His first question is: What are the questions I need to answer in order to allow me to solve cases?

When I was teaching at a boarding school I had a class ask if they could do their homework in the classroom – they felt their work was more productive in that room. They had not yet realized the key to their learning was the series of questions which lead them to understanding. No one questions, no one wonders, no one examines like children. It is not simply that children love questions but they live question. Socrates Cafe. Too bad many lose this skill and have to work so hard to re-develop. From Conceptual Block Busting by James Adams: The first reason we lose our questioning attitude is we are discouraged from inquiry. After a child reaches a certain age, parents and others are often no as patient with questions (especially if they are busy or do not know the answer). The second reason the child's inquisitive nature is socialized out of us (or at least diminished) has to do with the great knowledge game. We learn as we grow older that it is good to be smart. Smart is often associated with the amount of knowledge we posses. A question is an admission that we do not know or understand something [Nitchtwissen]. We therefore leave ourselves open to suspicion we are not omniscient.

A teacher is tempted to emphasize the facts and push students to obtain the answers (teaching to pass a particular test). Martin Heidegger put it well as he described teaching: Teaching is more difficult than learning because what teaching calls for is this: to let learn. The real teacher, in fact, lets nothing else be learned than learning. His conduct, therefore, often produces the impression that we properly learn nothing from him, if by learning we now suddenly understand merely the procurement of useful information.

Learning what and how to ask questions is a key to fully understanding and learning the material. We need to form links to what we already know. Retention rate and comprehension is increased dramatically if this is done. From Learning to Use What You Already Know, Until one connects the experience and finds the patterns among them, or places the experiences into context additional to those in which the experience occurred, learning is not likely to take place. I talked to a high school student taking a statistics and was amazed at the pace and quantity of material the teacher required. The teacher moved from current topic to the next topic with great speed and made great use of a powerful calculator to solve most of the problems. At the end of the course the student received a grade of B+. While happy about his grade he felt he had very little understanding of the material. He learned to follow a process, without any knowledge of why or how each part was related to the others. He commented, he will take it again in college and hopes this time to learn the material. In one week

I received several calls to tutor some students in Calculus, all from the same school and teacher. They are good students but in a panic. The school has moved to block scheduling (a little longer class in which they cover a year long course in one semester). They are moving so fast in the course one student said all she can do in the class is writing as fast as she can with no time to think or ask questions; very poor learning environment.

Teaching someone how to learn opens up a world of adventure and knowledge and provides one the tools for one to continue for themselves. From the web site From Now On (www.fno.org):
"Questions allow us to control our lives and allow us to make sense of a confusing world, they are tools that lead to insight and understanding. If all you have is the technology, you are not an information producer, you are just a consumer."

Remember: Asking questions is a very good way to find out about something. – Kermit the Frog.

Posted in All Categories, Methods |

How to Solve It

Posted on March 21, 2006 by jisommer

Ask most students what they think about their math class and you will most likely get a negative response. Boring, will never use it, can't understand it, etc. Yet many of these same students love to watch one of the popular detective/crime shows such as CSI. What's the connection to a detective show? – Problem Solving. I picked CSI because of its popularity (several versions of it) and also because its attraction is not the physical fights or gun battles. It is really is about science and solving the puzzle.

The study of mathematics is a great training ground in problem solving techniques useful in areas other than mathematics.

"Solving problems is a practical art, like swimming, or skiing, or playing the piano: you can learn it only by imitation and practice. . . . if you wish to learn swimming you have to go in the water, and if you wish to become a problem solver you have to solve problems.- Mathematical Discovery"

Many students struggle with mathematics or any hard problem (hard being on in which the answer is not readily known) because they do not know where or how to start to solve it. Stephan Shapiro 24/7 Innovation made the following observation. When a good detective sets out to analyze a crime scene or investigate a case, he never starts by asking What evidence can I gather? He is much smarter that that. His first question is, What are the questions I need to answer in order to allow me to solve cases?

In this post, I would like to present problem solving approaches from four different individuals – Walter Shewart, Leonardo DaVinci, George Polya and Rene Descartes. I think you will see the approaches have a lot in common.

Walter Shewart is considered the Grandfather of Total Quality Improvement and a mentor of Dr. Demming (quality guru who played a big role in Japan's success in manufacturing, sometimes referred to as the father of modern quality control). He developed a process to analyze and solve process problems so a person or company can improve. His process is called the Shewart Cycle (or the improved version Deming Wheel)Â and many times is referred to as PDCA. It is an iterative approach which has proven to be effective.

- PLAN
  Define the problem, fully understand what is known, objectives, constraints
  Develop processes necessary to deliver results in accordance with problem
- DO
  Set criteria and select a solution process
  Create and try potential solutions
  Select an approach, work it out, document
  Implement solution
- CHECK
  Evaluate results against objectivesÂ
  Cross check via other methods when possible
  Does is make common sense?
  May need to go back to Plan if not satisfied with the results
- ACT
  Can you use this solution in other similar problems?
  Can it be extended or generalize to apply to others?

Michael Michalko wrote a book called Thinking Like Genius: Eight Strategies used by super creative from Aristotle and Leonardo to Einstein and Edison. Here are his 8 steps (also see http://www.studygs.net/genius.htm): The emphasis is creative problem solving.

1. Look at problems in many different ways, and find new perspectives that no one else has taken (or no one else has publicized!)
2. Visualize! Draw it.
3. Produce! A distinguishing characteristic of genius is productivity. It is okay to not do it right the first time – you learn from mistakes (Edison did).
   -> The next 4 have very similar purpose – look at the problem with a fresh approach.
4. Make novel combinations. Combine, and recombine, ideas, images, and thoughts into different combinations no matter how incongruent or unusual. One definition of creativity is the ability to make unexpected connections.
5. Form relationships; make connections between dissimilar subjects. Use what you have learned in math in a history class, etc.
6. Think in opposites. Another technique to make unexpected connections or novel combinations.
7. Think metaphorically. Direct comparison between the unrelated.

8. Prepare yourself for chance. In other words, failure. Many times you can learn more from what went wrong than if you got it exactly right the first time.

George Polya (1887-1985) was a great advocate in encouraging the use of problem solving in learning mathematics. He wrote a classic book How to Solve it. He also published a two-volume set, Mathematics and Plausible Reasoning (1954) and Mathematical Discovery (1962). These texts form the basis for the current thinking in mathematics education and are as timely and important today as when they were written. Polya has become known as the father of problem solving.
Here are his four principles of problem solving from How to Solve it: (with some of my additions, also see http://www.mathgym.com.au/htdocs/polyab.htm)

1. UNDERSTANDING THE PROBLEM
   First. You have to understand the problem.
   What is the unknown? What are the data? What is the condition? Is it possible to satisfy the condition? Is the condition sufficient to determine the unknown? Or is it insufficient? Or redundant? Or contradictory?
   Draw a figure. Introduce suitable notation.
   Separate the various parts of the condition. Can you write them down?
   This step is all about learning to ask the right questions.
2. DEVISING A PLAN
   Second. Find the connection between the data and the unknown. You may be obliged to consider auxiliary problems if an immediate connection cannot be found. You should obtain eventually a plan of the solution.

   Have you seen it before? Or have you seen the same problem in a slightly different form?
   Do you know a related problem? Do you know a theorem that could be useful?
   Look at the unknown! And try to think of a familiar problem having the same or a similar unknown.
   Here is a problem related to yours and solved before. Could you use it? Could you use its result? Could you use its method?

   Should you introduce some auxiliary element in order to make its use possible?

Could you restate the problem? Could you restate it still differently? Go back to definitions.

If you cannot solve the proposed problem try to solve first some related problem. Could you imagine a more accessible related problem? A more general problem? A more special problem? An analogous problem? Could you solve a part of the problem? Keep only a part of the condition, drop the other part; how far is the unknown then determined, how can it vary? Could you derive something useful from the data? Could you think of other data appropriate to determine the unknown? Could you change the unknown or data, or both if necessary, so that the new unknown and the new data are nearer to each other?

Did you use all the data? Did you use the whole condition? Have you taken into account all essential notions involved in the problem?

3. Carry out your plan.
   Carrying out your plan of the solution, check each step. Can you see clearly that the step is correct? Can you prove that it is correct?
   Does it pass the common sense test?

4. LOOKING BACK
   Examine the solution obtained.
   Can you check the result? Can you check the argument?
   Can you derive the solution differently? Can you see it at a glance?

   Can you use the result, or the method, for some other problem? What do you need to remember for later use, how will you remember?

   Notice the similarities to the first two approaches to problem solving. The approach is fundamental, applicable to many areas other than mathematics. Mathematics makes for a great training ground to build one's skills and your Problem Solving Maturity.

   Polya: "One of the first and foremost duties of the teacher is not to give his students the impression that mathematical problems have little connection with each other, and no connection at all with anything else. We have a natural opportunity to investigate the connections of a problem when looking back at its solution."

Rene Descartes was a mathematician and philosopher. In his book Discourse on Method he identifies fours laws for scientific and philosophical research. The laws are foundation for development of logical thought process – in mathematics referred to as proof. Let's take a look at how we may apply these laws to problem solving.

1. To accept nothing as true that is not recognized by the reason as clear and distinct;
   Understand the information and constraints of the problem. Don't read something into the problem or imply 'truths' not specifically stated. Note all that is known as this will be the base upon which to build the solution.
2. To analyze complex ideas by breaking them down into their simple constitutive elements, which reason can intuitively apprehend;
   Divide and conquer the problem. Break it down into manageable parts. Understand each element as well as relationships among them. Solutions to simpler elements or similar and less complex problems can be the guide you desire. A quote from DescartesÂ "Divide each difficulty into as many parts as is feasible and necessary to resolve it."
3. To reconstruct, beginning with simple ideas and working synthetically to the complex;
   Build your solution from the base elements – synthesis. From the Oxford dictionary: "the process or result of building up separate elements, especially ideas, into a connected whole, especially into a theory or system".Â
4. To make an accurate and complete enumeration of the data of the problem, using in this step both the methods of induction and deduction.
   Build upon what is known, subsequent deductions and understand the linkage and contribution of each. This process will ensure your solution has credibility.

"Each problem that I solved became a rule, which served afterwards to solve other problems. "
Rene Descartes

Posted in All Categories, Methods |

A mathematician, a physicist, and an engineer

Posted on March 17, 2006 by jisommer
Probably don't see many mathematics jokes so here is one I ran across when I was tutoring a student in symbolic logic.

A mathematician, a physicist and an engineer were traveling through Scotland when they saw a black sheep through the window of a train.
"Aha" says the engineer, "I see that Scottish sheep are black."
"Hmm" says the physicist, "You mean that some Scottish sheep are black."
"No", says the mathematician, "All we know is that there is at least one sheep in Scotland, and at least one side of the sheep is black!"
The process of inductive reasoning can be powerful, necessary and also lead one to making false assumptions.

From Wikipedia, the free encyclopedia
In traditional Aristotelian logic, deductive reasoning is inference in which the conclusion is of no greater generality than the premises, as opposed to deductive and inductive reasoning, where the conclusion is of greater generality than the premises. Other theories of logic define deductive reasoning as inference in which the conclusion is just as certain as the premises, as opposed to inductive reasoning, where the conclusion can have less certainty than the premises.

I see many students using their inductive reasoning to develop a general means of solving a particular type of problem. Many times they have made false assumptions and their method will not work for a wide variety of problems. But I am thrilled with the effort to make a generalization. That is a key part of the study of mathematics. They do need to learn the deductive part of reasoning to ensure the validity of the result of their inductive powers. I have had some students develop some pretty wild algorithms that have taken me a while to show the scope of applicability was not as large as they first believed. The challenge for the teacher is then to try to show how they can either use the student's inductive proposal to develop the accepted method or work through a similar thought process with them to reach the desired conclusion. In this way they get to fine tune their deductive reasoning. Wild ideas and approaches can lead to some very useful theories.

"An idea can turn to dust or magic depending on the talent that rubs against it." – William Bernbach advertising executive.

Posted in All Categories, Methods |

19th Century Mathematician's Education Advice

Posted on March 11, 2006 by jisommer

Mario Livio's book The Equation That Couldn't Be Solved: How Mathematical Genius Discovered the Language of Symmetry gives an account of Evariste Galois life and his development of Group Theory. Galois had many difficulties in school and offered his assessment of problems with the methods used to teach mathematics. I found his comments in 1831 to be still applicable today. The following is from a letter he wrote to the school officials.

"Until when will the poor youngsters be obliged to listen or to repeat all day long? When will they be given some time to reflect on this accumulation of knowledge, to be able to coordinate [find pattern in] this endless multitude of propositions in these unrelated calculations? … Students are less interested in learning than in passing their exams. … What is the origin of this deplorable habit of complicating the questions with artificial difficulties?"

His critique could be written today. Too much attention on passing exams and repetition of use of algorithms find many students with very little understanding or enjoyment of their learning environment. I talked with one student in a high school statistics class. The pace of the class was very fast, intent on cover all of the material required for the placement exam. A heavy use of calculators – memorizing key strokes needed to obtain the answers. At the end of the course he received an A- as a grade, yet admitted to me he had no idea what he learned or how to use it. He hoped he would gain an understanding when he took the course in college.

Another student was studying linear regression in Algebra. She was doing well at following the steps to get the correct answer. I asked her what the answers meant, what inferences she could make from the information. In what cases is this a useful tool. She could not answer the questions and said the teacher just showed them the steps to follow and how to use the calculator. We spent some time discussion the questions I asked and she went away from the conversation with a much better understanding.

Another student told me of comments a teacher made after they spent time on a particular topic in an Algebra class. He told them not to worry too much about understanding what was presented, “you only need to know this, that, etc. for the end of grade exam – you will never need it again after the test”.
No wonder so many student feel lost in mathematics and obtain no enjoyment.

The book Euclid’s Window by Leonard Mlodinow references Yeats poem in his assessment of the Babylonian approach to learning and using mathematics which is very similar to Galois’ assessment of mathematics education.

Yeats refers to Babylonian indifference to knowledge in this poem. This was a trait, which in mathematics, held them back from greatness. Pre-Greek humanity noticed many clever formulae, tricks of calculation and engineering, but like our political leaders, they sometimes accomplished amazing feats with astonishingly little comprehension of what they were doing. Nor did they care. They were builders, working in the dark, groping, feeling their way, erecting a structure here, laying down stepping stones there, and achieving purpose without ever achieving understanding.