

THE VANCOUVER SUN

Math Matters Articles

SCRATCH & LOSE

Eight lottery retailers caught ripping off customers, A4

MATH MATTERS

An expert tells you — and your kids — why, A7

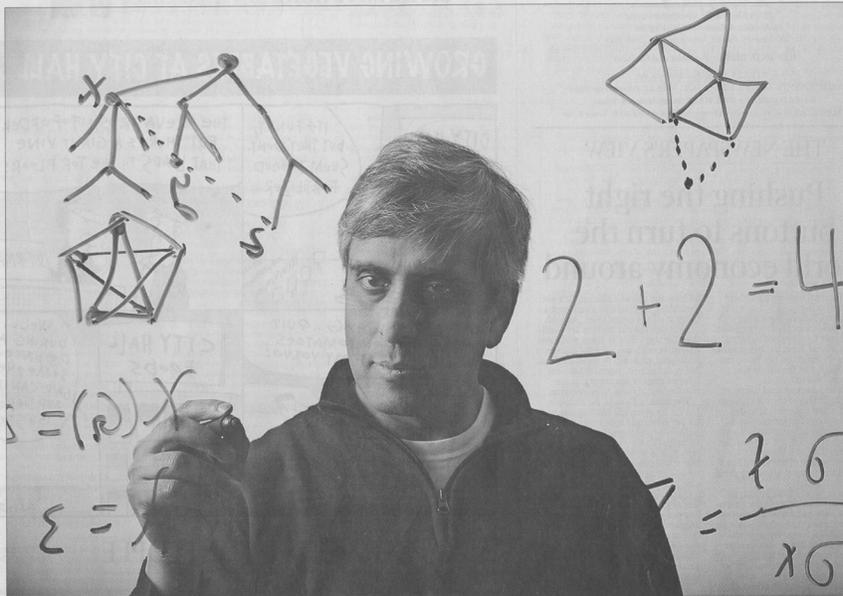
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WESTCOAST NEWS

THE VANCOUVER SUN, WEDNESDAY, MARCH 11, 2009 A7

THE DAILY SPECIAL



GLENN BASLO/VANCOUVER SUN

Over the coming weeks, SFU mathematician Dr. Arvind Gupta will introduce Vancouver Sun readers to the world of math and provide tips to keep, or get, your child engaged on the subject.

MATH'S COMPREHENSIVE — A GOOD BEAUTIFUL

Children ask why they need to learn math. Our guest writer from SFU answers

BY ARVIND GUPTA

Why do I need to learn math? This is a question that virtually every parent will be asked at some point during the nightly homework battle. And the worrisome thing is that most parents don't really know how to answer this. I remember when the father from the comic strip *Calvin & Hobbes* was asked this very question. His response: "Because it builds character."

As a mathematician, I could tell you a thousand really great reasons why math is important. I could tell you why math is amazing and beautiful! (Yes, I did just say math is beautiful.) But for those non-mathematician parents out there, how do you comfortably and truthfully answer this question?

I firmly believe that the key is to show children that math is everywhere in their world. And I mean everywhere.

Understanding numbers and how they work is necessary for our everyday life: when you go to the grocery store, make dinner, plan your monthly budget and dozens of other tasks. But it is beyond this basic arithmetic where the disconnect really occurs.

Once a child has mastered addition, subtraction, multiplication and division, we, as parents, also need to know the reasons why math is so important.

The bottom line is that math is applicable to every field of human endeavour, activity and industry. From helping us to understand the impacts of climate change, to predicting the future of our economy, to developing the latest MP3 player or the coolest new video game, the element linking all of these is math. And the list does not stop there.

Mathematical models are used by the forest service and governments to help them figure out, before a fire starts, how the flames are most likely to spread. The models look at different wind speeds, how close the area in question is to water and the type of surrounding terrain. In essence, the models paint a picture for firefighters so they can plan in advance the best way to attack a stubborn blaze.

In medicine, math helps scientists to understand how diseases such as diabetes, Alzheimer's, and HIV work in cells and organs. Scientists have discovered that there are tens of thousands of genes in the human body which play a role in virtually

Math Matters

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Do you have math troubles? Maybe your child has difficulty with a particular math concept. Or perhaps you are after new study techniques. Go to vancouver.sun.com/math to submit your questions. Dr. Arvind Gupta and his SFU research team will provide as many answers as possible online, and we will publish some with next week's column.

every disease known today. Imagine trying to sort through all those genes to determine how one gene, or a combination of several genes, plays a role in someone developing a certain disease. Math is the master of data-management. Math can help find patterns in seeming randomness and reveal information that scientists didn't know was there in the first place.

In the world of Internet security, mathematics is at the root of all the new strategies and technologies that keep your computer free of spyware, viruses, and worms. Your hard drive didn't get hit by the latest Internet beastie? You can thank math.

In search-and-rescue operations, mathematics-based planning tools enable searchers to assess the surrounding area to decide where to look, and how best to get there.

The overriding message here: Math is in every part of your life. When children question why they need to learn math, they need to know that it is relevant for them. It is important to take it out of the abstract and into the everyday. Math keeps planes in the air, makes credit card transactions secure and powers your Google search engine. And all of these innovations are built on a foundation that begins with the mastery of mathematical concepts from elementary school onward.

Of course it may not be obvious how math contributes to all these things — after all, this is one reason for this column. But just as most of us don't know how to perform a heart transplant, we do understand that the basic knowledge about life (oxygen, food, water etc.), cell organization and the circulatory system that we learn in elementary school are the foundation for eventually becoming a cardiovascular surgeon. We may have trouble visualizing a mathematical model but the process of learning what is necessary starts

with the basics — and then you build from there.

Over the coming weeks, I will introduce you to the world of math and provide tips to keep, or get, your children engaged. I won't make the claim that everything will be easy, but the journey to getting your kids interested in math may not be as difficult as you think.

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ONLINE
Check out our Math Matters website at vancouver.sun.com/math

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Some possible topics to help your child see how math is important:

- 1 Why do we need to know how to count?**
Help your young child think of ideas: counting toy pieces when cleaning up, playing board games, sharing cookies with friends, etc.
- 2 How can you make sure you are getting the correct change from the store clerk when you buy something?**
Chances are you won't have your calculator in your pocket (or if you do, you won't want your friends to know). Tell me how you figure it out.
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ful? Have you ever seen these graphs at home, in a magazine or newspaper, or around town?

Show your electricity consumption history on your monthly bill as an example.

"What does this bar graph tell our family about how we use electricity over the year and how we could be more environmentally responsible?"

Show your investment report or a construction site poster around town. "What does this pie graph tell us about how we've split up our investments in our portfolio? What does this pie graph at the skatepark tell us about who contributed the funding to pay for it?"

Show the financial section in the paper, look in a pamphlet, watch the news channel, or search online. "What does the zigzag of this line tell us about interest rates (or unemployment rates, stock market returns) over the last year (or whatever the time frame is that is graphed)?"



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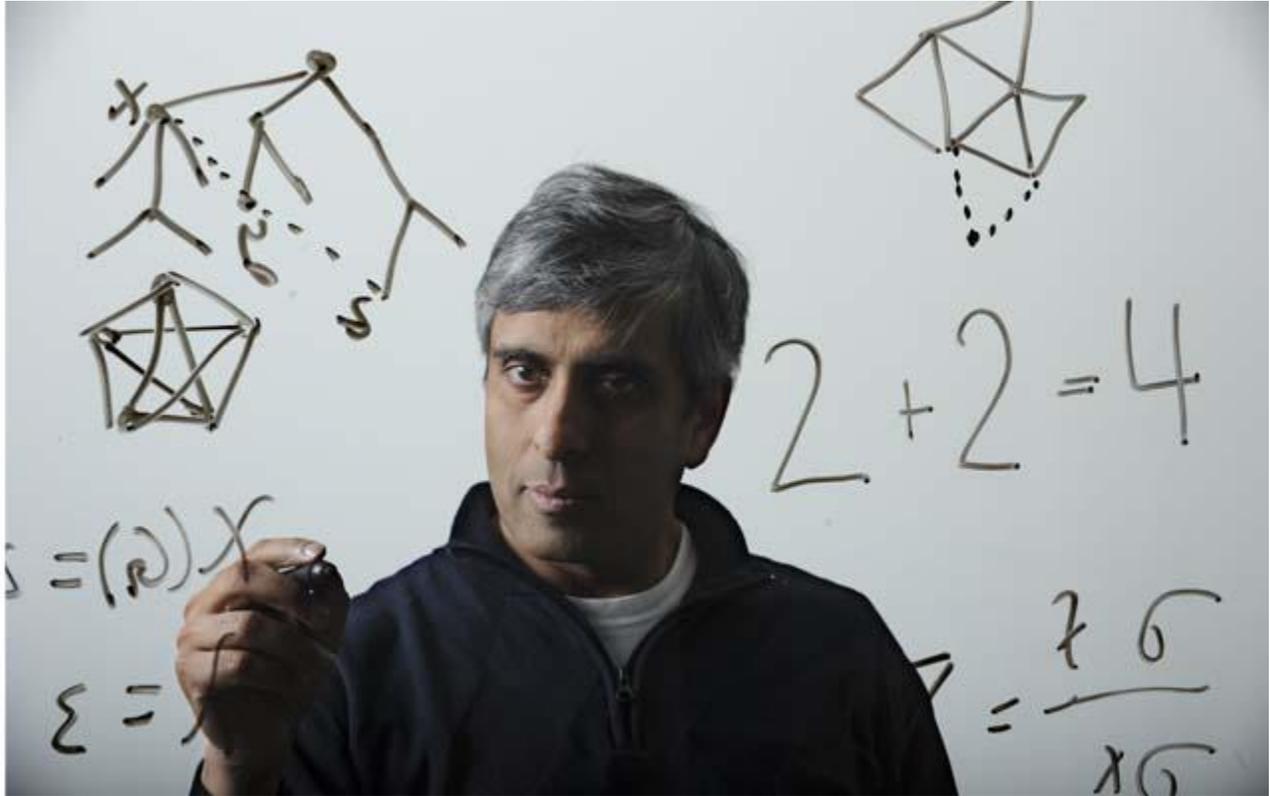
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Mathematician Arvind Gupta at Simon Fraser University in Burnaby.

Photograph by: Glenn Baglo, Vancouver Sun

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Give an example, and help your child to see that there are a number of ways to calculate change: Subtract the cost from the amount you give the clerk, count up from the cost to the amount you give the clerk, count by coins and bills (5, 10, 25, loonie, toonie, etc.) instead of by individual digits, and any other way that makes sense and works!

3. When do you think you might need to know the area or length of something? Which units would you use to measure it? mm? cm²? m? km?

Discuss how to calculate how to buy enough paint to cover the walls of your bedroom. Discuss the process of planning, visualizing, and calculating where to position bike jumps in the cul de sac. Discuss calculating how much lime to buy to line the soccer (or baseball, or football) field, or how much fertilizer to buy to green up the lawn.

4. Where do you think using a bar graph, circle graph, or line graph to show some information would be helpful? Have you ever seen these graphs at home, in a magazine or newspaper, or around town?

Show your electricity consumption history on your monthly bill as an example. “What does this bar graph tell our family about how we use electricity over the year and how we could be more environmentally responsible?”

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THE DAILY SPECIAL

MATH MATTERS

How to conquer your math phobia

Numeracy is a basic skill you can improve like any other, and games make it fun to do it

BY ARVIND GUPTA

Do your palms start to sweat when your child comes to you with math homework? Does your mind turn blank or fuzzy when you look at all those strange symbols? Did you select your career in part due to how little math would be required?

If you answered yes to any of these questions, there's a good chance that you are among the 20 per cent of people who are prone to math anxiety. Math anxiety prevents many people — regardless of intellectual ability — from developing and using the skills they need for numerical confidence in school and in life. But it doesn't have to. If you can shift your focus off your anxiety and onto the math itself, you can replace your anxiety with confidence.

The reality is that basic mathematical ability is not a special talent. It is a skill like any other that can be improved over time. And practice can be fun! If textbooks and worksheets give you a nervous stomach, set them aside for a while. Instead, try some of the many engaging and entertaining alternatives that are now available online, in daily newspapers or in your local toys and games store.

If you have trouble with a particular area of math, review the basics by using an online program such as Math.com, Coolmath.com, or Mathplayground.com. Sites like these offer lessons, games, puzzles and information that you and your children may enjoy. For more diverse explanations, try searching YouTube for your topic, for example "triangle proofs," "linear equations," "How to solve a Rubik's cube," or "Sudoku tips."

My favourite painless way to build problem-solving skills is through games and puzzles. The card game Set is a great way for all ages to strengthen visual perception and the ability to find patterns. Students in Grade 1 can play and beat adults, even mathematicians. Any activity that exercises logic will improve your ability to do math. Sudokus, played by tens of millions, is simply a form of a logic puzzle where you have to fit the numbers one through nine onto a grid according to a set of rules. In the same vein as Sudoku, Kakuro combines logic and addition,



JASON SCOTTIER

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There are lots of great books to help you get comfortable with math at any

level. For all manner of interesting problems, pick up a copy of one of Martin Gardner's collections of math puzzles, for example *The Colossal Book of Mathematics*, or *The Colossal Book of Short Puzzles and Problems*. Phillip Heathford's *Great Book of Math Puzzles* is a good title for kids aged nine to 12.

To increase your problem-solving confidence, it's essential to focus on how you get an answer, not just whether it is right or wrong. At all levels, don't be afraid to take risks with

your thinking, so that even if the final answer is incorrect, you can feel ownership of the process and proud that you came up with a method that got partway to the solution.

By the time you reach the next problem, you might have all the mental muscle you need to get it right, and even enjoy the attempt.

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ARVIND GUPTA ANSWERS YOUR MATH QUESTIONS

Going beyond the math textbook



THE STRESS OF HOMEWORK IS GETTING TO Zachary Drever, a Grade 3 student.

DARLENE COUWENBERGHS:

I am a math teacher for the Delta school district. I was so excited when I opened the paper this morning and found this lovely piece of journalism. I have been trying to make math more relevant by incorporating math projects into my classroom. I have been having difficulty with Math 10 Principles. I have only found one to go with the linear relations unit. The Applications projects don't cross over easily. I was wondering if you would know of any relevant projects, or if you could point me in the right direction.

Hello, Darlene. Kudos to you for going beyond the textbook to introduce your students to applications of mathematics.

While there are many physical phenomena that provide the opportunity to explore linear relationships, here is an in-class activity your students can do with just a tape measure.

In Leonardo Da Vinci's drawing of an idealized figure, the Vitruvian Man, the man's height is the same as his arm span.

Have your students test the hypothesis that these values are linearly related by having everyone in the class measure their height and their arm span with a tape measure. Plot these

values on a graph with height along one axis, and arm span along another.

What do they observe? This activity combines measurement, graphing and statistical interpretation and can be extended in many ways. Can the students predict their height from their forearm length? Let your students use their creativity to come up with more ideas. Visit the Math Matters web page to find links to lots more math activities.

Good luck, and I hope this helps!

DIANA SCHMIDT:

What are your recommendations for the child in elementary school in Vancouver who loves math but finds all the materials provided in class too easy? The child may not necessarily be a math prodigy but grasps concepts quickly and wants more challenging material than the curriculum has provided so far, even when given material from higher grades.

Hello, Diana. I don't know if you are writing this question as a parent or teacher, but my answer would be the same either way.

To keep the child engaged and excited about math, the student, parent, and teacher all need to agree on a plan

to stimulate the child both in the classroom and at home.

Becoming bored with math by not being challenged puts the child at risk of losing his or her passion for the subject. My recommendation: go deeper, not higher.

First, the teacher needs to be certain the child thoroughly understands a concept and can transfer the understanding to new situations rather than just memorizing "how to get the right answer".

For example, does the child think that 74 is an odd number because there is an odd digit in the 10's place? This kind of misconception is common if children just memorize a rule about 0, 2, 4, 6, 8 representing even numbers.

If the child has truly mastered a concept, the teacher and family need to decide if they want to move on to learning outcomes from higher grades to fulfill the child's need for challenge.

This may or may not be appropriate depending on the individual, but even if it is, the child may still need further challenge.

In either case, I would encourage some in-depth problem solving or logic puzzles on the topic of study to take the child to some higher level, deeper thinking.

A great site to look at is www.rulich.maths.org which provides

free mathematics enrichment materials (problems, articles and games) for teachers and learners from ages five to 19 years. All the resources are designed to develop subject knowledge, problem solving and mathematical thinking skills. Sudoku, Kakuro and Kenken games are other quick ideas for now.

You will find many more suggestions for math games, puzzles, and activities to stimulate, improve, and challenge mathematical thinking in our week 2 article about math phobia. You can also read our article in the coming weeks about good math maintenance for students who are doing well in math class. Have fun with it!

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MATH TIPS | For parents

Breathe. Your past experiences with math are not the same as your child's, and your own experiences with mathematics now can be different from those you had in school. You may be surprised at how much easier it is to understand math away from the social pressures or performance expectations of the classroom.

Try looking at a math concept as you might watch a play or read a book. Give yourself time to understand the whole story. Come back to it multiple times and look at it from different perspectives. Give yourself as much time as it takes to solve the problem in front of you. Remember, this isn't a

race or a competition. **Treat math like yoga,** cooking, playing an instrument or doing a martial art; realize that with practice, you can master the parts that are not purely skills. The parts that are not skills can be appreciated even if they cannot be mastered. Set aside some time for practising math every day.

Work with your kids on math starting in Grade 1, and relearn math as they learn. This way, when they come to you with Grade 8 homework, you will be prepared. Don't assume that your child is learning a math skill the same way you learned it in school; chances are that she's not. Have her explain

how they tackled a problem in class and try to support her in that strategy. The goals of mathematics education may have changed since you stumbled through learning the steps of long division. The focus in today's classrooms is on understanding and using the concepts, not just memorizing the how-to steps. Progressive educators take students from the concrete to the abstract. Think kinesthetic (hands-on), verbal, or visual learning first, paper and pencil later. Move those blocks, dice, or paper clips around before you write down the math equation on paper. Remember, numbers are just symbols we use to represent what hap-

pens around us. As often as you can, help your child see mathematics as skills about ideas, logic, problem solving, patterns, and tools to make sense out of our world.

Be positive and encouraging. Really believe that your child can learn to love math and your confidence will be contagious. If your child is struggling, do not say, "I always hated math, too." Or, "I wasn't good at math, either." Or, "I know it's useless, but you have to do it." Children will take on their parents' attitudes. If Mom says she couldn't do it, then a child may believe her fate is already spelled out the same. It is never too late for you to learn.

Work out math problems together. Don't be embarrassed! Contact your child's teacher for guidance. Search online for a video about the topic in question.

It may be difficult for you to go through this process if you have your own emotional baggage about math, but it would provide excellent modeling of self-confidence, perseverance, and problem-solving. If sticking it out isn't possible for you when your child gets into higher grades, look for outside support for your child. Find a relative or friend who is comfortable with math, or a professional tutor.

How to conquer your math phobia

BY ARVIND GUPTA, VANCOUVER SUN MARCH 17, 2009



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Photograph by: Jason Scott, Canwest News Service

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Diana Schmidt:

What are your recommendations for the child in elementary school in Vancouver who loves math but finds all the materials provided in class 'too easy'? The child may not necessarily be a math prodigy but grasps concepts quickly and wants more challenging material than the curriculum has provided so far, even when given material from higher grades.

Hello, Diana.

I don't know if you are writing this question as a parent or teacher, but my answer would be the same either way.

To keep the child engaged and excited about math, the student, parent, and teacher all need to agree on a plan to stimulate the child both in the classroom and at home.

Becoming bored with math by not being challenged puts the child at risk of losing his or her passion for the subject. My recommendation: go deeper, not higher.

First, the teacher needs to be certain the child thoroughly understands a concept and can transfer the understanding to new situations rather than just memorizing "how to get the right answer".

For example, does the child think that 74 is an odd number because there is an odd digit in the 10's place? This kind of misconception is common if children just memorize a rule about 0, 2, 4, 6, 8 representing even numbers.

If the child has truly mastered a concept, the teacher and family need to decide if they want to move on to learning outcomes from higher grades to fulfill the child's need for challenge.

This may or may not be appropriate depending on the individual, but even if it is, the child may still need further challenge.

In either case, I would encourage some in depth problem solving or logic puzzles on the topic of study to take the child to some higher level, deeper thinking.

A great site to look at is www.nrich.maths.org which provides free mathematics enrichment materials (problems, articles and games) for teachers and learners from ages five to 19 years. All the resources are designed to develop subject knowledge, problem solving and mathematical thinking skills. Sudoku, Kakuro and Kenken games are other quick ideas for now.

You will find many more suggestions for math games, puzzles, and activities to stimulate, improve, and challenge mathematical thinking in our week 2 article about math phobia. You can also read our article in the coming weeks about good math maintenance for students who are doing well in math class. Have fun with it!

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Math tips for parents

BY ARVIND GUPTA, VANCOUVER SUN MARCH 17, 2009

Breathe. Your past experiences with math are not the same as your child's, and your own experiences with mathematics now can be different from those you had in school. You may be surprised at how much easier it is to understand math away from the social pressures or performance expectations of the classroom.

Try looking at a math concept as you might watch a play or read a book. Give yourself time to understand the whole story. Come back to it multiple times and look at it from different perspectives. Give yourself as much time as it takes to solve the problem in front of you. Remember, this isn't a race or a competition.

Treat math like yoga, cooking, playing an instrument or a doing a martial art: realize that with practice, you can master the parts that are purely skills. The parts that are not skills can be appreciated even if they cannot be mastered. Set aside some time for practising math every day.

Work with your kids on math starting in Grade 1, and relearn math as they learn. This way, when they come to you with Grade 8 homework, you will be prepared. Don't assume that your child is learning a math skill the same way you learned it in school; chances are that she's not. Have her explain how they tackled a problem in class and try to support her in that strategy. The goals of mathematics education may have changed since you stumbled through learning the steps of long division. The focus in today's classrooms is on understanding and using the concepts, not just memorizing the how-to steps. Progressive educators take students from the concrete to the abstract. Think kinesthetic (hands-on), verbal, or visual learning first, paper and pencil later. Move those blocks, dice, or paper clips around before you write down the math equation on paper. Remember, numbers are just symbols we use to represent what happens around us. As often as you can, help your child see mathematics as skills about ideas, logic, problem solving, patterns, and tools to make sense out of our world.

Be positive and encouraging. Really believe that your child can learn to love math and your confidence will be contagious. If your child is struggling, do not say, "I always hated math, too." Or, "I wasn't good at math, either." Or, "I know it's useless, but you have to do it." Children will take on their parents' attitudes. If Mom says she couldn't do it, then a child may believe her fate is already spelled out the same. It is never too late for you to learn.

Work out math problems together. Don't be embarrassed! Contact your child's teacher for guidance. Search online for a video about the topic in question.

It may be difficult for you to go through this process if you have your own emotional baggage about math, but it would provide excellent modelling of self-confidence, perseverance, and problem-solving. If sticking it out isn't possible for you when your child gets into higher grades, look for outside support for your child. Find a relative or friend who is comfortable with math, or a professional tutor.

THE DAILY SPECIAL

MATH MATTERS

Math is never wasted on the young

Children as young as four months can tell the difference between 1, 2 and 3

BY ARVIND GUPTA

You may be surprised to learn that it's never too early to sharpen your child's mathematical mind. I don't necessarily advocate reading the digits of Pi to your baby in utero, (at least not for mathematical reasons—if you find it soothing, then go for it), but there are plenty of ways that you can help your baby or toddler explore the mathematics inherent in the world around them. Years before children understand the symbols of language or written numbers, they are actively engaged in making sense and order out of everything they encounter.

Researchers of infant cognition can tell the difference between quantities of one, two and three. Recent studies of brain activity show that at four to five months, babies can detect arithmetical errors such as 1+2=3, and can perform the equivalent of 2+1=1. By six to nine months, babies can distinguish between quantities with high ratios, such as groups of 8 and 16.

And we know that babies and young children perceive their environments numerically, and also through other aspects of mathematics such as shape, space, motion and change. They use the patterns they find in things they touch, see and hear to learn the boundaries and the possibilities present in their environments. The message here: Children are natural mathematicians.

As kids continue to grow and develop, however, improvement in their mathematical ability is not as consistent. For instance, when they learn to speak around age two, they start verbalizing numbers and making computations with words, not just basic concepts, and begin making errors such as 1+1=3. As they learn to count, kids naturally use their fingers to add and subtract.

This is something that adults might discourage, but studies show that we should do just the opposite. When children use their fingers to count, they are developing their ability to calculate and to think with a level of abstraction that

allows them to perform more complex operations.

Until about age five, kids have more difficulty performing arithmetical operations when done verbally, while they are able to perform arithmetic non-verbally with a high degree of accuracy.

What I take away from this research on mathematical cognition in young children is a great respect for the processes of mathematical discovery that babies and toddlers are already engaged in without any instruction or intervention from adults.

Their natural curiosity and imagination will lead them through what child psychologist David Elkind calls the "fundamental curriculum," or "our knowledge of things, their sensory properties, their spatial relations and their temporal sequencing."

We can provide toys and experiences that give them material to explore, but they will do most of the work of educating themselves as they play.

Babies and toddlers also respond to social motivation, so as parents we can support our children's development by exploring math through shared play, reading and family activities. This can be as simple as sorting socks, or figuring out how many spoons should go on the breakfast table.

As we look for ways to help our young children learn, it is important to remember that the learning that goes on before a child reaches kindergarten is markedly different from the learning that older children and adults engage in. Follow your child's natural motivation for cues on what he or she is interested in exploring. Encourage your child to ask questions and gather information by reading with her and engaging her in conversation.

Playing with and talking about the numbers, shapes and patterns that your child encounters every day are great ways to witness your child's mind at work, and to provide encouragement as she discovers the mathematical nature of reality.

NEXT WEEK: Arvind Gupta will take a look at girls and math. Does gender make a difference?



Gregory McBain and Nathalie Purchio enjoy a smile from their son Liam. Children educate themselves as they play.

ARVIND GUPTA ANSWERS YOUR MATH QUESTIONS

Websites, books, games bolster learning

BOB WERNER

Many of the students that I tutor at all grade levels lack recall of basic facts—often they revert to counting on their fingers or mentally counting to do basic computation. It would be useful to have a list of websites and activities (games, etc.) that would provide help to improve rote skills while at the same time having fun. I use a deck of cards (remove face cards and use Ace for one) and have all my students play card games (Rummy, Fish, etc.) where the pairs add up to 10 (instead of getting pairs of the same cards). I also time them to see how fast they can go through this deck with pairs adding to 10 (called TENZIES). It would be very helpful to have more information on activities and games for all grade levels.

Dear Bob,

The current B.C. curriculum does emphasize the use of mental math strategies to learn basic math facts so using fingers and Popsicle sticks to count is just fine. The good news is that there are loads of websites, books, and games that can be used concurrently to reinforce the learning that children are doing in the classroom and with tutors.

In terms of websites, www.kidsnumbers.com has a variety of online games to practice adding, subtraction, multiplication and division as well as time, fractions, algebra and money. Another site for practice games is www.playkidsgames.com; just click on "math games." The site [\[multiplication.com\]\(http://multiplication.com\) has a great section of games that will help to teach both multiplication and division. A whole host of fun activities are available at \[www.funmath.com\]\(http://www.funmath.com\).](http://www.multi-</p>
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If you are able to pay for books or games, check out the websites for "Box Cars and One-Eyed Jacks" or "Making Math More Fun." The books Multiplication in a Flash and Memorize in Minutes: The Times Tables use pictures and stories such as "skate a skate a sticky floor" with a picture of two skaters with guns on their skates and $8 \times 8 = 64$ at the top of the page. Remember that research shows that our brains remember things better when told in a story or song.

I hope this gives you some new ideas to use with your students, Bob.

CONCERNED PARENTS

My fourth grade daughter consistently gets a B in math in her Montessori school, but doesn't seem to be able to apply math in real life at all. She knows no math facts rote, and can't do a single digit division question without drawing a picture and apportioning out the dividend "manually"—like dealing cards. In a board game, she counts the dots on the dice and can't make change—even with straight dollars, no cents. I told the teacher that we are very concerned but she says that we just don't understand and is expecting to much. We want to help her at home, but the school doesn't want us to give her math practice sheets because they call that "drill

and kill." Are we way off base here? Should we just relax about this?

Dear Concerned Parents,

Rudes to you for being engaged in your child's schooling. Remember that there are many ways to help children practice math concepts without using practice sheets. Try focusing on one area of concern at a time. For addition, subtraction, multiplication and division, you can use dot stickers of one or two colours in different arrangements on paper plates. Flash these quickly and have your daughter try to visualize and remember the number that was on the plate. In the case of addition: three yellow and four blue make seven dots. As for making change, it sounds like you could have some fun playing store at home. Help your child to see that she can make change in different ways: by counting up from the cost to the given amount, or by subtracting the cost from her amount, or by using coin and bill denominations (10, 25, etc.) to add up from the cost to the given amount. Start with simpler questions and work your way to more complex situations as she gains confidence.

The Math Matters columns and online question area at www.vancouver-sun.com/math will continue to provide parents with websites and ideas for games and activities to develop the applied math skills that you want to support in your child. Perhaps check out my answer to Bob's question this week where I provided many websites that have fun math games for all ages.

Math Matters

This series on math will run every week for the next six weeks in The Vancouver Sun. Do you have math troubles? Maybe your child has difficulty with a particular math concept. Or perhaps you are after new study techniques. Go to vancouver-sun.com/math to submit your questions. Dr. Arvind Gupta and his MITACS research team will provide as many answers as possible online, and we will publish some with next week's column.

I would also suggest maintaining a productive dialogue with your daughter's teacher. The B.C. government provides learning outcomes for mathematics in each grade which you could review with the teacher. If you have concerns that your child cannot do what is stated there then you can discuss the philosophy of the particular school and classroom with regards to the learning outcomes expected. Then together you can decide if you need to further individualize her studies during math class at school. Good luck!

DAVE KENNEDY

Very happy to see your article. What about math help for adults—a lot of people have suddenly found themselves back at college and university and none of the math looks familiar—

yikes! Are there any math programs, books or DVDs that you recommend that do not cost a fortune for people lost in the math wilderness?

Dear Dave,

This is a great time for adults to go "back to school" to learn math. If you are finding certain math concepts from your courses tough to grasp, try the fabulous video and voiced-over whiteboard lessons on sites like freemathhelp.com, or through a search on YouTube or MathTube (Thank you to Sun reader, Denis, for that one). Other sites like math.com or coolmath.com have detailed text lessons using examples to guide you through a new concept. You can also find online tutoring services like z1200.com where you can choose your tutor by their qualifications, availability and hourly rate.

If you are taking a university or college-level math course, and your faculty does not offer an online supplement to your class, try to find similar online course support materials provided by another Canadian university. The UBC Math Department has a great online supplement for its first year calculus class.

As for recommending books and DVDs, this would depend on what level of math you are taking and what topic you need help with. I recommend using the internet as much as possible to find the help you need—it's instant, often free, and topic specific.

FOR MORE USEFUL WEBSITES GO TO VANCOUVER.SUN.COM/MATH

MATH TIPS | For parents

Put out little blocks or other small toys that will fit in an egg carton, and watch your child fill up the carton. (Good for practicing one to one correspondence.) You can increase the matching skills by colouring the bottom of the egg holes to match different colours of blocks to see if he/she can match it.

Draw different coloured circles or use hoola hoops, and provide a variety of coloured objects or toys then help your child to sort them.

Sort toys by size or shape. Play "which one doesn't belong?"

Babies love to fill and empty, stack and sort—and they learn about early math

concepts while they're doing it. Provide containers and small shapes for your baby to stack, fill, empty, and knock over.

Provide large shape stencils or dotted lines for your child to trace with a paintbrush or wide marker.

Bake and cook with your child. Let him count out the measurements, scoop the dough, wash the fruit, and read the numbers on the recipe.

Playground and different toys help your child to compare different sizes and shapes of objects he creates.

Play store. You can sort by food type, colour, and trade "money."

Read, read, read. There are many fabulous books out there that connect basic literacy concepts with early literacy. Vancouver-based publisher Gumboot Books has a number of books that combine poetry and mathematics, including the new title "ARHYTHMETIC." For more titles, check out Pat Dickinson's article "Choosing Books You Can Count On" available online from the Journal of the National Association for the Education of Young Children.

To help connect vocabulary to spatial sense, ask your child to show you the biggest chair in the room, the shortest pencil, the smallest book, the longest

hockey stick.

Play a movement game and ask your child to go "below" the table, "on top of the carpet," "beside" the computer, "in front of" the fridge, etc.

Play with blocks! Plan wooden blocks that combine balance and proportion.

Go on a shape hunt when you are out for a walk or running errands together. Encourage your child to look at shapes in the world around them.

Also, try a number hunt, looking for

speed signs, distances, prices of goods, sheet numbers and much more, says Vancouver Sun reader Pam Hagen.

Play games: memory games to match pictures (limiting the number of pairs so that your toddler can be successful) or the family favorite Go Fish for number recognition, simple board games like CandyLand to practice counting.

Do simple puzzles for spatial sense. Should you turn the piece to fit in it or is just the wrong shape all together?

Use words about time during routines: bedtime, afternoon, "Before/After we go there, we will..."

Maths and toddlers: It's never too early

BY ARVIND GUPTA, VANCOUVER SUN MARCH 24, 2009



It's never too early to teach your child basic maths.

Photograph by: Handout, Files

You may be surprised to learn that it's never too early to sharpen your child's mathematical mind. I don't necessarily advocate reading the digits of Pi to your baby in utero, (at least not for mathematical reasons—if you find it soothing, then go for it), but there are plenty of ways that you can help your baby or toddler explore the mathematics inherent in the world around them. Years before children understand the symbols of language or written numbers, they are actively engaged in making sense and order out of everything they encounter.

Researchers of infant cognition have discovered that very young children can tell the difference between quantities of one, two and three. Recent studies of brain activity show that at four to five months, babies can detect arithmetical errors such as $1+1=3$, and can perform the equivalent of $2-1=1$. By six to nine months, babies can distinguish between quantities with high ratios, such as groups of 8 and 16.

And we know that babies and young children perceive their environments numerically, and also through other aspects of mathematics such as shape, space, motion and change. They use the patterns they find in things they touch, see and hear to learn the boundaries and the possibilities present in their environments. The message here: Children are natural mathematicians.

As kids continue to grow and develop, however, improvement in their mathematical ability is not as consistent. For instance, when they learn to speak around age two, they start verbalizing numbers and making computations with words, not just basic concepts, and begin making errors such as $1+1=3$. As they learn to count, kids naturally use their fingers to add and subtract.

This is something that adults might discourage, but studies show that we should do just the opposite.

When children use their fingers to count, they are developing their ability to calculate and to think with a level of abstraction that allows them to perform more complex operations.

Until about age five, kids have more difficulty performing arithmetical operations when done verbally, while they are able to perform arithmetic non-verbally with a high degree of accuracy.

What I take away from this research on mathematical cognition in young children is a great respect for the processes of mathematical discovery that babies and toddlers are already engaged in without any instruction or intervention from adults.

Their natural curiosity and imagination will lead them through what child psychologist David Elkind calls the “fundamental curriculum,” or “our knowledge of things, their sensory properties, their spatial relations and their temporal sequencing.”

We can provide toys and experiences that give them material to explore, but they will do most of the work of educating themselves as they play.

Babies and toddlers also respond to social motivation, so as parents we can support our children’s development by exploring math through shared play, reading and family activities. This can be as simple as sorting socks, or figuring out how many spoons should go on the breakfast table.

As we look for ways to help our young children learn, it is important to remember that the learning that goes on before a child reaches kindergarten is markedly different from the learning that older children and adults engage in. Follow your child’s natural motivation for cues on what he or she is interested in exploring. Encourage your child to ask questions and gather information by reading with her and engaging her in conversation.

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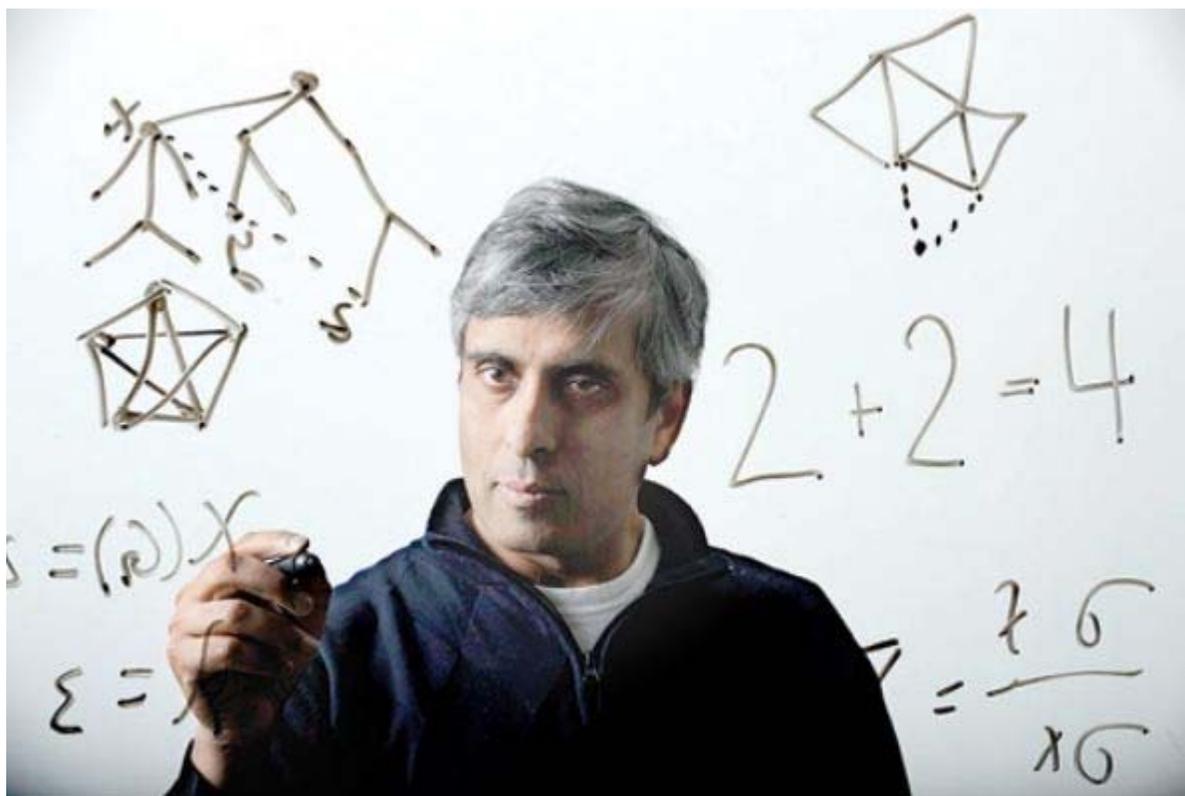
Next week: Arvind Gupta will take a look at girls and math. Does gender make a difference?

Do you have a math question for Dr Gupta? Post it to our soundoffs section below and the doctor will answer the best questions next week.

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Dr Gupta answers your math questions

MARCH 24, 2009



Mathematician Arvind Gupta says parents should show children that math is everywhere in their world.

Photograph by: Glenn Baglo, Canwest News Service, Canwest News Service

Vancouver Sun readers ask our resident math expert the questions that vex them about teaching their children mathematics.

Bob Verner says:

Many of the students that I tutor at all grade levels lack recall of basic facts —often they revert to counting on their fingers or mentally counting to do basic computation. It would be useful to have a list of websites and activities (games, etc.) that would provide help to improve rote skills while at the same time having fun. I use a deck of cards (remove face cards and use Ace for one) and have all my students play card games (Rummy, Fish, etc.) where the pairs add up to 10 (instead of getting pairs of the same cards). I also time them to see how fast they can go through this deck with pairs adding to 10 (called TENZIES). It would be very helpful to have more information on activities and games for all grade levels.

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Dear Dave,

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If you are taking a university or college level math course, and your faculty does not offer an online supplement to your class, try to find similar online course support materials provided by another Canadian university. The UBC Math Department has a great online supplement for its first year calculus class.

As for recommending books and DVDs, this would depend on what level of math you are taking and what topic you need help with. I recommend using the internet as much as possible to find the help you need — it's instant, often free, and topic specific.

Got a question of your own? Leave it in our soundoffs section below and Dr Gupta could answer it next week.

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Fun ways to help your toddler learn math

BY DR ARVIND GUPTA, VANCOUVER SUN MARCH 24, 2009



David Pelletier and Jamie Sale with their new baby, Jesse, at a news conference in November 2007 in Quebec City. The Olympic gold medal-winning pairs skaters, who were married in 2005, are new inductees into the Canadian Olympic Hall of Fame.

Photograph by: CNS, files

It might take a while to get around to long division, but a toddler is certainly capable of learning the basics required to adapt to math. Try these tips with your child and calculus could be just... well... years away. But still.

- Put out little blocks or other small toys that will fit in an egg carton, and watch your child fill up the carton. (Good for practicing one to one correspondence.) You can increase the matching skills by colouring the bottom of the egg holes to match different colours of blocks to see if he/she can match it.
- Draw different coloured circles or use hoola hoops, and provide a variety of coloured objects or toys then help your child to sort them.
- Sort toys by size or shape. Play “which one doesn’t belong?”
- Babies love to fill and empty, stack and sort — and they learn about early math concepts while they’re doing it. Provide containers and small shapes for your baby to stack, fill, empty, and knock over.
- Provide large shape stencils or dotted lines for your child to trace with a paintbrush or wide marker.
- Bake and cook with your child. Let him count out the measurements, scoop the dough, wash the fruit, and read the numbers on the recipe.
- Playdough and different tools help your child to compare different sizes and shapes of objects he creates.
- Play store. You can sort by food type, count, and trade “money.”
- Read, read, read. There are many fabulous books out there that connect early numeracy concepts with early literacy. Vancouver-based publisher Gumboot Books has a number of books that combine poetry and mathematics, including the new title “aRHYTHMeTic”. For more titles, check out Pat Dickinson’s article “Choosing Books You Can Count On” available online from the Journal of the National Association for the Education of Young Children.
- To help connect vocabulary to spatial sense, ask your child to show you the biggest chair in the room, the shortest pencil, the smallest book, the longest hockey stick.
- Play a movement game and ask your child to go “below” the table, “on top of” the carpet, “beside” the computer, “in front of” the fridge, etc.
- Play with blocks! Plain wooden blocks teach about balance and proportion. DUPLO, Lego, Tinkertoys, K’Nex — whatever you have available to build with and use it.
- Go on a shape hunt when you are out for a walk or running errands together. Encourage your child to look at shapes in the world around them.
- Also, try a number hunt, looking for speed signs, distances, prices of goods, street numbers and much more, says Vancouver Sun reader Pam Hagen.
- Play games: memory games to match pictures (limiting the number of pairs so that your toddler can be successful) or the family favorite Go Fish for number recognition, simple board games like Candyland to practice counting.
- Do simple puzzles for spatial sense. Should you turn the piece to fit in or is it just the wrong shape all together?
- Use words about time during routines: bedtime, afternoon, “Before/After we go there, we will...”

THE DAILY SPECIAL

MATH MATTERS

Math and gender: Is there a link?

The performance gap is negligible, so we should encourage boys and girls to resist stereotypes

BY ARVIND GUPTA

The relationship between gender and mathematics in North American culture is a complicated thing. "Men are from Mars, women are from Venus" style stereotypes are often unquestioned, confessing to being bad at math is socially acceptable, and unmediated math anxiety is common, particularly among women. With few exceptions, people who are good at math are portrayed in popular media as nerdy, hypercompetitive, socially inept males with pocket protectors.

My own daughters, ignoring the indisputable evidence of their parentage, point out to me that math just isn't very attractive. But, it seems that with the popularity of the TV show *Numb3rs*, and the recent success of the best-selling book *Math Doesn't Suck* by TV star and mathematician Danica McKellar, math does seem to be losing some of its stodgy image — perhaps not soon enough to sway my daughters and their friends, but maybe for a younger generation.

Like many of their peers, my daughters are capable young women who do well in math and exhibit the kind of curiosity and intellectual drive that would make them successful mathematicians. But for some reason, they just aren't interested in pursuing it as a career.

Although we have come a long way since the days of gender-tracking students' educational options, in countries like Canada and the U.S., fewer women than expected end up pursuing advanced degrees in fields like math, engineering and computer science. While the historic gender performance gap in mathematics is now negligible, women remain under-represented in the field.

The study "Culture, Gender, and Math" published in the journal *Science* last year, underscores this fact. Using data from 40 OECD (Organization for Economic Cooperation and Development) countries, it shows that in societies with high levels of gender equality, "girls perform as well as boys in mathematics and much better than in reading."

But, in another large-scale study of 44 industrialized or industrializing countries, researcher Karen Bradley observed that, "gender gaps in attitudes toward math and math careers was greater in advanced industrial societies, despite the smaller math achievement gap."

This attitude gap is what mystifies



Fewer women than expected end up pursuing advanced degrees in fields such as math, engineering and computer science.

me. With competitive quantitative skills and superior reading abilities, girls, in many ways, are in a better position to succeed than boys! Categorically, boys tend to perform slightly better than girls in geometric or spatial testing, but with practice there is nothing that girls can't learn and excel at.

Yet instead of confidence, many young women seem to internalize self-doubt, and distance themselves from pursuing the quantitative knowledge that will open up dozens of highly rewarding and interesting career paths. Be it from parental attitudes, teacher cues, the media or their peers, often

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ARVIND GUPTA ANSWERS YOUR MATH QUESTIONS

Woodchoppers earn from math books, games

TAMMY WILLIAMS

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appropriate activities for play to encourage your child to move along where he's at without boring or frustrating him with tasks that are too easy or too hard.

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LOUIS

What about probability? I'm told that humans aren't born with this capability, unlike counting, so that's why we don't handle uncertainty well in our de-

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Hi Louis,

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Math Matters

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Do you have math troubles? Maybe your child has difficulty with a particular math concept. Or perhaps you are after new study techniques. Go to vancouver.sun.com/math to submit your questions. Arvind Gupta and his MITACS research team will provide as many answers as possible online, and we will publish some with next week's column.

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JENNIFER SHERLOCK

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MATH TIPS | For parents

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Give your sons and daughters early math and science experiences. Visit a local science museum or look for math and science camps.

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for girls). Fun board games such as *Labyrinth*, *Rush Hour* and *Tipover* encourage spatial abilities.

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As schools have become increasingly attentive to the educational needs of girls, author and counsellor Barry MacDonald reminds us not to leave boys behind in his best-selling book *Boy Smart: Mentoring Boys for Success at School*. (www.mentoringboys.com)

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The books have companion websites, www.mathdoesntuck.com and www.kissmymath.com. Definitely worth a look.

Math and gender: Is there a link?

The performance gap is negligible, so we should encourage boys and girls to resist stereotypes

BY ARVIND GUPTA, SPECIAL TO THE SUN APRIL 1, 2009

The relationship between gender and mathematics in North American culture is a complicated thing. "Men are from Mars, women are from Venus"-style stereotypes are often unquestioned, confessing to being bad at math is socially acceptable, and unmediated math anxiety is common, particularly among women. With few exceptions, people who are good at math are portrayed in popular media as nerdy, hypercompetitive, socially inept males with pocket protectors.

My own daughters, ignoring the indisputable evidence of their parentage, point out to me that math just isn't very attractive. But, it seems that with the popularity of the TV show *Numb3rs*, and the recent success of the best-selling book *Math Doesn't Suck* by TV star and mathematician Danica McKellar, math does seem to be losing some of its stodgy image -- perhaps not soon enough to sway my daughters and their friends, but maybe for a younger generation.

Like many of their peers, my daughters are capable young women who do well in math and exhibit the kind of curiosity and intellectual drive that would make them successful mathematicians. But for some reason, they just aren't interested in pursuing it as a career.

Although we have come a long way since the days of gender-tracking students' educational options, in countries like Canada and the U.S., fewer women than expected end up pursuing advanced degrees in fields like math, engineering and computer science. While the historic gender performance gap in mathematics is now negligible, women remain under-represented in the field. The study "Culture, Gender, and Math" published in the journal *Science* last year, underscores this fact. Using data from 40 OECD (Organization for Economic Cooperation and Development) countries, it shows that in societies with high levels of gender equality, "girls perform as well as boys in mathematics and much better than them in reading."

But, in another large-scale study of 44 industrialized or industrializing countries, researcher Karen Bradley observed that, "gender gaps in attitudes toward math and math careers was greater in advanced industrial societies, despite the smaller math achievement gap."

This attitude gap is what mystifies me. With competitive quantitative skills and superior reading abilities, girls, in many ways, are in a better position to succeed than boys! Categorically, boys tend to perform slightly better than girls in geometric or spatial testing, but with practice there is nothing that girls can't learn and excel at.

Yet instead of confidence, many young women seem to internalize self-doubt, and distance themselves from pursuing the quantitative knowledge that will open up dozens of highly rewarding and interesting career paths. Be it from parental attitudes, teacher cues, the media or their peers, oftentimes girls don't think they're supposed to be good at math, or, if they are, that it will make them less feminine. Some girls are still getting the message that it's okay to be smart, but just not too "math smart." What they believe about themselves is critical to their ability to succeed in math.

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Toddlers learn from math books, games

Arvind Gupta answers your math questions

BY ARVIND GUPTA, SPECIAL TO THE SUN APRIL 1, 2009

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Math Tips

For parents

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THE DAILY SPECIAL

MATH MATTERS

Math, music dance to the same beat

Kids who play an instrument can perform more complex arithmetical operations than those who don't

BY ARVIND GUPTA

From the rich complexity of the Bach fugues to the catchy songs of the Beatles, music and mathematics overlap in all kinds of interesting ways.

Beyond the basic uses of mathematics in music theory and notation (such as chords, time signatures, or dotted half notes representing a count of three), music has also been the source of research in many areas of mathematics such as abstract algebra, set theory and number theory.

Would you believe that research has shown that certain pieces of music end up being more popular and mainstream due to their 'mathematical' structure?

For example, *Pachelbel's Canon in D* — sure to be a top choice for brides again this summer — is said to reach the masses because of its repetitive structure, a trend very apparent in music today. No doubt the amazing popularity of hip-hop music, with its rhythmic beats and looping breaks, is partially due to our innate mathematical need for rhythm and patterns.

Jason Brown, professor of mathematics at Dalhousie University, used a mathematical tool called a "Fourier Transform" to analyse and solve the decades-old mystery of which instruments and notes actually make up that wild opening chord of the Beatles' song *A Hard Day's Night*. Hint: it's more than George Harrison's 12-string guitar. Brown is now using his sound-wave analysis of Beatles music as inspiration for new songs. (Check out his piece *A Million Whys* online to see how it's working.)

In the field of cognitive research, the mind-body connections between music and mathematics have fuelled continuing debate surrounding the so-called "Mozart Effect," which was first popularized in the early 1990s. In some studies, test subjects performed better on spatial-temporal tasks — such as visualizing a boat in one's mind and then building it with Lego pieces — immediately following exposure to a Mozart sonata.

This might be explained by the fact that the same parts of the brain are active when listening to Mozart as when engaged in spatial-temporal reasoning.

Dr. Frances Rauscher of the University of Wisconsin Oshkosh has been heavily involved in research on music and cognitive performance. She gives far more credit to the active playing of instruments than simply passive listening.

In her 2006 article published in the *Educational Psychologist*, she explains that "young children provided with instrumental instruction score significantly higher on tasks measuring

spatial-temporal cognition, hand-eye coordination and arithmetic." Part of this is due to the amount of overlap between music skills and math skills. For example, Rauscher says the part-whole concept that is necessary for understanding fractions, decimals and percents is highly relevant in understanding rhythm. "A literate musician is required to continually mentally subdivide beat to arrive at the correct interpretation of rhythmic notation," she writes. "The context has changed, but the structure of the problem is essentially the same as any part-whole problem posed mathematically."

The visual and spatial skills that a child exercises every time he practises an instrument and plays music strengthen his mental-physical connection.

The link between the physical practice of music and strong mathematical abilities are demonstrated in studies that show that kids who play a musical instrument can perform more complex arithmetical operations than those who do not play an instrument. The slow work of practice, the attention to detail and the discipline it takes to learn an instrument are also excellent preparation for the practice involved in building strong math skills.

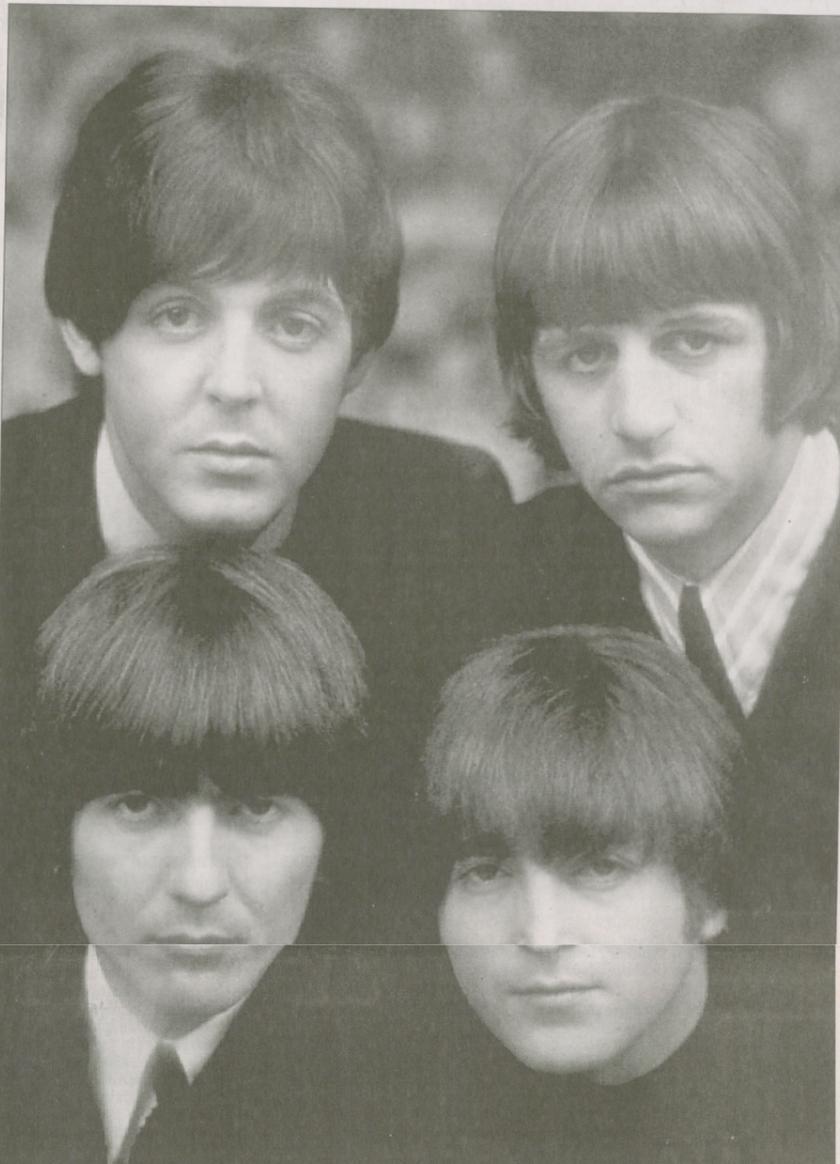
The math-music connection shines in the field of education as well. Research shows that children who learn their academics through music and dance retain the information better than children who learn the same concepts by verbal instruction.

You may have noticed this yourself if your children are in a school participating in the Learning Through The Arts program established by the Royal Conservatory of Music. In LTTA, teachers and professional artists collaborate on lessons using art, dance, story and song to explore math, science and other subject areas.

So the next time you find yourself wanting to get up and dance to the music, remember that those pleasurable patterns of rhythm, beat, harmony and melody are actually embodied mathematical expressions.

Next week: When you think about careers that use math, do you get stumped right after "accountant"? In next week's column, Dr. Gupta will highlight 10 careers that require top-notch quantitative skills. I guarantee you'll be surprised!

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ARVIND GUPTA ANSWERS YOUR MATH QUESTIONS

Girl power can mean a career using math

LEE WOODS

This excellent series on math is long overdue! I have noticed with alarm my teenage daughter and her friends seem to be squeaking by in their math classes. They seem to believe that math is for boys only and they "dumb" down constantly. They all want to be famous like Beyonce and don't seem to understand the importance of math and science.

In our cult of celebrity worship, this attitude is encouraged in school and society. I want my daughter and all young women to pursue the careers of their choice but not all these girls are going to be rich movie stars and rock stars. These are the same women who have trouble counting out change in their part-time retail jobs even when the cash register shows them the exact amount.

How can parents get their kids able to function at the standard level required in the real world while working towards

their dream jobs? I am very worried about my daughter's future and worry she will be left behind. How can I get my daughter interested in math before it is too late?

Hi Lee, I'm glad you see the need to promote math, science, technology, and engineering with young women. And as you are aware, keeping your teenage daughter's interest and confidence in math is crucial. We all know what a big difference a little intrinsic motivation can make.

*As a start, make it personal and find out what careers interest your daughter. Take a look at the math websites we posted with the March 31 "Math and Gender" article, such as *GirlsareIT*, *Girlsgettech*, and *girlstart* on the Vancouver Sun website and show your daughter some new possibilities while surfing together.*

You will find career descriptions, bios of professional women, and tips

for parents on how to encourage their daughters to pursue math, science, technology, and engineering.

Locally, Science World has a program called Opening the Door. This is a networking event for students in Grades 10-12 who are interested in careers in science, technology, engineering or mathematics.

The program provides students with the opportunity to meet professional scientists, engineers, technologists and technicians who work in a variety of fields.

The key is to connect kids with real people who have careers which use math and science.

Science World also has a program called Scientists & Innovators in the Schools, which brings engineers, technologists and technicians into B.C. schools to speak to children in Grades K to 12 about their research. Perhaps talk to your daughter's math teacher about inviting a local scientist or business person who uses math in their job

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into the classroom.

Another site that I came across that looks fabulous is the *Expanding Your Horizons* conference network in the United States. They provide support to professional women in sciences, technology, engineering, and mathematics, who want to plan and deliver a conference to encourage young

women like your daughter to keep up their math and science studies for future opportunities. Suggest that your daughter search "Expanding Your Horizons" in YouTube to see how exciting the possibilities are.

Also very timely — next week's *Math Matters* article will reveal 10 fabulous careers that use math. And they are not the usual ones that you would think of!

On a daily basis, do all that you can to encourage and help her be successful in math at school. Check with her teacher to see what support you can help provide at home. You could also take a look back at our original *Math Matters* article about why we all need math. Don't despair and keep looking for that hook — that career or situation that will show her the connection between math and her future.

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MATH TIPS | For parents

Are those struggles getting your child to practise her instrument every day worth your trouble? The simple answer: Yes! Not only is your child developing her ability to make beautiful music, but she is also strengthening her mind for mathematical thinking.

Keith Devlin in his book, *The Math Gene*, points out that musicians and mathematicians alike use abstract notation to describe on paper the patterns that exist in their mind. A trained musician reading musical symbols moves straight to "hearing" in his mind the sounds that the symbols represent. Similarly, a trained mathematician reading mathematical symbols moves directly to think about the patterns

that the symbols represent. It's not surprising then that medical imaging shows the brains of professional musicians when listening to music are similar to the images of brain activity of professional mathematicians solving a mathematical problem. Although the imaging of amateur musicians and mathematicians has not always shown the use of similar circuits in the brain, the potential for mathematical and musical neural pathways to complement each other exists if your child keeps practising that guitar!

Whether your child practises and composes music daily, or just enjoys dancing around the house to music, providing the right music for the right purpose can help

your child learn in general but potentially excel at mathematics.

Play music in the background during a lesson or homework session. Music can activate us emotionally, mentally and physically to help us remember the learning experience and information. Music can also create a highly focused learning state in which large amounts of content information can be processed and learned. Baroque music, such as that composed by Bach or Handel that is 50 to 80 beats per minute, creates an atmosphere of focus that leads students into deep concentration in the alpha brain wave state. Learning vocabulary, memorizing facts or reading to this music is highly

effective. On the other hand, energizing Mozart music assists in holding attention during sleepy times of day and helps students stay alert while reading or working on projects.

When helping your child with memorizing facts or figures, be they mathematical or not, try putting the information to rhythm or rhyme. These catchy, musical elements will provide a hook to help her recall those important details in stressful situations. These songs, chants, poems, and raps will improve the memory of content facts and details.

Arvind Gupta

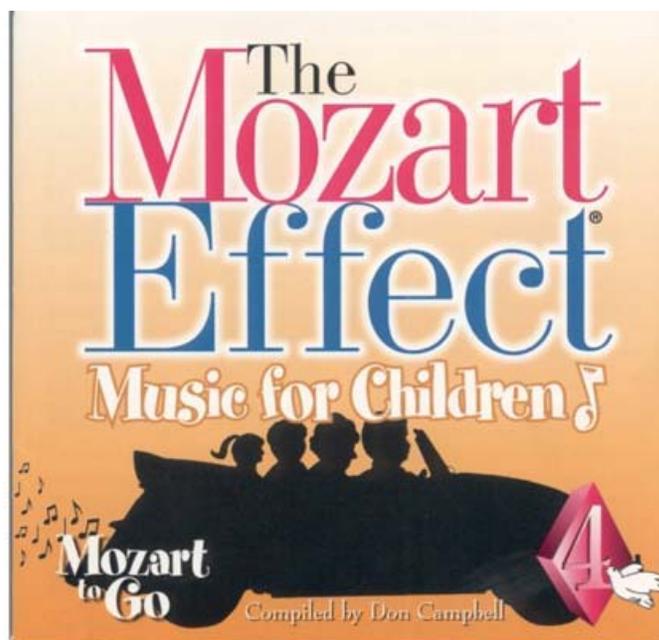
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The interesting connection between math and music

BY ARVIND GUPTA , SPECIAL TO THE VANCOUVER SUN APRIL 7, 2009



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Photograph by: ..., Vancouver Sun files

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In her 2006 article published in the *Educational Psychologist*, she explains that "young children provided with instrumental instruction score significantly higher on tasks measuring spatial-temporal cognition, hand-eye coordination and arithmetic." Part of this is due to the amount of overlap between music skills and math skills. For example, Rauscher says the part-whole concept that is necessary for understanding fractions, decimals and per cents is highly relevant in understanding rhythm. "A literate musician is required to continually mentally subdivide beat to arrive at the correct interpretation of rhythmic notation," she writes. "The context has changed, but the structure of the problem is essentially the same as any part-whole problem posed mathematically."

The visual and spatial skills that a child exercises every time he practises an instrument and plays music strengthen his mental-physical connection.

The link between the physical practice of music and strong mathematical abilities are demonstrated in studies that show that kids who play a musical instrument can perform more complex arithmetical operations than those who do not play an instrument. The slow work of practice, the attention to detail and the discipline it takes to learn an instrument are also excellent preparation for the practice involved in building strong math skills.

The math-music connection shines in the field of education as well. Research shows that children who learn their academics through music and dance retain the information better than children who learn the same concepts by verbal instruction.

You may have noticed this yourself if your children are in a school participating in the Learning Through The Arts program established by the Royal Conservatory of Music. In LTTA, teachers and professional artists collaborate on lessons using art, dance, story and song to explore math, science and other subject areas.

So the next time you find yourself wanting to get up and dance to the music, remember that those pleasurable patterns of rhythm, beat, harmony and melody are actually embodied mathematical expressions.

Next week: *When you think about careers that use math, do you get stumped right after "accountant"? In next week's column, Dr. Gupta will highlight ten careers which require top-notch quantitative skills. I guarantee you'll be surprised!*

Arvind Gupta is a father of three, a mathematician and scientific director of MITACS, a national research network focused on connecting university-based math researchers with companies and other organizations to solve real-world challenges. For more information on MITACS, visit www.mitacs.ca.

Arvind Gupta answers your math questions

Lee Woods

This excellent series on math is long overdue! I have noticed with alarm my teenage daughter and her friends seem to be squeaking by in their math classes. They seem to believe that math is for boys only and they "dumb" down constantly. They all want to be famous like Beyoncé and don't seem to understand the importance of math and science.

In our cult of celebrity worship, this attitude is encouraged in school and society. I want my daughter and all young women to pursue the careers of their choice but not all these girls are going to be rich movie stars and rock stars. These are the same women that have trouble counting out change in their part-time retail jobs even when the cash register shows them the exact amount.

How can parents get their kids able to function at the standard level required in the real world while working towards their dream jobs? I am very worried about my daughter's future and worry she will be left behind. How can I get my daughter interested in math before it is too late?

Hi Lee,

I'm glad you see the need to promote math, science, technology, and engineering with young women. And as you are aware, keeping your teenage daughter's interest and confidence in math is crucial. We all know what a big difference a little intrinsic motivation can make.

As a start, make it personal and find out what careers interest your daughter. Take a look at the math websites we posted with the March 31 "Math and Gender" article like [GirlsareIT](#), [Girlsgotech](#), and [girlstart](#) on the Vancouver Sun website and show your daughter some new possibilities while surfing together.

You will find career descriptions, bios of professional women, and tips for parents on how to encourage their daughters to pursue math, science, technology, and engineering.

Locally, Science World has a program called Opening the Door. This is a networking event for students in Grades 10-12 who are interested careers in science, technology, engineering or mathematics.

The program provides students with the opportunity to meet professional scientists, engineers, technologists and technicians who work in a variety of fields.

The key is to connect kids with real people who have careers which use math and science.

Science World also has a program called Scientists & Innovators in the Schools, which brings engineers technologists and technicians into B.C. schools to speak to children in Grades K to 12 about their research. Perhaps talk to your daughter's math teacher about inviting a local scientist or business person who uses math in their job into the classroom.

Another site that I came across that looks fabulous is the Expanding Your Horizons conference network in the United States. They provide support to professional women in sciences, technology, engineering, and mathematics, who want to plan and deliver a conference to encourage young women like your daughter to keep up their math and science studies for future opportunities. Suggest that your daughter search "Expanding Your Horizons" in YouTube to see how exciting the possibilities are.

Also very timely — next week's Math Matters article will reveal 10 fabulous careers that use math. And they are not the usual ones which you would think of!

On a daily basis, do all that you can to encourage and help her be successful in math at school. Check with her teacher to see what support you can help provide at home. You could also take a look back at our original Math Matters article about why we all need math. Don't despair and keep looking for that hook — that career or situation that will show her the connection between math and her future.

Math tips for parents

Are those struggles getting your child to practise her instrument every day worth your trouble? The simple answer: Yes! Not only is your child developing her ability to make beautiful music, but she is also strengthening her mind for mathematical thinking.

Keith Devlin in his book, *The Math Gene*, points out that musicians and mathematicians alike both use abstract notation to describe on paper the patterns that exist in their mind. A trained musician reading musical symbols moves straight to "hearing" in his mind the sounds that the symbols represent. Similarly, a trained mathematician reading mathematical symbols moves directly to think about the patterns that the symbols represent. It's not surprising then that medical imaging shows the brains of professional musicians when listening to music are similar to the images of brain activity of

professional mathematicians solving a mathematical problem. Although the imaging of amateur musicians and mathematicians has not always shown the use of similar circuits in the brain, the potential for mathematical and musical neural pathways to complement each other exists if your child keeps practising that guitar!

Whether your child practises and composes music daily, or just enjoys dancing around the house to music, providing the right music for the right purpose can help your child learn in general but potentially excel at mathematics.

Play music in the background during a lesson or homework session. Music can activate us emotionally, mentally and physically to help us remember the learning experience and information. Music can also create a highly focused learning state in which large amounts of content information can be processed and learned. Baroque music, such as that composed by Bach or Handel that is 50 to 80 beats per minute creates an atmosphere of focus that leads students into deep concentration in the alpha brain wave state. Learning vocabulary, memorizing facts or reading to this music is highly effective. On the other hand, energizing Mozart music assists in holding attention during sleepy times of day and helps students stay alert while reading or working on projects.

When helping your child with memorizing facts or figures, be they mathematical or not, try putting the information to rhythm or rhyme. These catchy, musical elements will provide a hook to help her recall those important details in stressful situations. These songs, chants, poems, and raps will improve the memory of content facts and details.

Dr. Arvind Gupta

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THE DAILY SPECIAL

MATH MATTERS

Count on a career full of excitement

People who develop quantitative skills can expect to garner top jobs with a high rate of satisfaction

BY ARVIND GUPTA

One question I often get asked is, "What careers could I have with a math degree?" In this year's CareerCast "JobsRated.com" survey of 200 occupations, the top three jobs were mathematician, actuary, and statistician. And, in a sign of what the future holds, five of the next seven top jobs all require strong mathematical skills. These rankings, developed by analyzing a large number of factors including working conditions, competitiveness, hiring outlook and physical exertion, underscore the transformation underway in our society to one in which the generation and application of knowledge are increasingly highly prized. Those with quantitative skills will increasingly be in a position to garner the best careers leading to the highest rate of job satisfaction.

But if you're under the impression that jobs that use mathematics are the ones that are dry and dull, you'll be surprised to discover the vast array of opportunities available. Consider these interesting options.

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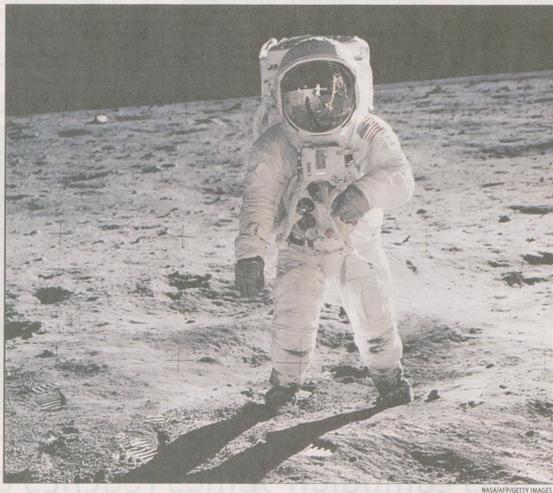
In addition to incredible physical and mental endurance, space exploration requires sophisticated geometric, spatial and other mathematical skills. Who can forget those nail-biting moments in the film *Apollo 13* when Tom Hanks and mission control at NASA were frantically making the calculations and adjustments to get the crippled spaceship back to Earth?

Baseball analyst

Major league baseball teams often hire mathematicians known as sabermetricians to develop statistical analyses of player records to optimize the resources available to the team. Sabermetricians advise coaches on the best possible batting orders and game strengths, pitcher tendencies and other quantifiable factors.

Climatologist

Interpreting the rich sources of data that make up weather patterns and climate trends is a critical field for understanding the world we live in, and how it is likely to change in the future. This is a field with far-reaching connections to the environment, agriculture, oceanography, and even archeology, in which geochronologists date



NASA astronaut Edwin E. "Buzz" Aldrin Jr. walks on the surface of the moon July 20, 1969. In addition to incredible physical and mental endurance, space exploration requires sophisticated geometric, spatial and other mathematical skills.

archaeological sites and reconstruct past climates.

Criminologist

Mathematics provides a host of powerful tools for understanding and fighting the reasons that people become criminals in the first place to understanding how neighbourhood design can encourage or discourage criminal activity. Criminology professors Paul and Patricia Brantingham at SFU work with the School of Computing Sciences and the mathematical modelers at the Interdisciplinary Research in the Mathematical and Computational Sciences Centre to maintain a repository of past and current crime data to answer questions and identify patterns in crime around Vancouver and other real and

simulated urban environments.

Cryptographer

Cryptographers build or break codes for applications in defence, Internet security, and financial transactions. In and his fellow British mathematicians developed mathematical technology that broke the Nazi code using the famous Enigma machine, thus playing a major role in the outcome of the war and also laying the foundations for modern computing.

Video game designer

Do you or your children line up at Future Shop in the wee hours, eagerly awaiting the release of the latest gaming platform? Computer-based

animation for video games combines mathematics, computer science, art, physics and biomechanics. It is all those calculations that make the movement of characters, explosions, smoke and substances required to ooze seem so real.

City planner

Achieving a balance between urban esthetics, public safety, transportation, building and renewal in our cities is the job of city planners. Using software and complex calculations, these behind-the-scenes folks work with elected officials on the best ways to improve upon, and build, our cities. Using forecasting — you guessed it, more math — planners shed light on future population growth in different areas of a city, which guides the development of trans-

port services, community centres and other essential infrastructure.

Playwright/actor/entertainer

Entertainment is laced with mathematics on the screen and behind the scenes, from the mathematicians who consult for the show *Numb3rs*, to CBC TV host Jennifer Gardy, *Bill Nye the Science Guy*, and the stars of *MythBusters*. A phenomenal example: John Mighton, Canadian playwright, author, mathematician, and educator, has written several math-themed plays. He was in the movie *Good Will Hunting* with Robin Williams and Matt Damon. And lately his acclaimed program *Jump Math* has shown that all kids can do mathematics. Of science and art, Mighton has said, "If the two worlds communicated more, we'd have much richer art and science as a result."

Pyrotechnics expert

Blowing things up can be fun and exciting, but it requires a high degree of precision and accuracy. From fireworks displays, to the controlled demolition of buildings, to special effects for movie stunts, lives hang in the balance of the calculations made before the fuses are lit.

Transportation designer

Transportation design is a part of the growing field of industrial and commercial design, which combines art and engineering to enhance the form and the function of the objects and machines that we use in our everyday lives. Designing efficient and elegant cars, airplanes, and other modes of transportation requires great creativity, as well as a strong grasp of the numbers and logic of physics.

And this is just the tip of the iceberg. The ability to reason about our world by logically analyzing information and then making the decision that has the best chance of giving an optimal result is not limited to any one profession. So

should I study math? find out what he wants to do when he grows up, and your math brings to the job. I know that this list of jobs will continue to grow.

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ARVIND GUPTA ANSWERS YOUR MATH QUESTIONS

Hands-on work key to mastering everyday math

PATRICK O'CONNOR

Great answers to the questions about math in this series. I too have noticed many people have problems with basic math in grocery stores. I have seen many puzzled looks as consumers struggle with basic concepts like converting pounds into kilograms. Also, there is confusion about pints and ounces and what item is the better price. What do you suggest to help families better understand the practical math needed for interest rates, saving money on groceries, and other real life situations?

Hi Patrick,

I think the key to understanding the math we need every day is to use it and apply it repeatedly and practically. Ounces, millilitres, pounds and grams — how do you make sense of it? For elementary-aged children, they need to

have a hands-on understanding of different quantities. For example, using a measuring cup and two of the same water glasses, ask them to fill one glass with eight ounces of water and the other with 250 millilitres of water and ask what they observe. They will see that eight fluid ounces and 250 ml are the same! You can then stretch this concept to ask how many millilitres four ounces would be, and so on. The same could be done with a kitchen scale and measuring the same quantity of dried beans using both grams and pounds. Use flyers or a trip to the grocery store with a clipboard to compare prices and measures to determine the best buy. Is peanut butter in bulk a better buy than the jar of Skippy? Even more motivating, give the child a set amount of money to buy some favourite foods from the bulk section so that he can calculate the best buys and take the most treats home! For interest rates,

spend some time looking at different bank accounts online. Make it personal by allowing your child to "invest" his paper route money with you for different rates of return and see what happens to it after a few months.

LOUIS CHANG

I really enjoy this math series and feel I was meant to read it. I will be returning to university in January. I only have high school math and that was 20 years ago! I can barely get through addition and subtraction to my great shame. University is so expensive and so is retraining to upgrade my skills. What would you do if you were in my position? Help! I am starting from scratch and on an extremely tight budget. I do not know where to begin. Thanks.

Dear Louis, Firstly, know that you are not alone! But the good news is that unlike when

you were in high school, there are countless free online tools available with the click of a button. When you encounter a difficult topic in one of your courses, go online and try the video and voiced-over whiteboard lessons on sites like freemathhelp.com, or through a search on YouTube or MathTube. Other sites like math.com or coolmath.com have detailed text lessons using examples to guide you through a new concept.

To build your confidence before January, I would recommend taking a refresher course through continuing education in your school district or your local community college. If your future classes do not offer an online support material, try to find similar online course support materials provided by another Canadian institution. For example, the UBC Math Department has a great online supplement for its first-year calculus class.

Math Matters

This is the final installment of our six-part series on math in The Vancouver Sun.

Do you have math troubles? Maybe your child has difficulty with a particular math concept. Or perhaps you are after new study techniques. Go to vancouver.sun.com/math to submit your questions. Arvind Gupta and his MITACS research team will provide as many answers as possible online.

Many courses provide a teaching assistant or open office hours to students. Don't be shy about using both of these resources. All the best!

FOR SOME USEFUL WEBSITES GO TO VANCOUVER.SUN.COM/MATH

MATH TIPS | For parents

Students entering Grade 10 in September 2009 will be the last to enrol in the current mathematics courses in British Columbia. The three math streams now offered are Principles of Math, Applications of Math, and Mathematics of Math.

Whichever path your child chooses will either limit or open his options after high school.

Principles of Math 10 to 12 allows for the most options, providing the prerequisite math skills for most post-secondary programs with a goal to develop the formalism students will need to continue on with the study of calculus. Applications of Math 10 to 12 aims to prepare students for non-calculus based post-secondary programs of study such as certificate programs, diploma programs, continuing education programs, trades programs, technical pro-

grams, and some university programs. Essentials of Mathematics 10 to 12 provides students with the necessary numeracy skills and concepts to be successful in their daily lives, business, industry and government. It is very important to sit with your child and think carefully about which stream makes the most sense.

Students entering Grade 10 in B.C. in September 2010 or later will be choosing from three new pathways developed by the Western and Northern Canadian Provinces in cooperation with Basic Education, Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut, Saskatchewan and Yukon together developed the Common Curriculum Framework for Grades 10-12 Mathematics: Western and Northern Canadian Protocol (WNCP).

The seven ministries of education collaborated with teachers, administrators, parents, business representatives, post-secondary educators and others to develop the framework. The purpose was to develop consistent student outcomes across the WNCP jurisdictions and to enable easier transfer for students moving from one area to another.

The three new mathematics pathways are Pre-calculus 11 to 12, Foundations of Math 11 to 12 and Apprenticeship and Workplace Mathematics 10 to 12. Grade 10 students will need to choose between two courses: Foundations of Math and Pre-calculus 10, which will lead to either pathway in Grade 11 and Apprenticeship and Workplace Mathematics 10.

The Pre-calculus pathway leads to entry into post-secondary programs that

require the study of theoretical calculus. Topics include algebra and number measurement, relations and functions, trigonometry, and permutations, combinations and binomial theorem. The Foundations of Mathematics pathway leads to post-secondary studies in programs that do not require theoretical calculus. Topics include financial mathematics, geometry, measurement, number, logical reasoning, relations and functions, statistics and probability.

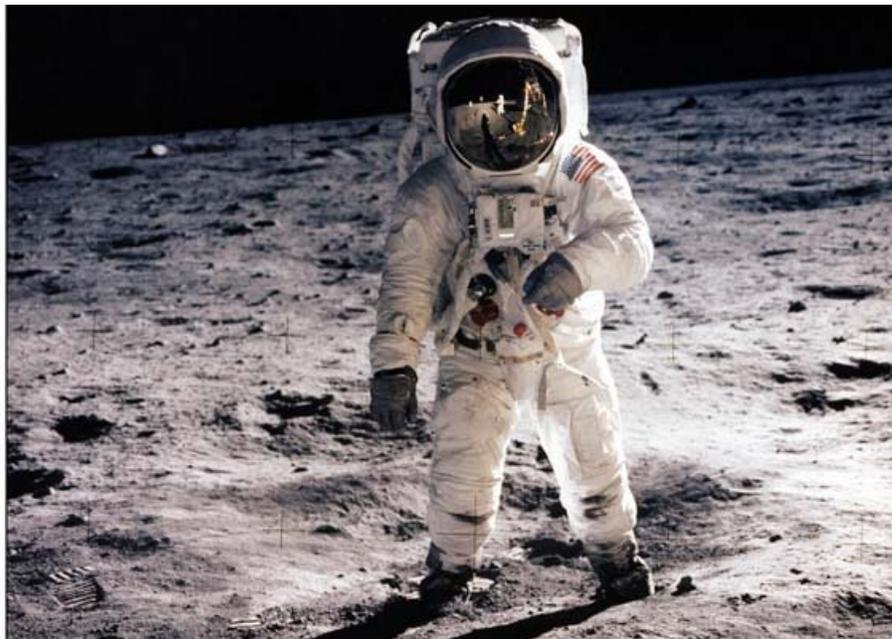
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According to the 2008 Common Curriculum Framework, all three of the pathways provide students with mathematical understandings and critical-thinking skills, and when deciding between the options, students should consider their interests, both present and future. And don't forget to research the admission requirements for the different post-secondary programs, as they vary by institution.

If your child will be entering Grade 10 after September 2010, it is very important that you become familiar with the changes to the B.C. high school math curriculum. Discuss the possibilities and limits with your child's teachers and guidance counsellors. And ask hard questions. It will take some time for everyone to become familiar with these changes. You can find full details at www.bced.gov.bc.ca/irp/irp_math.htm.

Exciting careers abound with a math degree

BY ARVIND GUPTA, SPECIAL TO THE VANCOUVER SUN APRIL 14, 2009



This picture taken 20 July, 1969, shows astronaut Edwin E. Aldrin Jr. walking on the surface of the moon. In addition to incredible physical and mental endurance, space exploration requires sophisticated geometric, spatial and other mathematical skills.

Photograph by: ..., NASA/AFP/Getty Images

One question I often get asked is, "What careers could I have with a math degree?" In this year's CareerCast "JobsRated.com" survey of 200 occupations, the top three jobs were mathematician, actuary, and statistician. And, in a sign of what the future holds, five of the next seven top jobs all require strong mathematical skills. These rankings, developed by analyzing a large number of factors including working conditions, competitiveness, hiring outlook and physical exertion, underscore the transformation underway in our society to one in which the generation and application of knowledge are increasingly highly-prized. Those with quantitative skills will increasingly be in a position to garner the best careers leading to the highest rate of job satisfaction.

But if you're under the impression that jobs that use mathematics are the ones that are dry and dull, you'll be surprised to discover the vast array of opportunities available. Consider these interesting options:

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far-reaching connections to the environment, agriculture, oceanography, and even archeology, in which geochronologists date archeological sites and reconstruct past climates.

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Mathematics provides a host of powerful tools for understanding and fighting crime. This ranges from quantifying the reasons that people become criminals in the first place to understanding how neighbourhood design can encourage or discourage criminal activity. Criminology professors Paul and Patricia Brantingham at SFU work with the School of Computing Science and the mathematical modellers at the Interdisciplinary Research in the Mathematical and Computational Sciences Centre to maintain a repository of past and current crime data to answer questions and identify patterns in crime around Vancouver and other real and simulated urban environments.

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Many courses provide a teaching assistant or open office hours to students. Don't be shy about using both of these resources to help you understand difficult concepts. All the best!

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Ending the nightly homework battle

BY DR. ARVIND GUPTA, SPECIAL TO THE VANCOUVER SUN APRIL 23, 2009



According to a 2008 Survey of Canadian Attitudes Toward Learning, 72 per cent of Canadians reported that homework is often a source of household stress.

Photograph by: ..., Canwest News Service files

Homework is nearly always a contentious topic — no matter what kind of assignments teachers send home, someone is very likely going to be upset.

Often, the result is conflict and stress for families which have lead to some school districts debating limiting or even banning homework.

According to a 2008 Survey of Canadian Attitudes Toward Learning, 72 per cent of Canadians reported that homework is often a source of household stress.

I would hazard to guess that math homework accounts for a disproportionate amount of that stress, and explains the fact that one in three parents surveyed have hired a math tutor for their child.

However, more than 80 per cent of surveyed parents agreed that doing homework develops good work habits and enhances learning, so I wouldn't think that those rallying cries to ban homework are going to be heeded any time soon.

With the competing demands of school, extra-curricular activities, jobs and family life, homework can easily be neglected or resented. According to a 2005 Statistics survey, Canadian teenaged girls completed an average of 10.3 hours of homework per week with boys completing only 8.1 hours per week. But regardless of how you and your children feel about the time required by homework, the best way that your children can organize those study hours is to make mathematics a top priority.

The key is for you to help your child take ownership of his or her own learning process and to provide the resources and encouragement needed to support this learning.

The bottom line is that math homework is essential, especially for middle school and high school students. If completing math homework is a source of conflict between you and your child, it is time to redraw the battle lines so you and your child are allies in the quest to learn. It's nearly impossible to learn mathematics without doing homework; the best way to master math is through regular practice.

One important consideration for parents is that their own attitude about homework has an effect on that

of their child.

A study completed last year by Dr. Linda Cameron and Dr. Lee Bartel of the Ontario Institute for Studies in Education notes: "There is a very strong positive relationship between parental attitude toward the child's homework and how frequently they help the child." The study also indicated that, "There is also a strong relationship between parental feeling of competence to help with homework and (a) the frequency with which they help the child, (b) how positive they feel the effect of homework is on family relationship, (c) the effect they feel it has on the child's achievement."

Interestingly, the study showed that children's attitudes toward homework start out highly positive, with 85 per cent of kindergarteners "enthusiastic or willingly cooperative." By Grade 4 however, "61 per cent are very resistant to only grudgingly cooperative."

According to Drs. Cameron and Lee, "This change is related to the time required by homework – more homework correlates with more negative attitude and therefore higher the grade the more negative [the attitude]." They also noted that the more time a child spends watching TV or playing video games, "the more negative the attitude toward homework -- probably due to increased pressure from parents."

If you are able to help your child manage his or her time wisely, staying on top of math homework while maintaining positive personal interactions, that's great. If your own knowledge is limited, or if the tension over homework is running too high, the challenges of parent-child conflicts on top of the challenges of learning math may prove to be too difficult for you and your child to manage alone.

Don't give up — seek help from a knowledgeable friend, relative, or tutor. Check with your child's teacher to see what kind of tutoring or support resources are available through the school, and continue working toward a productive learning environment for your child.

Regardless of your level of technical ability, your attitude toward homework and toward mathematics can still make an important difference to your child's success.

Dr. Arvind Gupta is a father of three, a mathematician and scientific director of MITACS, a national research network focused on connecting university-based math researchers with companies and other organizations to solve real-world challenges. For more information on MITACS, visit www.mitacs.ca.

Tips for Preventing Math Homework Conflicts

1. Understand why it's important for you to be involved in your child's education, and be there to help him or her. This may give you the extra patience you need.

Vancouver's Gordon Neufeld's "Power to Parent" workshops and bestselling book *Hold on to Your Kids* explain how parenting and teaching from a place of strong attachment yields great success in learning.

The Northwest Regional Educational Laboratory in Portland performed an extensive review of literature on parent involvement in education. Based on their work, the editors concluded that, "The research overwhelmingly demonstrates that parent involvement in children's learning is positively related to achievement. Further, the research shows that the more intensively parents are involved in their children's learning, the more beneficial are the achievement effects. This holds true for all types of parent involvement in children's learning and for all types and ages of students.... there are strong indications that the most effective forms of parent involvement are those which engage parents in working directly with their children on learning activities in the home. Programs which involve parents in reading with their children, supporting their work on homework assignments, or tutoring them using materials and instructions provided by teachers, show particularly impressive results."

2. Deal with the protests and questions of "Why do I need to learn this?" and have your answers ready! Take a look at the Math Matters columns on March 10 and April 16 for some help.

3. Create the right environment for your child to do his or her homework.

Consider time of day, proximity to mealtime, distractions such as TV or telephones, lighting, and location. Set aside an appropriate workspace, such as a large desk or open table, with plenty of room for books, paper, and other tools. Properly considered, these will help your child with focus. A routine time to complete the work before doing something fun provides further motivation.

Let your child be the one in charge of the math homework – be available to help when needed, but resist the urge to micromanage or to complete your child's work for him. The level of help needed will change with the child's age, but the principle is the same: being in charge empowers your child to feel he has control over his learning rather than be tempted to play the victim of evil teachers and tyrannical parents.

4. Don't assume your way to solve the problem is the way your child has been taught or the way he or she wants to do it. If you are going to present your own ideas, do it after he's had a chance to share his. If you can, clarify any misconceptions your child might have about how to solve something. If he or she doesn't believe you, look for a lesson online (see links below). Your child may believe a stranger's video lesson before yours - don't take it personally.

5. Be sure that your child has phone number or email address of a friend that can be contacted for emergency phone calls such as, "What's the homework?" or "When's the test?"

6. Familiarize yourself with the teacher's expectations, the textbook, and any routines or recommended resources for math homework. And stay in regular contact with your child's teacher, but especially when he's having difficulty. It is a good idea for your child to be aware that you are in touch with his or her teacher, so there aren't any hurt feelings over surprise "invasions" of their privacy.

7. Use online resources for lessons, homework tips, games, and resources

For step-by-step guides and solutions to your problems: <http://www.webmath.com/>

For video explanations of math problems from a variety of instructors: <http://www.mathtv.com/>

Resources for Algebra, Geometry, Trigonometry and Calculus students: <http://highschoolace.com/ace/math.cfm>

Ask Doctor Math includes a thoughtful and thorough archive of explanations of questions about mathematics: <http://mathforum.org/dr.math/>

Hundreds of activities and lessons from Kindergarten through grade 12: <http://illuminations.nctm.org/>

8. Help your child to persevere when she feels like giving up.

Keep in mind that math challenges are compounded if your child does not have a strong enough foundation in the topics building up to the task at hand. Try to identify if the difficulty is with skills that she should have already mastered. If it is, then your energies are best spent in reviewing. Your child will not be able to move forward if the foundation is not there.

9. Let your child know that you understand their frustration, but don't feed it. Don't say things like, "Oh, I know. I hate math too!" Instead, use constructive sympathy, for example, "I had some trouble in math at times, but I kept trying, and it felt so good after I learned it!" If the situation has escalated to tears – your child's or yours - take a break. Once things are this hot, not much concentration or learning can occur.

10. Ask questions to help your child discover his or her own path to solving the problems in question, for example: Is there an example in the book like this? Do you have an example like this in your notes? Can you do some easier problems and go back to this one after? What part of the problem is giving you trouble? Let's read the problem together and make sure we understand what it is asking.

Can we draw a picture of the problem? Can we make up an easier problem that is similar to this? Then we can work our way up to this one. What did your teacher say about this assignment? Why don't we

take a 10-minute break and come back to it?

11. If you are at a standstill and the preservation of your parent-child relationship is at risk, consider finding outside help. Find a relative or family friend to help your child once a week. Your sister-in-law may be just the right person to help your daughter prepare for a quiz! Check to see if the school has a homework resource room outside of class time. Ask your child's teacher or school counselor for the name of a recommended tutor. When looking for a tutor, seek someone who is knowledgeable and qualified in the subject at hand, and who will get along well with your child.

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Math Matters: Related Articles

There is no escaping the influence, and the virtues, of math

VANCOUVER SUN MARCH 18, 2009

In an effort to illustrate what he described as the "unreasonable effectiveness" of mathematics, the late Nobel laureate physicist Eugene Wigner used to tell a story.

The tale concerned two former high school friends, one of whom had become a statistician working on population trends. The statistician was explaining the meanings of various symbols he used when his friend asked about the meaning of pi.

When the statistician explained that pi was the ratio of the circumference of a circle to its diameter, his friend responded, incredulously, that "surely the population has nothing to do with the circumference of the circle."

The friend's incredulity is understandable, since it's reasonable to wonder what a relatively abstract matter like the circumference of a circle has to do with a population. But that is the unreasonable effectiveness of mathematics -- math seems to insinuate itself into everything, even things where it appears not to belong.

For example, everyone knows that math is absolutely essential to physics and, to a lesser extent, to the other natural sciences. But what many people don't know, and others choose to forget, is that math is crucial to the study of just about everything, including ecosystems, financial markets and sports scores.

Truly, everything is number, as the Pythagoreans said. And that is why everyone needs a decent understanding of mathematics.

The problem, of course, is that most people, particularly when they're in school, don't see how math is relevant to their lives. In an ironic way, this may be a direct result of its unreasonable effectiveness.

Although math historically grew out of practical needs, such as the need to measure land or to calculate financial transactions, it soon reached an impressive level of abstraction, a level that seemed to divorce it from the real world.

This abstraction makes math a difficult study, and also leads many students to wonder why they must study such formal fare. But abstraction is also math's virtue, for by refusing to restrict itself to any particular study, it becomes applicable to everything.

As positive as that is, it still leaves us with the problem of making math exciting and engaging. Indeed, as mathematician John Allen Paulos once observed, many people seem to wear their (putative) inability to do math as something of a badge of distinction.

Fortunately, though, some teachers have recognized that ignorance of math isn't something to be proud

of -- in fact, it's fatal. And these teachers have taken it upon themselves to improve the teaching, and the learning, of this uniquely versatile subject.

One such teacher is Simon Fraser University mathematician and scientific director of MITACS (Mathematics of Information Technology and Complex Systems) Arvind Gupta, who is writing a continuing series for The Vancouver Sun on the importance and beauty of mathematics.

Other teachers have been involved in reworking the way math is taught in British Columbia and elsewhere, by emphasizing the very real world applications of this seemingly other worldly subject. This is a hopeful development, as it will help students to understand why they're doing math rather than simply how to do it.

And in the process, it could help more students -- and ultimately, the rest of us -- to better understand the world.

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Nearly everyone who responded to Tuesday's Sun Opinion web page poll question -- 91.67 per cent -- said the provincial government should implement two of the main recommendations of the Davies commission on police-related deaths.

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It's time to take a new approach to math

When many otherwise successful students need to hire tutors for a subject, something is wrong

BY STEPHEN HUME, VANCOUVER SUN APRIL 6, 2009



Math education specialist Carole Saundry works with Grade 1 and kindergarten students at Tait elementary.

Photograph by: Ian Lindsay, Vancouver Sun files, Vancouver Sun

Everybody seems to be weighing into the great mathematics discussion, so permit me my two-bits worth.

For the most part, it's not about the math, or the kids -- it's about our collective obsession with treating miscalculations as failures rather than embracing them as the true learning opportunity that every error should become.

In science, business, sports, the arts, it's always the mistakes that teach us the most. Knowledge and skill advance by trial and error. I sense that getting it wrong is an essential part of learning. Sometimes, it takes many wrong answers to discover a way to the right one.

Yet when we teach math, we obsess slavishly about wrong answers. In the classroom, on examinations, for entrance to university, true success means getting all the answers precisely right. Failure means having wrong answers exceed some arbitrarily predetermined threshold.

It's not necessarily even about wrong answers. I know kids who have been marked down for having arrived at the right answer but by some unorthodox method instead of what's prescribed. In other words, thinking laterally and outside the box is wrong, too.

Provincial and national statistics demonstrate convincingly that kids like and enjoy math in the elementary grades. It's only as they progress through high school that interest wanes and many come to fear, loathe and detest math.

So we have a system which takes students who enjoy math and then, in a few short years, grinds the pleasure and sense of creative play out of most of them. But the kids' responses are not innate; they come from somewhere else. If it's not from them, it must be from the system and its propensity to humiliate and marginalize.

I empathize. As a kid, I, too, went through the agonies of trudging to the blackboard to get my long division wrong. Was public shame an incentive to improve? Not at 13. I developed an elephant-sized case of math anxiety. I fled math at the first opportunity; took the minimum required to matriculate; did

the minimum amount of work to scrape through with the minimum grade that permitted me to go on; joined my classmates in self-fulfilling ridicule of what we feared; never took another math course and, in university, avoided courses with math components.

So I was shocked when, holding down a management job responsible for budgets in the tens of millions, the standard psychological evaluation required of senior executives reported that my math aptitude was on the high end of the bell curve rather than the low.

Recently, I watched my daughter go through the same process in high school. Let me say that this is not a young woman who shies from challenge. At university she takes on difficult subjects she's never before studied and does well at them.

In Grade 7, she'd ranked near the top of the national math test she'd taken for fun; by high school she'd walked out of her math class never to return, preferring to complete her university entrance requirements by correspondence -- and I watched in astonishment as her grades suddenly shot up by 25 per cent when she was left to work on problems by herself.

When I interrupted an animated discussion with her mother over some fine points of Latin syntax to ask her what had happened, this is the gist of what she said:

If math is ultimately the language of relationships, we never seem to get beyond the grammar and basic punctuation in the classroom. We reward students with innate aptitudes and marginalize those without at a time when adolescents are most self-conscious and their self-esteem is most vulnerable to a sense of public humiliation.

Imagine teaching English literature, she said, by requiring students to memorize the Oxford Unabridged Dictionary, grading them only on their ability to correctly spell the words they are required to memorize and on whether they can parse the sentences. Imagine teaching Romeo and Juliet by counting Shakespeare's use of bilabial fricatives and ignoring the big themes of passion, pride, love, jealousy and betrayal with which teenage readers most identify.

Some time ago, writing a short piece I'd been asked to contribute to the Victoria-based magazine *Island Parent* on the subject of math anxiety, I called a dozen friends and acquaintances who either have teenagers now in high school or whose kids have just passed out of the system.

I had one question: Did your kids require the help of an outside tutor to get through the final few years of math in high school? Every parent I called said yes, they had, indeed, felt compelled to hire a tutor to help otherwise academically proficient teenagers get through math. The response was corroborated by a 2007 report from the Canadian Council on Learning, which found that about 30 per cent of Canadian parents had hired tutors to assist their kids with math. Those students averaged B or higher in their general academic performance.

According to a 2004 report from the B.C. College of Teachers, almost half of secondary school math classes were being taught by teachers without a background in mathematics. It seems that even the teaching profession is affected by the compounding uninterest that afflicts the subject.

Perhaps, however, there are significant lessons to be learned from the fact that somewhere near a third of our brightest high school students need outside help in math.

The first lesson is that once they begin studying the subject one-on-one outside the classroom, most math students do well enough to meet post-secondary requirements. The second is that the system as it now exists unfairly penalizes students whose families can't afford to hire a tutor.

The mantra of technologically advanced society is math skills. If that's the case, why do we persist in an educational model that doesn't appear to work?

Should we be completely reinventing the classroom environment when it comes to math?

Should we be training, hiring and providing financial incentives to more teachers while moving to much

smaller math classes where there's a sense of collegiality and one-on-one instruction is genuinely possible?

Should we be teaching math in shorter periods but teaching it every day and in a gaming atmosphere?

Should we be looking at greater use of online resources where kids can progress at their own rate without constant comparison to those who are more advanced in their skills?

I don't pretend to know the answers here, but I do know that one classic definition of stupidity is to keep repeating the same mistake.

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