

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 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



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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-

times 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.

A fascinating study by University of B.C. researchers Ilan Dar-Nimrod and Steven J. Heine published in *Science* in 2006 showed that "women who read of genetic causes of sex differences performed worse on math tests than those who read of experiential causes."

The reason for this result, they sus-

pected: "If individuals share the same genetic foundation at the base of the stereotype, they might feel that the stereotype applies to them ... people might react differently if the origins of the group differences were perceived to rest on the specific experiences that people's groups have had. People may reason that their own experiences are different or that they can resist the effects of their experiences."

While research into math and gender issues will continue to expand, we know enough right now to encourage our girls and our boys to resist stereotyping themselves or others, and to

take interest in the many exciting places that mathematics can take them.

Next Week: Does your child love hip hop but struggle with algebra? Stay tuned for next week's article in which I'll explain how loving (or hating) a particular tune is about the math behind the music.

Arvind Gupta is 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

Toddlers learn from math books, games

TAMMY WILLIAMS

Hi, Last week's article mentioned websites and ideas for introducing math at age five. Do you have suggestions for introducing math to children as young as two? We are teaching our two-year-old son math by counting; introducing two numbers every two weeks, both written and numerical, in puzzles and game formats and would really appreciate any other suggestions for teaching math at his age.

Hi Tammy,

You may have read them already, but if you haven't, look at the *Math Matters* article from March 25 entitled "Math and Toddlers", plus the tips "Fun ways to help your toddler learn math". This includes fun and simple games and activities to do with your child to excite your son's naturally-developing mathematical mind. Please take a look at the suggested online math resources for kids for parent resources, recommended books, and online games that you can try together with your son as he nears the age of three.

A great place to look for guidelines about what your child should know and when, is the "Ages and Stages" link on the *Invest in Kids* website (www.investinkids.ca). Here you will find age-

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.

Certainly, you can expose your son to the written symbols that represent the concept of the number two (2), for example.

Keep in mind, though, that research shows that children of your son's age who are developing their language skills and trying to match up new mathematical language with their pre-existing understanding, will make mistakes and confuse the words even though a concept is clear to them outside of spoken or written language. So don't worry if you show your son three blocks and he says or points to the number four — these language and reading skills will develop later. Instead, you could have him place those three blocks inside three cups so he can further explore one-to-one correspondence. Eventually, he will also be able to choose a drawing of three dots to match those three blocks.

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-

cision-making without formal training?

Hi Louis,

A very interesting question, Louis. We don't appear to be born with an ability to handle probability. Even the idea that there 'is' such a thing as chance seems to be learned only from real-life experience. And even after a lifetime's experience, it still remains rather mysterious. The mystery is not in the mathematics: the mathematical theory of probability is quite well-understood. The mystery is why the mathematics describes the real world so well.

Behavioural psychologists Daniel Kahneman and Amos Tversky in their book *Judgement Under Uncertainty: Heuristics and Biases* studied how people handle chance. They performed a number of clever experiments to show that people badly misestimate probabilities and, in fact, do not do well at applying logic to them.

In one experiment, they described a woman named Linda. Then, they asked the subjects to order the probabilities of the truth of several statements about her. Three of the choices were (a) Linda is active in the feminist movement, (b) Linda is a bank teller and (c) Linda is a bank teller who is active in the feminist movement. Approx-

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 vancouversun.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.

imately 85% of participants thought that (a) was most probable which was reasonable from the description which they were given and in addition thought that that (c) was more probable than (b), in spite of the fact that, logically, it couldn't be as it described a strictly smaller class of people than (b). Interestingly enough, this was independent of the amount of training they had had in probability or statistics. Try it yourself — even when you know (b) has to be more likely, it's hard not to pick (c).

More recently, author Nassim Nicholas Taleb, in his book, *The Black Swan: The Impact of the Highly Improbable* claimed that even very expe-

rienced, intelligent people are particularly bad at estimating the probability of rare occurrences — and that people can make a lot of money from this fact. I hope this provides some food for thought.

JENNIFER SHERLOCK

I am a Grade 4/5 teacher and read your article this morning. I was interested in purchasing two of the books that you mentioned *Memorize in Minutes: the Times Tables* and/or *Multiplication in a Flash*... however, when I phoned ARTEL and then 32 Books in North Vancouver I had no success. The first book is out of print and they could not find the other without a publisher or more info. Can you suggest where I might find these?

Hello Jennifer, I found a link to Krimsten Publishing from the *Multiplication.com* website when I Googled the title *Memorize in Minutes*. I can't speak for the reliability of the publishing company, but they have both books on sale as a package. Good luck!

FOR SOME USEFUL WEBSITES GO TO VANCOUVERSUN.COM/MATH

MATH TIPS | For parents

WITH YOUNGER CHILDREN:

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

Make a conscious effort to avoid gender stereotyping when you buy toys for your children. Don't forget that girls and boys can both enjoy spatial games and building toys like blocks, K'Nex, and Lego (and if it has to be pink, the Lego website has a section of recommended products

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

Find out what your child is doing in math and science at school or in the child care setting. Does your child come home excited about an interesting activity or experiment he or she did that day? Talk about it.

Whenever you encounter a gender stereotype, remind both boys and girls that they can become anything they want

to be — including a mathematician, engineer or scientist.

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 Smarts: Mentoring Boys for Success at School*. (www.mentoringboys.com)

WITH MIDDLE SCHOOL AND HIGH SCHOOL STUDENTS:

As children plan for high school, en-

courage both boys and girls to take math and science.

To see the new mathematics courses for Grades 10 through 12 to be implemented in 2010 through 2012, go to www.bced.gov.bc.ca/irp/irp_math.htm. It's never too early to learn about post-secondary entrance requirements.

Suggest that your daughter read up on the work of female mathematicians, as well as other resources on women in math and science. Google the "Association for

Women in Mathematics" and read some great biographies.

And don't forget the great new books *Math Doesn't Suck* and *Kiss My Math* (for middle school math and pre-algebra respectively) by Danica McKellar formerly of the hit TV show *The Wonder Years*.

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