Submission of Articles

The *Ontario Mathematics Gazette (OMG)* is looking for articles, news and "good ideas" useful to mathematics teachers or mathematics teacher education. We are seeking submissions from mathematics teachers K-12 and tertiary, that describe teaching mathematics content in an innovative way.

The criteria for manuscript submission to the *OMG* includes the following:

- The ideas/activities are of interest to the readership
- The article/ideas are not widely known or practised and are innovative.
- The mathematics content is appropriate for the readership.
- The mathematics content is accurate.
- The article is well written and grammatically correct.
- The article/ideas are free of sexual, ethnic, racial and other bias.
- The article has not been published previously, nor is out for review by other publications.

Articles must be original. Your article must be word processed, preferably using *MS WORD*, double spaced on one side with wide margins, not exceed 10 pages of text and prepared according to the *Publication Manual of the American Psychological Association Fifth Edition*. Diagrams and figures should be drawn by computer if possible or neatly drawn in black ink in camera-ready form. Embedded images should also be submitted separately in jpeg or tif format. Proof of the photographers' permission is required. For photos of students, parent or guardian permission is required.

You must submit **4 hard copies** of your article to the Editor **Marilyn Hurrell** whose address appears on page 2. Your name may not appear anywhere in your article, including web sites. Your name and full mailing address and e-mail address must be included on a separate sheet. Your article will be sent out for blind review. If it is accepted as is, or with major/minor revisions or rejected, you will be notified. Once an article is accepted for publication, computer files of text, original graphics and photos will be required. E-mail submissions are welcome but must be followed by hard copies.

The Editor reserves the right to edit manuscripts before they are published. Once an article is published it becomes the property of OAME.

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The *Ontario Mathematics Gazette*—ISSN 0030–3211—is indexed in the Canadian Education Index and is published four times per year. Its Canadian Publication Mail Product Sales Agreement Number is 40051074.

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▲ Editor's Message



MARILYN HURRELL, EDITOR

The University of Waterloo Mathematics competitions brought names such as Gauss, Pascal, Caley, Fermat, Descartes and Euclid into the mathematics classrooms, but did the students realize that there were colourful stories behind each of these names? Imagine little Fred Gauss, age 8, astounding his math teacher, who had assigned the unruly class the task of summing the numbers from 1 to 100 to give himself a little break. Fred took just a few moments and presented the solution! He went on to be know as "The Prince of Mathematics".

Descartes saw in a dream a Cartesian world where most math problems could be modelled and represented on a grid, or so the story goes. This poor man died an early death when he went to tutor the Queen of Sweden. She demanded her lessons at 3 am, and Descartes caught pneumonia in the draughty castle. My personal favourite is Evariste Galois, a young Frenchman, who failed math exams repeatedly because he found the questions too trivial to bother writing answers. He died at age 21 in a duel, defending the honour of a woman. The night before the duel, he stayed up frantically writing out the mathematics in his head, stopping repeatedly to scribble in the margins "I have no time, I have no time...". Romanticized stories can be told about Pythagoras and his group of rowdies in the Greek school for boys only, where he formalized his Theorem at the age of 18.

I regularly assigned a Mathematics Essay to my Grade 10 students, not just a biography but sometimes a famous problem in mathematics such as the Golden Ratio. I had a list and students could pick a topic. I know they and I enjoyed this diversion from daily routine and it gave me an opportunity to see my students from a different perspective.

With this issue of the *Gazette*, you will notice a slight change in the first two pages. We have reorganized the Table of Contents, updated the call for submissions and changed the order of headings. The OAME Membership form can be found on the last page of the *Gazette*.

This issue marks the first for Trevor Brown as the

Abacus Editor. He introduces himself in his first Editor's Message to be found in the *Abacus* insert.

My apologies to Joanne Harris who has acted for several years as a reviewer for the *Gazette*; I left her name out of my list of reviewers in the June issue. Joanne has also been a contributor to the *Gazette* with a Book Review published in the Sept 2002 issue.

Enjoy this new school year and the opportunities it brings! ▲

Marilyn Hurrell

▲ Letters to the Editor

Dear Editor,

Assessing EQAO: Listening to Teachers.

The Education Quality and Accountability Office (EQAO) administers the province-wide assessments for grade nine mathematics, but who assesses EQAO? I am a Ph.D. student at Western, and I need your help to find out how these potentially high-stakes assessments have affected teachers. My research questions include ones like these:

1. Do teachers view the EQAO assessments as examining the most important constructs in grade nine mathematics at an appropriate depth?
2. Do teachers agree with the nature and results of the EQAO assessments?
3. How do the EQAO results compare to classroom marks by strand and category, and to report card marks? Are teachers influenced by the evaluation scores reported by EQAO?
4. What positive and negative consequences do teachers report as they implement the new curriculum and prepare for the new assessments?

My main data collection tool is an Internet-based questionnaire to collect quantitative data addressing questions like the ones above. I will also collect hypothetically relevant data such as teaching experience, familiarity with the mathematics content, and available support (such as resources and professional development). I hope that as many grade nine mathematics teachers as possible will participate in the survey section so that I can collect a representative sample from the province. Second, there will be e-mail interviews with some teacher volunteers. Since this too is Internet-based, geography poses no problem; anyone in the province (with even a slow Internet connection) will be able to participate to help explain my findings.

The on-line survey will be open for participation from Friday, October 1, 2004, to Saturday, October 23, 2004, and should take about half an hour of your time. The address for the survey is **http://www.edu.uwo.ca/Survey/Kitto/SurveyOn.asp**. All responses will be stored in a secure database; any potentially identifying information will be removed and pseudonyms will be assigned to all interviewees for analysis and reporting purposes.

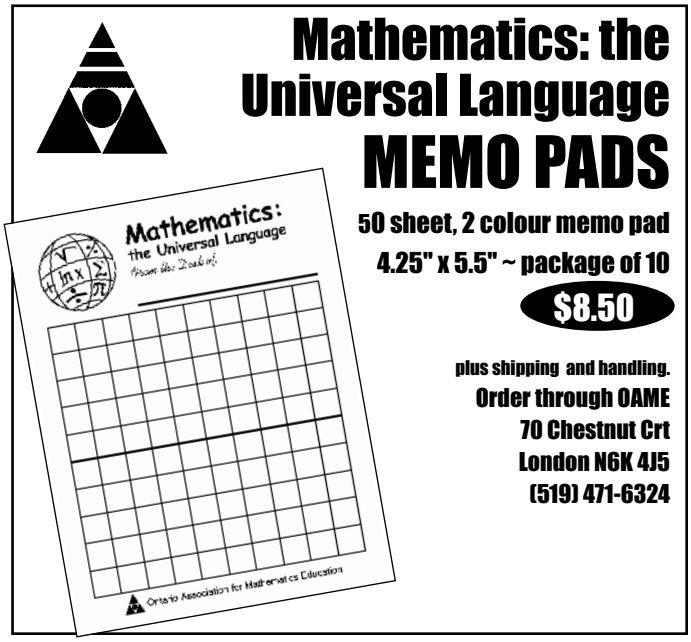
I know how hard it can be to find time for outside activities, but I hope you can help me with this research project by completing the on-line survey early in October, and perhaps by volunteering for a follow-up e-mail interview.

Rick Kitto (Ph.D. Candidate), rkitto@uwo.ca

Dear Editor,

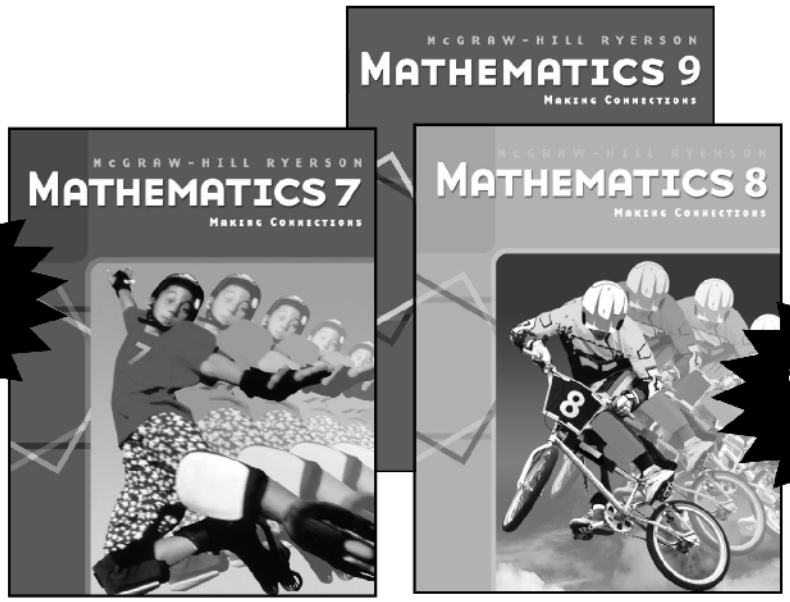
I just read your Editor's Message in the June 2004, *Gazette* and have a similar problem to share with you. Just last week as I was completing the MPM1D curriculum, I ran into an error in the *Nelson 9* textbook (p 465 # 9b). Aluminum costs $0.2¢/ metre squared. Rather amusing, if not the fact that a math textbook is written and proofread by those with a great degree of math knowledge....

Ewa Kasinska, School of Liberal Arts, Toronto. ▲



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▲ President's Message

GORD COOKE



Gord Cooke is a classroom teacher with the Upper Canada District School Board. He is the program leader for Mathematics and joint leader for Social and Environmental Sciences at Thousand Islands Secondary School. He also served a stint as English Language Coordinator for the Grade 9 Assessment of Mathematics at EQAO.

Just so you know it is me writing this column and not some hired gun, I'm going to talk about technology in the classroom. You know that is one of my favourite topics.

One of the articles in this year's NCTM annual yearbook is titled 'Teaching Mathematics with Technology: An Evidence based Road Map'. It offers the following model for the growth and development of an individual teacher's use of technology. It is the Play, Use, Recommend, Incorporate and Assess model. (PURIA, not like the dog chow.)

Let's take the familiar example of *The Geometer's Sketchpad*. When you first met it, didn't you Play with it? The cool factor was high here as you found ways to duplicate constructions that you used to do with compass and ruler. Then you discovered the Animate button and sketches came alive. When you figured out how to construct a locus you were in a state of mild euphoria. Or, maybe that was just me. But you probably all experience the new technology in a setting without any predetermined goals.

Then you Used the software to create better graphics for your worksheets and tests. It became a tool to create objects that had the geometric properties you really wanted to illustrate. It lost the dynamic nature but your paper copies looked a heck of a lot more mathematical. You were putting your tool to a good use.

Next comes the Recommend or Regard in limited use stage. You share it with a colleague and talk about the possibilities it offers. Or a student comes to you not really understanding that "rectangle inscribed in a circle yielding a maximum area" problem. You see the software as the perfect way for this problem to come alive. This is the beginning of the tool becoming communal property rather than just yours.

Now you are ready to Integrate the software into a class setting. There were lots of supports written into the new text books and lots of web sites with ideas. This phase may last for a considerable time and have lots of dimensions to it as you find new ways to use the tool for more than just locating the centroid of a triangle. Your thinking now moves to how to use the tool to improve student learning. This is the Assess mode whereby you are thinking of how student learning has changed in the presence of the new technology. You can design your own activities which incorporate the tool in purposeful ways.

Here in Ontario we are promoting the SWIMMM model in the classroom: Start With Immediately Manipulable Mathematical Models. When introducing a student to new technology, give them a prebuilt sketch or file to play with. Let them experience the "cool" factor. Think of Nathalie Sinclair's Mystery Points (see the *SketchMad* site at http://hydra.educ.queensu.ca/sketchmad) or some of Judy Dussiaume's work which accompanies TIPS. A student's early experience can be just as rich as ours. Starting with a list of instructions on how to build a right angled triangle just doesn't cut it.

Finally I would like to offer my own interpretation of an EQAO study which shows that student use of technology in grade 9 correlates strongly with higher achievement. When I offer this evidence to skeptics they frequently discount it citing other factors. Well, I agree that there may be other factors and I think this is one of them: teachers who integrate technology have had to learn how to use it well and teachers who are continually learning can't help but be better teachers. ▲

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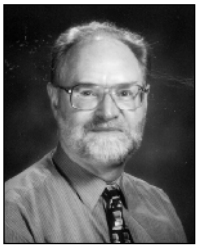
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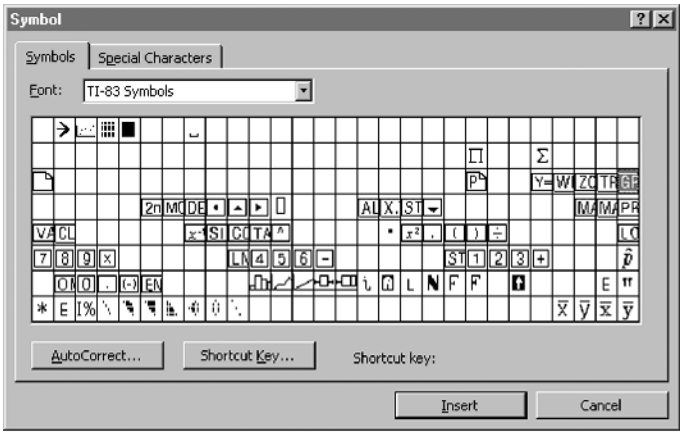
▲ Technology Corner: Fonts and Connectivity

FRED FERNEYHOUGH



Fred Ferneyhough is Head of Mathematics at Harold M. Brathwaite SS in Brampton and is a technology consultant for Harcourt Publishers. He is an avid user of, and advocate for, the use of technology in the mathematics classroom.

In the June article, some of the characters in the article made no sense. This was due to the fact that I had been trying a new font on my computer and neglected to pass that information along to the editor and printer. There is a TI Font that allows the user to download a software program called *TI Connect*. When installed on your computer, *TI Connect* installs some fonts that allow the user to use symbols in their documents. These symbols look like the keys on the TI83/84 devices and you can insert symbols such as [2nd], [ENTER], and [GRAPH]. Each key on the keyboard has a symbol as shown in the map below.



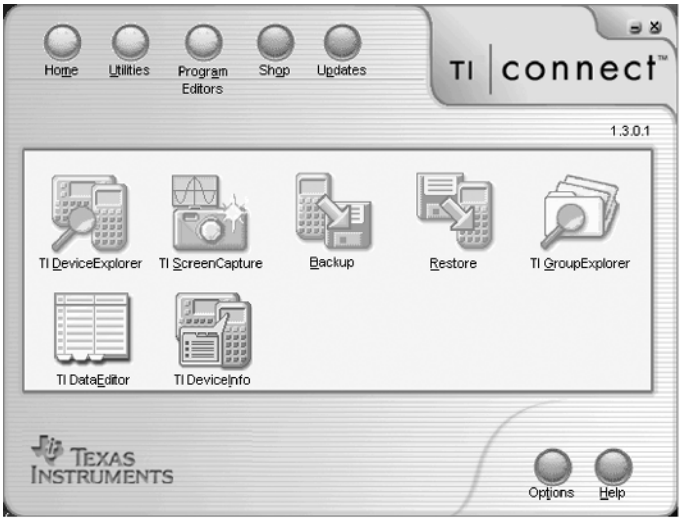
Unfortunately, this only works in *MS Word* and there are no plans to make it accessible in *WordPerfect*. To access the symbol map, click on the **Insert** menu in *Word*, and then select the **Symbol** option. The map will appear on your screen. As you click on each cell in the map, you will see the full keystroke symbol. Once you find the symbol that you need, click on the **Insert** button at the bottom of the window. Click on the **Cancel** to close the window.

There are several other advantages to using *TI Connect* that teachers should be aware of transferring data and programs and screen captures. To download the program, access the *Texas Instruments* education portal at http://education.ti.com, and follow the links for products and for downloading software. You will find a drop down box where you can select *TI Connect*. On the left side of the page that comes up, you will find a link for downloads. Click on this link and then the link that reads "Download TI Connect 1.3 for Windows®". You should see the following window:



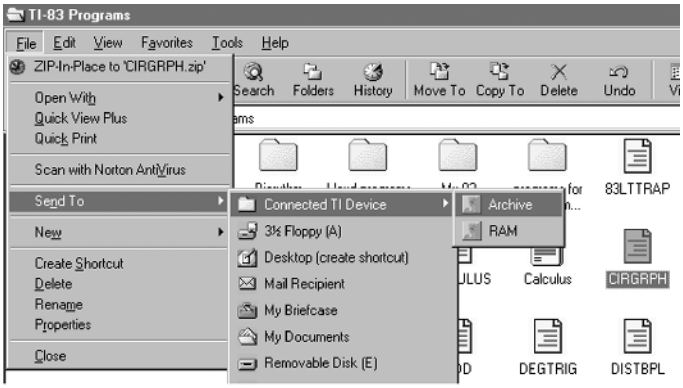
This will allow you to create an account with *Texas Instruments* where you can download this software and all other software for calculators such as apps.

Once you install the software, a desktop icon will be created for you that will allow you to run the program. When you see the screen below, you can move data and software between your calculator and your computer, save screens and get updates to apps installed on your calculator.



One of the most useful features is the easy transfer of programs to your calculator. Let's say that I send you a program through e-mail and you store it somewhere on your hard drive. By going through "My Computer" on

windows you can locate the program, click on the **File** menu and select the sub-options as shown. In this example, the program called "cirgrph" is transferred to my calculator. This program takes a set of values in List 1 and produces a pie graph based upon these values. The transfer is quick and easy.



Ti Connect has many other features that users can take advantage of. Fonts, screen captures and file transfers are the most common uses. ▲

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▲ Assessment Corner: Assessing Mathematical Processes – A Complex Process

CHRIS SUURTAMM



Chris Suurtamm is an Assistant Professor of Mathematics Education at the University of Ottawa. She is an experienced mathematics teacher who is committed to helping teachers with the implementation of the new curriculum and assessment practices.

Mathematics is more than content. Doing mathematics is a complex process and proficiency in mathematics means a certain level of expertise, competence, knowledge, and facility in mathematics. This article discusses the importance of recognizing mathematical processes and the challenge of examining mathematical processes in the assessment process.

In an analysis of a variety of curricula from several jurisdictions (Suurtamm & Vézina, 2003) mathematics content strands such as number sense, geometry, measurement, algebra, statistics, and probability can be easily matched across curricula from most countries and provinces. However, mathematical processes are often not as easily matched. International assessments such as TIMSS and PISA have prompted international standards for curriculum. Hence, curricula from different jurisdictions share similar characteristics such as:

- Curriculum objectives are usually divided into content strands
- Content strands are similar across jurisdictions
- Many curricula have process strands

However, different jurisdictions define and discuss mathematical process strands in different ways. Some countries and provinces have additional frameworks to support the processes of mathematics. Occasionally one or more of the processes may be included as a content

area, or more frequently, a process is seen as cutting across several content areas. One or several of:

- applying mathematics,
- developing mathematical thinking,
- logic,
- problem solving, and
- mathematical inquiry

are process components that appear in some of the curricula (Ruddock, 1998). Denmark uses mathematical competencies as a basis for the structuring of math education, includes eight mathematical competencies:

- Mathematical thinking
- Problem tackling
- Modelling
- Reasoning
- Representing
- Symbol and formalism
- Communicating
- Using aids and tools

and considers the mastering of mathematics to be the mastering of these competencies (Blomhoej & Hoeigaard, 2003).

The processes of mathematics are highly emphasized in several jurisdictions such as Quebec, New Zealand and Singapore. For instance, in Quebec, there are three particular competencies:

- problem solving
- reasoning through concepts and mathematical processes
- communication with language of mathematics

that are thread throughout the curriculum. Singapore's curriculum (Ministry of Education, Singapore) focuses on mathematical processes and includes this diagram of the processes (figure 1) in every level of their curriculum:

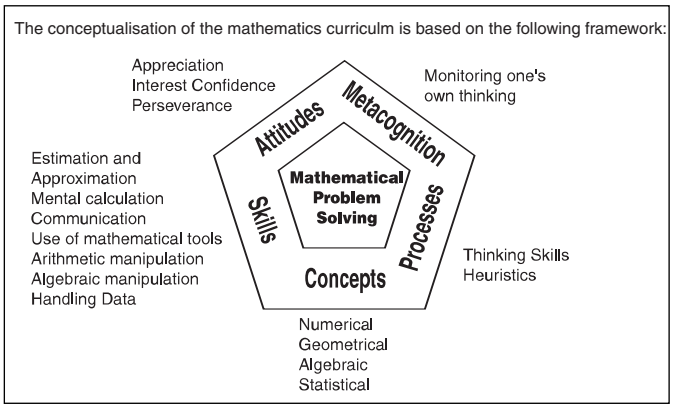


Figure 1. Singapore Framework of the Mathematics Curriculum

This framework encompasses the whole mathematics curriculum from primary to secondary school. The primary aim of the Singapore mathematics curriculum is to enable pupils to develop their ability in mathematical problem solving. Mathematical problem solving includes using and applying mathematics in practical tasks, in real life problems and within mathematics itself. In this context, a problem covers a wide range of situations from routine mathematical problems to problems in unfamiliar contexts and open-ended investigations that make use of the relevant mathematics and thinking processes. As seen in the diagram, the attainment of problem solving ability is dependent on five inter-related components; attitudes, skills, concepts, processes and metacognition, that all form a part of problem solving. Concepts refer to the basic mathematical knowledge needed for solving mathematical problems, covering numerical, geometrical, algebraic, and statistical concepts. Skills refers to manipulative skills that pupils are expected to perform when solving problems. They include estimation and approximation, mental calculation, communication, use of mathematical tools, arithmetic and algebraic manipulation, and handling data. Processes refer to the thinking and heuristics involved in mathematical problem solving such as comparing, identifying patterns and relationships, spatial visualization, using a diagram/model, working backwards, using guess and check, or simplifying the problem. Metacognition refers to the ability to monitor one's own thinking processes in problem solving and attitudes refers to the affective aspects of mathematics learning such as enjoying mathematics, showing confidence in using mathematics, and persevering in solving a problem.

As recognized by many, mathematics is a complex task. Kilpatrick, Swafford, & Findell (2001) define mathematical proficiency as having five components:

- *conceptual understanding*—comprehension of mathematical concepts, operations, and relations
- *procedural fluency*—skill in carrying out procedures flexibly, accurately, efficiently, and appropriately
- *strategic competence*—ability to formulate, represent, and solve mathematical problems
- *adaptive reasoning*—capacity for logical thought, reflection, explanation, and justification
- *productive disposition*—habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

These components represent different aspects of a complex whole and are not independent. Rather, they are interwoven and interdependent and cannot be easily separated.

This complexity of mathematics and the interconnectedness of the processes of mathematics have strong implications for assessment. An assessment program that merely uses paper and pencil tests will overlook many of the mathematical processes. An assessment program that uses a variety of strategies and tools will be more suitable to capturing the complexity of mathematics. Rich mathematical tasks allow students to develop and show their competencies in problem solving, communication skills, mathematical thinking and perseverance. Further, the timely use of self-assessment helps students foster metacognitive skills such as a positive attitude towards mathematics and responsibility towards one's own learning, that are strongly recognized in the Singapore curriculum as being essential to learning mathematics. Assessment that includes observation and conferencing with students allows teachers to have a window into students' mathematical thinking and strategies for solving problems. Comments and anecdotal feedback to students helps students to determine the processes that they are mastering well and those that need further development. Such an assessment program is a complex task for the teachers. However, in order to develop mathematical proficiency in students, the full range of content and mathematical processes must be a foundation for curriculum, instruction, and assessment.

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▲ Friday Special



JACK WEINER

Fridays at the University of Guelph, five minutes before the end of class, I say, "Pens down, books closed, it's "Friday Special" time!" Then I show on screen an article or cartoon or letter or…something that has to do with math, the "real world" and has absolutely nothing to do with class, assignments or tests. It is math for fun. Often, it is some flagrant example of how the media abuse math. I hope you use some of these. Make them "Monday Morning" specials or "We need a break!" specials. If one falls flat, blame me. If it works, you take the credit.

I am writing this on June 21, one week from the federal election. I am really hoping that this is the year of the Green Party. That would surprise EVERYONE, including, I am sure, the Green Party. I imagine if it happened, the new members of the governing party would look at each other somewhat perplexed and say, "So, uh, what do we do now?"

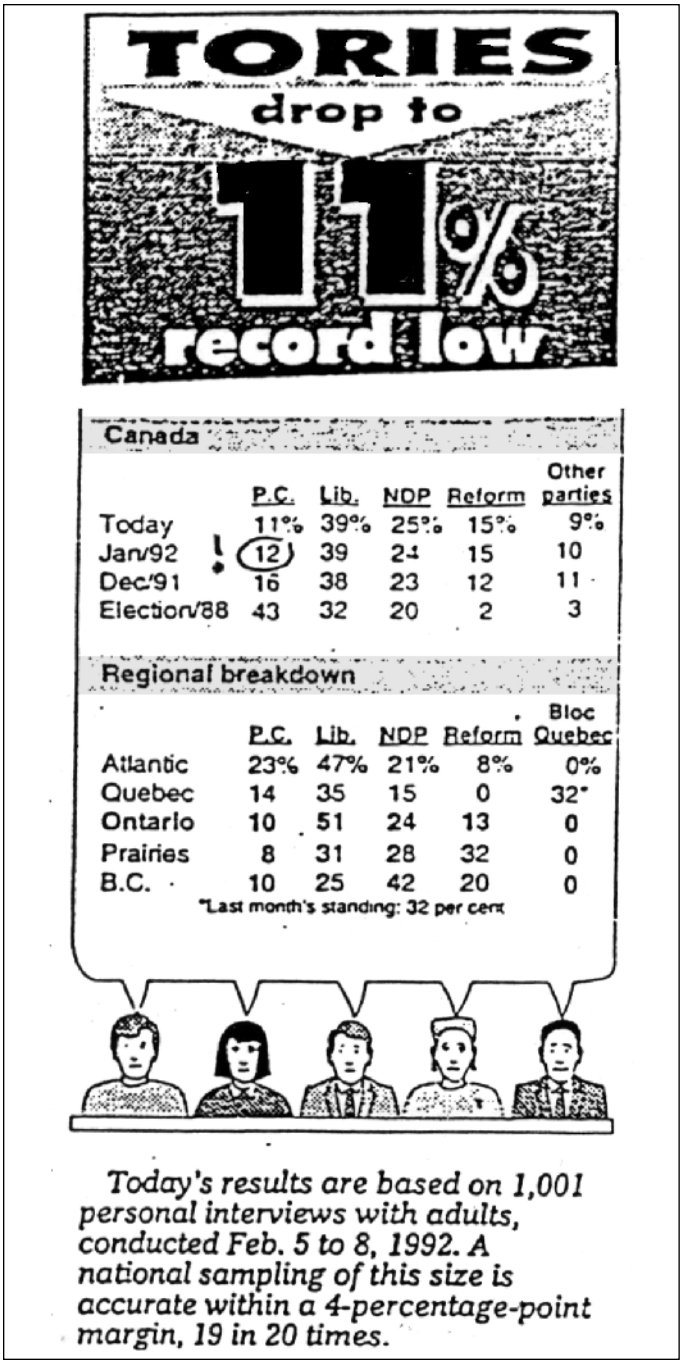
Because of the ubiquitous polls in this pre-election week, I decided the Friday Special would be a polling example of, "When the media does math, the media usually gets it wrong!" (I was tempted to write "an 'a-polling" example, but decided against it!)

Look at the accompanying page, reprinted from the Toronto Star in February, 1992. In January, 1992, the Tories were at a very low 12%, according to a poll.

Note the italicized explanation.

"Today's results are based on 1001 personal interviews with adults, conducted Feb. 5 to 8, 1992. A national sampling of this size is accurate to within a 4-percentage-point margin , 19 in 20 times."

With a little nudging from you, your students should be able to interpret this. Assuming the same polling methods were used in January, we can say with 95% confidence (that is, 19 times out of 20*), that the **true value** of where the Tories stood in January is between 8% and 16%, that is in an interval centred at and within 4 percentage points of 12%. The true value? This is the



actual percentage that the pollster would have found if **every** voter had been polled.

The problems. The February poll has the Tories at 11%. First, in spite of the italicized proviso, the newspaper implies this is the true value of where the Tories stood. It is not necessarily the true value, but an estimate from another sample. Second, and this is the more important problem for me, **even if 11% were the true value**, it lies between 8% and 16%. This is NOT A SIGNIFICANT CHANGE from January's sample!

Why, then, is the headline, "Tories hit record low with 11%"?

When the media does math, the media usually gets it wrong!

So, did the Greens get in?

Have a great 2004/2005 year!

Best wishes, Jack

*Basically, this means that if we did, for example, 2000 samples, we would expect the true value to be in approximately 1900 of the confidence intervals from these samples. Note the true value may not in fact lie between 8% and 16%. ▲

Ontario Association for Mathematics Education PUBLICATIONS

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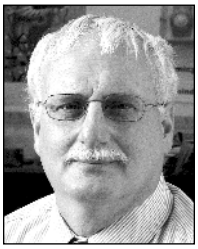
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▲ OAME/NCTM September 2004 Report



JOHN KERSLEY

First, I would like to thank Frances Schatz for the kind words of introduction in the June 2004 issue of the *Ontario Mathematics Gazette*.

Frances has done a fantastic job as OAME/NCTM representative for the past eight years. OAME has been extremely pleased with her contributions. It is my goal to carry on with the excellent example she has established. I wish her and her husband, Frank, all the best in their retirement.

New Regional Service Representative

I would like to offer my congratulations to Marg Warren as the new Regional Service Representative for NCTM's Canada Eastern region, which includes Ontario.

Membership Information and Benefits

The NCTM web site is www.nctm.org. It is worth a visit. For the mathematics educator, it offers information on the NCTM Standards, conferences and events, publications, products for lessons and the classroom, and job postings. To access everything on the site one needs to have at least an individual membership. Membership dues contribute to the development of resources and materials, the many various conferences and the delivery of NCTM services. For Canadian membership rates contact me via e-mail for a current individual application form. The cost is $117.50 in Canadian dollars for a year, including postage. It must be paid in Canadian dollars. If you apply on-line with a credit/debit card, you will pay the full exchange rate. It will cost more. At the current rate it is around $130 Canadian.

NCTM Conferences

The NCTM holds many conferences during the year—one annual and several regional. Upcoming regional conferences include New Orleans November 4 – 6 2004 and Minneapolis November 11-13 2004. Further information and details can be found at www.nctm.org/meetings. NCTM members save more than 40 percent on advance registration rates. If you are interested in speaking at these or any NCTM conference there is a form available at www.nctm.org/meetings/speaker.htm.

NCTM Publications and Resources

NCTM offers an extensive set of resource and reading materials for the mathematics educator at all levels—elementary, intermediate, senior and college/university. These can be found at www.nctm.org/catalog. Again contact me for pricing and avoid the full exchange rate if ordering on-line and using credit/debit card payment option.

Online Resources Include

Reflections consist of opportunities to view, analyze and reflect on instructional mathematics teaching practices through video examples.

Illuminations consists of resources that illustrate the Principles and Standards, including applets for student exploration, lesson plans, video vignettes of mathematics teaching and reviewed mathematics web resources.

Figure This! features mathematics challenges, hints and solutions for the intermediate grades and helpful hints for doing homework in mathematics. ▲

NCTM

CALL FOR MANUSCRIPTS

The NCTM's *Mathematics Teacher* journal has a call for manuscripts for the November 2006 Focus Issue, "Making Mathematics Meaningful". The issue will be co-edited by editorial panel member, Louis Lim. Please see http://my.nctm.org/eresources/mt/calls_mt.asp for further information or e-mail Louis at Louis_Lim@edu.yorku.ca. Articles from classroom teachers are particularly sought.

▲ Hey, It's Elementary

Holding Up a Mirror. Looking through a Window. A Model for Professional Development That's No Laughing Matter.



LYNDA COLGAN

"Net lingo" is one of many languages in which I am not proficient. I am certain that many people use e-mail acronyms such as CUL8R (see you later), G2G (got to go), IC (I see), IMHO (in my humble opinion), KWIM (know what I mean?) or FCOL (for crying out loud) as a regular part of their electronic correspondence to add personality and a touch of "with-it-ness" to their typewritten note. I am certain that many people send e-mails that include sign-offs like <3 (heart) :) (happy face) :((sad face) :-& (tongue-tied) and ;) (wink) as a way of personalizing their message or closing the cyber-gap. In spite of the omnipresence of these e-mail acronyms, I rarely find that the jokes that make the WWW circuit rarely make me LOL (laugh out loud) [although most days I could use a good dose of therapeutic humour, arguably the best medicine], nor do I find myself having a burning desire to include these abbreviations or artforms in my e-mails.

Until recently, that is. After returning to Kingston in early July from my annual month-long retreat to Rote Cottage on the south shore of Nova Scotia, I opened my e-mail account to find over three hundred messages. Many were spam. Many were out-of-date memos. Some were notes from students. And several were academic journal articles forwarded to me from a colleague in the education psychology department at Queen's. He has been sending me a number of such articles recently since we are about to embark on a research study together that we hope will contribute to the understanding of developmental mathematics disabilities and provide addition fodder for the debate on the nature and causes of dyscalculia. As I made my way through the abstracts and tables of contents for the various journals with pertinent literature, I was wondering if I was way over my head in this world of educational psychology and cognitive science. Then suddenly I found myself with a VBG (very big grin) and forwarding messages to all my friends assuring them that they too would soon be HF (having fun).

You see, somewhere in the middle of the mountain of paper, John had included two articles for "fun". The first was "Why Dogs Resemble Their Owners" by Nicholas Christenfeld and Michael Roy from the scientific journal *Psychological Science* [for those of you who are interested check the June 2004 edition or go to the online version of the *Washington Post*, May 11, 2004 searching for All Things Considered]. The second article was called "Giving Students a Hand" by Susan Goldin-Meadow from the University of Chicago, excerpted in the *American Psychological Society Observer*.

As any of you who know me would guess, the first article made me think HHVF (Ha, Ha, very funny) and made me smile because of the important relationship that I share with my black Labrador Retriever, Brigg, but it did not make me FOCL (fall off the chair laughing).

The second article did make me FOFL (fall on the floor laughing). This scientific paper made me LOL because it was about the importance of gesture in teaching. The researcher had conducted an extensive study on how our hands help us to teach and to learn. She describes the information that is communicated by gesture and posits that children actually learn more deeply when they gesture (particularly in the area of mathematics) than when they don't. She concludes that teachers should gesture with their hands because she says, "when children see gesture, they're more likely to use gesture, and more importantly, kids who use gesture, learn."

Any of you who have attended one of my workshops knows, I gesture. A lot. SCNR (sorry could not resist). Up until now, I have desperately tried not to gesture. But now I have been vindicated. TYVM (thank you very much).

My self-consciousness about my hand-flips all started when I was a student at the Faculty of Education at the University of Toronto in 1977. As a regular part of our teacher education program, we were required to film ourselves teaching a lesson of our choice during our student teacher placements. Then we were required to watch our lesson and provide a critique. Two of my faculty student teacher colleagues were also required to view the video and then critique the lesson as well.

Finally, we de-briefed as a group.

I'll never forget the experience of watching myself teach on tape. Why did I stand in front of the diagram on the board when I was asking questions about the diagram on the board? Why did I ask such inane questions? Why did I repeat every student's correct response like a parrot? Why did I flinch when that student challenged me about the answer to a question? Why didn't I provide thinking time – too often jumping in and answering the question myself – and worse still looking a bit pleased with myself that I knew the answer? And, why, oh why, were my arms flailing around like a drowning person in the middle of the ocean?

Watching the tape was a lesson in humility. I had an image of myself as a teacher. It did not match what I saw and heard. The de-briefing with my colleagues, though supportive, made me acknowledge the effect my other non-verbal communication habits had and take note of ineffective as well as inefficient classroom strategies and teaching techniques.

The experience was powerful. It promoted reflection, not based on what I perceived myself to have done during a lesson, but based on real evidence of how I behaved and conducted myself during a lesson. I was able to self-assess, and I was also assessed by my peers. I was also able to plan for the future. It was soon after that experience that I vowed to always buy teaching clothes with pockets (my plan to solve the problem was to keep my hands in those pockets unless I was writing at the blackboard or on the overhead projector). It was also soon after that experience that I seriously studied questioning techniques and sought to understand the nature of problem solving.

I don't know what the current protocol is at other faculties of education, but I know at Queen's, this videotaping/reflection/collaboration activity is not part of the regular B.Ed. practicum or field-based program. I think it should be. I also think it could be a powerful exercise in professional growth and school community building. More importantly it could be an effective professional development model. If small groups of teachers were provided with the opportunity and the structure to analyze their own practice, I believe that there could be an improvement to practice.

We need to learn more about teacher effectiveness, especially in the domains of mathematics and science teaching. There have been some attempts to do that by having teachers observe "best practice" videos featuring enthusiastic mathematicians and educational leaders and then challenging classroom-based educators to try these same techniques in their classrooms. Often this is a tall order.

Perhaps we can learn more about effectiveness by working together in small ways to improve mathematics teaching by understanding the lesson experience from the learner's perspective. By capturing the action from the other side of the desk, we have a perfect opportunity to study our own delivery in the classroom.

It is often said that teaching is a relationship and it is well documented that students are willing to invest effort when the nature of that relationship is positive. We need to see ourselves and our peers need to see us through the eyes of the child in order to assess the degree to which we are relating to our students on academic, emotional, social and pedagogical levels. We need to measure the mutual zone of comfort in our classroom. We need to gauge the degree to which we exude excellence, enthusiasm, energy and empathy. What do the children's faces tell us about how supported they feel in the classroom? To what degree do we create a sense of wonder or puzzlement? How are our communication skills? Do we complete our sentences – or our students sentences? Do we answer student questions respectfully? Is our information accurate? How well do we reinforce the main ideas or illuminate difficult points? Does our demeanour or our non-verbal cues unknowingly create distance from our students or inhibit communication?

Just as there is a risk with looking in the mirror, there is also a risk in looking through the window into other classrooms. Nonetheless, we do need to learn how to be effective teachers from one another – and we need to learn that there are many ways to be effective. Most often, we base our opinions of our fellow staff members by their actions and behaviours on the playground, in the staffroom, at workshops or in the corridors. Rarely, do we see each other teach in the classroom – the place where our professionalism should be judged.

Peer observation through videotaped lessons can give teachers an opportunity to learn from each other in a non-threatening environment. Where there is no judgmental outcome and an atmosphere of trust between the participants, teachers share ideas and suggestions openly and constructively to their mutual professional benefit, enabling them to share best practices and concerns as well as identifying staff professional development needs.

There must be two components to "peer observation": the actual observation of teachers by one another through videotaped lessons, and them talking about it afterwards.

Studies of peer observation in England have demonstrated that the process promoted trust between teachers. On the one side this is because it required trust. Without some trust the activity could not have occurred. On the other side, peer observation led to a deepening of trust, enhanced the quality of working relationships, and increased the understanding between teachers.

The same studies showed that peer observation became the context for the development of a shared language between teachers about teaching and learning. It is often hard for teachers to talk to one another about what occurs in their own classrooms. The words used by one teacher about what he or she does are interpreted by the other with insufficient knowledge of the context. Many assumptions are made that the first teacher may recognise to be incorrect but is unable to overcome. Teaching conversations are often reduced by these means to the 'common denominator' of vague generality. As a result of sharing experiences, and talking about them analytically, teachers doing peer observation came to know what each meant when they referred to aspects of classroom life. The conversations between them, rooted in knowledge of the context, and based in reasonable assumptions, became meaningful acts of communication - further reinforcing the understanding and trust between the members of staff concerned.

Peer observation was also attributed to raising teachers' awareness of change and professional growth. It is common for teachers to be unaware of change in themselves or in others. Each teacher does the best they can at that time, but is rarely aware of how different what he or she is doing may be from how it was before, of how much development there has been. The teachers who were involved in peer observation in the English studies, however, because of the systematic and sustained context, saw change occur in others, and consequently in themselves, and started to appreciate that they were getting better, both individually and collectively. This was added to by the self-awareness that often accompanied the process of peer observation - when choosing words carefully, for example. The sense of progress in turn promoted a sense of worth.

Peer observation promoted exploration of real classroom issues. One reason for this was that the teachers agreed not to observe specially prepared 'show' lessons, but to see teaching as it usually takes place. This meant that their discussions were much more likely to be relevant and applicable to what would be happening the next day and succeeding days. Although any kind of observation may result in seeing teaching ideas that might be taken away and used, the peculiar contribution that peer observation seemed to make was through the empathy that arose. The observer, who had just been, or who would shortly be, videotaped and then observed, seemed to be more aware of the relationship between his or her own classroom and teaching and what he or she was observing. The expression "You are doing just what I do!" was a characteristic comment, and often led to a discussion about whether the common approach should be changed, and if so, how - perhaps with subsequent observations offering the supporting framework for exploratory innovation. As a result peer observation discussions seemed to be even more useful than discussions that occurred after watching published video material, for example.

Finally, peer observation seemed to enhance professionalism and self-esteem. Again, it can reasonably be said that the unconfident teacher will not take part in peer observation. However, when the less confident teachers in the Leeds Consortium could be persuaded to begin, it resulted in improved self-belief. Once started, a sense was soon felt of being part of a larger whole, and in that context of being someone whose work was worth watching and talking about, and whose opinions were valued and to other people's understanding. This in turn raised the confidence of the teachers in themselves as professionals.

If videotaping and observation of lessons is to be used as part of a process of professional development, it is unhelpful if the teacher being observed is performing in an unnatural way. It is important to emphasize that it does not matter which actual lesson is observed – in fact it is the object of the exercise to make the observation part of normal practice, as everyday a way of seeking to improve teaching as, say, keeping a journal.

It is essential that the observation and subsequent analysis is not done with any other purpose than to inform the teachers' own work. The discussion subsequent to an observation (which might be called the "feedback session") is the most sensitive point in the whole observation process. One can unintentionally say things that are interpreted as negative, and the potential of the process for building up trust is destroyed in a

moment. The risk of this, based on past experience, is enough to deter many teachers from agreeing to take part in observation and feedback routines. It is important therefore that the 'ground rules' are mutually agreed in advance - and that they apply to both parties, as it can be just as stressful to give feedback as to receive it, and the fear of being misinterpreted should not be underestimated. It should, for example, be agreed by the participants that listening to what is being said in order to avoid jumping to conclusions is important, as well as always supporting observation points with examples and cases.

As one teacher said, "Observing other people's teaching has given me new ideas for my own teaching and has illustrated techniques I would never have thought of on my own. Being observed by other teachers from my school also gave me ideas about how the class looks from the student's perspective, and about things I might try in order to increase the effectiveness of my teaching."

Another commented, "I find that I am fairly skeptical of "innovative" teaching techniques until I see them demonstrated effectively. Watching someone use an unfamiliar technique allows you to assess its effectiveness and to begin to determine how to apply it in your own teaching."

And finally, in a comment reminiscent of my hand-waving, another teacher said, "It is very difficult to imagine what the students see throughout the class period. The observers have that pleasure and can tell you how things looked, whether you "umm"ed a lot, whether you made effective eye contact, whether the writing on the board was clear, etc. The feedback is very concrete and pertinent to your teaching style."

I hope to CUF2F (see you face to face) during the coming school year at workshops and conferences. And yes, I'll have my video camera with me. It's time again to look in the mirror myself. TMA (take my advice) … you should try it too.

References

John Threlfall (2001) *The Nature and Benefits of Peer Observation: Using Research and Evidence to Improve Teaching and Learning.* Summary Produced for the TTA/DfEE Teacher Research Conference, 7 March 2001, School of Education, University of Leeds. ▲

▲ GET INTERACTIVE: WEB SITES

KEVIN MAGUIRE



Kevin Maguire is an Instructional Leader in Mathematics/Numeracy for the Toronto District School Board. Kevin is also an OAME Director. His particular interests include teaching with technology and elearning.

In this space, web sites of interest to teachers of mathematics will be shared. In this issue, the spotlight will be on Algebraic Thinking. Relatively recent research has led educators to consider more widespread and early attempts to infuse algebraic thinking in our mathematics curricula.

Pattern

http://mathcentral.uregina.ca/RR/database/RR.09.97/maeers7.html

This site, developed by Maeers and Seaman at the University of Regina, provides a great deal of background and resources for teachers. Theory and classroom applications are blended to provide a broad picture of the importance of pattern in mathematics learning.

Building Bridges to Algebraic Thinking

http://illuminations.nctm.org/lessonplans/6-8/bridges/

In this lesson, students attempt to make a transition from arithmetical to algebraic thinking by extending from problems that have single-solution responses. Values organized into tables and graphs are used to move toward symbolic representations.

Developing Algebraic Thinking

http://my.nctm.org/eresources/view_article.asp?article_id=2072

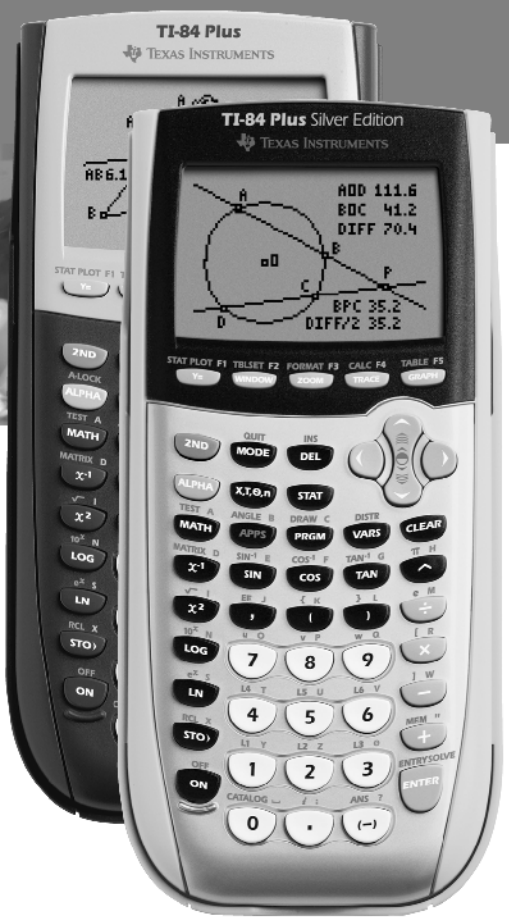
This resource, similar to the one above, takes an in depth look at teaching with a specific focus on algebraic thinking. Suzanne Alejandre provides a complete "story", detailing her approach to using this activity with her Grade 7 students, with a range of technological

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supports. Readers may recognize the "Traffic Jam" activity as a variant of "Frogs".

A Framework for Algebraic Thinking

http://www.learner.org/channel/courses/learningmath/algebra/session1/part_a/

This site, part of the Annenberg series on Mathematics Professional Development, asks teachers to reflect on algebraic thinking, in the broadest possible terms. Video clips show teachers discussing the fundamentals of algebraic thinking with other teachers. Try the famous "Eric the Sheep" problem! (in Part B)

Activities that Practice Function and Algebra Concepts

http://www.shodor.org/interactivate/activities/algebra.html

From the Shodor Foundation (www.shodor.org) which has been developing interactive activities for mathematics learning for a number of years, this site provides applets which could be used in different courses from Grades 9 to 12. From coordinates to slope to functions to conics to complex numbers – lots to explore! ▲

Upcoming Events

For further information on OAME Chapter Conferences contact the Chapter Representative and for NCTM conferences, contact John Kersely, OAME/NCTM Rep

See the last page in this *Gazette* for contact information.

OAME Chapter Conferences and Events

September 30 2004	St Doiminic School Bracebridge: 4:30 - 8 pm	MAC^2
October 14 2004	St Augustine Catholic HS	Y^{4}MA
October 15 & 16 2004	Sudbury	NOMA
October 21 2004	see GVMA web site	GVMA
October 28 2004	Location TBA	PRMA
November 2004	Location/date TBA	QSLMA
November 6 2004	University of Ottawa	COMA
February 2005	Thunder Bay	NWOAME
June 10-11 2005	Sudbury	NOMA: OMO 2005

OAME Annual Conference

May 12 - 14 2005	NEXUS: Building Mathematical Connections York University	hosted by TEAMS

NCTM Conferences

April 6 - 9 2005	Anaheim, California	83rd Annual Conference

Other

October 25 or 26 2004	Esso Family Math Centre London	For info Call UWO 519-661-2111 X 88951

▲ *E-Stat* and other StatCan Resources for the Grade 12 College Math Course

JOEL YAN, STATISTICS CANADA



Joel Yan has been part of the Learning Resources Team at Statistics Canada in Ottawa for more than 10 years. As a mathematician he is passionate about developing StatCan resources for math and helping teachers use these resources with their classes.

Want to increase the use of real data and technology in your MAP4C (grade 12 Math College Apprenticeship) course? Amy Scales from Listowel District Secondary School, Avon Maitland District School Board has done just this by developing a series of 10 sequenced activities for teaching the Statistics Unit of MAP4C.

Amy writes: "To add pizzazz to the presentation of the Statistics Unit this year, I relied heavily on the Statistics Canada site for my college course. I developed lessons that slowly introduced *Fathom* and the various excellent resources from Statistics Canada; *E-STAT*, *Statistics Power From Data* and *Census at School*. My students enjoyed working with real data. All of the activities and their support materials are on my school web site: http://fc.avonmaitland.on.ca/~amy_scales ."

The activities are organized under two main headings:

One Variable Statistics:

1. *E-Stat* Investigation.
2. Introduction - Data collection
3. Sample Selection
4. Survey design
5. Graphing with *Fathom*
6. Measures of Spread
7. Measures of Central Tendency

Two Variable Statistics

8. Linear Regression
9. Quadratic regression
10. Exponential Regression

***E-STAT* Investigation** introduces students to the process of requesting data.

Introduction – Data Collection to **Survey Design** have students work at their own pace through the *Statistics Power from Data* site. Students also refer to *Census At School*.

Graphing With *Fathom* to **Measures of Central Tendency** have students using *Fathom* to perform calculations, produce graphs and make conclusions: data was collected from the class and *Census At School*. In these exercises students researched their own data from *E-STAT* and referred to *Statistics Power from Data*.

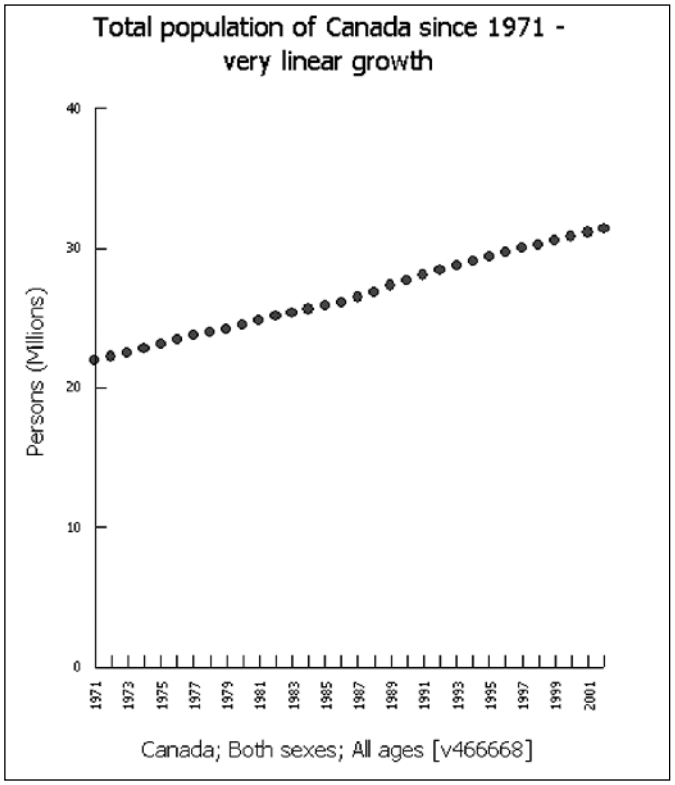
Finally the **Linear Regression** to **Exponential Regression** exercises have the students creating curves of best fit for various data sets. These rich tasks prompted students to investigate the properties of the curves. After each exercise students were provided with data from Statistics Canada and asked to fit models and make predictions. Students responded well to these tasks because they felt their work had value.

Next year we will request random samples of the responses from the Canadian database on *Census At School* as well as from the international database, and compare them with last years results."

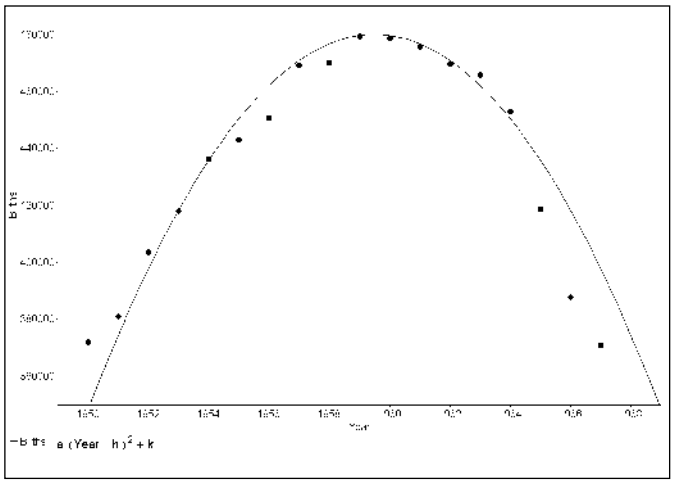
Modeling Functions and Curve Fitting using *E-STAT*

E-STAT contains a wide range of authentic data about Canada and Canadians. With its most recent release in July of 2004, *E-STAT* contains over 25 million time series organized into over 2,000 well-structured multi-dimensional tables. Also we have enhanced *E-STAT* scatter graphs and added the capability to generate frequency histograms and 7-number box-and-whisker plots to visually show the distribution, median, quartiles, and spread of *E-STAT* data series.

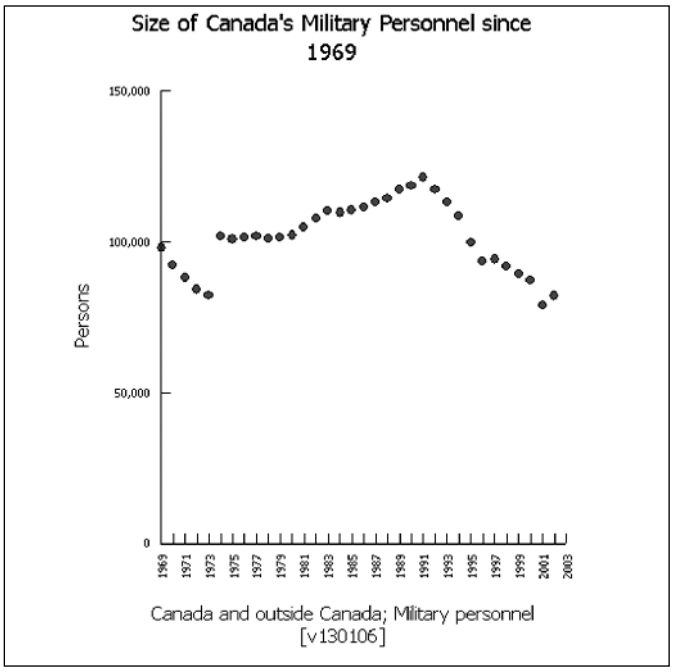
This huge *E-STAT* database can be used for curve-fitting and modeling of linear, quadratic, exponential and trigonometric functions. Below are examples that demonstrate of how the *E-STAT* time series data can be modeled by typical functions taught in high school mathematics classes. The specific *E-STAT* series number is given below the graph. The baby boom activity below demonstrates the steps for extracting data and using it with *Fathom* for modeling mathematical functions. Note: All these StatCan resources can be found at http://www.statcan.ca/english/edu/index.htm



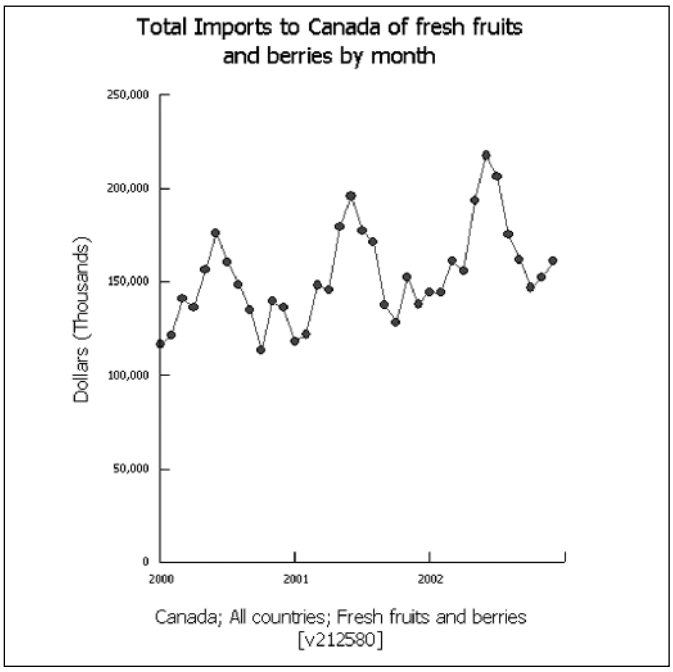
Simple Linear Function: The huge *E-STAT* database can be used to depict time-growth linear functions such as this one showing the population growth in Canada since 1971.



Quadratic Function: In the Baby Boom activity, students learn the advantage of using vertex form of a quadratic equation $y = a(Year-h)^2 + k$.



Piecewise Linear Function: The slope and direction of the line varies over time, as a result of government decisions about the need for Canadian military personnel based on budget and world affairs. A sudden jump in values occured in 1974 when military reserves were included.



Trigonometric and other Periodic Curves: Time series that are seasonal such as imports of fruits can be approximated by trigonometric or other periodic functions.

Quadratic Power - Modeling the Baby Boom using *E-STAT* Data & *Fathom*

In this activity, students will learn an advantage of the vertex form of a quadratic equation. Data on births in Canada are extracted from *E-STAT* and imported into *Fathom*. Within *Fathom*, students use sliders to model a quadratic relation and adjust the parameters to maximize the visual fit of the parabola to the Canadian Baby Boom. Sliders help students gain an understanding of the values of the h and k parameters. I want to acknowledge Manny Avila of the Queen's Faculty of Education for his help developing this activity.

Overall Expectations

- Determine through investigation, relationships between the graphs and the equations of quadratic functions
- Determine through investigations the basic properties of quadratic functions

Specific Expectations

- Identify the effect of simple transformations
- Explain the role of a, h and k in the vertex form of the quadratic equation $y = a(x - h)^2 + k$ representing a parabola
- Collect data that may be represented by quadratic functions, from secondary sources
- Fit the equation of a quadratic function to a scatter plot using an informal process, and compare the results with the equation of a curve of best fit produced by using graphic calculators or graphing software

Classroom Instruction

Review the vertex form for a parabola. You can have the class work through all the steps on the student worksheet to extract the data on **births** from *E-STAT* and import it into *Fathom*. Alternatively, you can start with the *Fathom* data file provided at http://www.keypress.com/fathom/sample_documents/ and then all you have to do is use the sliders, starting at step 18 in the procedure below.

Student Worksheet

Your Task

In the real world, a graph related to human population only rarely approximates the shape of a parabola with any accuracy. However, occasionally the underlying

conditions lead to population trends which closely follow a parabolic shape over specific time periods. The so-called "baby boom" occurred right after World War II. Canadian soldiers returning in great numbers after the war got married and/or started having children within a few years after returning to Canada. The result was a huge increase in births in Canada beginning in 1948. Births rose for several years to a peak in 1960 and then began to decline. In this activity we will determine if a parabola is a useful model for representing the number of births per year for this post-war baby boom period.

Procedure

1. Open the *E-STAT* web site at http://estat.statcan.ca
2. Select your language of choice and then click "Accept and enter" at the bottom of this screen.
3. Click **Search CANSIM** on the left side bar and then click **Search by Table Number** and click **Continue**.
4. Retrieve Table **053-0001** — *Vital Statistics, births, deaths, and marriages, quarterly* by using the CANSIM search tool on the left side bar in *E-STAT*.
5. On the subset selection page choose as follows:

   Under Geography, select **Canada**

   Under Estimates select **Births**

   Under From select **Jan. 1950**

   Under To select **Dec. 1968**
6. Click the **Retrieve as individual Time Series** button.
7. In the Output specification screen, under output format selection, click the down arrow and select Scatter graph.
8. From the, **The frequency of the output data will be** pull down menu select **converted to annual (sum)**.
9. Click the **Go** button. This should generate a scatter graph.
10. In order to transfer the data to *Fathom*, click the **Back** button on the browser. On the Output specification screen, under output format selection, click the down arrow and select **Plain text table, time as rows**. This is the most reliable format for transferring time series from *E-STAT* to *Fathom*. Once you see the data displayed, highlight all the relevant data values. Then under the **Edit** pull-down menu, select **Copy** to copy the selected data.
11. Open ***Fathom***.
12. Create a new collection.
13. From the Edit pull-down menu, select **Paste cases**.

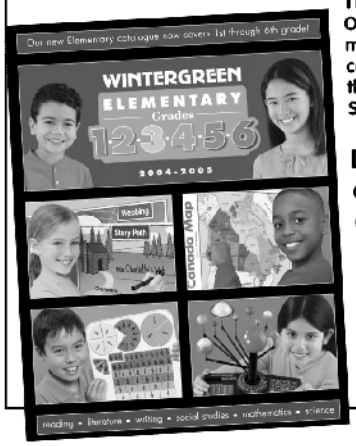
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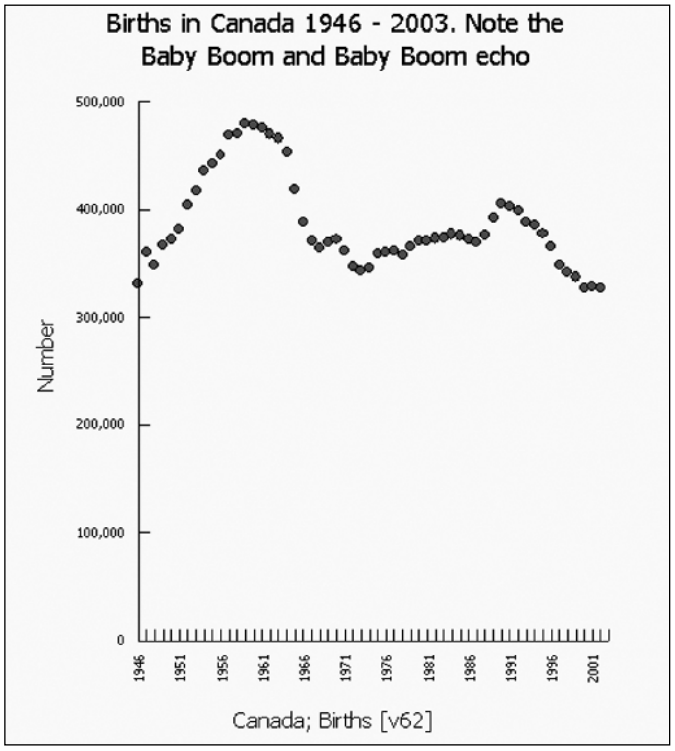
14. Create a new case table
15. Rename the attributes if necessary to year and birth.
16. Create a births vs year scatter plot
17. Save your *Fathom* document.
18. Create a new slider by dragging the slider (second button from the right) onto the workspace.
19. Rename the slider V1 as a.
20. Create 2 more sliders and name them h, and k respectively.
21. Right click on the graph and select **Plot function**.
22. Enter the quadratic relation in vertex form (select the appropriate attribute name, e.g., year, years, etc.,) For example, births = $a*(year - h)^2 + k$. Note that you do not have to enter the dependent variable and so enter $a*(year - h)^2 + k$.
23. What is the interpretation of h for this curve?
24. What is the interpretation of k for this curve?
    a. Answer: (h, k) are the coordinates of the vertex of the parabola.
25. You can adjust the slider variables by dragging the number line, or you can double click the slider and define the range and value. Since we know that h is the year where the maximum number of births occurs, you can save time by typing in this value.
26. Adjust the sliders until you generate a parabola which best models this Baby boom data.
27. Right click the graph, and select **Residual plot**. Use the residuals to help you find the most appropriate parabola using the sliders.
28. Do the values of h and k concur with your answers above?
29. How does changing the value of a affect your parabola?
30. What are your best values for a, h and k?
31. Enter the data in *Excel*, *TI-Interactive* or a graphing calculator and perform a quadratic regression analysis.

    What is the equation of the quadratic regression curve of best fit? What is the computed r^2 value?
32. How well does the equation of your parabola from using the sliders above compare with the computed quadratic regression equation? Discuss briefly.

Enrichment

33. Repeat this process for a later time period to see if there is a significant "baby boom echo".
34. Is the shape of the births curve replicated when the baby-boomers start to have their own children? Compare the 2 curves. (See graph below.)
35. When is the peak year of the baby boom echo?
36. What is the period of time between the 2 peaks?
37. How might you interpret this period of time?

    Answer: This is one measure of the period between generations.



StatCan Institutes for Math Teachers

By popular demand, Statistics Canada will be running institutes for teachers of MDM4U, MAP4C and other math courses this fall. The sessions will focus on how to effectively use the Statistics Canada web site (www.statcan.ca), resources for teaching mathematics, including *E-STAT*, our on-line statistics book *Statistics:, Power from Data*, and *Census at School*. Participants will work through a sequenced series of lessons using the latest statistical datasets. All participants will receive a CD-ROM containing teacher resources and exemplary student culminating projects. To discuss a possible session for your region or board, contact Joel Yan at mdm4u@statcan.ca or 1-800-465-1222. ▲

▲ Photo Math – A new way of picturing math

RON LANCASTER



Ron Lancaster is a Lecturer in Mathematics Education at the Ontario Institute for Studies in Education at the University of Toronto. He is also an independent mathematics consultant and works with teachers, students and educational organizations in North America, Asia and Israel.

"A picture is worth a thousand words" is an expression that is often used to convey the importance of using images to make a point. The point of this column is to go beyond this notion and promote the idea that in fact "A picture is worth a thousand numbers". Photos with Math is what readers can expect to find in every Photo Math column and the emphasis will be on seeing and doing mathematics everywhere. Teachers may want to assign these questions to their students as part of an overall effort to make connections between the curriculum and the world around us. Establishing these connections is at the heart of the new Ontario curriculum as well as the new NCTM document, *Principles and Standards for School Mathematics*. It is hoped that these questions will inspire students to be more creative and playful and that in the end, students will develop an ability to see the world from a different perspective.

Teachers and students are encouraged to pose mathematical questions related to their own encounters and to submit these problems along with photographs to Ron for possible publication in future columns. Photos can be sent via e-mail or by regular mail.

Introductory comments for the September 2004 Column

The material for this month's column was created by three outstanding educators from Hamilton: **Julian D'Angela**, **George Fawcett** and **Paul Lessard**. These three educators have worked together as a team for many years with the Hamilton-Wentworth Catholic District School Board as mathematics teachers and board-wide curriculum consultants. They are well known and highly respected for their contributions to education beyond their Board.

Over the last few years, Julian, George and Paul have focused on a variety of initiatives to help teachers help kids who hate math with the hope that more kids will say "AHA, I can see the math!" Some of their initiatives include: grade 7-9 readiness and diagnostic organizers; GSP and WinPlot activities; excursions in recreational mathematics; open-ended investigations with concrete materials; informed classroom strategies that highlight partners, coaching and teamwork; an in-depth collection of rich investigations including Deck of Cards, Neverending Story, Big Sister Calendar, Problem Solving with Canadian Stamps and the Twelve Days of Christmas.

They are presently developing a math line for Tree House Press Inc. (www.treehousepress.com). This line includes; *Investigating Mathematics with Manipulatives Grades 1-5*, the *Grade Nine Academic Assessment Workbook* and *Teachers' Resource*, the *Math Poster Series* and the *Math Photo Collection*. These resources have been integral parts of their professional development series – *The Great Math Adventures: Grades 1 to 9*. Last year they presented this series in 21 cities. New resources are being developed for this calendar year. For further information e-mail contact@treehousepress.com.

The photos in this article are from the *Photo Math Collection* which they have created to help their partners in education refocus on reluctant problem solvers, boys' achievement and better communication for all. Indeed it is designed to hook kids on exploring the math that they encounter in their day-to-day lives.

Photograph 1



(a) How many packages of paper can be placed on the middle shelf? Discuss your answer with a partner.

(b) Look carefully at the top shelf. What would be the least and most number of packages of paper that could be on the shelf? Explain and justify your thinking.

(c) How much money would be required to buy all of the packages that you see on the three shelves?

(d) Write two other questions about this display and trade with a partner.

Photograph 2



(a) How many boxes of Raisin Bran are in this display?

(b) How many cases of Raisin Bran could be bought with $500?

(c) What is the total mass of the Raisin Bran display?

(d) Write two other questions about this display and trade with a partner.



Photograph 3

(a) How many jars of jam are in this display?

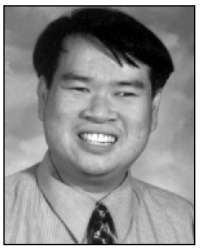
(b) How long does a jar of jam last in your home? How long will this display last with your family. Discuss your solution with a partner.

(c) Write two other questions about this display and trade with a partner.

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▲ Put on Your "Mathematical Glasses": Connecting *The Simpsons*® and Mathematics

Louis Lim



Louis Lim is department head of mathematics at Unionville HS and a PhD student at York University. He is currently an editorial panel member of the NCTM's Mathematics Teacher*. In 2003, Louis was the recipient of the York University Faculty of Education Alumni Association's* Excellence in Teaching Award*. He continues to find innovative and creative ways to make mathematics fun for his students.*

For years, Ron Lancaster has created Math Trails for his students[1]. Workshops have been offered at past OAME conferences where Ron would take conference delegates, often accompanied by his own students, on guided walks. In recent issues of his PhotoMath column in the *Ontario Mathematics Gazette*, mathematics has been captured in buildings, signs, sculptures, and sidewalk mosaics. I am convinced, when we put on "mathematical glasses", we can find mathematics all around us.

As a regular viewer of the popular animated television show, *The Simpsons*®, I have continually been surprised with the numerous mathematical references made. To my delight, Professors Sarah Greenwald (Appalachian State University) and Andrew Nestler (Santa Monica College) wrote an article in the April 2003 issue of the Mathematical Association of America (MAA)'s *Math Horizons* titled, "Simpsons Rule!" In fact, the authors have created a web site, www.simpsonsmath.com, which currently contains 23 printed pages of scenes from *The Simpsons*®, where mathematics makes an appearance. Greenwald and Nestler state that there is no accident that mathematics appears on the television show since several writers have university degrees in mathematics from Harvard. During the past several years, I have kept a pencil and notepad close by so I could jot down scenes that contain mathematics. I knew there was something special about watching that television show!

In this article, I highlight several instances where I have used scenes from *The Simpsons*® in my mathematics teaching. As a classroom teacher, I am aware that *The Simpsons*® may not be considered the most ideal program for students to watch, although it has been argued on CBC radio that it is the best television show ever[2]. Currently in its 15th year on television stations such as Global and the CBC, we must accept that students watch the program, even though the original audience was intended for adults[3]. As a result, we need to teach students how to critically analyze the effects of various forms of media, on equity, for example. Such a skill is important since we do not want students to take everything at face value.

Emphasis in the new mathematics curriculum has been placed on how to introduce concepts to students. The graphing calculator and the *Geometer's Sketchpad* have opened the doors for exploration so that students are actively engaged in discovering concepts, which should lead to better comprehension and retention. Should emphasis also be given to lesson closures?

My favourite scene occurs when Homer finds a pair of glasses, which actually belong to Henry Kissinger, in the toilet[4]. When Homer puts on the glasses, he says, "The sum of the square roots of any two sides of an isosceles triangle is equal to the square root of the remaining side," only to be corrected by the man in the next washroom stall, "That's a right triangle, you idiot!" When providing closure to the Pythagorean Theorem unit, my

[1] See Ron Lancaster's article, "Math Trails – An Award Winning Method for Connecting Mathematics with the World Around Us" in the December 1998 issue of the Ontario Mathematics Gazette*.*

[2] Speaking with Ron Lancaster, he recalls hearing this remark on the CBC radio.

[3] In the fall 2003, a "Simpsons Extravaganza" took place at the Metro Convention Centre in Toronto. Thousands of Simpsons® fans, including many young families, enjoyed the display of original drawings, sketches, and production cels.

[4] I am the proud owner of an original production cel of this scene! My cel is unique since each movement of a character requires a separate cel.

students identify the **three** mistakes in Homer's description. We also discuss the appropriateness of the remark "you idiot" since I do not want students calling each other derogatory names.[5] Homer has certainly found a pair of "mathematical glasses", even if they are a bit crooked!

When teaching a lesson on derivatives in calculus, I include the scene with Bart Simpson's grade 4 teacher using differential calculus in a humorous manner: "So, $y = \frac{r^3}{3}$, and if you determine the rate of change in this curve correctly, I think you'll be pleasantly surprised … Derivative $dy = \frac{3r^2}{3} dr$, or r^2dr, or r dr r. Har de har har! Get it?" All my calculus classes have chuckled at this scene. In fact, former students would often state this experience to be a memorable moment of the course! I think it is important, especially in calculus, to include humour, since the learning environment is often marks-driven.

When discussing irrational numbers, I use a scene with two girls playing a game by reciting the digits of π: "Cross my heart and hope to die. Here's the digits that make π: 3.141 592 653 589 793 238 4 …" After reading the www.simpsonsmath.com web site, I became enthused to learn that the camera deliberately moved away from the children's game since, by reciting the digits of π, the game would theoretically never end! Perhaps this analogy will help students remember irrational numbers.

One final scene that has impacted my mathematics teaching is Homer entering the 3rd dimension. According to Greenwald and Nestler, the scene lasted 7.5 minutes! I remember writing the equations in the background on my note pad: "1 + 1 = 2", "$e^{\pi i} = -1$" and "$1782^{12} + 1841^{12} = 1922^{12}$". In particular, I found $1782^{12} + 1841^{12} = 1922^{12}$ very interesting since I knew, according to Fermat's Last Theorem, that the equation could not be true. Students are fascinated that this 350-year-old problem was solved only a decade ago by Andrew Wiles. I tell students that Wiles learned of Fermat's Last Theorem[6] when he was 10 years old and spent many years before he proved that there are no



http://xo.typepad.com/blog/2003/12/fullscale_simps.html

solutions to $x^n + y^n = z^n$, n > 2, and x, y, and z are positive integers. I also emphasize that solving mathematical problems can take hours, days, months, years, and even decades; perseverance and determination are key factors.

Recently, a grade 12 calculus student brought to my attention to the "Simpsons House Giveaway", a contest that 15 million people entered in 1997. The prize, a full-scaled replica (both inside and outside) of the four-bedroom house, can be viewed using an Internet search engine by typing in "Simpsons" + "house". Such a discussion should enthuse my future grade 10 applied mathematics students when they learn about scale-drawings.

In this article, I have provided four instances where I have used *The Simpsons*®, with great success, in my teaching. I encourage readers to visit www.simpsonsmath.com since many more mathematical scenes are discussed, which also contain animated photos! The past half a decade has been very challenging for teachers, with the implementation of new curriculum, instructional and assessment practices. It is time to reflect and refine our practices. One way to make the learning environment non-intimidating is through the use of humour. Although some teachers may be hesitant to use *The Simpsons*® in their teaching, I would argue that since some students are already watching the television show, we could teach them how to critically analyze the program. Several years ago, I recall asking a student in the hallway, "Do you have a lot of homework tonight?" His response, "No … I'm going to spend the evening watching *The Simpsons*®." If a student provided a similar response today, I would say, "Remember to put on your 'mathematical glasses'!" As the show is currently in its 15th season, I wonder what mathematical surprises await us! ▲

[5] I would like to acknowledge the feedback provided by the blind reviewers in my original manuscript. Their concerns about equity have strengthened my article.

[6] A readable book for senior level high school students interested in learning more about Fermat's Last Theorem is Simon Singh's Fermat's Enigma*, published by Penguin Books.*

OAME/AOEM Awards Nomination Process

Deadlines

Nominations for awards to be presented at the Annual Conference must be received by January 31 of the calendar year in which the conference takes place.

Nominations received after January 31 will be considered for awards to be presented during the next three calendar years. A nomination will be allowed to stand for three consecutive years. After that time, the nomination must be renewed. A standing nomination may be amended at any time by the original nominator. The nominator need only inform the chair of the Awards Committee in writing of the proposed changes to the nomination form.

The OAME/AOEM Nomination Form

Write a letter supporting the nomination of your candidate for the indicated award. Provide specific and detailed information about the nominee's activities as they relate to the following areas of consideration:

- demonstrations of excellence and creativity in mathematics education;
- specific contributions to mathematics education in the school, region, province or nation;
- demonstrates leadership in mathematics education in the school, region, province or nation;
- support of and contribution to the activities of OAME/AOEM, and
- contribution to the development of students both within and outside of the classroom.

Please include any additional information that you feel may be relevant to the nomination, but which may not be specifically mentioned above.

The Nomination Cover Page

Complete the Nomination Cover Page and attach it to your letter of recommendation for the nominee.

Incomplete or inaccurate information may cause a nomination to be withheld from consideration.

OAME/AOEM LIFE MEMBERSHIP AWARD

The Life Membership Award is given to recognize a person who has contributed in a significant way to OAME/AOEM; demonstrated outstanding leadership in mathematics education; and has accumulated 10 or more years of membership in OAME/AOEM.

KENNETH D. FRYER AWARD

In Memory of the late Kenneth D. Fryer, OAME/AOEM, in conjunction with the Grand Valley Mathematics Association, established the Kenneth D. Fryer Award. The award is to be given annually to recognize a mathematics department which fosters collegiality, team work, and excellent classroom teaching; contributes to the overall development of students; and demonstrates leadership in the mathematics education community.

AWARD FOR OUTSTANDING CONTRIBUTION TO OAME / AOEM AND MATHEMATICS IN ONTARIO

This is to recognize an individual who has made significant contribution to OAME/AOEM, but who is not necessarily an educator or a member of OAME/AOEM.

AWARD FOR EXCEPTIONAL AND CREATIVE TEACHING IN ELEMENTARY MATHEMATICS

The award is presented annually to recognize an exceptional and creative elementary teacher who demonstrates excellence in mathematics education by contributing to the overall development of students.

AWARD FOR EXCEPTIONAL AND CREATIVE TEACHING IN SECONDARY MATHEMATICS

The award is presented annually to recognize an exceptional and creative secondary teacher who demonstrates excellence in mathematics education by contributing to the overall development of students.

AWARD NOMINATION COVER PAGE

INTENDED AWARD *(please check one)*

- ❑ **Life Membership**
- ❑ **Kenneth D. Fryer**
- ❑ **Award for Outstanding Contribution to OAME / AOEM and Mathematics Education in Ontario**
- ❑ **Award for Exceptional and Creative Teaching in Elementary Mathematics**
- ❑ **Award for Exceptional and Creative Teaching in Secondary Mathematics**

Nominee's Information:

_____

Name of Nominee (Principal and Department Head for K.D. Fryer Award)

_____

_____

School, Organization, or Business Address

Telephone Number ( ) _____

Fax Number ( ) _____

Home Address _____

_____

Home Phone ( ) _____

Nominator's Information:

_____

Name of Nominator

_____

_____

School, Organization, or Business Address

Telephone Number ( ) _____

Fax Number ( ) _____

Home Address _____

_____

Home Phone ( ) _____

SEND TO: Judy Dussiaume

▲ Ribbit Ribbit

JIM SCHUTER



Jim Schurter is a retired secondary school mathematics teacher and department head. For the last two years, he and a series of coop students from the University of Waterloo have been creating the web site mathfrog.ca in an effort to help grades 4 –6 parents, teachers and students.

Many in mathematics education are well aware of the leadership that *The Centre for Education in Mathematics and Computing* (CEMC) at the University of Waterloo continues to provide through intermediate and senior mathematics contests. However, some may not realize that during the last few years CEMC has also begun to offer support to grades 4, 5 and 6 educators and students. Some initiatives include Math Fun Resources and Online Games (MathFrog), the Emmy Noether Circles, the Mathematical Growth series and Invitations to Mathematics.



Math Fun Resources & Online Games

Approximately two years ago, a small group of interested mathematics educators from CEMC and the Centre for Learning and Teaching Through Technology (LT3) met with the goal of using technology to improve certain aspects of mathematics education. After considerable investigation, it became evident that although good computerized mathematics games captivate students' interest, many seem to provide little in terms of long-term understanding. Also, a steady diet of paper and pencil exercises, no matter how well planned, frequently creates disinterested students who complete assigned work without adequate understanding. It was decided that integration of technology with paper and pencil exercises might be a very effective and enjoyable method of reinforcing and practicing the fundamentals of mathematics. It was also concluded that the greatest positive effect could be achieved by providing assistance to teachers, students and parents at the junior level.

For the past 18 months, several educators have been creating mathfrog.ca, a web site of free self-contained lessons for grades 4, 5 and 6. Each lesson, available in both French and English, combines an excellent mathematics computer game or technological tool with appropriate paper and pencil follow-up exercises. One or more of the expectations in the Ontario curriculum is addressed by each lesson. Much field-testing, in a variety of classroom settings, has verified that the technological and paper sections of each lesson can be used in a variety of ways but are most effective as a package.

The primary aim of mathfrog.ca is to provide teachers with quality stand-alone lessons that can be used for a change of pace at the end of a unit. Also, they can be utilized effectively when the regular teacher must be absent. In addition, these lessons are available to students and parents at home.

During the next year, more lessons will be created. Some will involve the use of technological tools such as *Geometer's Sketchpad*. The creators of mathfrog.ca encourage every grade 4, 5 and 6 mathematics teacher to visit this free web site, to read the short page for first time visitors, to investigate the master list and to use some of the appropriate lessons. Doing so should help to reduce teacher preparation time and provide students with some variety in the type of lesson delivered.

Emmy Noether Circles

These circles will be available three times during the present school year. Each circle (set of problem-solving activities) consists of six problems with hints and solutions for teachers. The problems, to be used at each teacher's discretion, are designed to provide opportunities for grades 5 and 6 students. Although somewhat generic, the problems, which reflect the Ontario curriculum, are suitable for use either by individuals or groups. The first circle should be available in September from the web site cemc.uwaterloo.ca. More information is contained in a fall mailing due to

arrive in your school shortly.

Mathematical Growth Series

Problem solving plays an important role in the study of mathematics. To help students develop their problem-solving skills, teachers must be comfortable in this regard. Each of the grades 5-6 and 7-8 series of workshops offer a wealth of professional development to assist participating teachers become more comfortable and proficient with problem-solving. Boards of education and teachers are encouraged to inquire about arranging such workshops for their teachers.

Invitations to Mathematics

This set of 15 booklets, created over the last few years by a team led by co-editors Lorna Morrow and Bev Marshman, provides many activities to introduce and investigate various units of the current Ontario mathematics curriculum. At present, these booklets support grades 4, 5 and 6 in the areas of data management, probability, patterning, geometry and measurement. Each booklet contains the activities, all necessary black line masters, complete solutions, teachers' notes and suggestions for assessment. Three more booklets, highlighting number sense, will soon be available.

A visit to cemc.uwaterloo.ca will provide much useful information about the Invitations To Mathematics series, the Mathematical Growth Series, the Emmy Noether Circles and much more. In addition, mathfrog.ca contains more than 30 free ready-made lessons. Grades 4, 5 and 6 teachers, parents and students should find these materials both educationally valuable and enjoyable. ▲

▲ Olympic-Sized Mathematics OMO 2004

JACQUELINE HILL AND SANDRA JEAN PRICE



Jacqueline Hill is a teacher of mathematics at Port Perry High School. Her involvement in the mathematics education community includes Course Profile writing, Workshop Leader, Pine Ridge Math Association President, and writer for Nelson Thomson Learning.



Sandra Jean Price has worked for the Durham District School Board for the last nine years. She is currently a grade seven teacher at Westcreek Public School in Pickering, Ontario. She is the new chapter representative for the Pine Ridge Math Association. Sandra has been involved in organizing both the OAME provincial conference in 2003 and the Ontario Math Olympics in 2004.

Find a four digit number that does not begin with 0, whose first two digits when added to the last two digits have a sum of 18, and whose last digit, when followed by the first digit forms a perfect square. Have you figured out the answer? Students from across Ontario converged on the University of Ontario Institute of Technology in Oshawa on Friday, June 18th to answer a series of such questions.

The top 120 out of 14 000 grade 7 and 8 math students



in the province, the "best of the best", competed at the University of Ontario Institute of Technology for top team in the province in the 2004 Ontario Mathematics Olympics. Each team was sponsored by a local chapter of the Ontario Association of Mathematics Education, the provincial association that initiated the event. This year it was hosted by the Pine Ridge Mathematics Association.

Upon arrival on Friday night, students presented team chants that linked their team to their chapter and explained the boundaries of their chapter. These chants were assessed and teams were awarded points towards their competition total. An "enormous feast" was provided for both students and chaperones in the dining hall. After dinner, students had an opportunity to explore four different stations of topology, a mind-bending branch of mathematics that often involves hands-on puzzles. An evening of socializing followed, allowing students to get to know one another before the competition.

On Saturday, the students' skills were tested in four separate events in these Olympics: the individual event, the technology event, the relay, and the team event. While students exercised their minds, their chaperones and coaches spent a fun filled day at *Cullen Gardens and Miniature Village*. They played miniature golf, viewed the gardens, toured the driving range, and had a wonderful lunch at *The Restaurant*.

The awards ceremony and celebration video concluded the 2004 OMO. The celebration video captured the highlights of the two-day event. The awards were sponsored by the *Ontario Power Generation* and *Texas Instruments*. In third place were the SAME (Scarborough Association for Mathematics Education) students Puja Bagri, Jane Han Zhang, William Zhoa, and Matthew Wang. Second place was awarded to another SAME team comprised of Rebecca Chung, Sherry Zhang, Timothy Chung, and Leslie Tung. The trophy for first place returned to London for yet another year. The ISOMA (Independent Schools of Ontario Mathematics Association) team of Jonathan Erlichman, Taheer Datoo, Briar Findlay, and Ruby Lung received first place honours. ▲



▲ OAME has a new Web Site Co-ordinator

GREG CLARKE
OAME WEB SITE COORDINATOR
E-MAIL: webmaster@oame.on.ca



Hi! My name is Greg Clarke, and I will be your web site coordinator. I am a mathematics and computer science teacher with the Simcoe Muskoka Catholic District School Board, currently working out of the board office as a Secondary Program Coordinator. I started my teaching at St. Joseph's High School in Barrie in 1988, and then moved to Patrick Fogarty Catholic Secondary School in Orillia for the next ten years. My wife Julie teaches French, Italian and English at Patrick Fogarty, and we have three great children, Jonathan (grade 8), Alexandra (grade 7) and Daniel (grade 4). More recently, I have been a Computer Consultant for our board, and now have the position of Coordinator which allows me to work with Math, Science and Tech teachers from all of our secondary schools in the board.

I'm looking forward to working with math teachers across the province in this new role. For the past two years, I have been the Chapter Rep for the Mathematics Association for Cottage Country (MAC^2), and have been able to attend the OAME Board meetings three times a year - what a great group of people - talented and energetic!

By the time you read this message, the OAME web site will have undergone a redesign which has been in process for the past year. New features that will be added to the web site and made functional throughout this year include a Members Only section with access to files and downloads, as well as an online Shopping Cart that will accept credit cards. You will also be able to update your membership, or renew your membership online. Keep checking in to see the latest web site developments ... my goal is to have something new on the site at least once a week!

If you have suggestions, please e-mail me and let me know: webmaster@oame.on.ca ▲

▲ 2004 OAME Awards Presented at the Annual Conference

Life Member Award



SUSAN STUART retired in 2003 with an overwhelming list of contributions to mathematics education. Susan served as both an educator and a consultant for the Rainbow DSB and then as a professor at the Nipissing Faculty of Education. For over 19 years Susan served OAME provincially as well as locally, through the NOMA chapter. Susan has played numerous roles in OAME including the presidency in1996/97. Sue has been a presenter at ALL OAME conferences since 1986. Her workshops and papers have been presented nationally and internationally. Susan's expertise in teaching mathematics has brought her to South Africa, Britain, Ireland, Anguilla, Montserrat, St. Lucia, and Antigua. Even in her retirement Susan continues to be actively involved in mathematics education.

Award for Exceptional Creative Teaching in Secondary Mathematics



JACQUELINE HILL teaches at Port Perry High School in the Durham DSB. Jacqueline has a talent for helping students who are "math-haters" become "math-lovers" by creating a fun environment where successes are celebrated. On the first day of classes Jacqueline's door holds a Welcome to Success sign. Her principal says that Jacqueline wears the title Math Teacher like a badge of honour – she can find the fun and beauty of numbers in almost any situation. Jacqueline is an OAME director and president of the Pine Ridge Chapter. She chaired the 2003 OAME Annual Conference for educators and the 2004 Ontario Math Olympics for students. A student who attributes her success to Jacqueline said, "Mrs. Hill was always finding ways to push me to the next level, making me learn in ways that were fun and in ways that I could understand."

Award for Exceptional Creative Teaching in Elementary Mathematics



KEVINA MORRISON teaches at Highbush Public School in Pickering with the Durham DSB. Kevina is the site administrator for computers at her school and runs Techy Tuesday courses. She shows her passion for mathematics through her commitment to work on an assortment of local, regional, and provincial projects. Kevina embraces the use of manipulatives and various technologies and shares her expertise with others by leading workshops on *Fathom*, *Sketchpad*, and *TABS+*. Although Kevina is an elementary educator, she has participated in marking Grade 9 EQAO assessments. Kevina accepts any challenge that will help her students.

Kenneth D. Fryer Award



GORDON GRAYDON MEMORIAL is a secondary school in the Peel DSB. The staff in the mathematics department work as a close knit team, supporting each other, sharing the workload, and always striving for the best programs for students. They have developed units

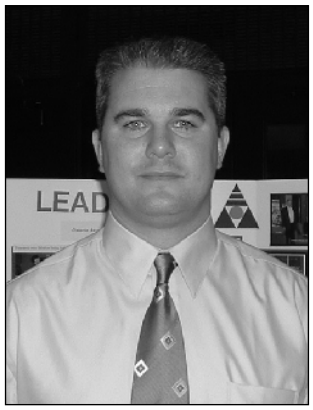
that link mathematics to sports, construction, hospitality and foods, shopping and recreation. In one project, Gordon Graydon students designed and constructed "boats", and the culminating race took place in a water pool at *Ontario Hydro*. A stock market challenge project and a grade 9 project titled "Nine is Not Just a Number" are two additional examples of the creativity of this staff. Math department members work collaboratively with teachers of other disciplines and with the community. They encourage students to tutor and coach both at their own school and at feeder schools. Congratulations to this deserving team of innovative educators.

Award for Outstanding Contribution to OAME



DAVID ROSENBLOOM, Manager of Consumer and Community Relations and **PAUL SHERVILL**, Director of Channel Management are employed by *Union Gas Ltd*. Paul and David represented their company and its parent corporation, *Duke Energy*, in establishing a partnership with OAME to support math education in Ontario. *Union Gas* provided funding for the OAME Vision Project: Growing up Mathematically. This project articulates a vision of learning mathematics from JK to Grade 12 and it includes classroom ready activities, teacher lesson guides, a video, and a professional development package. *Union Gas* also supported the 2003 and 2004 Ontario Mathematics Olympics for students, as well as three provincial awards for mathematics educators. Union Gas recognizes that a strong math foundation is essential for student success in a global economy.

The *Union Gas* Award for Teaching Excellence in Mathematics – Leadership



DAVE LAMONTAGNE is the Curriculum Chair of Mathematics at Notre Dame CSS in Ajax. Through his role in the Durham Catholic DSB, Dave has developed materials that have been used to implement the new curriculum. His work was well recognized with respect to the Grade 12 Workplace course and the Grade 9 Essential Math course. Also, Dave coaches several sports and serves as the co-ordinator of a Christmas outreach program. Over $120,000 was raised for community members. Dave's principal acknowledges that Dave is an inspiration to all staff.

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The *Union Gas* Award for Teaching Excellence in Mathematics – Secondary



HEATHER BOYCHUK is the Program Leader for Mathematics at Lasalle SS.in Sudbury. Heather is relatively new to the teaching profession but during her 6 years as an educator Heather has played a very active role in numerous mathematical adventures. Heather is the president of NOMA and a director for OAME. She has worked on several Rainbow DSB and provincial initiatives. A small sampling of these include TIPS (Targeted Implementation and Program Supports), Ontario Math Olympics, conferences, and workshops. One of Heather's students said "Mrs. Boychuk takes a personal interest in each student and is aware of every individual's own needs and learning ability. You can walk into math with the worst attitude but after having Mrs. Boychuk as your teacher, you walk out feeling like Einstein!"

The *Union Gas* Award for Teaching Excellence in Mathematics – Elementary



BEATA MYHILL teaches at Cedarview Middle School in Ottawa. She is a frequent workshop presenter for the Ottawa-Carleton DSB and for local and provincial conferences where she shares her expertise about manipulatives and technology. Beata is an active member of the COMA executive. Her principal said "Beata's students are motivated and actively engaged in the learning process, using hands-on/minds-on activities to reinforce mathematical concepts." Beata is passionate about teaching and continues her own professional growth by taking courses and attending conferences. As an exemplary leader in mathematics in the classroom, at the system level, and across the province, Beata is clearly a very deserving recipient of this award. ▲

▲ Activities for the Middle School Math Classroom: Games and Problem Solving

A. CRAIG LOEWEN



Dr. Loewen is an associate profession of mathematics education with the Faculty of Education at the University of Lethbridge, where he also serves as the Assistant Dean of Student Programs. Dr. Loewen is currently the editor of delta-K, the journal of the Mathematics Council of the Alberta Teachers' Association. He is particularly interested in researching and developing interesting ways to make the learning of mathematics both meaningful and fun.

Reprinted with permission from delta-K*, the Journal of the Mathematics Council of the Alberta Teachers' Association. Volume 41, Number 1, March 2001, pages 37 - 46.*

Editor's note: In the original article. Dr. Loewen describes eight games. We have only included four of these games in this issue.

There is an unmistakable similarity and strong link between problem solving and mathematical games. First let's explore problem solving. Consider this definition of problem solving: Problem solving is a process that occurs when a set of conditions and a goal are given, but the solver must provide or develop the means to achieve the goal. In other words, problem solving is an active task that has both a starting and (at least one) end point.

Process

The whole notion of problem solving as process is extremely important because we must teach our students that most problems do not have an obvious or necessarily quick solution. Indeed most problems in real life are not resolved quickly at all. Wouldn't it be nice if they were? Many of our students become handicapped by the two-minute rule: they say or think, "If I can't solve

it in the first two minutes, I will never solve it," and they concede defeat too quickly. Unfortunately we often encourage the two-minute rule through examples we present (always solved correctly within the time limits) and our evaluation practices (20-minute quizzes comprising 10 questions). Real problem solving takes and deserves adequate time. In fact, we may have to accept that real problem-solving abilities can not realistically be measured in a typical testing format; it simply contradicts the process dimension of the activity.

Conditions and Goal

Problems always come with a set of conditions. Sometimes the conditions are obvious and straightforward, and sometimes we have to collect our own data, sort through the information given to weed out extraneous statements and so on. The goal in a problem becomes the resolution of these conditions.

When we have somehow reconciled all of the information given, collected or found (and thus met the task presented), we consider the problem to be solved. Typically the conditions in a problem are given as a series of statements, and the goal is given as a question that follows those statements. We can dramatically alter the complexity and interest of problems by altering the number, nature and format of both the conditions and goal.

Developed Means

If it is intuitively obvious to the solver how the conditions and the goal(s) may be reconciled; that is, how the problem is solved, then it is probably fair to say the given activity is merely a task (in classroom terms, a drill-and-practice exercise) and not a problem at all. In other words, in real problem solving we expect to have to wrestle a little. We expect the activity to be challenging and fraught with frustration, some disappointments and failures and, of course, some successes. The nature of problem solving is that the solver brings forward his or her own insights, skills and strategies into the process while developing new methods, thus experiencing a number of small failures and victories before the ultimate success (a solution) is finally attained.

The above elements constitute a basic description of problem solving, but let's not forget that problem solving is ultimately a complex task. For example, remember that the solver must also be motivated to solve the problem. The problem must have some relevance or inherent interest about it before the solver will be willing to engage it. Let's also not forget that another higher level of mental processing is associated with problem solving: the ability to monitor progress, the ability to evaluate the effectiveness of strategies, the flexibility to modify the chosen strategies that have proven to be ineffective and so on. While it is not the purpose of these games specifically to address these higher mental abilities, the good news is that these metacognitive talents can be encouraged and can be (should be) actively taught in our classrooms.

But what does all this have to do with games in the math classroom? Simply put, a game is in fact a type of problem. Like a problem, a significant process is involved in playing the game, and like a problem a game usually requires a strategy and a means to achieve the goal. It is fair to think of the rules of the game as the conditions of a problem, and the goal of the game is usually how the game is won or finished. Sometimes the goal is to beat your opponent and sometimes it is just to work well with your team or to make it further in the game than the last time. A game is a complex problem that often contains many smaller problems embedded within it. The advantage a game has over more typical problem solving activities falls in the motivation element inherent within it. My students used to groan when I announced we would try some problems, yet they would cheer when I announced I had a game for them instead. Problems come in many different forms, and games represent one motivating way to engage our students in some significant and challenging problem-solving activities.

Here are some suggestions and considerations for integrating games in your math classroom:

- Where possible emphasize the mathematics vocabulary used in any game. To work with others, we need to communicate clearly, and students will need to use appropriate mathematical terms to communicate effectively during all classroom activities.
- Try to collect games that can be easily adjusted to make them more or less difficult. Highly flexible games can also let you apply a familiar game structure to an alternative math concept. Games that are flexible in this way help reduce the amount of time spent introducing a new game to the class.
- Recognize that games are appropriate for all grade levels; young children and adults alike enjoy these types of activities. Students may have some suggestions for how certain games can be modified or adapted, consider getting your students to modify, develop and create their own games, too.

▲ Five Dice

Objective: Solve problems involving multiple steps and multiple operations (Alberta mathematics program of studies, Number [Number Operations], Grade 5, Outcome 13) Materials: Five regular six-sided dice for each team or player, pencil, paper and calculator.

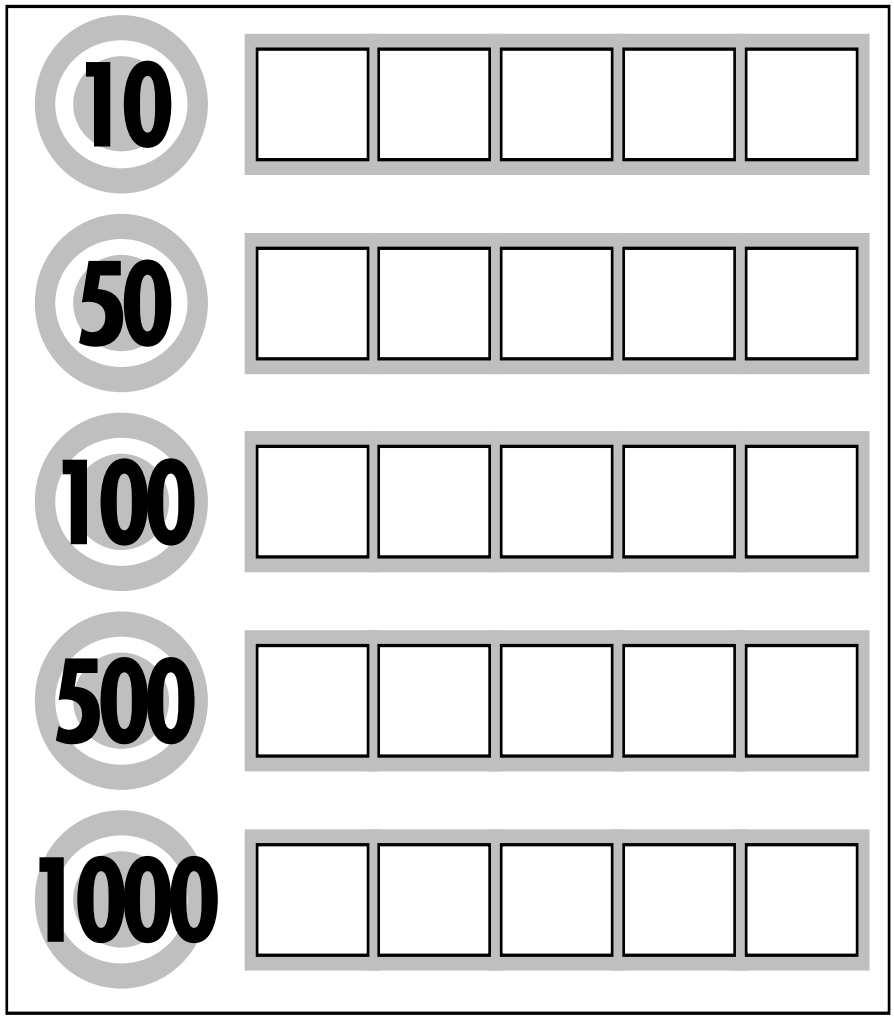
Players: Two or more

Rules

1. Each player or team rolls five dice and records the values rolled.
2. These values are now used to construct an equation with the result as close to the target as possible using the rules stated below. Assume we rolled the values shown:



   a. Numbers may be used to specify place values. For example, using the digits above, we could make the values 56, 16 or even 156 or 651 and so on.
   b. Brackets may be used wherever desirable.
   c. Exponents are not permitted.
   d. The values may be used to create whole numbers only.
   e. A number may be used only once unless doubles are rolled.
   f. All numbers must be used.
3. Players roll the five dice for each new target number.
4. After completing each target, teams or players compare results to see which equation has a value closest to the target. The closest player scores one point for each target.
5. The team with the greatest point total at the end of the game wins.



Adaptations

1. Substitute 10-sided dice for the 6-sided dice.
2. Have players use the values to build equations with results between 0 and 100. The player who can build the greatest range wins.
3. Permit players to use exponents.

▲

▲ Factors

Objective: Distinguish among and find multiples, factors, composites and primes, using numbers 1 to 100 (Alberta mathematics program of studies, Number [Number Concepts], Grade 6, Outcome 3).

Materials: Factors game board, two crayons, calculator

Players: Two

Rules

1. The objective of this game is to shade the greatest number of spaces on the Factors game board as possible, which, when summed, have the highest total.
2. On a turn a player will select any available number (a number not already shaded) and will proceed to shade it as well as all remaining numbers that are a factor of his or her number. For example, if a player chooses the number 75, he or she could shade all of the following (assuming they have not already been shaded on an earlier turn or by another player): 75 1 3 5 15 25

75	1	3	5	15	25

3. Players alternate until each player has had three turns. At the end of the third turn, players take the calculator and add up the numbers they shaded.
4. If a player fails to shade a factor that he or she could have shaded, the opponent may point out the error and claim that number. If a player shades a number incorrectly, the opponent claims that number.
5. The player with the highest sum after three turns wins the game.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Adaptations

1. Instead of playing for the highest sum of shaded numbers, play to see who can shade the greatest number of spaces.
2. Allow players to use factors more than once. If a player selects 100, the number 100 is out of the game, but the factors (1, 2, 4, 5, 20, 25 and 50) can be used again.

▲ The Right Stuff

Objective: Use the Pythagorean relationship to calculate the measure of the third side of a right triangle, given the other two sides in two-dimensional applications (Alberta mathematics program of studies, Shape and Space [Measurement], Grade 8, Outcome 2)

Materials: The Right Stuff game board, ruler, pencil, calculator, one six-sided die, one ten-sided die

Players: Two

Rules

1. On a turn, a player rolls both dice (that is, both the six- and ten-sided dice). These values represent the base and height of a right-angled triangle.
2. The player now draws this triangle on the grid provided and, using the Pythagorean relationship, calculates the length of the third side. The accuracy of the calculation can be checked by his or her opponent by measuring the length of the third side (in centimetres).
3. Using the table provided, the player now determines his or her score for this roll, based on the length of the third side.
4. Players both take three turns, rolling the dice, drawing the triangles, calculating the length of the hypotenuse and scoring points. The player with the highest score after three turns wins.

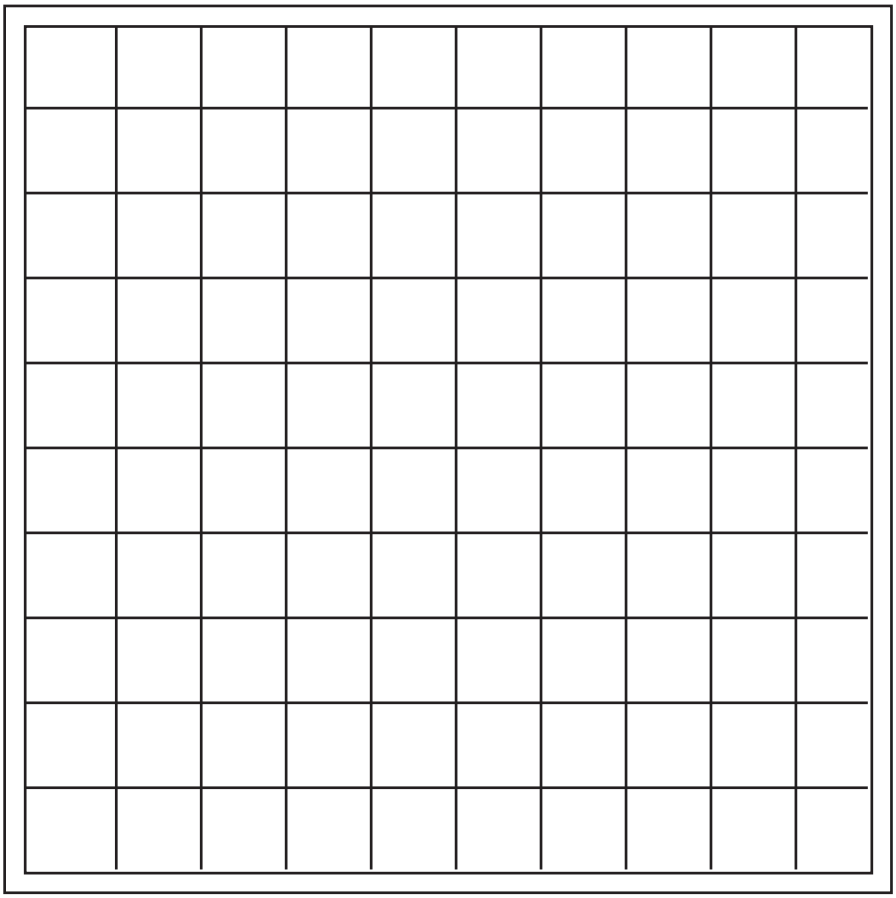
Example

Assume a player rolls a five (on the 6-sided die) and a seven (on the 10-sided die). The player would draw a triangle with a base of 7 cm and a height of 5 cm. The third side would have a measure of 8.60 cm, and the player would score two points.

Adaptations

Change the rules so that the player scores the same number of points as the length of the third side. For a solitaire game, allow a player to take as many turns as she or he can up until she or he can not fit the triangle on the grid. Triangles may not overlap, cross, be contained within another triangle and so on.

Score double points if the third side of your triangle has a whole number value.

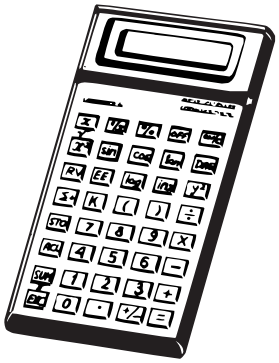


1.00 – 3.00 cm	4 points
3.00 – 5.00 cm	2 points
5.00 – 8.00 cm	1 point
8.00 – 10.00 cm	2 points
10.00 – 12.00 cm	3 points

Your score:

_____

▲ Target Game



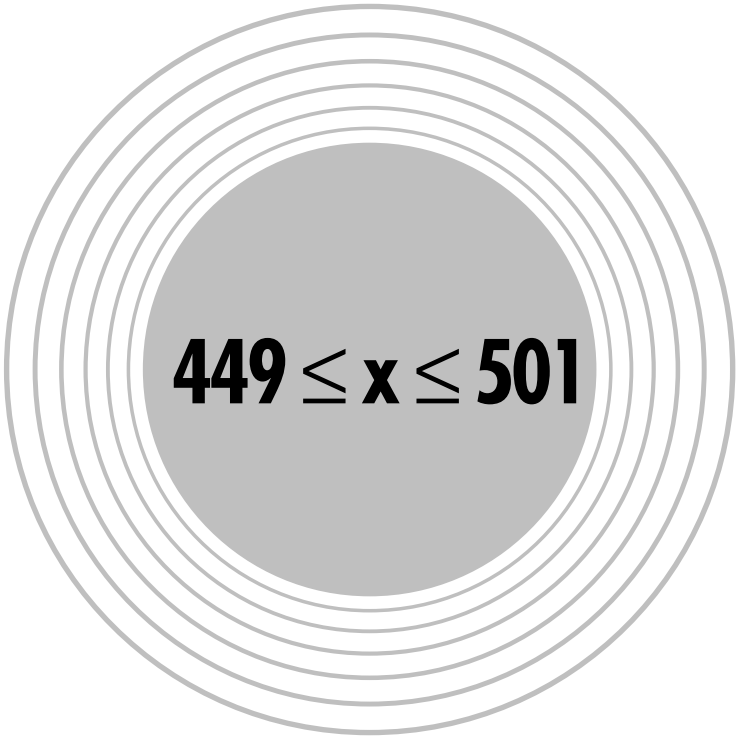
Objective: Estimate, compute and verify the sum, difference, product and quotient of rational numbers (Alberta mathematics program of studies, Number [Number Operations], Grade 8, Outcome 10)

Materials: Calculator

Players: Two or more

Rules

1. To begin the game, have one player type into the calculator a random four-digit number, no two digits alike. For example, start with 2753 in your calculator.
2. The players will now take turns multiplying the value in the calculator by any decimal they wish, trying to obtain a product that falls in the range specified below:
3. $499 \leq x \leq 501$
4. The calculator is not cleared between players, but instead, each player starts with the value left behind by the previous player.
5. The first player to hit the target is the winner.



Adaptations

1. Play again, but this time you may only divide (no multiplying) to hit the same target.
2. Start with a larger (5- or 6-digit number) or with a value between 0 and 1.
3. On a turn, before you may multiply or divide, you must hit the square root key.
4. Play as a solitaire game: what is the fewest number of turns necessary to hit the target?
5. Play against a friend. Play the game as above except each player has his or her own calculator. Each player may take four turns. Whoever is the closest after four turns is the winner.

▲ Directors' Dialogue



Jacqueline Hill is a teacher of mathematics at Port Perry High School. Her involvement in the mathematics education community includes Course Profile writing, Workshop Leader, Pine Ridge Math Association President, and writer for Nelson Thomson Learning.

We had two winners in the June 2004 *Gazette*. You too could be a winner. All you have to do is be one of the first 10 people to e-mail me, and tell me two different ways you are going to implement things from the current issue of the *Gazette/Abacus* in your classroom in the next few weeks.

This edition of Director's Dialogue highlights events at the Friday and Saturday June 5 and 6 2004 OAME Board of Directors' meeting at the Holiday Inn Select, Toronto Airport.

The Board Meeting was called to order at 8:02 PM. President Gord Cooke welcomed all Board members. Gord and past president Stewart Craven acted out "The Warlord's Puzzle" as read by Bev Farahani. It signalled a change in the way things are going to be run this year. OAME has gone back to an older format where Chapter Reps also sit on standing committees. As well, and after the two year task of developing the Vision Project, there was a "no homework policy" after the work that took place on the Saturday brainstorming and writing sessions. A focus on hands-on was prevelant throughout the two days.

Other Highlights include:

CHAPTER REPS MEETING: As this was the start of a new OAME year, time was taken for introductions. New Chapter Reps include Lynda Ferneyhough (CHAMP), Chris Kirkpatrick (ISOMA), Sue Melville (NOMA), Maribeth Williams (NWOAME) and Sandra Price (PRMA). A sharing of best practices was done.

FUTURES: Lyn Vause reported that they were working on a Fundraising initiative that sees committee members approaching businesses for partnerships.

SHARING: Connie Quadrini shared a "Running the Line" web site that offers a wide variety of student centred activities. It can be found at http://standards.nctm.org/documents/examples/chap5/5.2index.htm#APPLET. Judy Dussiaume presented Ministry Licensed software called "Smart Ideas". It contains a "clip it" section and would be great for making mind maps.

Chapter Reports:

CHAMP – REP: Lynda Fernyhough: The Chapter held a very successful mathematics contest for grades 7 – 11. They used a scantron format, and it was overall a great success. They hosted "Assessment Madness" on May 20th 2004.

COMA – Rep: Peter Lenczewski: COMA held their spring forum in April 2004 on "Assessment Madness", aimed at secondary teachers. Their Chapter playdowns for OMO were a great success with 240 participants. The fall conference is set for Saturday November 6, 2004 at the University of Ottawa S.I.T.E. building.

GOLDEN – Rep Elizabeth Pattison: An April 2004 conference was held. The theme was "Math for all Ages". At the Annual Dinner they honoured Dr. Eric Muller who has been a driving force in the Chapter for many years.

GVMA – Rep: Paul Fennell: Paul was very pleased with the 2004 OAME Annual Conference. Their next mini-conference will be held Thursday October 21st 2004. See the GVMA web site for details.

ISOMA – Rep: Chris Kirkpatrick: The ISOMA Chapter is starting a new year with a host of new executive members. They are considering going back to a fall mini-conference format.

MAC² – Rep: Greg Clarke: Their Spring mini-conference in Barrie was a big success with over 100 participants. They held their second annual Junior Math Challenge with great success. Their next mini-conference will be held September 30 at St Dominic Catholic School in Bracebridge.

NOMA – Rep: Sue Melville: Plans are underway for the October 15-16 2004 Fall Conference to be held in Sudbury. NOMA looks forward to hosting OMO in June 2005.

NWOAME – Rep: Maribeth Williams: Math Fest, held in February 2004 had over 200 participants. NWOAME welcomed 110 new members to OAME. Plans are being made for Math Fest February 24 - 25 2005

PRMA – Rep: Sandra Jean Price: This year they are hosting a Fall and a Spring mini-conference. The Fall conference is on October 28, 2004 with the theme:

Math – Make it Happen.

QSLMA – Rep: Robert Sherk: Plans are well underway for their annual mini-conference in November 2004. They have been keeping in touch via e-mail newsletters.

SAME – Rep: Sumintra Koowar: Their May 2004 mini-conference was a big success...from the home baked cookies to the Chinese food, to the 140 people who attended. The one and only Trevor Brown topped off the evening with his speech.

SWOAME – Rep: David Petro: They are planning some TIPS workshops for the summer.

TEAMS – Rep: Pat Margerm: Teams is currently working on OAME 2005.Theme: NEXUS: Building Mathematical Connections. They have 9 strands which participants can experience. Visit the OAME web site and link to the 2005 Annual Conference.

WOMA – Rep: John Ferguson: Their Arpil 1 2004 "Fool Proof" at Fanshawe College mini-conference was a great success with 166 participants. Dave Mitchell was the entertaining Keynote Speaker. Joke of the set "If a statistician sleeps with his head in a fridge and his feet in an oven, will he, on average, be comfortable?"

Y^{4}MA – Rep: Rosey Mastrofrancesco: They have secured Don Fraser for their October 14 2004 Fall Conference at St Augustine Catholic HS. It should be a good laugh with Don! Everyone is welcome to attend.

Closing Remarks

You can look forward to some ideas on how to use your *Gazette/Abacus* in the classroom from our Chapter Reps and Board members in the next issue.

Yours in Mathematical fun,

Jacqueline ▲

▲ Nominations for OAME/AOEM Board of Directors 2005-2006

Each year, elections are held for a President-Elect, a Vice President (3 year term), and 6 to 9 Directors (3 year term) of OAME/AOEM. Nominations for these positions are to be submitted by 4:00 p.m., January 21, 2005, to:

Stewart Craven, Past President

Include the nominee's qualifications with the Nominations Form. A nominee must be a member of OAME. By March 2005, the Nomination Committee will publish a slate of candidates, including qualifications, for consideration by the membership. Voting will be by mail, and is open to all OAME/AOEM members. The election results will be released at the Annual General Meeting of the OAME/AOEM in Toronto, May 2005.

NOMINATION FORM

I nominate: _____

For the position(s) of: ☐ President-Elect ☐ Vice-President ☐ Director

Nominee's Address: _____

_____

Telephone: H ( ) _____ W ( )_____

Nominator's Name : _____

Nominator's Address: _____

Telephone: H ( ) _____ W ( )_____

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WOMA - **John Ferguson**

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