Mathematics Council NEWSLETTER

The Alberta Teachers' Association

Providing leadership to encourage the continuing enhancement of teaching, learning and understanding mathematics.

Volume 16 **Number 7** **June 1998**

From the Editor

Are we overlooking a great resource? I believe we are. When did we last make a sincere effort to involve the parents of our students in their mathematics program?

A survey by *Money* magazine found that the amount of support received from parents and the community was the most important factor in academic excellence in the best school districts in the country. The importance of parent and community support should not be underestimated.

Parents should work with teachers to understand the mathematical goals for the classroom, how these goals will be measured and the ways in which parents can further mathematical understanding at home. Parents can support their children's mathematics education by looking for ways to link mathematics to daily activities. By becoming active partners in the homework process, parents can increase students' confidence in their mathematics abilities and encourage students to value mathematics and to continue their learning.

Why not make the involvement of parents in the mathematics program for 1998–99.

Have a good summer! ▲

—Art Jorgensen

Summer Science and Mathematics Workshops

Summer Science and Mathematics Workshops will again be offered by Canadian Teachers Teaching with Technology and Athabasca University. Week-long workshops, "Connecting Math and Science" in Edmonton and Canadian "Secondary School Math" in Calgary, will be held the week of August 17–21. Sessions focus on use of calculator-based technology in teaching with the new curriculum. Calculators will be available at cost.

The $125 fee for each workshop includes lunch, with university lab credit available at extra cost. "Elementary School Math" will also be run in Calgary, August 19–20. More information is available from Martin Connors at 434-1786 or 1-800-788-9041 (martin@athabascau.ca), Bob Hart at 284-3729 (bhart@cbe.ab.ca) or the Web page http://www.athabascau.ca/html/staff/academic/mconnors/inst.htm. ▲

Monograph Update

An upcoming monograph to be published by the Mathematics Council will feature the primary mathematics curriculum, specifically the Grade 2 objectives taken from the Mathematics Protocol Document. In this monograph, the author Craig Loewen (of the University of Lethbridge), will provide a manipulative activity, writing activity and word problem all of which relate to the chosen objectives. The document will also provide adaptations of given activities for the Grades 1 and 3 levels. The monograph will feature a wide range of problems, both traditional and nontraditional. Just to get you started, try this more challenging sample problem!

Problem: With her pattern blocks, Jocelyn built a shape using eight blocks. A yellow block covers one-third of her shape. Build a shape like Jocelyn's. Can you make such a shape without using any green blocks?

Solution: There are eight combinations of blocks that fit the rules, but only one solution not using any green: it contains six blue and two red blocks. ▲

—Craig Loewen

***Inside*: Position Paper of the MCATA Regarding Use of Calculators in Provincial Assessment Programs**

Calculator Position Paper Prelude

As you are all aware, MCATA worked on developing a policy statement regarding the use of calculators in provincial assessment programs this year. This position paper was approved at the March 18, 1998, meeting of the Table Officers Committee of the ATA Provincial Executive Council.

This paper was developed at the beginning of the school year, circulated to all MCATA members in October and served as the basis of many discussions around the province and especially at our provincial conference. We collected all of the comments and prepared a revised version of the paper. The MCATA executive approved the revised version at its January meeting.

As we listened to the many comments regarding the use of calculators in studying mathematics, however, we realized that many people were not aware of how calculators could be used at different grade levels. So, as part of sharing the Calculator Position Paper with you, we asked four teachers to describe how they use calculators in their classrooms. Here are their stories.

Division I: K–Grade 3

Submitted by Sandra Unrau, Elbow Park School, Calgary

Primary students explore calculators to understand their basic operation and to work with interesting problems. In the beginning students explore the device with the goal of understanding how the calculator works—entering numbers, adding, subtracting, obtaining an answer and clearing the calculator are explored. These look like simple things but are necessary to effectively use the calculator in the classroom. The students must understand that the calculator is controlled by the user. Something my Grade 1 students enjoy is a partner activity where one student says a basic fact out loud (including the answer) and the other student verifies it with the calculator. This builds their confidence in using the calculator, and they come to see themselves as proficient users.

As my students become more fluent in basic facts, they love to challenge the calculator. They write out a list of 10 or so basic facts they know (they determine this list so success is guaranteed) and ask two others to join them. One student reads the basic fact and the other uses the calculator to obtain an answer. The challenger calls out the answer and is always able to beat the calculator user because of the time needed to punch in the numbers. The ultimate goal of this activity is not about basic facts but to let the students understand the power of mental mathematics. This skill is important for students to appreciate. They begin to get a sense of when a calculator is an advantage and when it slows you down. Calculators should extend math power, not be used for easy mental calculations.

Grade 2 students love to explore larger numbers and work with "what if" scenarios, which I often start at the beginning of the year and they soon catch on to and take over. Calculators are perfect for this—the students don't get bogged down with the calculating and are able to maintain enough excitement to finish the exploration. Often these scenarios come from literature I have read to them, (there are many good books that generate math problems but two specific examples are *Alexander, Who Used to Be Rich Last Sunday* by Judith Viorst and *Something Good* by Robert Munsch) but they can also come from real class situations. In our latest scenario, we figured out how much food we would be able to collect for the food bank if all the students in our school made two or three contributions each. We speculated what the answer range would be, and then some students got out their calculators to check our speculation. This experience showed all the students the value of estimating and having an approximate answer before using the calculator. Students build a stronger number sense when using a calculator to check their approximate answer than if they have no idea what the answer will be. I find they often say, "This answer doesn't make sense. I better do it again."

The primary classroom can build confidence in how the calculator works, an understanding that the user is in control of what happens, a nascent sense of when to use a calculator and when to use mental mathematics and finally a sense that the user should know if the answer is reasonable or not.

Division II: Grades 4–6

Submitted by Lynwen Hart, Capitol Hill School, Calgary

Calculators are powerful learning tools and yet can be, especially at a secondary level, can be a problematic assessment device. In Division II, learning should weigh more heavily than assessment.

The use of calculators is mandated by the new Program of Studies. The preferred approach, however, is not to replace knowledge of basic facts or computation, but to enhance problem-solving, exploration of concepts and development of relationships. The questions are

"How do we use calculators appropriately?" and "How can we develop good activities?"

I find that students quickly learn when it is reasonable to use the calculators. An easy way to introduce them and a good place-value activity is the following example: I "call out" the following numbers, two and three tenths, thirty-one and seven hundredths, four and one hundred thirty-seven thousandths. While I am calling out the numbers, students are keying the numbers into their calculators and pressing the [+] key after each entry. Then I ask them to find the sum of the numbers. However, students are not just entering the numbers in their calculators though, I usually also have them record on paper what they have entered in the calculator. If a student does not get the correct sum, then he or she has a place to review the work.

This type of activity needs to be adapted to different number levels, but it provides a springboard for pictorial discussion and/or concrete representations of the numbers.

Division III: Grades 7–9

Submitted by Betty Morris, Edmonton Catholic Schools, Edmonton

There are several places throughout the new junior high mathematics curriculum where calculators should be used. I have selected examples from Grade 8 where students are working with exponents and square roots.

Example 1

Use a calculator to determine the values of 152^2, 15.2^2 and 1.52^2. Describe the patterns that you see with the values of these numbers.

Example 2

Use a calculator to develop a table of square roots for the numbers 3–15 (could be any numbers). Round the decimal values of the square roots to three decimal places. Create problems that could be asked about this table of numbers.

Three problems that students have generated from this table are

1. 6 is half of 12. Determine whether the $\sqrt{6}$ is half of $\sqrt{12}$.
2. 3^2 is 9. Explore and describe the relationships between $\sqrt{3}$ and $\sqrt{9}$.
3. Jane conjectured that since 6 + 9 = 15, $\sqrt{6} + \sqrt{9} = \sqrt{15}$. Show an argument that would support or not support Jane's conjecture.

Division IV: Grades 10–12

Submitted by Cynthia Ballheim, St. Mary's High School, Calgary

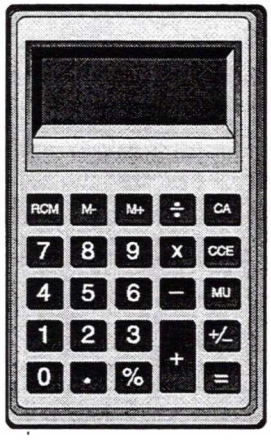
This is an example from Math 20 of the current curriculum. It can be done in cooperative groups or as a homework assignment.

Investigate the graphs of these function and record your results.

1. $f(x) = x^2$
2. $f(x) = 2x^2$
3. $f(x) = 1/2x^2$
4. $f(x) = -1/2x^2$
5. $f(x) = -2x^2$
6. $f(x) = -1.5x^2$

Summarize your findings by identifying similarities and differences between each of the graphs. Classify what you have found according to the definitions for transformations found in your textbook. In addition, add another parameter (of your choice) to the functions and describe its effect.

Assignments like these (that is, several quadratic equations given as well as their roots and students asked to investigate what this means in terms of the factors involved and/or the graph of the given functions *or* several polynomials—quadratic, cubic and quartic—given in an attempt to discern their basic shape and search out similarities and differences) require that students begin to construct their own meaning of mathematics as a process of human inquiry. The appropriate use of the calculator, then, is not as an answer device (as is clear from the nature of the questions asked) but rather as a tool to be used to unveil the mysteries of mathematics. ▲



Position Paper of the MCATA Regarding Use of Calculators in Provincial Assessment Programs

The following position paper and recommendations have been reviewed and ratified by the MCATA executive, January 16, 1998, and approved by the Table Officers Committee of the ATA Provincial Executive Council, March 18, 1998. This position paper was first drafted by the MCATA executive, shared and vetted with both members of MCATA and colleagues within Alberta's mathematics education community, and then revised based on comments received. The position paper includes four recommendations: one for each of the Grades 3 and 6 Mathematics Achievement Tests and two for each of the Grade 9 Mathematics Achievement Test and the Grade 12 Mathematics Diploma Examinations. It is intended that Alberta Education consider adopting either one of the two recommendations for the Grade 9 and Grade 12 programs.

Background

In May 1997 representatives of the MCATA executive attended a meeting with the Science/ Mathematics Unit of the Grade 12 Diploma Examinations of Alberta Education. The discussion surrounding that meeting was about the role of a calculator on diploma examinations.

Teachers who are attempting to adhere to the current Mathematics/Sciences Diploma Examinations Calculator Policy, as stated by Alberta Education, find it difficult to implement. Many of the calculators currently being used by students on the Diploma Examinations are alphanumeric. The current policy indicates that programs to facilitate the computation of formulas on the Mathematics 30 and 33 formula sheets are allowed, as well as programs for graphing quadratic relations. There are many ways that students can store notes in these calculators, however, and it is becoming increasingly difficult to ensure that students are not using these calculators for storage of notes. As calculator technology continues to evolve, this issue surrounding storage of notes will not only affect the Grade 12 mathematics diploma examinations but also the Grade 9 mathematics achievement test. For example, there is a scientific calculator with graphing capabilities that is currently being marketed to junior high school students.

In further discussion with the entire MCATA executive, we felt it was necessary for MCATA, as a representative of the mathematics educators in Alberta, to develop a position paper about the use of calculators and technology in provincial assessment programs. We felt that, with the advancing and evolving nature of calculators and computers, the diploma examinations would not be the only assessment program affected. There is a common belief among the executive members that as students increasingly use technologies in learning mathematics, they should also have access to the use of these technologies in assessment situations.

Beliefs

MCATA supports the role of technology as identified in the Western Canadian Protocol and the *Alberta Program of Studies for K–12 Mathematics, 1996–97.* Technology plays a role in mathematical processes where calculators and computers are used as tools to

- develop concepts,
- explore and demonstrate mathematical relationships and patterns,
- organize and display data,
- assist with solving problems and thus promote independence,
- encourage students to be inquisitive and creative,
- decrease the time spent on tedious computations,
- reinforce the learning of basic number facts and properties,
- develop an understanding of computational algorithms,
- create geometric displays and
- simulate situations. (*Alberta Program of Studies for K–12 Mathematics*, 1996, p.11)

Along with the technology-related statements in the *Alberta Program of Studies for K–12 Mathematics, 1996–97,* MCATA also supports the following:

- Students engage in solving realistic problems using information and the technological tools available in real life and that skills, procedural knowledge, and factual knowledge are assessed as part of the doing of mathematics. (*Assessment Standards for School Mathematics*, National Council of Teachers of Mathematics, 1995, p. 11)
- The assessment of students' knowledge of *mathematics procedures* should provide evidence that they can: recognize when a procedure is appropriate; give reasons for the steps in a procedure; reliably and efficiently execute procedures; verify the results of

procedures empirically (e.g., using models) or analytically; recognize correct and incorrect procedures; generate new procedures and extend or modify familiar ones; appreciate the nature and role of procedures in mathematics (*Curriculum and Evaluation Standards for School Mathematics*, National Council of Teachers of Mathematics, 1989, p. 209)

- ✘ The assessment of students' knowledge of *mathematical concepts* should provide evidence that they can: label, verbalize, and define concepts; identify and generate examples and non-examples; use models, diagrams, and symbols to represent concepts; translate from one mode of representation to another; recognize the various meanings and interpretations of concepts; identify properties of a given concept and recognize conditions that determine a particular concept; compare and contrast concepts (*Curriculum and Evaluation Standards for School Mathematics*, National Council of Teachers of Mathematics, 1989, p. 223)
- ✘ The assessment of students' ability to use mathematics in *solving problems* should provide evidence that they can: formulate problems; apply a variety of strategies to solve problems; solve problems; verify and interpret results; generalize solutions (*Curriculum and Evaluation Standards for School Mathematics*, National Council of Teachers of Mathematics, 1989, p. 228)

Recommendations

In light of the directions established by the *Alberta Program of Studies for K–12 Mathematics* (1995–97), the statements about student assessment, the continued improvements in technology and the way in which technology is changing the face of mathematics education, MCATA recognizes the importance of technology in provincial assessment programs.

Recommendation 1

Grades 3 Mathematics Achievement Testing Program

If the Grade 3 Mathematics Achievement Testing Program continues to be administered, then MCATA recommends that Alberta Education continue with the position that:

> Those students for whom the four-function calculator is a familiar classroom tool are encouraged, but not required, to use a calculator when writing the multiple-choice component of the Grade 3 Mathematics Achievement Test. (*Grade 3 Mathematics Information Bulletin*, 1997–98, p. 28)

Rationale

MCATA believes that this position supports the use of technology as a tool in the mathematics program.

Recommendation 2

Grades 6 Mathematics Achievement Testing Program

If the Grade 6 Mathematics Achievement Testing Program continues to be administered, then MCATA recommends that Alberta Education continue with the position that:

> Those Grade 6 students for whom the four-function calculator is a familiar classroom tool are encouraged, but not required, to use a calculator when writing the Grade 6 Mathematics Achievement Test. (*Grade 6 Mathematics Information Bulletin*, 1997–98, p. 23)

Rationale

MCATA believes that this position supports the use of technology as a tool in the mathematics program.

Recommendation 3

Grade 9 Mathematics Achievement Testing Program

If the Grade 9 Mathematics Achievement Testing Program continues to be administered, then MCATA recommends that Alberta Education considers packaging the test into two parts; one part that students would write without the use of technology, and one part where students would require the use of a scientific calculator, or equivalent technology.

Grade 12 Mathematics Diploma Examinations Program

MCATA recommends that Alberta Education considers packaging the Grade 12 diploma examinations in two parts: one part that students would write without the use of technology and one part where students would require the use of a scientific calculator with graphing capabilities, or equivalent technology.

Rationale

The rationale to consider a test and examination packaged into two parts is that it will provide an opportunity to assess a broader range of learner outcomes, across strands and mathematical processes in the Alberta Program of Studies.

We would propose that both parts of these tests/examinations would assess mathematical thinking and processes, as described in the Alberta mathematics

curriculum documents. For example, questions that ask students to show that they can visually identify the graph of a particular function or relation cannot currently be asked in Mathematics 30 as students with a graphing calculator are able to enter the equation of the function and plot the graph. Similarly, in Grade 9, to have students select the graphical representation of a box plot would not currently be an equitable question to ask as some students may have calculators that can produce a box plot, given a set of data.

Recommendation 4

Grade 9 Mathematics Achievement Testing Program

If the Grade 9 Mathematics Achievement Testing Program continues to be administered, then MCATA recommends that Alberta Education consider revising the current calculator policy to indicate that students require the use of a scientific calculator, however, that these calculators be cleared of all notes and programs not built-in to the calculator.

Grade 12 Mathematics Diploma Examinations Program

MCATA recommends that Alberta Education consider revising the current calculator policy to indicate that students require the use of a scientific calculator with graphing capabilities, however, that these calculators be cleared of all notes and programs not built-in to the calculator. We would also recommend, that because the calculators are changing at such a rapid pace that Alberta Education, at the end of each school year, distribute a list of approved calculators for use on the following year's diploma examinations.

Rationale

This approach would reinforce the notion that all students would have access to equivalent technologies. ▲

Thoughts for the Day

- ☺ If students were self-starters, none of us would ever need to be cranks.
- ☺ A teenager, asked by his teacher if he ever listened to the voice of conscience, replied, "I don't know. What channel is it on?"
- ☺ If you regularly blow your own horn, people will be quick to get out of your way.

Conferences

NCTM Canadian Regional Conference, Calgary, October 23–24, 1998

"Mathematics Education: Living the Challenge" will take place in the Calgary Convention Centre and Palliser Hotel. This is shaping up to be a super conference, professionally and socially.

Currently, over 150 sessions are planned, so there should be something for everybody. All sessions will be on a first-come first-served basis. There will be no ticketed sessions.

We are hoping for a large turnout. It would be great if PD days could be organized at the local level for the Friday, so that those teachers who teach students mathematics could be free to attend the conference. We are really looking forward to seeing you and your colleagues.

A registration form is attached. If you don't need it, pass it on to a colleague. ▲

Calgary Elementary Mini-Conference

Our April mini-conference was a great success. This year we worked with the Calgary Science Consortium to offer both science and mathematics sessions. We held two evenings, one for each division. The sessions and the science/math focus received positive feedback.

About 250 teachers attended the two evenings. Watch for another joint mini-conference for next year. ▲

—Sandra Unrau

Math Symposium

The 11th Semi-Annual Alberta Mathematics Leadership Symposium, which was held in Red Deer on May 22, 1998, proved to be a great success. It got off to a rousing start by our president Florence Glanfield, who got the crowd of over 90 involved in a discussion on leadership. Other excellent discussions took place in sessions devoted to the new math curriculum, international test results, timetabling, the use of technology, professional development and effective teaching practices. The organizing committee is to be commended for doing an excellent job.

The next symposium will be held in Calgary on October 22, the day preceding the NCTM Regional Conference. If possible, plan to attend. ▲

—Art Jorgensen

New Web Site

Are you looking for a Web site that will provide you with some excellent information? Then look no further. The Web site http://camel.math.ca/Education/ will fill the bill. Sponsored by the Canadain Mathematical Society, this site contains a multitude of hot links to useful math education sites. ▲

—George Stone

An Excellent Resource

The book *Math Time: The Learning Environment* is a must for every teacher of primary grades. And it has been published at just the right time! With the hiring of so many teachers for class-size reduction, this book is an excellent, supportive resource for setting up the classroom learning environment.

Thoughtfully written by Kathy Richardson, *Math Time: The Learning Environment* guides the teacher through important decisions about classroom environment. In the first chapter, "Creating the Learning Environment," the following topics are carefully addressed:

- ✘ How do we get our classrooms ready?
- ✘ How do we help our children learn to work independently?
- ✘ How long should children explore?
- ✘ How do we know when to move on?
- ✘ How do we make the transition from exploration to concept development?

This book is published by Educational Enrichment, 770 W. Rock Creek Road, PO Box 1524, Norman, Okla. 73070; phone 1-800-292-6022. ▲

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 Mathematics Council Newsletter is published several times yearly by the ATA for the Mathematics Council. Editor: Art Jorgensen, 4411 5 Avenue, Edson, Alberta T7E 1B7. Editorial and production services: Central Word Services staff, ATA. Address all correspondence to the editor. Authors' opinions are not necessarily those of MCATA or the ATA. ISSN 0823-1117