Mathematics Council NEWSLETTER

The Alberta Teachers' Association

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Effective Questioning

Developing and asking effective questions requires a great deal of effort and practice. Too often questions asked are of only the "yes, no, right, wrong" type. They leave little to the imagination or creativity of the student.

Thus, it is obvious that the teacher plays the key role in effective questioning.

Marilyn Burns in the February 1985 issue of the Arithmetic Teacher outlines the teacher's role in developing effective questions and provides some real food for thought.

The Teacher's Role

The questions teachers ask deserve careful attention. Students should be encouraged to make conjectures and to examine the validity of their thoughts. They need to search for convincing arguments that support their conjectures or that show discrepancies in others' thinking. They should be flexible enough to consider other approaches and willing to change their position if new light is thrown on the situation. Questions that promote this kind of thinking are of the following types:

What do you think?
Why do you think that?
How come _____'s answer doesn't make sense?
What if _____ ?
Can you find another way to explain that?
Can you convince me?

The questions will be effective only if the classroom atmosphere supports addressing these kinds of questions openly, even courageously. To create such an atmosphere, teachers need to be models of inquiring learners themselves. Students need to feel that teachers value the exploration of these types of questions as an important aspect of their mathematics learning. Teachers need to emphasize to students that the foremost goal of their mathematics learning is thinking mathematically, not merely getting right answers.

When errors in students' thinking occur, they should not be viewed as unfortunate mishaps but as opportunities for learning. The classroom needs to be a safe place so that new ideas can be tried out--so that children feel free to risk offering their thinking, even if they make mistakes. Persistence with thinking, not speed, needs to be valued. Putting the values on quick, correct responses does not help to establish an environment in which the process of mathematical thinking is encouraged.

Teachers need to ask students to find ways of verifying their solutions for themselves, rather than relying on the teacher or the answer book for verification. Verification may be difficult for teachers to demand; answer keys have long been a part of the teacher's domain in teaching mathematics. In considering this issue, however, we may be helped by taking a careful look at the real-life uses of mathematics. Real problems do not necessarily have one correct solution. At times, several possible solutions exist. Often, an exact solution isn't even required; being close is sufficient. Most important, in real life, it's up to each of us to decide when a solution is "right" or "best." In light of these issues, providing answers does not enhance students' critical thinking skills. On the contrary, giving answers can stop the thinking process. Teachers need to see their major role as focusing students' attention on meaningful questions.

Along with not giving answers, teachers need to ask students to explain their approaches and results, even when they're correct. Often, teachers nod and affirm a child's correct response but question the child only when an error has been made. If teachers question children's responses only when they are wrong, the children soon catch on. The instruction should be structured so that students describe their methods and solutions not only to the teacher but also to their classmates. Time for discussion is needed so that students are encouraged to listen, question, and learn from each other.

The Road of Math

Take a line, a straight line
And divide it into three.
Make the three lines form three angles,
And a triangle have we.

Now take this little triangle
And twirl it about in space,
Twirl the triangle 'round and 'round;
A cone is what we face.

Now look at the bottom of our cone.
We see a circle true.
Now let's examine the circle
And what it can do for you.

Let's draw a line through the center
Of our circle round.
We've discovered something new:
The diameter we've found.

Let's look at the line 'round the circle.
The circumference says, "Hi!"
Divide the circumference by the diameter,
And we've found the number Pi.

Now take our semicircle
And take a point on the rim.
Using the diameter, form a triangle.
(It doesn't take much vim.)

Look carefully at this triangle.
If you do, something different you'll see,
For the largest of its angles
Has exactly ninety degree.

Now take two of these new right angles.
Put their vertices in the circle's
center there.
With the diameter under one side of each angle,
We're ready to form a square.

Mark the points on the circumference
Where the right angles do fall.
Construct triangles in both semicircles,
And that is all.

From a line, to a triangle, to a cone,
To a circle, to Pi, to a square.
We have traveled the roads of math,
Which will take you anywhere!

Consecutive Number Sums

Try to write all the numbers below as the sum of 2 or more consecutive numbers.

1 =	9 =	17 =
2 =	10 =	18 =
3 =	11 =	19 =
4 =	12 =	20 =
5 =	13 =	21 =
6 =	14 =	22 =
7 =	15 =	23 =
8 =	16 =	24 =
		25 =

LOOK FOR PATTERNS!

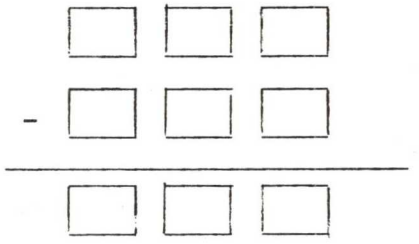
Math Manipulatives

The September 1984 issue of Instructor magazine has an article on math manipulatives titled "Getting Manipulative About Math" by Janet K. Scheer, Cheryl A. Presley, and Mary Cox Small. It talks about using everyday items such as plastic spoons, straws, beans, and Cheerios. For example, it tells how to make Cheerio counters:

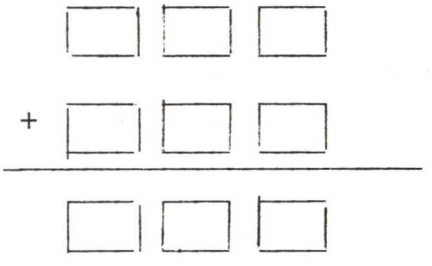
> Cheerio counters are inexpensive and fun to make, and each child can have his or her own set. Set up this system: a single Cheerio represents one unit; 10 Cheerios glued on a popsicle stick make a long; 10 longs glued on two perpendicular sticks, raft style, make a flat; and 10 flats stacked on top of each other make a box. Dye the Cheerios to make them sturdier and more colorful. You'll need two boxes of Cheerios for a class of 25, food coloring in several colors, cookie sheets, and an oven. Put several drops of red food coloring in a large bowl half filled with water. Dip about half a box of Cheerios in the water, just long enough--about 30 seconds--to impart color. (If Cheerios stay too long, they'll get soggy and fall apart.) Then spread them onto a cookie sheet so that they don't overlap. Bake at 250°F for about 30 minutes. The Cheerios will become hardened and the color will get brighter. Repeat with other colors until you have enough for the class.
>
> Children can use the Cheerios, with popsicle sticks and white glue, to make their own set of counters. This is a great way to teach place value.

BEST PROBLEM CONTEST

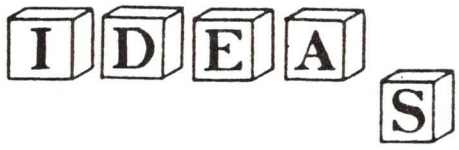
1. Place one of the digits 1, 2, 3, 4, 5, 6, 7, 8, or 9 in each square to make a true subtraction problem with the smallest possible difference. Each digit can be used once and only once. (All numbers are to be whole numbers.)



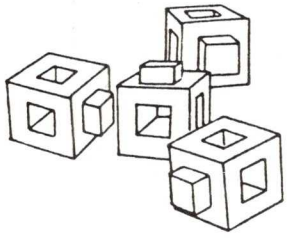
2. Place one of the digits 1, 2, 3, 4, 5, 6, 7, 8, or 9 in each square to make a true addition problem with the largest possible sum. Each digit can be used once and only once. (All numbers are to be whole numbers.)



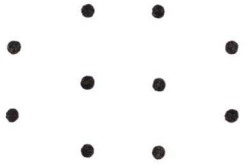
Answers on page 7.



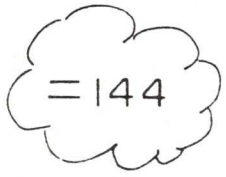
How many ways can you fold a piece of paper?



How many shapes can you make with 4 cubes?



You have 10 points. How many line segments are needed to connect each pair?



Write 10 computational exercises that have the answer 144. Use +, −, x, and ÷ at least once in each exercise.

New Policy – *Arithmetic Teacher*

The Arithmetic Teacher Editorial Panel has adopted a new policy that authors may submit copies of only one manuscript for review for the "IDEAS" section. We hope this change will encourage more readers to submit their good ideas to this section.

The Arithmetic Teacher will also receive manuscripts on several "Hot-line" topics for review and publication. The topics are:

- Primary Grade Mathematics
- Problem Solving
- Meeting the Needs of the Special Student
- Calculator/Computer Use
- Geometry

Five copies of IDEAS manuscript or articles on "Hotline" topics should be mailed to:

Managing Editor, Arithmetic Teacher
1906 Association Drive
RESTON, Virginia 22091

WHAT'S NEW?

Junior High School Mathematics Review

In conversation with Ron Cammaert, he indicated that a special ad hoc committee was to be established this spring for the purpose of reviewing the new junior high school math texts which are available. The committee will be recommending piloting various series for the 1985-86 school year, with the objective of having specific recommendations in place by the fall of 1986.

Some of the series which are being looked at are published by Houghton-Mifflin, Nelson Canada, and Holt.

Curriculum Implementation: A Framework for Action

Written by Ian Dow, Ruth Whitehead (co-authors of the first publication, New Perspectives on Curriculum Implementation), and Ruth Wright, all of the University of Ottawa, the 60-page publication develops a comprehensive framework for identifying strategies to overcome the barriers to curriculum implementation. This framework was developed from the findings of the previous study and an extensive review of current literature on curriculum and administration. A variety of strategies are presented which will assist teachers, principals, consultants, and coordinators to bring about effective implementation of curriculum guidelines. The inclusion of a section on inservice program activities and suggestions is a welcome addition to a publication of this nature.

Copies are available at $6 each (including handling and postage) from OPSTF, 1260 Bay Street, Toronto M5R 2B7. (Please include your cheque made payable to OPSTF with your order.)

Lights! Camera! Fractions!

MP 4082 MAG 1984 14 min., color

Two student aides create a special demonstration for the younger students on these concepts: fractions as equal parts of a whole, regions, sets, numerator and denominator, equivalent fractions, and the numberline.

Available from Central Alberta Media Services, 2017 Brentwood Blvd., Sherwood Park, Alberta T8A 0X2 (Telephone: 464-5540).

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It's not too early to be thinking about next fall. Don't forget!

The 1985 MCATA Conference will be held in Lethbridge during October 24-26.

Chuck Allen has already been confirmed as a main speaker and presenter.

If you have ideas for sessions or speakers, please send them to Gary Hill, c/o Gilbert Patterson School, 12 Avenue - 12 Street S, LETHBRIDGE, Alberta T1K 0P1 (Telephone: 329-0125).

Education Reform –
Principals Agree with Teachers

A recent survey conducted by the National Association of Elementary School Principals confirms what classroom teachers have been saying for some time: Lower class size and more time to teach will greatly improve learning.

The NAESP survey of elementary principals calls for a lowering of class size to 20:1 overall and for a 15:1 ratio in kindergarten through third grade.

The survey also reveals that students lose some two hours of instructional time each day because teachers are called on to perform so many non-instructional duties.

The study recommends that teachers be paid for 10 days of inservice training each year, calls for additional administrators if school enrollment exceeds 400 students, and proposes an end to situations where elementary principals supervise more than one school. Over 17 percent of the nation's elementary principals are presently called on to service more than one school.

Answers to BEST PROBLEM CONTEST (from page 4):

(1) 783 - 659 = 124 The difference is unique, but the subtrahend and minuend can have different arrangements.

(2) 654 + 327 = 981 The sum is unique, but the addends may be a different arrangement.