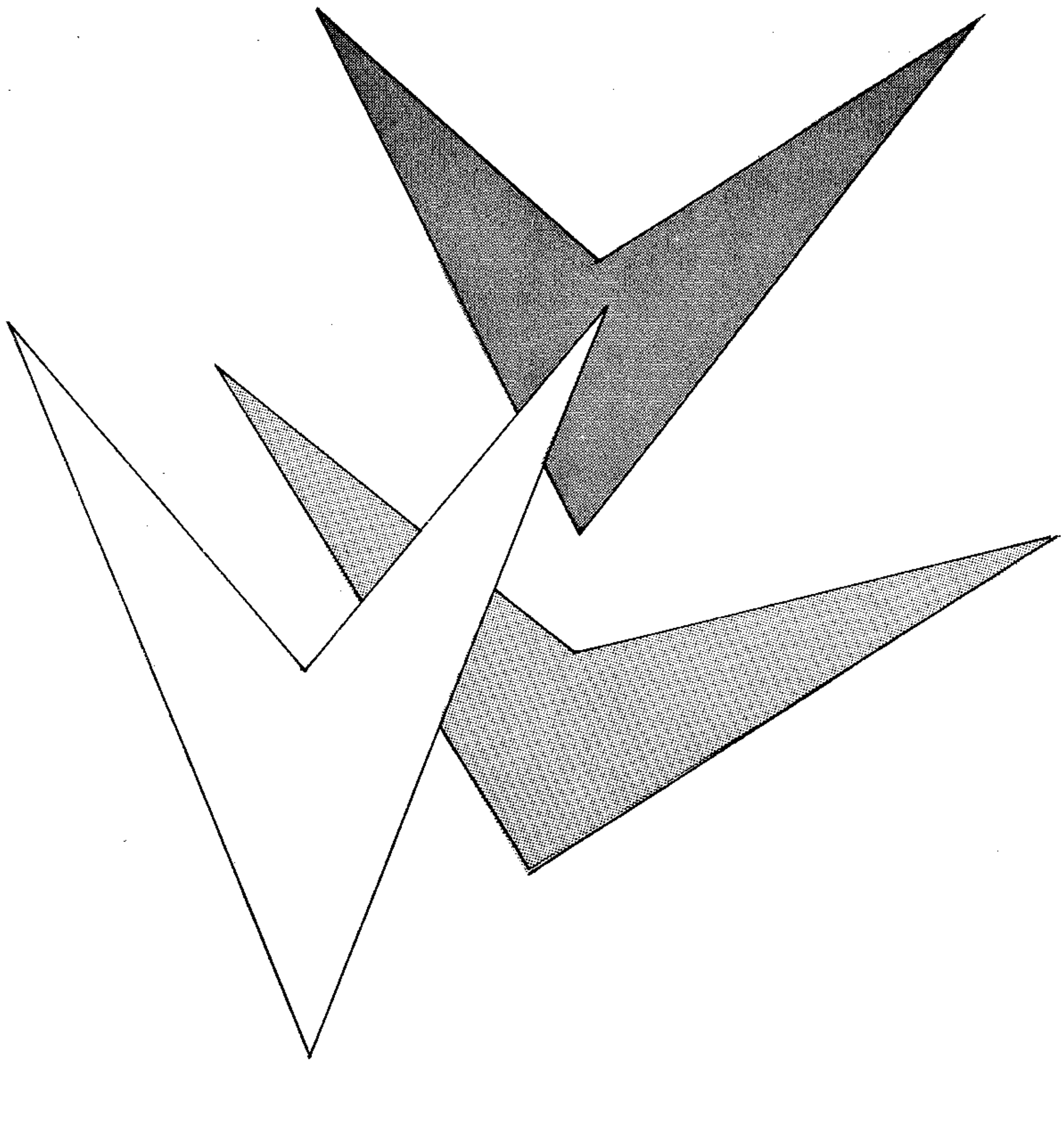
TEXAS MATHEMATICS TEACHER

T.C.T.M.



Texas Council of Teachers of Mathematics

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TEXAS MATHEMATICS TEACHER

Texas Council of Teachers of Mathematics

Volume XXXIII October, 1986 No. 4

PRESIDENT'S MESSAGE

This is my swan song as your president. As of the completion of the TCTM business meeting at the 33rd Annual Conference for the Advancement of Mathematics Teaching (CAMT) in Austin on Friday, October 10, from 8:00 a.m. to 9:00 a.m., Maggie Dement, from Spring Branch ISD, will assume the presidency. I wish her well in her endeavors with and for TCTM.

As I approach the end of my two-year term as president, I look back and realize that many of the goals set by and for me as president have not yet been attained. While it is true that the Texas Mathematics Teacher has become a refereed journal and has undergone some format changes (I would hope improvements), the setting up of an actively functioning editorial board for the journal has not been accomplished, nor has provision been formally made for the change in editorship that will be necessary when our current esteemed editor steps down after so many years of faithful service.

Another area that has not been effectively handled is the establishment of operating procedures that involve the regional directors actively in the development and institution of policies and program. Something that has bothered me throughout my term in office is how to get TCTM more actively engaged in all areas of mathematics education in Texas when the geographic distribution of members and officers is so broad. Related to the same issue is membership--both the recruitment of new members and the provision of services to existing members. The primary center of focus seems to be the journal, with the only other activity of TCTM as a whole being our role in the CAMT meetings. I doubt that these two functions are sufficient to develop and maintain a viable and effective organization.

I am willing to accept the blame for the lack of effective organization and operation of TCTM during my term of office. I could offer several excuses, some of which you might consider valid, but I will not do so. Rather, I will state that I hope in the future, under more active and aggressive leadership, and in an atmosphere less clouded with controversy, frustration, and uncertainty, that TCTM can become a strong and positive influence on mathematics education in Texas at all levels and attain those goals not yet realized. I wish the incoming president and all future leaders of TCTM the very best as they work toward that end.

—Ralph W. Cain

DATES FOR CAMT

1986:	October 9 — 11	1989:	June 22 — 24
1987:	August 3 — 5	1990:	June 20 — 22
1988:	August 2 — 4	1991:	June 19 — 21

Note your mailing label for
renewal date of TCTM membership!

STUFF Strategic Tactics Ultimately For Fun

Dear T.C.T.M. Member,

September is here and where are you? We do not have a "STUFF" winner this month because you did not send us any stuff. The offer is still good. Membership is on a one-to-one correspondence basis; one activity--one free membership. We need your ideas if this stuff is going to be worth the stuff it is printed on.

We are standing by our mail boxes eagerly waiting for your large brown envelopes.

Send your material to Bettye Hall, Mathematics Dept., Houston I.S.D., 3830 Richmond, Houston, TX 77027 or Judy Tate, H.C.D.E., 6208 Irvington Blvd., Houston, TX 77022.

Welcome back,

Stuff Staff
Bettye & Judy

PRIMARY ACTIVITIES

LADYBUG DOMINOES

PREPARATION: Enlarge the pattern so that the ladybug is about 15 cm long and 10 cm wide. Cut 20 to 30 ladybugs out of red construction paper. Use a black marker to color her face and legs black and to put the dots on her wings.

The ladybugs are made to use like dominoes. One wing has one set of dots and the other has a different set of dots.

PURPOSE: The ladybugs are used to match dots as in dominoes. The child learns to match three dots on one side of a ladybug with three dots on one side of another ladybug. You may want to set a rule that says the ladybugs must face in the same direction.

VARIATION: The individual ladybugs can be used for addition facts. If they are used this way you may want to print the sum on the opposite side of the ladybug.

HALLOWEEN SUBTRACTION

Primary students enjoy poems and puppets. Why not use them for mathematics.

HALLOWEEN SUBTRACTION

Mary Alice Kelly

Three little ghosts on Halloween night,
Saw a witch and shrieked in fright.
The witch just laughed and shouted, "Boo!"
One ghost ran home, and that left two.

Two little ghosts in two little sheets
Went to a door to say, "Trick or treats."
But when the door swung open wide,
A scary goblin stood inside.

One ghost gulped and said to the other,
"I'm going home and stay with mother."
Of the three little ghosts, there was now one alone,
Too frightened to utter a groan or a moan.

One little ghost who shivered and shook
With every single step he took.
A fraidy-cat ghost can't have much fun,
So he cried, "Wait for me!" and then there was none.

INTERMEDIATE ACTIVITIES

RHYMING PUZZLE

Here is a puzzle to try on third, fourth and fifth grade students.

Take the number that rhymes with shoe. (2)
Multiply it by the rhyme of tree. (3)
Add that number to the rhyme of pour, (4)
Then subtract the number that rhymes with gate. (8)
Add to this the rhyme of free. (3)
Divide this number by the rhyme of drive. (5)
The answer you get should rhyme with fun. (1)

CALCULATOR NIM

PURPOSE: This activity is designed to promote logical thinking skills and a basic understanding of even and odd numbers.

MATERIALS: Two players and one calculator.

DIRECTIONS: The game begins by entering the number 15 into the calculator. The players take turns subtracting a 1, 2 or 3 and pressing the = sign. The player who causes the calculator to go to "0" or below is the loser.

VARIATIONS: Three or four players and the game begins with 25.

Game begins at 1000 and players subtract a one-, two-, or three-digit number using 1's or 0's as the digits. Examples: 100, 1001, 11. Zero alone cannot be used.

Start with 1500 and divide by either 2, 3 or 5. The player going below one loses.

MIDDLE SCHOOL ACTIVITIES

PATTERN SEARCH

Find the pattern using your calculator. Work the first 3 problems in the set; then see if you can discover the pattern. If you find the pattern, finish the problems by just writing in the answers. If you cannot find the pattern after 3 problems, work one more and then see if you see the pattern.

1.
6 x 7 =
66 x 67 =
666 x 667 =
6,666 x 6,667 =
66,666 x 66,667 =

2.
9 x 9 =
99 x 99 =
999 x 999 =
9,999 x 9,999 =
99,999 x 99,999 =

3.
8 x 88 =
8 x 888 =
8 x 8,888 =
8 x 88,888 -
8 x 888,888 =
8 x 8,888,888 =

4.
4 x 44 =
4 x 444 =
4 x 4,444 =
4 x 44,444 =
4 x 444,444 =
4 x 4,444,444 =

5.
5 x 5 =
5 x 55 =
5 x 555 =
5 x 5,555 =
5 x 55,555 =
5 x 555,555 =

6.
6 x 6 =
6 x 66 =
6 x 666 =
6 x 6,666 =
6 x 66,666 =
6 x 666,666 =

HIGH SCHOOL ACTIVITIES

INTEGERS

NUMBER: For 2 to 4 players

MATERIALS: A deck of playing cards. Let the red cards have negative values. Paper to keep score.

(Continued, page 5)

TOSSING FOR TWO CONSECUTIVE HEADS

Harris Shultz and Bill Leonard
California State University, Fullerton, CA 92634

In the study of probability, the repeated tossing of a coin until two consecutive heads appear can provoke several challenging questions. One might ask for the number of different ways in which the experiment will end after exactly k tosses. One might also inquire about the expected number of tosses in this experiment.

Regarding the first question, let us denote by F(k) the number of different ways in which the experiment will end after exactly k tosses. We note that F(1) = 0 and F(2) = 1. For k = 3 the only possibility is THH, and for k = 4 there are two possibilities, HTHH and TTHH. Thus, F(3) = 1 and F(4) = 2. Consider the case k = 9. If the first toss comes up heads, then the second toss must come up tails. Accordingly, there are two distinct patterns for k = 9: (otherwise, seems to imply F(9) = 2)

HT****THH and T*****THH,

where neither of the strings **** and ***** contains two consecutive heads. Since the string ****THH can be obtained in F(7) ways and the string *****THH can be obtained in F(8) ways, we have F(9) = (F(7) + F(8). This argument for k = 9 can be applied to an $k \geq 3$:

$$F(k) = F(k-2) + F(k-1).$$

Therefore, F(n) is the (n-1)st term of the Fibonacci sequence (for $n \geq 2$).

Let us generalize the second question: If a coin is repeatedly tossed, what is the expected number of tosses until n consecutive heads appear? We denote this expected value by E_n and make use of conditional expectation (see[1]):

$$Exp(X) = P(A)Exp(X \text{ given } A) + P(\sim A)Exp(X \text{ given } \sim A)$$

The differenc $E_n - E_{n-1}$ is the expected number of tosses, x, needed after we have obtained n-1 consecutive heads until we have obtained n consecutive heads. After we have obtained the former, there are two equally likely possibilities for the very next toss:

(A) we get a head;

(~A) we get a tail.

If A occurs then we will have obtained n consecutive heads, while, if A does not occur, then we must start over. Therefore,

$$Exp(X \text{ given } A) = 1$$

and

$$Exp(X \text{ given } \sim A) = 1 + E_n.$$

Therefore,

$$E_n - E_{n-1} = Exp(x) = (.5)(1) + (.5)(1 + E_n),$$

or,

$$E_n = 2(E_{n-1} + 1). \quad (1)$$

This recurrence relation will give us every value of E_n once we note that $E_0 = 0$. We list some values of E_n:

n	0	1	2	3	4	5	6	7	8
E_n	0	2	6	14	30	62	126	254	510.

Notice that each term of this sequence is 2 less than the corresponding term of the more familiar sequence 2, 4, 8, 16, 32, 64, 128, 256, 512, ... Therefore, we can write the explicit formula

$$E_n = 2^{n+1} - 2. \quad (2)$$

A routine induction argument will confirm that (2) follows from recurrence relation (1).

BIBLIOGRAPHY

1. P. N. De Land and H. S. Shultz, An elementary approach to conditioning arguments, Teaching Statistics 6 (1984).

(Continued from page 4)

DIRECTIONS: Each player is dealt three cards. The players then try to make the largest possible value with any combination of adding, subtracting, multiplying or dividing. Each player explains and records his score for the round and is then dealt three more cards. Any player may challenge if he/she thinks the score is incorrect or that the maximum was not scored.

After each round each player adds the score to the previous total. Cards are reshuffled when the deck is used up.

The game ends when someone reaches a total of 500 or when a time limit is reached.

VARIATIONS: Use a fraction or decimal deck. Use more that three cards. Play with the first one to reach -500 being the winner.

ALGEBRAIC WAR

PURPOSE: Evaluating algebraic expressions

MATERIALS: Ordinary deck of cards. Use the face value for 2 through 10 and Ace = 1, Jack = 11, Queen = 12 and King = 13.

Deck of cards with algebraic expressions in one variable.

DIRECTIONS: The deck of playing cards is shuffled and dealt out to the players. The cards are placed in a pile face down in front of each player. The expression cards are shuffled and placed face down in front of the dealer.

Play begins by each player turning up the top card from his deck and the dealer turning up one of the expression cards.

Each player evaluates the expression using the value of his card. The player with the highest value for the expression wins the round and takes all the cards used in the round. Ties are broken using a second value card and the same expression card.

Play continues until one player has captured all the other players' cards or when one player runs out of cards.

If a person states an incorrect value for his card, the first person to correctly evaluate the expression using the value may claim the value card.

VARIATION: use the red cards as negative numbers. Use the deck without the Jack, Queen and King.

THE MATH ATTITUDE -- FIFTH GRADERS SPEAK OUT ABOUT MATH

Christen Tomberlin
5302 11th #118, Lubbock, TX 79416

Mathematics has changed over the years moving toward a refocusing on the essential elements. What progress has been made due to this movement? How do the children feel about math? Are they enjoying it? This article will take a look at the attitudes and comments fifth graders have about mathematics.

The sample for this study consisted of fifty fifth graders from public and private schools in the Lubbock area. The sample included high and low math achievers from a mixture of income and socio-economic levels.

The interview consisted of two parts. The first section was oral and the second part was written. To begin the interview the following five questions were asked:

(1) What do you think about math?
(2) What do you like about math? What don't you like about math?
(3) Which do you like better, the math you're doing this year or the math you did last year?
(4) How much homework do you have in math? How many nights a week? Do you do it? Why? About how long does it take you?
(5) If you had to describe your math class in one word, what would it be?

The written portion of the interview asked the children to compare math to five other classes. The students circled the class they liked the best out of each group. Math was compared to social studies, language, reading, P.E., and science.

When this interview began I thought I would hear the same thing at every school I went to. In my mind I had come to believe that every fifth grader thought alike. Surprisingly differences weren't just between schools but great differences in attitude were evident among children in the same classroom. The following paragraphs discuss the student' responses to the oral interview.

WHAT DO YOU THINK ABOUT MATH?

The response to this first question was, for the most part, lukewarm. Math wasn't their favorite class, but fortunately it wasn't their worst. At least one student for every group of five interviewed expressed his/her boredom in the class. When asked why one student responded, "It's like knitting -- we have to go over and over everything and it's like we get a line a year, it's like a little bit of information. The next year you get a little itty bitty bit more like a little stitch or something."

WHAT DO YOU LIKE ABOUT MATH?

The students didn't have much to say about specific areas they liked but most responded, "(I like math when) I know what I'm doing." One young gentleman added, "I like it when we move into things that are hard and complex. It makes you feel like you're older."

WHAT DON'T YOU LIKE ABOUT MATH?

Overwhelmingly the response was "Word Problems!" The students explained that the hardest part about word problems is trying to figure out which mathematical operation is to be performed, "I don't like it (word problems) because I can't decide when to add and subtract."

WHICH DO YOU LIKE BETTER, THE MATH YOU'RE DOING THIS YEAR OR THE MATH YOU DID LAST YEAR? WHY?

This question brought a mixed review. Of the fifty students questioned, last year's math and this year's math were equally preferred. "I don't like this math class as much as last year's cause, see, we don't play any games. It's always up to the board and do contests and bleck!" Many of the students seemed to prefer this year's math because they knew what they were doing.

HOW MUCH HOMEWORK DO YOU HAVE IN MATH? HOW MANY NIGHTS A WEEK? DO YOU DO IT? WHY? ABOUT HOW LONG DOES IT TAKE YOU?

The students felt there was no end to the work they had to do. "Tons and tons and tons" was a common response. "My bag feels like I'm bringing my whole house to school." The students also seemed bored with the homework and because of this I felt they exaggerated the number of problems assigned. The students were motivated to do their homework for one basic reason, "You have to do it so you'll get a good grade. It's hard to get it done because (teacher) gives us so much."

IF YOU HAD TO DESCRIBE YOUR MATH CLASS IN ONE WORD, WHAT WOULD IT BE?

Answers ranged from, "I hate it, it's boring." to "Interesting . . . I like it." Surprisingly enough, the girls responded to this question very positively. They found math much more interesting and exciting than the boys did. For the most part, the boys expressed boredom and confusion in the classroom. This question seemed to throw the children as they thought about an appropriate response. More often than not, dissatisfaction was expressed more willingly and quickly than enjoyment and satisfaction.

The following two tables break down the students' feelings toward mathematics. Originally it was thought that the girls would score lower than the boys on the rating position simply because that's the old stereotype -- girls don't like math. Pleasantly, however, girls' attitudes seem to be changing towards math.

OVERALL SUBJECT PREFERENCES
Table 1

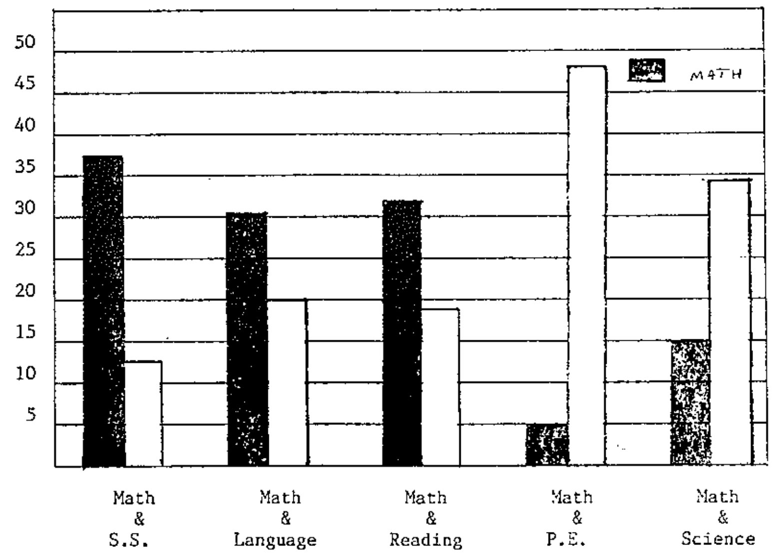


Table One shows the students' class preferences. This data was taken from the written interviews. Math scored considerably higher than social studies, language and reading. It was no surprise to find that math was not favored over P.E. Quite unexpectedly, however, math was ranked considerably lower than science because they did more activities in it.

Table two shows the breakdown of class preferences between girls and boys. It was pleasing to see the girls keep up with the boys in mathematics preference. Despite its strong showing, math was not expressed as either gender's favorite class.

(Continued, page 10)

LET'S HAVE INTERACTIVE BULLETIN BOARDS

Bettye Hall, Houston I.S.D.

INTRODUCTION

Do the bulletin boards in your secondary classroom lack pizazz? Do they have "the blahs?" Are they so small that you only have room for the bell schedule and the fire drill routes? Do you need help with their design? This article suggests alternative methods for the display of student work, mathematical concepts and some strategies for enlisting student involvement with the materials displayed.

WHEN SPACE IS LIMITED

If there is not an abundance of bulletin board space, make use of the walls. A quick but effective and usable bulletin board is "Let's Make a Train" -- an old fashioned steam engine pulling a long line of freight cars. The engine is simply a black construction paper silhouette of an old fashioned steam engine with a white square on which to write. The engine pulls "freight" cars also made of construction paper -- use lots of bright colors. Laminate the engine and the cars or cover them with clear plastic self-sticking paper.

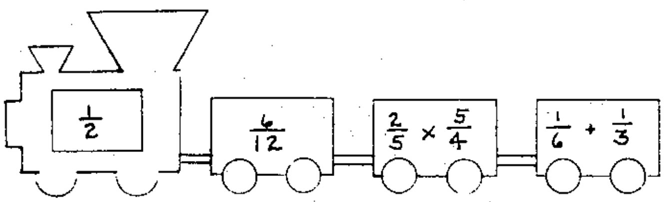


Figure 1

To use the train, the teacher selects the expression for the engine and the students supply equivalent mathematical expressions for the cars, see Figure 1. More than one train can be used at a time. Suggestions for sets of equivalent expressions would include: equivalent fractions, fraction, decimal or percent equivalents, algebraic expressions; and if done with an air of frivolity, the equivalent forms of the trigonometric functions.

If wall space is limited, a free standing poster can be made with posterboard. Two pieces of posterboard slotted so that they can be put together to form an X or three pieces taped in a triangular shape will provide display space for student reports or papers, see Figure 2 and Figure 3.

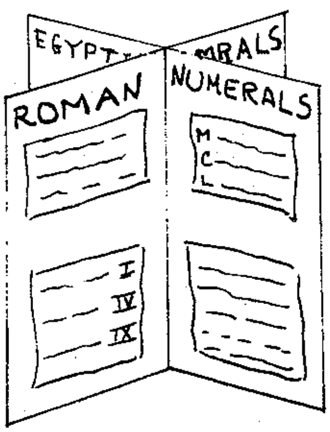


Figure 2

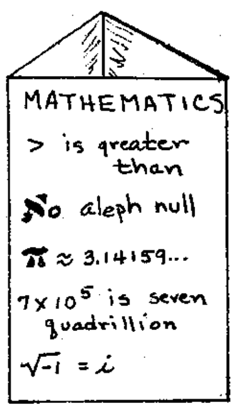


Figure 3

When something is to be revealed one part at a time, use a window shade, Figure 4, and roll it down one step at a time. Be sure to use masking tape on the shade. A large cardboard box covered with a brightly colored paper, Figure 5, makes a good base on which to display related information. A strip of textured cloth hung on a towel rod and suspended from the ceiling permits both sides to be used for display, Figure 6.

Window Shade

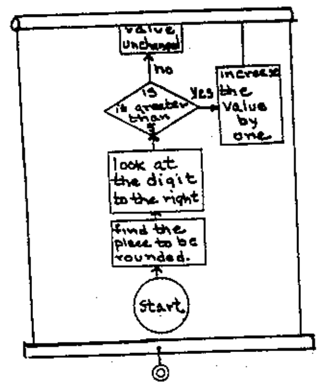
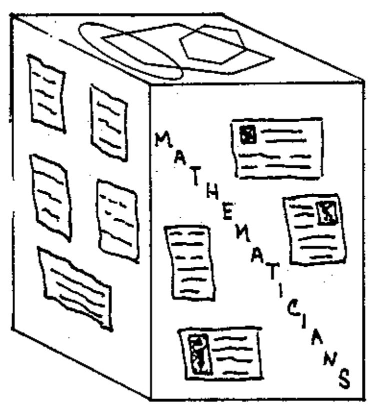


Figure 4

Figure 5

Large Cardboard Box



Long Strip of Cloth

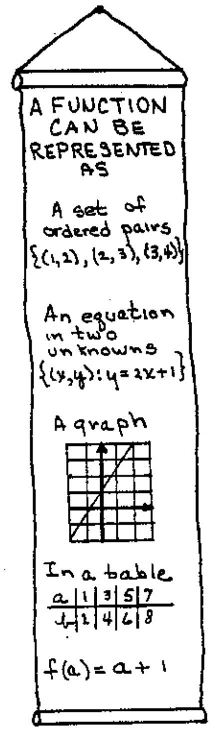


Figure 6

INVOLVEMENT BULLETIN BOARDS

Usable bulletin boards involve the student with the board. Here is an idea for a bulletin board with Magic Square and Magic Triangles, Figure 7.

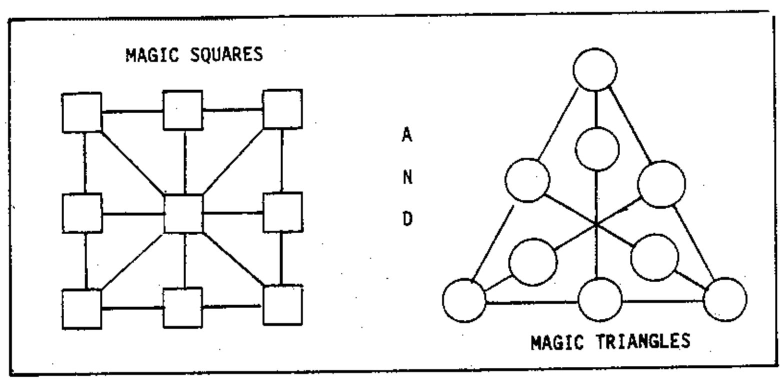
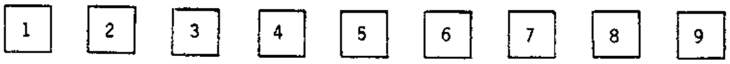


Figure 7

Put the configuration on the bulletin board without any numbers. Write the numbers on small pieces of paper or clear acetate and give them to a student. Have the student move the pieces around on the bulletin board until he/she has the numbers in a location that produces a magic square or magic triangle (each side and each diagonal has the same total.)

For the Magic Square use: (the sum of each side and each diagonal is 15)



For the Magic Triangle use: (the sum is the same as for the square)

One solution for this activity should look like Figure 8.

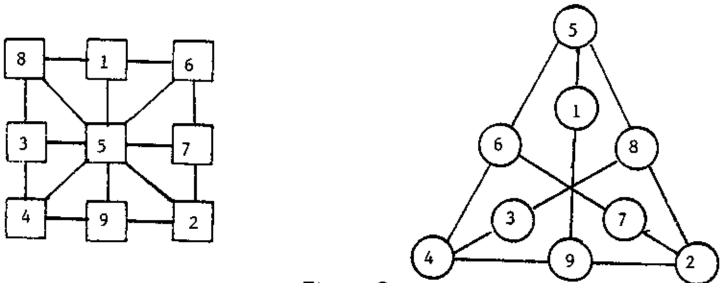
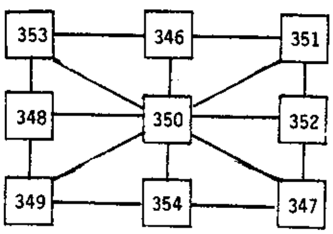


Figure 8

The beauty of this usable bulletin board is that the activity can be varied in content and difficulty depending on the numbers used. Working from the solution given, different sets of numbers and their solutions can be generated, see figure 9, (Cappon, John. "Easy Construction of Magic Squares for Classroom Use." Arithmetic Teacher, February, 1965.)

EXAMPLES:

1. Large numbers -- add the same two or three digit number to the digits 1 through 9; for example, add 245.



The sum is 15 + (3 x 345) or 1050.
For example: The top row is (8 + 345) + (1 + 345) + (6 + 345)
or 8 + 1 + 6 + (3 x 345)
15 + (3 x 345)

Figure 9

2. Fractions -- divide each of the digits 1 through 9 by the same number; for example, divide by 4.
   This would result in the fractions 1/4, 2/4, 3/4, 4/4, 5/4, 6/4, 7/4, 8/4, and 9/4. These should be reduced to lowest terms and written as mixed numbers where appropriate.
   The set then becomes 1/4, 1/2, 3/4, 1, 1 1/4, 1 1/2, 1 3/4, 2, and 2 1/4. The sum is 3 3/4 or 15/4 for each triplet grouping.

3. Integers -- subtract the same number from each digit 1 to 9; for example, subtract 6.
   The set then becomes -5, -4, -3, -2, -1, 0, 1, 2, 3. The sum is -3 or 15 - (3 x 6) for each triplet grouping.

Another usable bulletin board requires a graph grid, push pins, black ribbon, a loop of black elastic and skill cards, Figure 10.

The skill cards contain the coordinates of the vertices of a polygon. The first task requires the student to locate points on the grid and mark each location with a push pin. When all the points have been located, the loop of black elasticc is stretched around the pins to form a polygon.

The second task requires the student to identify the polygon formed. Each skill card is numbered and only the teacher has the key. A list of points and the polygons formed should

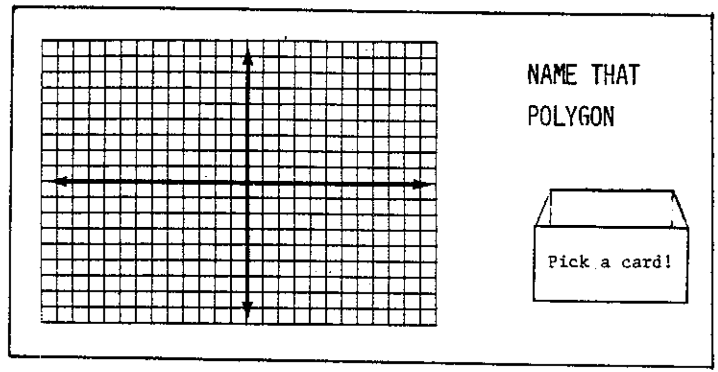


Figure 10

include the following:

Points	Name of Polygon
First Quadrant Only	
(1, 7); (4, 2); (6, 4)	isosceles triangle
(4, 11); (8, 5); (2, 1)	right triangle
(5, 6); (0, 6); (5, 1)	right isosceles triangle
(1, 4); (4, 7); (7, 4); (4, 1)	square
(3, 5); (1, 2); (6, 2); (8, 5)	parallelogram
(1, 5); (3, 2); (9, 6); (7, 9)	rectangle
(2, 6); (1, 1); (7, 3); (5, 7)	trapezoid
(0, 6); (2, 2); (6, 4); (4, 8)	rhombus
All Four Quadrants	
(-2, -3); (6, -1); (-1, 2); (7, 4)	parallelogram
(1, 3); (3, -1); (-5, -5)	right triangle
(-3, -1); (2, -3); (4, 2); (-1, 4)	square
(-1, 0); (7, -8); (-2, -9)	isosceles triangle
(0, -2); (6, -4); (2, -5); (8, -7)	parallelogram
(-8, 3); (3, 2); (-2, 8)	right isosceles triangle
(-5, 2); (-3, -1); (3, 3); (1, 6)	rectangle
(-1, 0); (4, -1); (3, 4); (-2, 5)	rhombus
(1, 4); (10, 6); (2, 2)	right triangle
(-3, 2); (-2, -3); (8, 5); (2, 6)	trapezoid
(-10, 4); (7, 3); (4, -3)	right triangle
(-3, 1); (1, -2); (7, 1); (3, 4)	parallelogram
(-5, -2); (1, 7); (2, 2); (0, -1)	isosceles trapezoid
(7, 9); (8, -4); (-5, -5); (-6, 8)	square
(-2, 5); (6, 1); (-2, -3)	isosceles triangle
(5, -2); (7, 5); (0, 7); (-2, 0)	rectangle

Junior high school/middle school students can use a meter stick and a chalkboard protractor to measure the sides and angles to determine the name of the polygon. Senior high school students with a background in algebra can use the formulas for slope and distance between points to determine the name of the polygon.

The grid can be made by using four sheets of 17" x 22" grid paper (purchased from mathematics suppliers) or by projecting a transparent grid onto the bulletin board and tracing over it. A careful student could be enlisted to draw the grid. The axes are made from thin black ribbon or bias tape so that they can be easily moved to a variety of locations. A simple translation will change the coordinantes of the given points so that they can be used with the new locations of the axes.

A third usable bulletin board deals with the old Chinese Tangram Puzzle, Figure 11. Most students are intrigued with tangrams. The seven pieces can be put together to form interesting shapes. The involvement bulletin board can be constructed using post-it strips on a laminated background. The large central tangrams in Figure 11 are attached to the laminated surface using the post-it strips so that they may be moved around by a student.

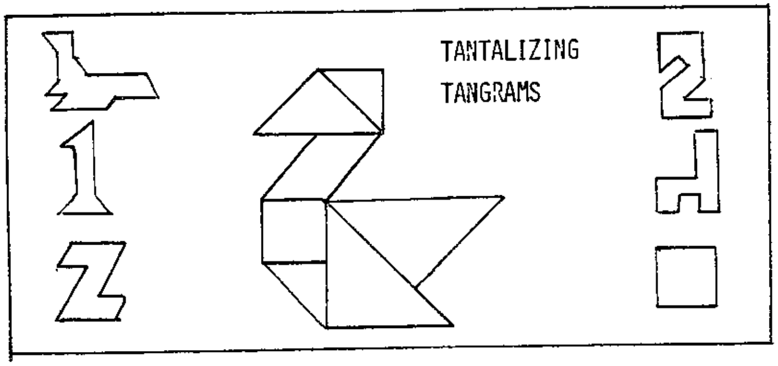
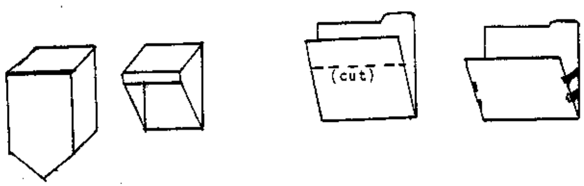


Figure 11

Around the edge of the bulletin board are small silhouettes of figures which can be constructed using the seven tangram pieces, see Tangram: Three Hundred and Thirty Puzzles by Ronald Read, published by Dover Press. When a student believes that he/she can construct one of the small figures, the student uses the large pieces to demonstrate this to the class. If the student successfully constructs the figure, then his/her name is placed on the bulletin board over the smaller figure. Making the smaller figures interchangeable will allow every student the opportunity to display his/her talent with the tangrams.

Volume and surface area are difficult concepts even for the tenth grade students in geometry classes. One effective working bulletin board helps students identify the correct formula for calculating these measure, Figure 12. To construct the board use a set of three dimensional models -- preferably student made and sets of 5" x 8" cards with appropriate formulas written on them. Attach "shelves" to the board. The shelves are made from half-gallon milk cartons and the card pockets from a file folder, see Figure 12.



1/2 gallon milk carton   file folder

Figure 12

The student takes the cards containing the formulas from the pocket and attaches each of them to a shelf. When each of the shelves has a formula on it, the student places the models on the shelves so that they match the correct formula; for example, a cube with the formula $V = e^3$

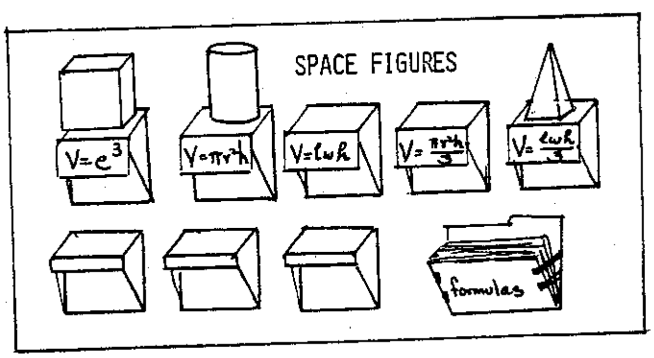


Figure 13

The set of cards and models should include the formulas for lateral area, total surface area and volume for a cube, a rectangular prism, a right pyramid with a square base, a right pyramid with a triangular base, a cylinder, a cone, and a sphere. This is a total of twenty one cards. Others may be added if other figures have been studied. This involvement bulletin board can be used as a review activity.

SUMMARY

Some secondary students need visual or tactile displays of concepts being studied. It is the teacher's responsibility to see that visual or tactile learners have the experiences necessary to reinforce their learning. Secondary mathematics classrooms need good mathematics displayed for students to see. The suggestions in this article are only a beginning. Every secondary teacher can expand on them and create other displays for their students.

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(Continued from page 6)

Subject Preferences of the Girls in Comparison With the Boys

Table 2

	girls	boys
Math over SS	20	18
SS over Math	5	7
Math over Lang	17	16
Lang over Math	8	9
Math over Read	17	16

	girls	boys
Read over Math	8	9
Math over P.E.	5	3
P.E. over Math	20	22
Math over Science	11	7
Science over Math	14	18

CONCLUSIONS

Even though the population sample was small, some of its information can be useful. In the area of homework a more problem solving approach would help the students understand their work better. Despite the children not stating explicitly that they felt homework was busy, overloaded work, this feeling was received during the interviews. Sixty and seventy problems for homework is not a learning experience, it is monotonous.

Games have a place in the classroom. They can be a great learning experience, but somehow the children aren't understanding what the games are really teaching them. The students don't realize how the math they're doing is going to be of any use to them as was expressed by a student when she said, "I think I'm never going to use it. Everyone tells me that I'm going to. In every class they tell us you're going to use math in your life so they make us learn it and everything and I think it's disgusting." The students interviewed had a definite like or dislike towards math. Their honesty was quite refreshing. The students need to be heard; after all they are the ones all the wonderful teaching strategies were created for.

Multicultural Mathematics for the Classroom

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Lincoln High School - Portland, OR

(Washington Mathematics, Spring, '85)

I have always found it interesting to note how previous cultures have influenced what we do today in all aspects of life. Math is no different, in mathematics we have a base 10 numeration system named "Hindu-Arabic." Why was that name chosen? Why two parts to the name? What did those and other previous cultures contribute to the development of math as we know it today? Did they develop it all themselves or did they borrow knowledge from other peoples before they passed it on to us?

These and other questions led me to develop a two week course which introduces various cultures - their contributions and numeration systems- to my students. I have presented it orally to my geometry classes over the past two years, and utilize overhead sheets as teaching aids. This article will describe the activity covered in two weeks and some of the information that is learned.

The first class discussion begins with a timeline and an educated guess of the actual development of numeration (from just a number sense of more or less sheep than my neighbor; to tallying, e.g., counting with stones representing the items; to words, e.g., the word for the ring finger became the word for 3, the word for the hand became the word for 5; to symbols representing the number, (e.g., the symbol "1" represented the word one, the symbol "2" represented the word two.) We discuss how many of the number words were and are related to body parts; and we compare and manipulate numbers from base to base (e.g., convert 4,362 to base two or base five and convert 562 in base twenty to base 10); the different bases are then related to those different cultures that used them.

The following lesson days are used to discuss the contributions and numeration systems of various cultures. Worksheets are handed out daily to assist in developing skills with manipulating the symbols used by the various cultures (e.g., write 463 in the Babylonian method, remembering to convert it to base 60 first); a quiz was given as a quick check of knowledge assimilated; and an open-note test was given the final day to check on both general information and the use of various symbols.

There are many groups of peoples that could be discussed, but this is an introduction and thus limited in scope. Below are the groups discussed in class and the major contributions of each to modern mathematical thought.

The **Africans** were the first to use base five and developed mathematics only as a societal need.

The **Arabs** preserved and distributed the information they assimilated. Math became more important. Written symbols were developed to meet the needs of administrators of conquered lands. Without them, the financial administration of these lands would have been in chaos.

The **Babylonians** used the base 60. The symbol $<$ represented 10 and the symbol V represented 1. They had problems due to the fact that no zero existed. Still, their contribution was great. They had a formula for solving quadractics and they had the correct concept for the negative numbers.

The **Chinese** mathematics was arithmetic and algebraic in nature. They developed the traditional and scientific numerals but had problems with approximation. The Abacus became a standard merchants tool.

The **Egyptians** developed their mathematics as nature dictated. They used symbols (hieroglyphics) and made statements of their results. Successive doubling and addition became a popular multiplication method.

The **Greeks** gave us geometry and developed a logical system of proof. They used the Attic and Ionic systems to represent their numbers.

The **Hindus** were responsible for our present numeration system including zero. There is evidence that an advanced civilization existed there 5000 years ago.

The **Incas** used quipus, knotted ropes and recorded their numbers.

The **Japanese** were isolated until the 19th century. Little development appears to have happened from the 8th to the 17th century. The Abacus was co-invented here.

The **Mayans** used an adjusted base 20 system with bars and dots used as symbols to represent their numbers. The calendar was a major contribution.

The **Romans** like the Arabs preserved the past. They gave us Roman numerals and a calculator.

The students like it. Comments include: 1) it was refreshing to be out of the book for a while; 2) it was fascinating to see what systems other peoples used and to see the impact they had on the development of mathematics; and 3) I appreciate our system a little bit more after having an opportunity to compare it to others and discover where certain concepts came from.

Overall, I am enthused with the topic and the opportunity to teach it within our curriculum. I had the chance to share it with fellow teachers at the 1983 Northwest Math Conference in Seattle and look forward to receiving feedback from any of them on their utilization of it in the classroom.

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