THE ALBERTA TEACHERS' ASSOCIATION

MATHEMATICS COUNCIL

NEWSLETTER

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MATHEMATICS OUTDOORS

Dr. Werner Liedtke

Dr. Liedtke recently completed his doctorate at the University of Alberta, having studied under Dr. L.D. Nelson. He is currently an Assistant Professor of Elementary Education at the University of Victoria, British Columbia.

Last summer I had the chance to observe, and in a small way be part of, a course offered in mathematics curriculum and instruction at the University of Alberta. During one of the sessions, the teachers enrolled in the course were sent outside to think about aspects of mathematics which could be taught outdoors. Many suggestions were made and it takes only a little imagination and time to make up a list of topics suitable for outdoor mathematics activities at all grade levels.

Some topics are suggested below, but as you stare out of your window after skimming over these paragraphs (not during!) many other ideas will likely come to mind.

CLASSIFICATION - Various objects have similar shapes, sizes (heights) or colors; materials are similar in many ways and plants can be classified according to various characteristics.

SERIATION - Buildings, plants or people can be arranged in order of size, graphs can be made to record the results; the lengths of shadows at different times of the day will result in an interesting pictorial representation.

In this issue

ONE-TO-ONE CORRESPONDENCE - Buildings, windows, doors, fence posts, gates and steps can be included in a list of matching problems; the resulting graphical representations can be made according to the cardinal number property of these and similar sets.

ORDINAL NUMBER - Cars in a parking lot or bicycles in a stand present an excellent situation for the creating of problems which use number pairs to locate objects in an array.

SHAPES - New two- and three-dimensional shapes can be discovered by examining buildings, fences, sidewalks and plants; new names will be learned and similar figures or shapes can be discussed.

PATTERNS - Bricks on a wall, holes in a wire-fence, sidewalk blocks, windows in a building and parts of trees or plants will not only lead to the discovery of patterns but also can lead to a stimulating discussion on symmetry.

TESSELLATION - The patterns displayed on walls, sidewalks and fences can lead to many activities related to this topic.

TOPOLOGY - Repetitive patterns on a wall or networks of sidewalks lend themselves for creating puzzles dealing with mazes.

AREA AND PERIMETER - By using various objects such as a brick, block or piece of string as a unit, many interesting problems can be made up.

MULTIPLICATION AND FRACTIONS - Arrays of bricks or sidewalk blocks and window or door frames may be suitable for devising problems dealing with these topics.

PROBLEM SOLVING (ESTIMATION) - Some of the variables which can be included in problems to be solved outdoors could include: the speed of the wind, the amount of rain or snow-fall, the height of trees and buildings, the number of bricks in a wall, the speed of a car, the number of cars travelling past the school on a given day; the list could go on since many of the possibilities depend on the location of a school.

Most of these activities will require little as far as materials is concerned. Some planning and organizing will be necessary, however. The greatest challenge will probably lie in making up appropriate questions which will encourage discussion and experimenting on behalf of the students. Someone suggested that the number of possible activities likely exceeds the number of nice days available. This may be true - especially for <u>some</u> parts of the country.

From the Editor's Desk

Recently a document came to our attention which summarizes, in a very general way, researchers' latest answers to certain questions dealing with elementary school mathematics. We wish to share some of these findings with you.

Do elementary students like mathematics? It is a widely accepted notion that mathematics is disliked by most students; however, results of numerous surveys contradict this. Many studies show that students frequently select arithmetic as their favorite subject.

What effect does the mathematical knowledge of parents have on the mathematical knowledge of their children? Research studies have found that increased parent knowledge of mathematics or classroom activities resulted in a higher achievement by students.

What steps can be taken to motivate the student in mathematics?

1. Verbal praise aids motivation and achievement.
2. Use of mathematical games aids motivation.
3. Reinforcement increases achievement in arithmetic.

Research findings on materials indicate that concrete materials should be used before proceeding to abstractions. The reading level of many arithmetic textbooks is too difficult.

Practical mathematics. Counting money and telling time are the most frequent out-of-school uses of arithmetic skills by students. Practical problems of interest to students promote greater achievement in problem-solving.

Research findings on mathematics operations indicate that drill and practice are necessary for computational accuracy, but they should be used only after effective developmental activities.

Research on organization and classroom management indicates that the type of classroom (departmentalized, team teaching, open area, egg-crated) apparently does not affect achievement. Grouping is desirable, especially within a class.

On students and teachers, research shows that students have more positive attitudes toward arithmetic when they perceive it as a useful skill, with practical values for out-of-school situations. Socioeconomic level affects background and achievement, but not so much in mathematics as in certain other curricular areas. The mathematical competency of teachers is still inadequate, but is improving.

Finally, the research indicates that *inductive discovery strategies* are effective, especially for retention and transfer.

For more information, the reader is referred to the original document, which is available from ERIC Reproduction Document Service, under identification number ED 034 087.

Murray R. Falk

Letters to the Editor

Dear Sir,

I understand that both the University of Lethbridge and the University of Alberta will accept Mathematics 13, 23, 33 in lieu of Mathematics 10, 20, 30 as a prerequisite for entrance to certain programs, but that the University of Calgary has refused to do so. Why does this variation in requirements exist? It appears that this will be a handicap to many students who had planned to attend the University of Calgary.

Curious Reader,
Calgary.

Dear Curious,

You will note that your name has been withheld, as per your request.

As to your question, your letter has been referred to the respective Deans of Arts and Science at each University, for their response. They have been asked to clarify their institution's positions with respect to the Mathematics 13, 23, 33 sequence. Their responses will be printed in a future issue.

The Editor.

Dear Sir:

With regard to the Alberta Mathematics Teachers' Conference held at the University of Calgary last fall, I, as others probably are, am somewhat disappointed with the discussions carried on.

Forms were issued to all teachers concerned, and we were asked to list any questions that we would like to have discussed. As it turned out, almost the entire discussion period was spent debating one "great" question which, apparently, was well hashed the previous year. Now to those teachers, especially those new to the profession, who were looking for enlightenment of some sort from the wealth of experience present, this must have proven rather frustrating, as it did for me.

I realize that it would be impossible to answer all questions, but an effort, at least, could have been made. If I may offer a suggestion, perhaps some of these questions in the future might be answered through your newsletter and valuable insights and ideas might be passed on.

B. MacInnis
Mathematics Teacher
St. Francis High School
Calgary

Dear Mr. MacInnis:

We will bring this before the Executive of MCATA at the earliest opportunity. We cannot, of course, guarantee that any action will be taken, but you can be assured that your suggestion will not be ignored.

The Editor.

Open-ended Explorations for your Math Corner

Nancy T. Hildebrand
Birchwood School
Bellingham, Washington

The following article is reprinted, with permission, from "Washington Mathematics", (Journal of Washington State Math's Council), XV, #2, December 1970.

Have you tried work cards to guide independent investigations for intermediate and junior high students? If so, have you wished for additional ideas that provide sufficient motivation but do not require extensive background materials or teachers' explanations? The following open-ended examples have been successful with individuals and small groups in the middle grades. Select from and adapt them (or better yet, allow children to do so) according to your classroom needs.

PERIMETER

1. Experiment with a geoboard or pegboard and rubber bands to find all the rectangles with perimeter 20 that fit the following rules:

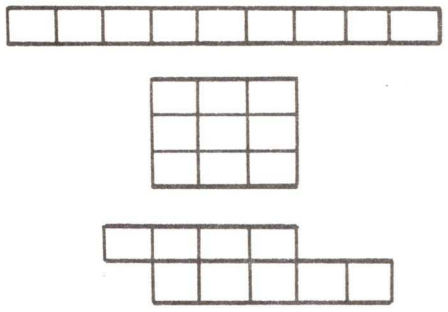
   Rule 1: Each side must measure a whole number of units - 1/2 unit not fair!

   Rule 2: Sides must follow lines - No jay walkers or diagonals allowed!

2. Draw each of the rectangles on dot paper.
3. Cut out the rectangles, order them according to length of longest side, and make a nest by pasting them one on top of the other on graph paper starting with the rectangle with the longest side. What pattern do you see?
4. What is the largest area possible under the rules given?
5. What is the smallest area?
6. If you were not limited to rectangular shapes, which one(s) having 20 unit perimeter(s) would enclose the largest area?

CONSERVATION OF AREA

1. How many different regions can you form using nine squares? (Do not overlap the squares. Organize your trials on dot paper.)
2. What is the largest perimeter you can have under these conditions?
3. What is the smallest perimeter?
4. Keep a record (chart) of your findings. For example:

REGION	PERIMETER
	

Then order the perimeters and plot the range of perimeters for the given unit area on a line graph. Compare graphs and try to predict maximum and minimum perimeters for other areas.

5. Experiment with 16 squares (or use dot paper) and predict the maximum and minimum perimeters.

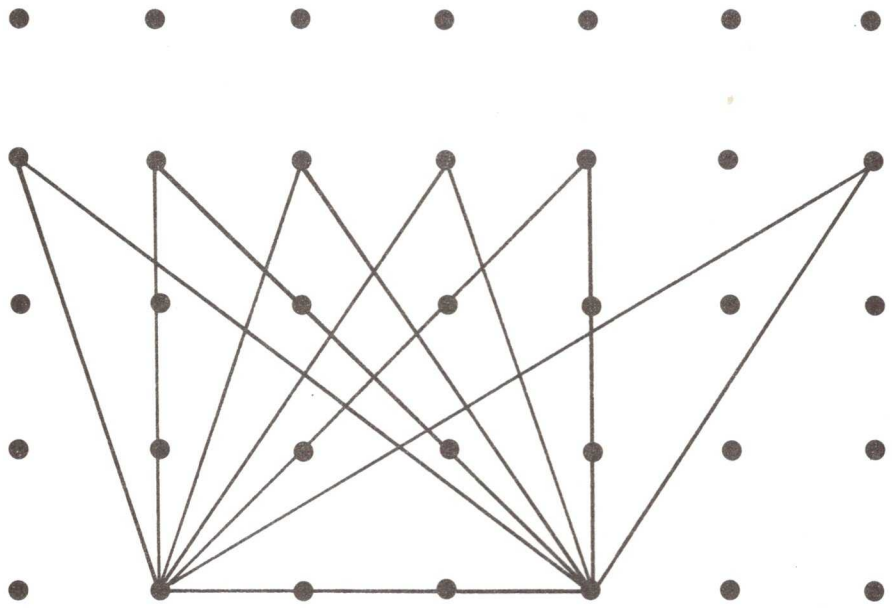
6. Check your guesses and graph the results as in 4.

7. Construct a line graph showing the number of outside edges in contrast with the perimeter.

8. Experiment with eight cubes and consider the maximum and minimum surface areas.

ATTRIBUTES OF TRIANGLES

1. Using a geoboard or pegboard and rubber bands, and a *single* base (for example, 2 units), construct five different triangles having the same height.



2. Find the area of all five triangles.

3. Make a chart to show the base, height, and area of all of the triangles.

4. Express as many ideas as you can as a result of your investigations.

5. Is there a relationship between the base and height of a triangle and its area?

6. Find the perimeters of the five original triangles and chart the perimeter and area of each. Which triangle has the shortest perimeter?

7. Predict the area of five triangles that have the *same base* as those in 1 above but are *twice as high.*

8. Draw the triangles in 7 on dot paper and find the areas to see whether you were correct.

9. Predict the area of five triangles that have the *same height* as those in 1 above, but have a base *twice as wide.*

10. Again draw the triangles and check your prediction.

11. Predict the area of five triangles that are *twice* as high and twice as wide as those in 1 above. Draw the triangles and check your predictions.

12. Find the triangle that encloses the largest area if the perimeter is 12 units.

MISCELLANEA

▷ The November, 1970, issue of *"The NTA Bulletin"* (Newfoundland Teachers' Association) carries a news item of interest to Alberta mathematics teachers: "125 teachers from across the province met in Gander on October 24 and formed a Mathematics Council... Guest speakers for the day were Dr. Joan Kirkpatrick who dealt with primary and elementary Mathematics..."

▷ We have received one copy only of a pamphlet entitled *"Positional Notation in the Gaussian Integers".* MCATA members may borrow this document. Address your request to the Editor.

▷ We remind you that letters to the editor are welcome anytime.

▷ First announcement of a new Journal:

MATHEMATICAL PROGRAMMING

Professor M.L. Balinski of the City University of New York will act as Editor-in-Chief to the new bi-monthly journal MATHEMATICAL PROGRAMMING, the first issue of which is to be published shortly by North-Holland Publishing Company, Amsterdam.

This new English language journal will publish papers on every theoretical, computational and applicational aspect of "mathematical programming", that is, everything of direct or indirect use for questions surrounding the problem of finding the extreme values of functions of many variables. This includes - along with the conventional topics in linear, nonlinear and integer programming - computer experimentation, techniques for formulating and applying mathematical programming models, computer programming devices of special interest to the subject, unconstrained optimization, and control theory done in the spirit of mathematical programming.

Papers will include expositions and surveys, original research and contributions to several special sections devoted to presenting shorter reports in a timely fashion: sections are planned giving short descriptions of newly available computer routines, summaries of successful practical applications, research announcements, book reviews, and a briefly annotated bibliography listing papers, books and programs germane to mathematical programming but appearing in other journals. This section, along with all other matter to be published, will be referenced.

Publication will be in bi-monthly issues and two volumes per year. The subscription price will be US $40.00 for 1971. The first issue is scheduled to appear in March 1971.

Subscription orders and requests for free sample copies may be sent to North-Holland Publishing Company, Journal Division, P.O. Box 211, Amsterdam, The Netherlands.

▷ We have extended the deadline for submission of your suggestions for a new title for this publication. Since *"Newsletter"* is no longer appropriate, we ask your help in choosing a new title. There will be a small honorarium paid to the person whose suggestion is used. Submit your suggestions to the Editor before April 1.

Mathematics Council Newsletter is published several times a year. Editor: Murray R. Falk, 2112 Palisdale Road S. W., Calgary 14. Publisher: The Alberta Teachers' Association, 11010 - 142 Street, Edmonton. Editorial and production service - Hilda Lindae. All news items, articles, and correspondence about this newsletter should be addressed to the editor.