TEACHERS' ASSOCIATION

MATHEMATICS COUNCIL

NEWSLETTER

Volume II, Number 2, June, 1963

Contents

OVERVIEW OF CHANGE - OR A LOOK AT THE FOREST BEFORE WE CAN'T SEE IT FOR THE TREES, by E. A. Krider

Editor's Note - Mr. Krider is a former principal at Oyen. During the past year he has been a teaching assistant in mathematics education while working toward his master of education degree.

The development of the mathematics curriculum in North America has been closely associated with the changing views of transfer of learning. In the half century before 1900, the theory of mental discipline held sway and it was accepted that transfer took place more or less automatically. Mathematics was of the sequential type and generally all high school students were required to take it without regard to what practical use it might be put (2). At this time it was usual for subject matter specialists to determine the content of the mathematics curriculum.

In the first decades of the twentieth century, we see a reaction against over-emphasis on factual knowledge and also the theory of mental discipline being discredited. The emphasis on specific transfer as opposed to general transfer, the ascendency of pragmatic philosophy, the stimulus response psychology, and the increased proportion of the population in our secondary schools, all lead to more emphasis being put on skills and specific information in mathematics. In the twenties and thirties, the stress was on social adjustment and training for democracy - "preparing the well-informed citizen" (3).

As the first half of the century comes to a close we see the gap between the subject matter specialist and the educationalist at its widest and the scholars at the forefront of knowledge starting to demand a voice in designing school curricula. Another facet of the development of mathematics that deserves mentioning is the emphasis in the forties on classes for the less gifted and in the fifties on classes for the gifted (3).

Finally we come to the big turning point in the development of the mathematics curriculum in the mid-fifties. Here we see the results of the reaction to the extremes of progressive education, the stimulus-response psychology, the over-emphasis on skills and specific information, the over-emphasis on the social and the utilitarian aspect of education, the extreme negative views on transfer. The following quotation illustrates the changing view on transfer -

> Virtually all the evidence of the last two decades on the nature of learning and transfer has indicated that, while the original theory of formal discipline was poorly stated in terms of the training of the faculties, it is a fact that massive general transfer can be achieved by appropriate learning (1:6).

The changes in ideas of transfer and the Gestalt psychology gave the reformers the psychological grounds for their movement. Bruner says -

> What may be emerging as a mark of our generation is a widespread renewal of concern for the quality and intellectual aims of education - but without the abandonment of the ideal that education should serve as a means of training well-balanced citizens for democracy (1:1).

With this movement we see the subject matter specialist moving back into the picture.

> Curriculum programs such as SMSG and UICSM sprang from the dissatisfaction of the subject specialists with the preparation being given for their discipline in the schools (4:187-192).

Although this turning point seems to have taken place suddenly about 1954, the proponents of the need for radical change in emphasis were actively campaigning long before this. Professor Cecil B. Read of Wichita University, lists quotations all taken from articles written between 1917 and 1932, registering the same complaints as voiced by the "revolutionists" of the fifties (7:181-6). Why did these people suddenly become the authorities in the field of curriculum building? First, the gap between what was taught in schools and what was known in the field became acute because of the explosion of knowledge. Secondly, the shortage of scientists and mathematicians came to the public's attention with the first Sputnik. With the millions of dollars poured into the cause by the American government, the reformers were away. A number of professional groups, attacking the problem of producing a new mathematics curriculum were set up. The three most influential groups are -

> The Commission of Mathematics of the College Entrance Examination Board (usually referred to as the Commission on Mathematics),
>
> The University of Illinois Committee of School Mathematics, headed by Professor Max Berberman (abbreviated UICSM),
>
> The School Mathematics Study Group headed by Professor Edward G. Gegle at Stanford (abbreviated SMSG).

These groups are made up of professional mathematicians, professional educators, psychologists, and usually practising teachers. It is hard to over-emphasize the impact that these three groups have made not only on mathematics curriculum but in the whole spectra of the school curriculum building (1:70). One cannot discuss recent mathematics curriculum change without referring to these groups.

In conclusion and at the risk of over-simplification, one might infer from this brief survey that the development of the mathematics curriculum in North America since the turn of the century has been a series of actions and reactions. If one is to extrapolate from this, we would expect a reaction to the modern approach to curriculum building as exemplified by Bruner, and the workers in the specific subject matter fields, to be discernible. In the case of mathematics this reaction is not only discernible, but is well established with a substantial following. C. Stanley Ogilvy, Hamilton College, Clinton, New York writes -

> After 20 years of propaganda in favor of the introduction of new mathematics, we can now discuss the beginning of a swing in the other direction. In almost every new issue of the Mathematics Teacher and the American Mathematics Monthly we find one or two articles cautioning us to move ahead slowly, to guard against discarding good and valuable material merely, to make room for something new for the sake of its newness (6).

And from a statement signed by 64 mathematicians in the United States and Canada -

> Mathematicians, reacting to the dominance of education by professional educators who may have stressed pedogogy at the expense of content, may now stress content at the expense of pedagogy and be equally ineffective. Mathematicians may unconsciously assume that all young people should like what present day mathematicians like or that the only students worth cultivating are those who might become professional mathematicians (5).

Could there be a little bit of truth in the statement that, in education, if you're old-fashioned long enough, you'll be modern!

References

(1) Bruner, J. S., The Process of Education, Harvard University Pres: 1960.
(2) Butler, C. H. and Wren, F. L., The Teaching of Secondary Mathematics, McGraw-Hill Book Company, Inc., 1960, Chapter I.
(3) Harris, Chester W., "Mathematics", Encyclopedia of Educational Research, Brett-MacMillan, Ltd., 1960.
(4) Hughes, Phillip, "Decisions and Curriculum Design", Educational Theory, 12 (July, 1962).
(5) Ontario Mathematics Gazette, Bulletin 1, No. 2 (October, 1962) p.5, "On the Mathematics Curriculum of the High School".
(6) Ogilvy, Stanley C., "Second Thoughts on Modernizing the Curriculum", The Mathematics Teacher, November, 1960.
(7) Read, Cecil B., "What's Wrong with Mathematics", School Science and Mathematics, Vol. LVIII, No. 509, (March, 1958).

HAVE YOU TRIED YOUR HAND AT PROGRAMMING? by Ruth Godwin

Editor's Note - Dr. Godwin is associate professor of education at the University of Alberta, Edmonton. During the summer of 1962 she participated in a programmed instruction seminar at Columbia University.

Most teachers have heard or read something about programming, but how many of them have tried to produce a program? Probably not enough. And yet, who has a better chance of writing a successful program than the able teacher who, through many years of classroom experience, has learned much of what students can learn and how they accomplish their learning?

Let us presume that you have read one or two articles on programming, that you have worked your way through a program (or more), and that you are ready to start programming. What follows is a brief (perhaps too brief), do-it-yourself guide for the writing of a linear program. Do what is required, step by step, and you should end up some months from now with a bit of programmed instruction and a wonderful feeling of accomplishment.

1- Review what you know about programmed instruction and do a bit of thinking about what might (or might not) be programmed in mathematics.

2- Choose a small item of information to teach. Define it as precisely as you can, remembering that you must take the student from where he is to where you want him to go in a series of small steps, mostly by way of socratic questioning.

3- Write a small statement, a "step" which is large enough for the student to take without being bored but small enough for the learner to complete successfully. (The student is always right in programming. Compose frames of such difficulty that the average student will be able to give the correct response to almost all of them.)

4- Write another statement, another and another, each building on its fellow until you teach whatever it is that you have decided to teach. Have the student compose rather than copy answers.

5- Use cueing techniques with whatever frequency you think that you should, especially in the initial frames, to help the student learn what you are determined to teach him. Cues can take several forms, such as: (a) partial presentation of a word (some or almost all letters omitted), (b) similarity of grammatical construction, (c) constriction of the range of response by grammatical construction, and (d) visual cues (e.g., italics, underlining, color).

6- Avoid the dullness of repetition by: (a) varying the context of each additional problem, (b) introducing new information related to a particular problem, and (c) requiring discriminations to be made between two or more problems separately accomplished in the past.

7- Vary your presentation by using some (or all) of the following types of frames: (a) lead-in items - to prepare a student for new information, (b) augmenting items - to supply additional new information, (c) interlocking items - to review what has been learned in addition to the presentation of new information (d) restate-review items - to rehearse an established (you hope) skill, (e) generalizing items - why explain this one to teachers?, (f) specifying items - to make use of a learned item in an illustrative case.

8- As you compose your program, follow this procedure: (a) use a 4x6 card for each frame, placing the completion on the back of the card (otherwise you won't be able to pupil-test efficiently make revisions, etc.), (b) give carefully-worded directions, (c) pay particular attention to transition, (d) student test your items, and (e) revise by adding more frames, writing a more precise bit of exposition, providing better (or more) cues, or giving an example or illustration.

You're on your own! One last word of caution: pupil-test, revise, and pupil-test again and again until you get about a 90 percent efficiency level for your program with average students.

Once you get started, you'll find programming a pleasurable activity (somewhat akin to the solving of crossword puzzles), and you'll find that it teaches you more than you thought it would about how children learn.

Have fun!

A CRITICAL ANALYSIS OF THE USE OF THE RATIO TEST IN COMPUTATION OF PROPORTIONAL EQUATIONS, by H. L. Larson

Editor's Note - Mr. Larson is superintendent of schools in Ponoka, and is president of the Red Deer Regional of the MCATA.

One outstanding feature of modern mathematics in elementary schools, as introduced by Scott Foresman texts, is the use of rate and ratio in solving problems. There is little doubt that Grade VI students can and do understand the first step in setting up the equation. Recognition of rate sense in so many problems and use of a placeholder to complete the open sentence is a startling innovation in the solution process. This is especially exciting when we note the methodical attack on problems made by youngsters at the tender age of eleven.

It is not this first step that we criticize, but rather the computational aspect. It is here that the development has been anything but precise. Let us examine some of the objectionable features of the use of ratio test -

(1) If we take any two rational numbers, such as a/b and c/d, and assume equality, it is true that ad = bc. A logical proof can be given and thus the cross products can be used as a property or, rather, theorem for further proofs.

It is also true that we often explain and develop solutions based upon fundamental laws which we have not formalized, especially at the elementary level. But can we conclude that students at this age can benefit from the short cut which we usually call cross-multiplication? Are we not falling into the traditional trap of using meaningless rules to get answers?

(2) But this is not the worst feature of the use of ratio test. Students at this age are not securely aware of the meaning of symbols. In using the ratio test we teach them literally to multiply across an equal sign. Later on when they multiply two rational numbers, especially algebraic numbers, they will certainly be confused to find a different situation entirely.

(3) Perhaps the strongest objection we can make in using the ratio test is that in so doing we are bypassing an excellent opportunity to teach these youngsters the use of fundamental laws of operation. These are the laws from which we derive our authority for using the "test" in the first place. We will show this by example later. We may sum up this argument with the old adage that the sins of omission are often worse than those of commission.

(4) Lastly, this excellent opportunity to use the basic laws of "inverse for multiplication" and "equality" will lay a firm foundation for deductive thinking. Children like to know the whys in mathematics and reference to basic laws is satisfying to them.

Of course these fundamental properties should be illustrated concretely. For example, the inverse law could be written 3/1 x 1/3 = 1 and changed occasionally using other whole numbers to replace 3.

Let us illustrate the solution of a problem using the ratio method by fundamental principles.

"What is the cost of 5 cans of corn if 3 cans cost 57 cents?"

Step One, English Problem - Mathematics Problem

Rate or Comparison	Ratio or Open Sentence
$\frac{\text{3 cans}}{\text{57 cents}}$ $\frac{\text{5 cans}}{\text{n cents}}$	$\frac{3}{57} = \frac{5}{n}$
or $\frac{\text{57 cents}}{\text{3 cans}}$ $\frac{\text{n cents}}{\text{5 cans}}$	$\frac{57}{3} = \frac{n}{5}$
or $\frac{\text{3 cans}}{\text{5 cans}}$ $\frac{\text{57 cents}}{\text{n cents}}$	$\frac{3}{5} = \frac{57}{n}$
or $\frac{\text{5 cans}}{\text{3 cans}}$ $\frac{\text{n cents}}{\text{57 cents}}$	$\frac{5}{3} = \frac{n}{57}$

All four of these are correct. For computational purposes, we shall use the second.

Step Two, Solution of Mathematics Problem or finding the replacement for n.

$$\frac{57}{3} = \frac{n}{5}$$

$$\frac{57}{3} = \frac{n}{1} \times \frac{1}{5}$$ (Rational components, from Identity law)

$$\frac{5}{1} \times \frac{57}{3} = \frac{n}{1} \times \frac{1}{5} \times \frac{5}{1}$$ (Inverse law and Equality)

95 = n (Simplify)

n = 95 (Reflexive law)

Step Three, Closing the sentence

$$\frac{57}{3} = \frac{95}{5}$$

Step Four, Interpretation

Five cans of corn will cost 95 cents.

In conclusion, we should note that, while the development of the above rationale may require a little more patience at first, it should be most rewarding. The student has been introduced to solving equations on solid ground that is sequential in nature. The ratio test method at this level is only an expedient that serves no developmental purpose in using fundamental principles for computation.

ACADEMIC YEAR INSTITUTES OF THE NATIONAL SCIENCE FOUNDATION

The Academic Year Institute program of the National Science Foundation supports the efforts of colleges and universities in providing opportunities for teachers of science and mathematics to spend an entire academic year in full-time study of the subject matter of their disciplines. Financial assistance from the Foundation will support about 1,700 experienced secondary school teachers and supervisors, 50 pre-service certificated secondary school teachers of science and mathematics, and 110 experienced college teachers as participants in this program during its eighth year, 1963-64.

Academic Year Institutes are conceived and conducted by the individual colleges and universities and provide course work in science and mathematics for teachers who may have received little formal scientific education beyond that of their undergraduate preparation. These courses are designed to increase the competence of teachers by improving and up-dating their knowledge of the subjects which they teach. They emphasize an understanding of basic principles and of the interrelationships of these principles. At the same time, attention is given to current developments in science and to the relevance of these to the secondary school curriculum.

It will be possible for many teachers participating in an Institute to earn a master's degree in science or mathematics, or in the teaching of science or mathematics, provided they satisfy the necessary prerequisites. However, admission to the graduate school and to candidacy for an advanced degree is ordinarily distinct from selection as an institute participant, and it is not necessary that participants become degree candidates.

During the 1963-64 academic year, two pre-service teachers will be participating in the Academic Year Institute at Washington University in St. Louis, Missouri. The two, Douglas Harke and James Vance, have just completed the professional year of teacher training following an approved degree at the University of Alberta.

Douglas Harke was born in Edmonton and received his elementary and secondary education at New Sarepta. Upon graduation from New Sarepta High School in 1959, he was awarded a Queen Elizabeth Matriculation Scholarship for his first year at the University of Alberta. Mr. Harke graduated from the University of Alberta with a B.Sc. in physics in 1962. He is involved in church youth work and has been president of the Canadian Moravian Regional Youth Council for the past year.

James H. Vance was born in Raymond, Alberta and received his elementary and secondary education in Raymond. He graduated from Raymond High School in 1956, and accepted an Alberta Hotel Association Scholarship to attend the University of Alberta. After attending for two years, majoring in mathematics, Mr. Vance went to France where he served for two and a half years as a missionary for the Church of Jesus Christ of Latter Day Saints. Upon his return, he completed a third year at the University of Alberta and received the B.Sc. degree in mathematics in 1962.

CAN HIGH SCHOOL STUDENTS LEARN SOME OF THE CONCEPTS OF MODERN MATHEMATICS? by Nora Chell and W. F. Coulson

Editor's Note - Miss Chell recently received her bachelor of education degree from the University of Alberta with a major in mathematics. She was awarded the Clarence Sansom Memorial Gold Medal in Education by The Alberta Teachers' Association. Mr. Coulson is assistant professor of education at the University of Alberta, Edmonton. He is a member of the Senior High Mathematics Curriculum Subcommittee of the Department of Education.

The first part of this article deals with the question expressed in the title from the standpoint of what various writers have said in the literature. Later parts will deal with the same question but from the standpoint of the research which has been done.

To answer the question, one must first ask, "What is modern mathematics?". Some have defined modern mathematics as meaning modern in approach, while others have defined it as meaning modern content taught by modern approaches. Demsey (3:25) says, "As far as high schools are concerned the word modern applies more to approach than to content". By modern mathematics, Dr. Paul Beesack, assistant professor of mathematics at McMaster University (2:71) means, "axiomatic or postulational method which is characteristic of so much of the mathematical activity of this century". Rourke (11:225) states modern mathematics is "a means of broadening old ideas and introducing new ones to clarify, simplify, and unify our mathematical concepts". Zant (13:595) comments that modern mathematics does not imply a totally new program, but the "newer programs present essentially the same subject matter as before, but it is developed from a different point of view and use is made of a relatively small number of new concepts such as sets, algebraic systems, binary operations, axiomatic systems, etc.". According to May (5:93), modern mathematics includes "such topics as logic, theory of set, Boolean algebra, and set theoretic approaches to relations functions, and other topics of mathematics".

For this paper, modern mathematics will be defined to mean modern concepts taught from a modern approach. Modern content will refer to group and field theory, topology, symbolic logic, and set theory while modern approaches will refer to the axiomatic approach or postulational approach and the set-theory approach. The literature will be reviewed first considering those articles which deal with the average student, then the slow student, third the above average and gifted student, and fourth with respect to mathematics clubs.

Average Student

At St. Laurent High School, Montreal, experiments in modern mathematics were conducted with three groups of students: average, top, and students in mathematics clubs. According to Richardson (9:37), the average students in Grades X and XI benefitted from "the discussion of the postulational method and its use in mathematics".

Rourke (10:12) in his address to the Canadian Teachers' Federation Seminar in 1960 says -

> The boys at Kent School were using the set language in notation very well in Grade XII, so the next year we pushed it down to Grade XI, then down to Grade X and now, in Grade VIII we teach the idea of a relation as a set of pairs, because it fits very well there, with some of the work we are doing.

In his article, "Some Implications of Twentieth Century Mathematics for High Schools", Rourke (11:86) states -

> At the Grade X level, I made the definition of the function explicit and we talk the language of sets and set solutions. We don't get stuffy about it and we allow ourselves some elliptical expressions. We may, on occasion call $2x + 3$ a linear function, as indeed generations of mathematicians have done and likely will continue to do for some time. But we will keep in mind that in this elliptical talk, the function is really the set of ordered pairs (x,y) defined by the formula $y = 2x + 3$.

Zant (13:593) in describing an Oklahoma experimental program in modern mathematics used for regular classroom students states -

> The program was considered very successful. Teachers reported much more interest and understanding on the part of the students than did those in classes taught from the traditional program. Students seemed to be as proficient in the standard skills of mathematics as those taking traditional courses, though no particular effort was made to make comparisons.

A summer school course attended by teachers and superior students is described by Montague (7:22-23) in her article "A Demonstration Class in a National Science Foundation Summer Institute". The students formed a demonstration class and the topics discussed included: The Development of Mathematics, Modern Concepts in Geometry, Modern Concepts in Algebra and Some Aspects of Applied Mathematics. Montague says -

> Follow-up correspondence with teacher participants has revealed that many of the concepts presented by the lecturers were used in their regular classes the following year. The teachers felt that, even though the demonstration group was a highly selective one, the ease with which they accepted new concepts indicated that the average students could also learn some of them.

From the above statements, it seems as though the average high school student can learn some of the concepts of modern mathematics.

Slow Student

Allen (1:14) states that the "set serves to make feasible a broadened introduction to algebraic symbolism and the sentence, be it equation or inequation". He also states that the introduction of sets, including the set concepts of union and intersection motivated, in particular the disinterested and slow learners (1:20). For the slow learner the material was new and different. (If sets motivated the students, is it not inevitable that they must have learned some of the concepts?)

From the results of the St. Laurent experiment, Richardson (9:38) states -

Sets of ordered pairs were used last year to present graphs to a group of students who were poor in algebra, and they showed good comprehension.

The opinions of two writers indicate that slow high school students can learn some of the concepts of modern mathematics.

Above Average and Gifted Students

In British Columbia an experimental program of Mathematics 91 was established in 1959-60, "to determine whether or not it is possible to incorporate new subject matter and new approaches to traditional subject matter into the regular course" (6:210).

The Chant Commission (12:257) reviewed the experimental classes and found -

> The results indicated that the classes could learn some additional concepts and also master the conventional material at a standard equivalent to that of other Mathematics 91 classes.

According to Richardson (9:38), advanced students were shown what is desirable in drawing up a system of postulates and discussed algebra from the viewpoint of the postulational method.

Rourke (11:85) states that the concept of the function (a set of ordered pairs (x, y) such that for each x there is exactly one y) as a kind of relation can be understood by many high school students, most certainly those capable of college study.

For the gifted child, Allen (1:22) says -

> . . . set terminology is felt to provide an unambiguous and succinct introduction to a number of concepts of beginning algebra.

Grossman (4:75-81) reports that at the National Science Foundation Summer Institute for high school students at Columbia, special topics such as Boolean algebra, groups, rings, integral domains, fields, and the development of the number system from Peano's axioms were taught.

Thirty-five students distinguished by their capacity and achievement participated in the 1961 course.

A similar report by Wilansky (12:250-254) states that gifted students were taught topics of linearity, group theory, and multiplication from a modernistic view of Lehigh University during the summer of 1960.

According to Montague (7:98-100), the demonstration class composed of gifted students at the National Science Foundation Summer Institute had no problems with the following topics: the development of mathematics, modern concepts in geometry, modern concepts in algebra, and some aspects of applied mathematics.

Nichols (8:100-103) describes a school held at Florida State University in 1958 in which the talented students were divided into two groups. Both groups studied the fundamental concepts of set theory. In addition, one group was given "instruction in development of the number system beginning with the notion of set, leading to the definition of a natural number, integer, etc. The students also learned to perform arithmetic calculations using various number systems." The students learned the new concepts very rapidly.

Articles written about modern mathematics and the above-average or the gifted child indicate that these students most definitely can learn some of the concepts of modern mathematics.

Mathematics Clubs

Allen (1:20) suggests that students can learn the concept of the set and the set approach to algebraic symbolism as an extracurricular activity in a mathematics club. He also says -

> The extracurricular programs which have been introduced in many of our high schools have revealed a number of occasions in which the interest of a pupil whose classroom performance has been mediocre was stimulated by an unfamiliar mathematical topic, a problem in change, an exercise in space perception, or the diagrammatic representation of the relationships between sets.

Richardson (9:37) reports that the concepts of modern mathematics were taught in the mathematics club at St. Laurent High School.

From the statements of these two writers, one gains the impression that at least one way to introduce the ideas of modern mathematics is through a mathematics club. This will take no time away from the authorized course and still present the interested students with some challenging topics in a challenging subject.

Conclusion

In each of the articles quoted here the authors indicated that high school students could learn some of the concepts of modern mathematics. Although traditionalists stated that they were definitely against modern mathematics, in no case, was there a statement suggesting that high school students could not learn some of the concepts of modern mathematics.

The writers recognize that many more articles could have been mentioned. Limitations of space made the problem of selection a difficult one. In the next article the writers will take a short look at the research. Is it possible to find evidence that is not merely an expression of opinion that high school students can learn modern mathematics?

Bibliography

(1) Allen, H. D. "Sets and the Inequation", The Teachers Magazine, 1960, Vol. XL, No. 200, pp.14-24.

(2) Beesack, P. R. "Modern Mathematics, Its Evolution, Logical Structure, and Subject Matter", New Thinking In School Mathematics, Ottawa, 1960, pp.71-82.

(3) Demsey, F. C. "Modern Ideas for a Basic Treatment of Algebra", The Bulletin (Ontario), 1962, Vol. 41, No. 1, pp.25-26.

(4) Grossman, G. "A Report of a National Science Foundation Summer Institute in Mathematics for High School Students at Columbia", The Mathematics Teacher, 1961, Vol. LIV, No. 2, pp.75-81.

(5) May, K. O. "Finding Out About 'Modern Mathematics'", The Mathematics Teacher, 1958, Vol. LI, No. 3, pp.93-95.
(6) Meredith, J. R., "What's Going On In Mathematics", The B.C. Teacher, 1958, Vol. XL, No. 5, pp.209-211.
(7) Montague, H. F. "A Demonstration Class in a National Science Foundation Summer School", The Bulletin of the National Association of Secondary School Principals, 1959, Vol. 43, No. 247, pp.98-100.
(8) Nichols, E. D. "A Summer Mathematics Camp for Talented High School Students", The Bulletin of the National Association of Secondary School Principals, 1959, Vol. 47, No. 247, pp.100-103.
(9) Richardson, D. N. "Experiments with Modern Mathematics", The Educational Record, 1960, Vol. LXXVI, No. 1, pp.36-39.
(10) Rourke, R. E. K. "School Mathematics in Russia and the United States", New Thinking In School Mathematics, Ottawa, 1960, pp.1-14.
(11) Rourke, R. E. K. "Some Implications of Twentieth Century Mathematics for High Schools", The Mathematics Teacher, 1958, Vol. LI, No. 2, pp.74-86.
(12) Wilansky, A. "A Research Program for Gifted Secondary School Students", The Mathematics Teacher, 1961, Vol. LIV, No. 4, pp.250-254.
(13) Zant, J. H. "Improving the Program in Mathematics in Oklahoma Schools", The Mathematics Teacher, 1961, Vol. LIV, No. 8, pp.594-599.
(14) The B.C. Teacher, "How the Commissioners See It", Vol. XL, No. 5, pp.207-208.

Members are reminded that the dues for the 1963-64 year may now be paid. A cheque for $5 should be mailed to:

Mrs. Jean Martin
Secretary-Treasurer
Mathematics Council, ATA
Box 277, Ponoka

Editor - Professor W. F. Coulson, Faculty of Education, University of Alberta, Edmonton