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EDITORIAL

How Satisfactory are STM and EMM?

The new program in junior high mathematics has been in use in Grade VII for two years and in Grade VIII for one year, and teachers have begun to develop opinions as to its strengths and weaknesses. One weakness often mentioned is the unsuitability of the text materials for the slow learner - the approximately 30 percent of the students at the lower end of the ability scale.

The unsuitability seems to result from several characteristics which fail to meet the requirements of the group in question:

- too high a level of reading ability needed,
- too much emphasis on "why" before "how",
- problem situations not closely enough related to the interests of the pupils.

If the teacher finds that these inadequacies exist or that the materials demand too much, he must do something about the situation. Certain measures are possible:

1. Be fully aware of the minimum requirements as set down by the Curriculum Guide. These may permit omission of some chapters or sections.
2. If that minimum is still too extensive, modify the work in a suitable manner. Not every word must be read; not every exercise has to be done.
3. Do not be a slave to verbalization, terminology and symbolism. A pupil can understand and apply an idea without being able to express it in mathematical language.

Finally, a question directed to the classroom teacher: Are you playing a sufficiently important role in curriculum change? Who knows better than you how effective the new programs are? The MCATA is your council, working to improve mathematics education in Alberta. Let the executive know what your opinions are!

INSTRUCTIONAL MATERIALS IN MATHEMATICS

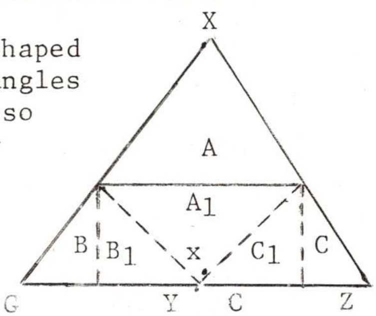
By N.G. Spillios,
Audio-Visual Supervisor, Edmonton Public School Board

While we might attempt to use bulletin board displays of pictures to describe the different forms of the cylinder, sphere, circle or square as they are seen in everyday life (for example, oil tanks at a refinery, illustrating the cylinder), the effectiveness of the use of such material will depend largely on the precise moment when these visualized examples are integrated in the lesson.

Other means can be used to bring meaning to mathematical concepts. Such models as the following can be easily constructed:

<u>The Sum of the Three Angles of a Triangle is Equal to 180°.</u>

Take a piece of wood half an inch thick and shaped in the form of a triangle to form the three angles x, y, and z. The triangle is cut and hinged so that the three small triangles A,B, and C may fold inwards to a new position A_1, B_1, C_1; the three angles x, y, and z added together form a straight line on the base, i.e. they are equal to 180°.



<u>Pythagoras' Theorem</u> - The construction of this model consists of a number of models, each consisting of a backboard on which is mounted in relief a right-angled triangle. On each side of this triangle is a square tray into which various wooden shapes can be fitted.

Have you considered teaching the concept of the ruler using an overhead projector? By projecting overlays of the divisions of the inch into 1/2, 1/4, 1/8, and 1/16 of an inch you can have a most effective lesson. You can also use overlays of fractions on the circle.

Examine the new sets of transparency masters recently released by 3M. Masters include Plane and Solid Figures, Sets and Sentences, the Pythagorian Theorem, Polar and Rectangular Coordinates, and Introduction to Probability.

COMPUTATION SIMPLIFIED

By T.P. Atkinson

Editors' Note: E.A. Smith is the principal of Alcomdale School, a three-room school 35 miles northwest of Edmonton. Mr. Smith teaches the pupils of Grades VI, VII, and VIII and also handles the mathematics program in Grades III, IV, and V.

On April 6, I was privileged to visit Alcomdale School to observe a group of children in Grades III, IV, V and VI doing computation in a manner somewhat different from that currently in style in Alberta schools. Although I witnessed examples involving the four fundamental operations and concepts of fractions and rates as well, I shall report on only addition and subtraction of whole numbers. Even this restricted topic would require pages for an adequate report. Consequently, I must be selective in the ideas I present, and I assume full responsibility for my choice.

To introduce these ideas, I quote from an extensive development that Mr. Smith has prepared:

> I have two purposes in mind while preparing this material. First, I attempt to bring order and simplicity to the present computational chaos by the systematic extension of the basic mathematical laws; second, I try to make it possible for the average child to do simple everyday computation in his head.

In achieving his objectives, Mr. Smith makes extensive use of basic facts of addition and of the commutative and associative properties. To determine the sum of 8 and 6, a Grade III girl reasoned:

$$\begin{aligned} 8 + 6 &= 8 + (2 + 4) \\ &= (8 + 2) + 4 \\ &= 10 + 4 \\ &= 14 \end{aligned}$$

She did not explain it or write it down in just the same manner.

Similarly, others thought out examples such as

$$\begin{aligned} 17 + 5 &= 17 + (3 + 2) \\ &= (17 + 3) + 2 \\ &= 20 + 2 \\ &= 22 \end{aligned}$$

and

$$\begin{aligned} 18 + 19 &= 18 + (10 + 9) \\ &= (18 + 10) + 9 \\ &= 28 + 9 \\ &= 28 + (2 + 7) \\ &= 30 + 7 \\ &= 37 \end{aligned}$$

Understandings and skills of the kind just illustrated make addition of several two-digit numbers relatively easy for the Grade III pupils. Here is an example that was demonstrated for me. Mr. Smith wrote the column of numerals on the chalkboard.

24 48 62 75	Reading from the bottom up, a Grade III boy announced the sums 75, 135, 137, 177, 185, 205, 209 in less time than it takes me to write them. Another checked his final sum by reading from the top down 24, 64, 72, 132, 134, 204, 209.

I leave to the reader the analysis of the mathematical principles being used. The procedure is extended to numbers expressed with three or more digits in Grades IV, V and VI.

248 679 584 263	Read from the bottom up: 263, 763, 843, 847, 1447, 1517, 1526, 1726, 1766, 1774. Read from the top down: 248, 848, 918, 927, 1427, 1507, 1511, 1711, 1771, 1774.

To perform subtraction in the manner in which Mr. Smith teaches it, one must think of a regrouping different from that which is the basis of the conventional algorithm. For example, 26 - 12 involves 20 - 10 = 10; 10 - 2 = 8 and 8 + 6 = 14. The procedure seems to work; a Grade VI pupil had no difficulty in going through the process 6174 - 3825 by the steps 3000, 2200, 2180, 2175, 2275, 2345, 2349.

Mr. Smith comments in his paper that "carrying" and "borrowing" do not occur in the algorithms and that what he uses is the "left-handed" or algebraic approach to arithmetic. I was interested to note that at least some of the pupils were aware of the conventional algorithms for addition and subtraction. One Grade VI boy to whom I talked said, "I like Mr. Smith's way better except when I make a mistake and then it is harder to find."

As stated earlier, there is much more to the total approach than just addition and subtraction of whole numbers. Mr. Smith makes effective use of the distributive property of multiplication over addition, of the identity element expressed in a suitable form in handling fractions and ratios and of miscellaneous relationships such as that expressed by $5 \times n = 10 \times \frac{1}{2}n$.

Irrespective of whether or not I agree with Mr. Smith's objectives or his techniques, I am prepared to say that what I was able to sample in my one-hour visit leads me to agree with Mr. Smith when he states, in reference to his objectives: "However, there seem to be several interesting side effects. Perhaps the most important of these is a tendency on the part of the child to like instead of dislike arithmetic."

A REPORT FROM *TIME*

The March 17, 1967, issue of *Time* Magazine contained the following interesting item in its education column:

> Johnny doesn't add very well. According to results of a major survey of math instruction in twelve nations released last week, the US is startlingly remiss in teaching its children how to add, subtract or solve calculus problems. Despite US prestige as the world's leading technological power, American 13-year-olds ranked a low eleventh in their understanding of math - outscoring only children from Sweden, and lagging well behind those from Japan. (Canada was not included in the study.)

This result occured in spite of the modern mathematics programs, or it is <u>because of</u> the modern mathematics programs. It appears that Mr. Smith's ideas are most timely.

ARTICULATION BETWEEN JUNIOR AND SENIOR HIGH SCHOOL MATHEMATICS
By L.C. Pallesen

Editors' Note: We are indebted to Len Pallesen, assistant superintendent of secondary schools, Calgary Public School Board, for the following article. Here he points out a definite problem in articulation and offers a partial solution. We invite comments from other teachers who have had similar or different experiences.

Is *Mathematics - Grade X* by McLean et al, the presently authorized test for Math 10, an acceptable text for those students who have followed either the Gage *Seeing Through Mathematics* series or the Holt Rinehart *Exploring Modern Mathematics* series through their junior high school years? This question is being asked repeatedly by the Senior High School Mathematics Subcommittee and many high school teachers. Unfortunately, there are not too many areas in Alberta where this question can be approached by actually examining the performance of "modern math" junior high graduates as they use *Mathematics - Grade X.* In one Calgary high school approximately 50 percent of the students taking Mathematics 10 used the *Seeing Through Mathematics* series for the three years of junior high. The comments which follow are based on questionnaires distributed to these students, their marks, and the comments of their teachers.

STM graduates score better in Math 10 than do graduates from the traditional Grade IX mathematics program. In one class of Math 10 where both "STM" students and "Traditional" students were included, the Easter examination marks show a significant difference, although the two groups were of comparable abilities. The range of scores obtained on the test was from 50 to 98. The "STM" students' mean score was 79, while the "Traditional" students' mean score was 63. This indicates that having the two groups in a single class or giving them the same examination placed the traditional students at a serious disadvantage.

In the school's organization it was not possible to arrange a class where all the students were of STM background. Consequently, it is not possible to determine accurately how effective the Grade X text might be under such conditions, which would permit the teacher to make certain adjustments. Teachers feel that the review chapters and the algebra need less time for "STM" pupils than for "Traditional" pupils. The course, as outlined in the Curriculum Guide, is not considered to provide adequate challenge for the more capable students with STM background. However, teachers felt that if it was possible to have a group of all STM background, then the early portion of the book could be handled more quickly and Chapters VI and VII, currently optional, could be treated fully. Under such conditions the text might contain sufficient material for capable students even with STM background.

Students' replies to a questionnaire would seem to lend support to the position that the course as presently outlined offers insufficient new material. The questionnaire asked students to "rate" the Grade X Mathematics which I have studied this year as

(a) entirely new work,
(b) containing some familiar topics,
(c) almost entirely made up of topics studied previously.

Student responses to this question, grouped according to their background and their mark on the Grade IX Departmental Examination, are indicated in the following table. (See table next page.)

The proportion of STM students who find the course "almost entirely made up of topics studied previously" indicates that teachers will have real difficulty in making the program attractive to this group.

In summary, it would appear that during the transition years when students may begin Mathematics X with either "traditional" or "modern" junior high background the teacher will encounter problems in trying to meet the needs of both groups in a single class. When all students have a modern mathematics background, it seems desirable to modify course content to include more material, or even to consider a change in authorization.

Pupil Appraisal

Program followed in Junior High School	Grade IX	Comment	Number	Percent
STM	A or H	a b c	0 28 22	0 56 44
Traditional	A or H	a b c	23 30 2	42 54 4
STM	B	a b c	4 26 11	10 63 27
Traditional	B	a b c	9 23 0	28 72 0
STM	C	a b c	3 7 0	30 70 0
Traditional	C	a b c	5 6 0	45 55 0

GRADUATE PROGRAMS IN MATHEMATICS EDUCATION

Contributions by S.A. Lindstedt, University of Calgary
J.S. Hrabi, Department of Education
S.E. Sigurdson, University of Alberta

Today there are 13 resident graduate students studying in the areas of mathematics education in Alberta and probably as many students from Alberta pursuing advanced degrees beyond the boundaries of the province. It becomes very obvious that as more experimenting with curriculum and instruction takes place, the need for teachers to improve their ability to understand and evaluate the new ideas becomes greater. Below are presented some statistics and comments on the graduate programs in mathematics education at the University of Alberta, University of Calgary, and a representative American university.

University of Alberta

Elementary mathematics program for a Master's degree: basically five courses and a thesis are required to be taken in one year of residence and a summer school. No students enrolled this past year.

Secondary mathematics program for a Master's degree: requirements are basically the same as above, but more emphasis is placed on mathematics. Two students are currently enrolled.

Doctoral programs are offered by both departments, the residence requirement being two years, in general. Currently there are six doctoral candidates in secondary mathematics education.

University of Calgary

A notable difference between this program and the program of its Northern counterpart: there is only one department at Calgary. The program basically comprises six courses and a thesis for a Master's degree. Four students are enrolled in the program.

At both universities in Alberta, the courses are selected from the three areas of mathematics, curriculum and instruction, and statistics, with perhaps additional emphasis on psychology or other foundational areas. The following three thesis topics indicate the interests of the students in these programs:

1. A Comparison of Three Alberta Matriculation Math Programs
2. The Use of Intuition in Teaching Mathematics
3. Student Self-Concept and Achievement in Mathematics

University of Colorado at Boulder

The Master's program consists of 30 semester hours plus a comprehensive examination. A thesis not being required at the Master's level is the major difference between this and the Alberta programs. Also a year of residence is not mandatory at Colorado.

The doctoral program at Colorado is similar to that offered at the University of Alberta, requiring 40 semester hours of courses (more than 50 percent of these are in mathematics) and a thesis. One difference is the 24-hour written comprehensive examination in areas of sociological foundations, psychological foundations, educative experience, mathematics, mathematics education. A total of 10 students are currently enrolled in this program.

Persons studying toward advanced degrees in the United States often cite the following advantages:

- The organization of courses into semester hours provides for a broader selection of courses and professors.

- Exposure to American education exposes one to a different set of educational traditions, forcing a re-examination of Canadian procedures.

- Greater opportunities to study at summer schools often allow the student to complete a program while spending only one year in residence.

It is important to become informed about various programs at the different universities if you plan to study for one or two years. This requires only a five-cent postage stamp.

ARTICLES TO READ

John W. Alspaugh and Floyd G. Delon, "How Modern is Today's Secondary Mathematics Curriculum?" *Mathematics Teacher*, January, 1967, pp. 50-56.

Although this article is a report of a study of the curriculum in the State of Missouri, the authors feel that their conclusions are representative of curriculum development on a national level. The concluding paragraph of the article sums up their findings.

> It is apparent... that implementation of a modern curriculum has progressed at varying rates in different courses. In content, the curriculum for the non-college-bound student has remained relatively constant. On the other hand, definite changes have occurred in the college-preparatory curriculum. Algebra has been the major area of modernization and revision. Geometry has undergone only slight revision, such as the integration of plane, solid, and coordinate geometry... Trigonometry has begun to disappear as a separate course, with much of its content being treated in other courses. Finally, there has been a lowering of the content previously considered college mathematics to courses such a Mathematical Analysis, Elementary Functions, and Matrix Algebra.

Brother L. Raphael, F.S.C., "The Return of the Old Mathematics", *Mathematics Teacher*, January, 1967, pp. 14-17.

Once in a while an article is written which brings our daily efforts into focus. The thought of the author is expressed in these two sentences.

> In our cultivated disdain for 'traditional' mathematics we fail to grasp the essential point: What was indeed distasteful and educationally unacceptable was precisely the method! And a corollary of this is that it is more than possible that the so-called new material may be caught up just in those 'traditional' methods.