THE ALBERTA TEACHERS' ASSOCIATION

MATHEMATICS COUNCIL

NEWSLETTER

Vol. IV, No. 1, February, 1965

Contents

DISCOVERY OR PROGRAMMING, by William F. Coulson

Is it possible that one sees two different trends in mathematics education as he surveys current publications from afar? On the one hand we have the experimental developments by such groups as the University of Illinois Committee on School Mathematics, School Mathematics Study Group, the Ball State Project, and the Madison Project. Upon closer inspection, one finds the discovery approach built into the material. Many present day authors are trying to imitate their style and their approach to the material.

Each of the groups mentioned previously and most of the authors

currently producing material for mathematics courses recognize and make use of pupil discovery of relationships and structure. Mathematics is recognized as a subject area which has a structure that is meaningful to the student. Thus, the students are able to discover relationships and to build one concept upon another. Mathematics does not become a series of isolated bits of fact and computations to be mastered until they become habit.

Taking the teacher and the teaching method into consideration, this approach is designed to give the student an opportunity to think for himself. The teacher must know a great deal about the material. He must know where he has been and where he is going and must know how to guide the pupils to develop the structure for themselves. Questioning techniques take on greater importance. Rules must not be presented to the student to be applied blindly to a multitude of simple examples until the mechanics become habit and these rules can be recalled upon the receipt of the proper stimulus.

It has been argued that the statement of the generalization by the student is not necessary. Some even feel that this is a hindrance. The spoken or written language gets in the way of the mathematical ideas. When a student is able to apply the generalization in an unfamiliar situation, then he knows what it tells him.

Others argue that it is necessary for the student to express the generalization. Only then can one be certain that the concept is known and understood.

On the other hand we have the type of curriculum exemplified by programmed materials. This development is not new but in recent years it has gained impetus especially in mathematics.

One of the most significant points involved in programming is that the student is led down a very definite path. The material to be mastered is presented in very small steps to insure "understanding" and correctness. The student is able to proceed very slowly and along a path determined by the author of the program. At no point is he permitted to meditate upon a related topic. His attention is always directed toward the mastery of one specific concept.

If one sticks to the traditional definition of mathematics, one thinks of it more as a tool subject. Is this all that mathematics is in this day and age? Many very prominent people do not accept this view alone. Mathematics has become more than mere subject matter to be mastered because it is useful in some other field of endeavor. It is thought of more as a way of thinking, as an academic discipline to be studied for itself. A great many mathematicians study mathematics just for the sake of the mathematics involved and not because of its utilitarian value.

Looking for a moment at the mathematics curriculum or at mathematics education, can we note any relationship in the trends? How do they appear to be affecting the curricula in mathematics? What is the effect of each of them on the teaching of mathematics?

It would appear that the two ideas are not very closely related. They would seem to be worlds apart. The discovery approach adopted by the UICSM and the SMSG would seem to give the pupil credit for being able to think for himself, for being able to recognize meanings, for being able to direct his attention toward a series of related learning tasks.

The approach adopted by those who advocate programmed instruction would appear to deny the ability of the pupil to do independent thinking. A stimulus is presented to the student to which he must make one and only one response. Since this response is right 90 per cent or more of the time, he has little or no opportunity to analyze. His attention is directed toward a rather narrow, limited topic.

The effect on the curriculum in the one instance seems to be a freeing one. Pupils are given an opportunity to act as mature mathematicians. Observations are made. These are accepted or rejected by proof. New observations or relationships are introduced, not necessarily by the teacher or text. These, too, are accepted or rejected by proof from what has gone before. The pupil is an active participant in the development of mathematical concepts.

Programmed instruction tends to do the opposite, as far as the pupil is concerned. Pupils are not given an opportunity to make independent

observations. They have little chance to analyze so that they might accept or reject a relationship. The opportunity to act as a mathematician is absent.

As far as the teaching of mathematics is concerned, one of these trends would permit the individual to develop as a skilled craftsman. The teacher would have a vast storehouse of knowledge which he would need to rely upon to keep the class moving in a correct fashion. For example, if a student wanted to solve quadratic equations, the teacher would know immediately whether or not this could be done with the knowledge possessed by the student. The teacher could then guide the student through the discovery of the various processes of solving this particular type of problem. Knowledge of his subject, then, is very important to the teacher who wants to follow the discovery approach used by the SMSG or the UICSM.

Programmed instruction would seem to leave very little for the teacher to do. When a student is unable to understand a specific point, the teacher could assist the student in mastering this concept. One other aspect of programming comes into play when a teacher builds a program of his own. During his labors, he becomes more intimately acquainted with the particular topic, with some of the problems involved in learning this topic, and with some of the problems involved in teaching this topic.

In this paper a brief look at two apparently divergent trends in mathematics education was attempted. Each teacher of mathematics must look more closely at each of these trends to see how they will or will not affect his teaching. It seems obvious that no teacher will remain untouched by these trends. Many people are advocating one or the other of these two approaches, people who are recognized as authorities in mathematics education. Perhaps it will be best for each teacher to conduct a little action research in his own classroom to help him decide. There can be no fence straddlers.

EFFECT OF THE STA PROGRAM ON DEVELOPMENT OF SKILL IN COMPUTATION, by T. P. Atkinson

Some of the questions which teachers and parents often ask about the

"Seeing Through Arithmetic" program being used in the elementary schools of Alberta are "Are computational skills being developed as well as formerly?" and "Does the program offer enough practice and drill in the mastery of the basic skills?"

Interested personnel of the Edmonton public schools have tried to answer such questions. In 1961 a survey test was administered to 3,500 Grade VII pupils and on the basis of results, norms were established. The test consisted of six sections:

5 minutes for adding of whole numbers
5 minutes for subtracting of whole numbers
5 minutes for multiplication of whole numbers
5 minutes for division of whole numbers
4 minutes for all four operations with common fraction numerals
4 minutes for all four operations with decimal fraction numerals

The number of items in each section was large enough so that none or very few pupils could do them all in the allotted time.

In September, 1964 the same test of six sections was administered to 4,000 Grade VII pupils, all of whom had received instruction for one or more years according to the STA program.

The data from these tests have not been analyzed completely as yet but a preliminary examination of them has led to a statement by Raymond Shaul, Supervisor of Junior High Schools for the Edmonton Public School Board. He says:

> In general, the introduction of the STA series in the elementary school has not adversely affected the elementary students in their mastery of basic computational skills as measured by the EPSB survey test administered in September, 1964 to all Grade VII students.

It is hoped that a statistical analysis of the data will be available soon. Mr. Shaul's statement - cautious as it is and should be - suggests that many fears and criticisms of teachers and parents that followed introduction of the STA program were unfounded.

ANNOUNCEMENT: SUMMER SESSION SHORT COURSE FOR TEACHERS

Most teachers know that new texts have been authorized for Grade VII mathematics and Math 10 beginning in September, 1965. Many new ideas are incorporated in the material. To assist teachers in becoming acquainted with the material and ways of presenting it to students, the Extension Departments of the University of Alberta, Calgary and Edmonton, are planning to offer a short course during the summer of 1965. The MCATA, the Department of Education, the Departments of Mathematics, and the Faculty of Education are cooperating to build a course which will be of value to teachers. In the near future plans should be finalized and a formal announcement made. Teachers should be watching for this and begin to make plans for the summer accordingly. The authorizations are:

Grade VII

Keedy, et al; Exploring Modern Mathematics, Book I, New York, Holt, Rinehart and Winston, Inc., 1964.

Van Engen, et al; Seeing Through Mathematics, Book I, Toronto, W.J. Gage Ltd.

Grade X

MacLean, et al; Secondary School Mathematics Grade Ten, Toronto Copp Clark Publishing Co. Ltd., 1964

TITLES OF BOOKS TO BE CONSIDERED FOR YOUR PROFESSIONAL LIBRARY

For the Elementary Teacher

Ohmer, Aucoin and Cortez; Elementary Contemporary Mathematics; Toronto, Blaisdell Publishing Company; 1964.

Shipp and Adams; Developing Arithmetic Concepts and Skills; Toronto, Prentice-Hall of Canada Ltd.; 1964.

For the Secondary Teacher

Meserve and Sobel; Mathematics for Secondary School Teachers; Toronto, Prentice-Hall of Canada, Ltd.; 1962.

Witter; Mathematics: A Study of Axiom Systems; Toronto, Blaisdell Publishing Company; 1964.

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SOME PUZZLES TO PONDER

Each of the boys in the Hemat family has as many sisters as he has brothers, but each of the girls has twice as many brothers as she has sisters. How many boys and girls are there in the Hemat family?

A well-known man selected a $10.00 hat in a store but he did not have that much money with him. In fun he suggested to the manager, "If you lend me the same amount of money as I have in my pocket, I will buy the hat." The loan and the purchase were made and the man walked out with the hat. Continuing his prank, he purchased a pair of shoes for $10.00 in a second store and an umbrella for $10.00 in a third store, using the same tactics each time. Now, however, he had no money left. How much did he have to begin with.

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