REPORT OF JUNIOR HIGH SCHOOL MATHEMATICS SUBCOMMITTEE

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Editor's Note: R. Plaxton has been in the Junior High Mathematics Subcommittee since its appointment. He has written several published articles on the work of this committee and on experimental work prior to the Grade VII authorizations. Here he brings us up to date at the fourth Annual Meeting MCATA - July 8, 1964.

I very much appreciate the opportunity to speak to you today concerning the work of the Junior High School Mathematics Subcommittee. I know that a number of your members have spent the last two days attending the seminars sponsored by our Mathematics Council. The last issue of The ATA Magazine reports that the seminars have been recessed for one day in order that the participants might attend this annual conference. If you think as I do, the noun "recess" produces in the mind some picture of a joyous release from bondage. I have some difficulty fitting such a picture with the one that was produced by reading through your program for today.

Wide-eyed Idealists

My talk today has been entitled "Report from the Junior High School Mathematics Curriculum Subcommittee". Anyone who would attend a talk with that title at this hour of the morning has certainly gone beyond the call of duty. This is especially true when one considers that the decisions that I am going to report are already widely known for they were published by the Department two weeks ago today. Perhaps I can make your presence here seem a little more reasonable by telling you that my purpose is not so much to report our final decisions as to examine the process and thought that led to those decisions.

It sometimes appears that curriculum decisions, far reaching in their effects, are made and dictated to the teachers of the province, with little thought of the consequences. Some suggest that such decisions are made by wide-eyed idealists who have been outside the classroom for so many years that they have lost all contact with reality. Perhaps a look behind the official pronouncement of the Department of Education concerning junior high mathematics will assist you in making judgments in this area.

Moment of Decision

I have said that I am going to report a decision already widely published. The widely-published decision that I mentioned earlier is actually only one month old; but news of decisions of this kind, because the decisions affect almost every teacher of

the subject in the province, travels fast. Nevertheless, in case there are some present who are not familiar with the decisions, I will review them briefly. Starting September 1965, not 1964 notice, two texts will be authorized for use in Grade VII classrooms in this province. The first is entitled Seeing Through Mathematics, Book One, and is published by Gage and Co. This is the same company that published Seeing Through Arithmetic, the book that has gained general acceptance in the elementary school. The second is entitled, Exploring Modern Mathematics, Book One, published by Holt, Rinehart and Winston, the publishers of the book presently authorized for Grade VII. Starting September, 1966, Book Two of Seeing Through Mathematics, often referred to as S.T.M. II, and Book Two of Exploring Modern Mathematics, usually referred to as E.M.M. II will be authorized. No recommendation for a Grade IX text or texts will be authorized for use in September, 1967. This means that students will write their first Grade IX examination on the new material in June, 1968. Senior high school teachers must be prepared to accept students with a very different mathematical background than previously, by September of that same year.

These decisions were not entirely unexpected. Some of you here today have already had rather extensive experience with one or other of these recommended series. Certain aspects of the decisions, however, require additional emphasis and explanation.

1. You will notice that this is a dual authorization. Either text series, or for that matter, both series may be used in our classrooms. As far as I know this is the first time that more than one mathematics text has been authorized for the same grade at the junior high school level.

2. Both series are entirely "modern" in their approach and content. The texts are very different from those presently authorized.

3. No text or texts, at the present time, have been recommended for authorization at the Grade IX level.

4. The books that I have with me today are not the authorized texts. Certain changes in the books in both series will have to be made before they can be used officially in our classrooms.

5. We are required to wait a full year after the books have been recommended for authorization before we can actually use them in our classrooms.

No doubt these comments have already raised a number of questions in your minds. I hope to answer some of them by reviewing the work of the subcommittee since its inception. May I begin by taking a moment to discuss how curriculum change takes place in Alberta. The provincial Department of Education maintains a curriculum branch and four major curriculum committees: the General

Curriculum Committee, the High School Curriculum Committee, the Junior High School Curriculum Committee and the Elementary Curriculum Committee. One of the major functions of these committees is to keep abreast of contemporary educational thought and to develop curricula and authorize textbooks. The Alberta Teachers' Association has three or four teacher members on each of these committees. From time to time the committees appoint subcommittees to study particular subject areas. One such subcommittee, the Junior High School Mathematics Subcommittee was formed nearly three years ago with a membership of eleven, including the associate director of curriculum and the mathematics consultant from the Department, a high school inspector, a professor of mathematics, two professors from the Faculty of Education who specialize in mathematics, two city superintendents and three teachers of junior high school mathematics. You will notice that this subcommittee has good representation from those groups who are most concerned with the teaching of mathematics. I mention this fact because I have heard teachers say that those most concerned with teaching mathematics have no say in what will be taught. It is true that curriculum development in Alberta, as in every Canadian province, is highly centralized. However, teachers have quite good representation on all committees and subcommittees in all except one province. In that province the curriculum department consists of one man.

The Junior High School Mathematics Subcommittee was directed to study the courses in mathematics now offered with a view of determining whether any changes should be made in the courses in light of the fact that new textbooks had been authorized at the elementary school level, and in light of new thought in mathematics teaching now present throughout the western world. We began by taking a very close look at the present texts. We agreed that they should be replaced if we could find a series that we felt would serve the teachers and pupils in Alberta better. Our decision was based on a number of considerations.

1. The Grade VII text now in use does not constitute a reasonable sequel to the Seeing Through Arithmetic series now generally accepted throughout the province in the elementary school. Those of you who have students in Grade VII this year who have taken the STA VI course will know, for example, that percentage is taught earlier and by a different approach in the Grade VII text.

2. The present texts are repetitive. Mr. Robert E. Rourke, when speaking to the CTF Seminar on "New Thinking in Mathematics" had this to say:

> Practically everyone at every level agreed, that in the United States there was no place in the whole program that was more wasted on mathematics than Grade VII and VIII. It was a rehash of the same old stuff of the first six grades - more of the same - and large amounts of time

> were devoted to the kind of arithmetic we were talking about yesterday, in which students were doing problems that were supposed to be of social significance to them.

We felt that much the same criticism could be applied to our courses in Alberta.

3. Finally there is much new material that was not included in the present text. According to C. Baley Price:

> The twentieth century has been the golden age of mathematics, since more mathematics and more profound mathematics have been created in this period than during all the rest of history.

Some of this new knowledge has finally filtered down to influence the junior high school programs. There is only so much time in which to teach mathematics. It seems reasonable to replace content no longer important to the learner. There is nothing wrong with the traditional program; it is simply outdated. The present texts have served well but we felt that the time for their retirement had come.

Thinking Men or Thinking Machines

Having made this decision we turned our attention to discovery of a kind of course that would likely be most valuable to the students of the next few years. No one can say with certainty what mathematics will be most important to students who will become productive members of society in the 1970's and '80's. I think, however, that certain trends are obvious. For example, the advent of calculating machines that carry out simple arithmetic computations faster and more accurately than man, have nearly eliminated the need for children performing computations with large numbers. It seems more important, therefore, to have children learn to operate the computing machine rather than have them learn to carry out operations of the sort which they may never perform again after leaving school. Conversely, we have not yet arrived at the stage where we can ignore the computational skills. No one has yet developed a pocket computor designed to compute problems as a watch tells time. We must continue to teach computation skills, but perhaps developments in technology have already reached the point where we should shift emphasis a little more toward basic understanding of mathematics. It has been a long time since we have added our grocery bill, but we still want to be able to do it if we must.

Another factor, in addition to technological advances, must be considered; there is more and more mathematics to learn as the years go by. We cannot meet the needs of mathematics by cramming

more and more material into an old organization. Instead we have to cast out useless parts, make broader and more general approaches and use general and unifying concepts. This is what is really meant by "modern mathematics". There is one content and one organization of mathematics that is given that name. In fact, widely different courses have been given the same name. All, however, have attempted to include simple, clear, and more broadly-based ideas about number and space.

Throw Out the Baby with the Bath Water

Our wish to include new ideas is no reason to discard the best of the old. The movement to incorporate modern concepts in our mathematics courses has been called a revolution. Revolutions can be dangerous because they tend to go too far; to throw out the baby with the bath water. A well-balanced program, we felt, should combine some of the more recent developments with the best of the traditional methods and topics.

With these thoughts in mind we set about finding a text for Grade VII that would:

- follow smoothly from the Grade VI authorized texts, especially the STA series;
- develop mathematical insight, power and understanding;
- be based on the structure of mathematical rather than on the practical application of the subject;
- use practical applications to illustrate basic principles whenever possible;
- not be too difficult or include too much material for students eleven and twelve years of age;
- not be so different that a vast training program for teachers would have to be initiated before any further action could be taken;
- retain the best of the present course;
- read easily into the kind of program now being developed in the higher grades.

We were hopeful, too, that we could find an integrated series for all junior high school grades. We hoped to avoid a split in the series such as we now have between Grades VIII and IX.

Through Adversity to the Stars

We were hampered right from the start by lack of material.

New ideas in mathematics have a way of filtering down from the university level rather than building from the bottom up. A few books had been published using the new content and approach at the college and high school level, but three years ago there were virtually no published materials available at the Grade VII level. In the first year we worked from incomplete materials often in monograph form. This problem became less serious as time went on, but it is still causing us some difficulty. One of the major reasons that the Subcommittee has not recommended a text for use in Grade IX is that the Grade IX texts in both series became available only very recently. As a result there has been little opportunity for studying or for trying out these texts.

By October 1962 we were able to institute trials with books from two different publishers. These trials were run to determine student reaction, teacher reaction, adaptability of the material to different ability levels and so on. One of the books used in these first trials was Seeing Through Mathematics, Book One. The first trial involved thirty classrooms. Approximately that number of classrooms have been involved in trials each year since that time.

I will not go into specific details of the results of these first trials. It is sufficient to say that the reaction of both students and teachers was favorable, and contrary to our expectations, the precise language and increased use of symbols seemed to cause the students little difficulty. Most teachers felt the material was more challenging and as a result more interesting.

During the 1962-63 school term thirty-three classes, or about eleven hundred students in Grades VII and VIII were trying out six different texts. The trials in that year were backed up by a good testing program and a questionnaire designed to determine teacher reaction. As a result of these trials we were able to lay down guidelines indicating the content we would like to have included in any authorized texts. These guidelines included much material that is usually included in "modern" texts. We were also able on the basis of the test results to eliminate all but two series of texts from consideration. The remaining series, of course, are those to be authorized starting September 1965.

During the last school year a Master's student at the University of Alberta, in Edmonton carried out, with the assistance of the Subcommittee, a well controlled experiment with classes using both series, and control classes using the presently authorized Winston text. The study was used as the basis for a thesis and was, therefore, very carefully conducted. That is why I have called this study an experiment rather than a trial. I understand that those of you most interested in Junior High School Mathematics will be discussing these experiments and trials later today, so I will not attempt now to give you a complete run-down of the results. Two facts were of particular importance to us:

1. Both series made it possible for students to learn a significant amount of new mathematics without loss to their knowledge of conventional mathematics.

2. Test results on an instrument prepared by the Master's student to measure new mathematical ideas, indicated superior achievement by Grade VIII students of average and below average ability studying Exploring Modern Mathematics over similar groups studying Seeing Through Mathematics. The differences in achievement were not large, but they were statistically significant, in the sense that there was less than one chance in a hundred that such differences would occur by chance. There was no significant difference in the results in the case of superior students.

Replies to the teacher questionnaire provided additional information. One factor over which the researcher had no control was the training and experience of teachers. While the years of experience of the teachers were very similar for both groups in the study, the teacher of the E.M.M. course had considerably more training in mathematics. What influence this training had on the results is not known. The questionnaire also indicated that teachers of the S.T.M. series were more inclined to favor the course than those who taught the E.M.M. course.

Zeroing-In on a New Curriculum

These findings were added to the experience and information gathered over a period of three years to produce a recommendation for a dual authorization. This decision was based on a number of considerations:

1. With the trend toward decentralization of some curriculum decisions, it was felt that there was considerable merit in providing local areas with the opportunity to make a decision concerning the text to be used in their schools. The members of the Subcommittee felt that the study necessary to make the decision would in itself be valuable training for teaching the course. They expressed the hope that as many teachers as possible would have the opportunity to study both texts.

2. Although the subjective judgment of the teachers involved in the trials seemed to favor the S.T.M. series, the objective evidence from the Master's study favored the E.M.M. series.

3. It was generally agreed that while extra training was very desirable for all teachers teaching either series in 1965, the need might be less severe in the case of E.M.M. because the format of the text was closer to that to which the teachers were accustomed. Since the opportunities for extra training vary considerably throughout the province, it was felt that a dual authorization might permit a greater degree of flexibility.

4. The actual content of the two series is sufficiently parallel to permit a common Grade IX examination.

5. It was felt that the problems arising from a pupil transfer would not be too significant since most pupil transfers in the province take place within a particular division or county and because our experience in this regard in the trial classrooms indicates that pupils adjusted to quite different programs remarkably quickly.

6. Finally, the university members on the Subcommittee could see no serious problems arising from the dual authorization with regard to preparation of inservice and preservice training programs, since these programs tend to stress the mathematical concepts rather than the details of a specific text.

Be Alive by '65

I have made reference to some of the reasons that the Subcommittee decided to recommend texts using the modern approach and content, decided to recommend a dual authorization, and decided not to recommend texts for authorization at the Grade IX level at this time. I will turn now to a discussion of why it was thought advisable to delay the authorization for one year. There were two major reasons for this action. The first is a very practical one. We have asked for certain revisions in the texts in both series to bring them more in line with Alberta's needs. The E.M.M. series for example, does not yet have a Canadian edition. We have asked that the texts be completely Canadianized. Those of you who have had experience with the presently authorized texts will know that Canadianization was never carried out completely in that series. We have suggested also certain changes with respect to problem solving and the handling of percentage, that will make for better articulation with the Grade VI S.T.A. series. Experience with the S.T.M. series has taught us that many teachers have difficulty completing the course, especially in the first year it is taught. We have asked Gage and Co. to rebind the Grade VII and VIII texts so that the courses in both years will be reduced somewhat in length. These changes cannot be made in time for school opening in September.

But even if the books could have been made ready we would have recommended a delay of one year. This delay in the face of mounting pressure for the new courses is an indication of the importance that we attach to giving every teacher in the province an opportunity to prepare well before teaching this course. The teachers who have taken part in the experimental programs, almost as one, have indicated the value, perhaps necessity, of training in modern mathematics before one undertakes to teach these new courses. Appropriate training for teachers is the most conspicuous and difficult prerequisite for the introduction of this program. The Department, The Alberta Teachers' Association, the University and local

school boards are all deeply concerned about this problem. I think it is safe to say that the change from the traditional course is more dramatic at the junior high school level than it has been at the elementary level or will be at the senior high level. I am concerned, if this course is introduced with too little warning and too little preparation on the part of teachers, that we might actually set mathematics teaching back a few years rather than advance it. It is easier to abuse these new courses than it was the traditional course, in much the same way as a poor mechanic can do more harm to a fine racing motor than to a tractor motor. There is no doubt in my mind, on the other hand, that one of the greatest values to arise from the introduction of this new course will come about because professionally-minded teachers will acquaint themselves with what is new in their field. I urge you to spread this message of the need for preparation to all your associates. This extra year gives time for much to be accomplished. The message need not be confined to junior high teachers. It is not too soon for senior high teachers to become acquainted with these materials. In order to ensure continuity three members of the junior high school subcommittee are also members of the senior high school subcommittee. These members tell me that activity in that committee will increase sharply now that the junior high school decisions are final.

I have discussed our decisions to date and some of the reasons for them. Perhaps some of you came to this gathering hopeful that I would describe the content included in the courses or present my impressions of the new texts. I have deliberately avoided these areas as much as possible. I could say little about content that would be useful to you. As teachers you are aware that there is really only one way to know a course. That way is to teach it. Even private study of the texts in their present form would serve you better than listening to a series of generalizations about content for forty-five minutes. There is really no substitute for individual effort in this regard.

As for my impressions of the course, I discovered after a few years of sitting where you are sitting today, that people closely associated with the development of a new program, in their attempts to enthuse others, become too enthusiastic themselves; and as a result leave the impression that the new developments will solve all our problems. We know that no course no matter how well developed can achieve the end. I am enthusiastic about the program. I think that teachers will find it more challenging to the intellect, more in harmony with contemporary thought, and more meaningful to students. I know that the ferment of new ideas caused by the introduction of the course will be good for the teaching of mathematics. The extra thought, study and preparation that each mathematics teacher will have to undertake will pay big dividends in broadening horizons and revitalizing teaching. But I also know that there will be some negative reaction. We feel comfortable with the <u>status quo</u>. Disturbing new elements make us

uneasy; extra work annoys us. I know too, that actual use of the texts on a large scale will force retreat on certain fronts. No committee sitting around a table could possibly identify all the areas of difficulty. Time, experience and constructive criticism will bring about the necessary changes

And, of course, new texts are only the beginning. A new curriculum is no substitute for inspired teaching. In fact, it is the other way around. Good teaching would be a very satisfactory substitute for a new curriculum. The success of any program is determined in the heart of the school, in a classroom where a teacher is face-to-face with a learning child. The success of this new program depends on you.