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ABSTRACT

This booklet summarizes the initial conference of the Canadian Association of Mathematics Teachers. The primary purpose of the conference was to exchange information on objectives, present state and proposed development of mathematics curriculum in the provinces of Canada and to comment on the difficulties experienced in introducing new approaches to mathematics teaching. Reports presented during the conferences are included. These reports are concerned with the changes each province has made in its mathematics curriculum in recent years. (Author/FL)

CANADIAN ASSOCIATION OF MATHEMATICS TEACHERS
in association with the Canadian Teachers Federation

INVITATIONAL MEETING, DECEMBER 1967

MATHEMATICS in CANADIAN SCHOOLS

C-68401

A CAMT CONFERENCE REPORT

MATHEMATICS IN CANADIAN SCHOOLS

REPORTS PRESENTED TO AN INVITATIONAL MEETING

OTTAWA, DECEMBER 8 and 9, 1967.

Published by the Canadian Teachers' Federation

PREFACE

The conference summarized in this booklet marked the beginning of the Canadian Association of Mathematics Teachers. At an earlier conference in March 1967 called by CTF representatives of mathematics teachers' organizations across Canada recognized the need for such an association. A planning committee consisting of Edward B. Murrin of Nova Scotia, Douglas J. Potvin of Quebec, John C. Egsgard of Ontario and A.W. Bruns of Alberta was selected by the conferencees to write a constitution and organize a first meeting for the association. The Constitution of CAMT which was approved at this conference on Saturday, December 9 describes the purpose of CAMT as follows: "The purpose of CAMT shall be to provide means of communication among provincial and territorial mathematics teachers' organizations and to coordinate common activities" (Article II).

As first steps in this communication this conference was held and a first issue of a newsletter was published. Douglas Potvin was the editor for this issue. The present editor is Marshall P. Bye of Alberta. The purpose of both the conference and newsletter was to exchange information on objectives, present state and proposed development of the mathematics curriculum in the provinces of Canada and to comment on the difficulties experienced in introducing the new approach to mathematic teaching. The conference was characterized by a willingness on the part of all to listen and by the acceptance of the fact that each province had something to learn from the others. It is important to note that it was discovered that each province has made a change in its mathematics curriculum in the last five years, and that this change has been made by Department of Education curriculum committees that had teacher representation from the elementary and secondary level. All provinces admitted that the rewriting of the curriculum is never finished. All indicated that even though they were not completely satisfied with what they now had they would not wish to return to the old curriculum and the old type of teaching.

Thanks are due to all the conference participants but especially to the representatives of the provincial departments of education. We believe that the first conference of CAMT has been beneficial to mathematics education in Canada. We hope that the CAMT can continue to serve the mathematics teaching community of Canada as well in the future.

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New Brunswick: Mr. P. J. H. Malmberg,
Director of Curriculum & Research,
Department of Education for New Brunswick.

It is a distinct pleasure to attend this invitational meeting of the Canadian Association of Mathematics Teachers. I am delighted to see that teachers, at the national level, are beginning to take an active interest in the instructional side of education. This interest gives me hope that before too long we shall have a national forum in Canada for the discussion of education as a professional endeavour.

Mathematics in New Brunswick at the present time may best be described in bridal terms - something old; something new; something borrowed; something blue. We are in the midst of a slowly accelerating change which began in the late 1950's and will never end.

In my remarks to you I would like briefly to:

1. Trace the development of mathematics in New Brunswick over the past decade

2. Describe the present situation

3. Indicate the probable course of future developments

Until the late 50's New Brunswick children, parents, grandparents, great-grandparents and teachers had followed the same mathematics curriculum for over fifty years. Crawford's Algebra and Hall and Stevens' Geometry had become enshrined like sacred books. Not even the sending aloft of Sputnik in 1957 disturbed the even pattern of the ritual.

In 1958, however, the recently appointed head of the Mathematics Department in the University of New Brunswick, Dr. R. L. Rosenberg, began to complain privately and publicly that students coming to him at the university were not well prepared in the subject. He was soon joined by his counter part in Mount Allison University of Sackville, Dr. W. S. H. Crawford. Together, they found an ear in a reform minded Director of Curriculum in the Department of Education, Mr. Don Middlemiss. In effect he told them: "Put up or shut up." If there was something wrong with the public school program in mathematics they were the ones to do something about it.

In 1959 a Mathematics Curriculum Committee was set up representing schools, universities and the Department. The Committee concluded that something was wrong with the school mathematics program - it was hopelessly out of date. This was true particularly of the secondary school program. However, for that very reason the Committee decided drastic changes might worsen the situation rather than improve it.

The Committee first developed a transitional program for grades 10 - 12, and introduced it on a pilot basis in ten schools. At the same times Doctors Rosenberg and Crawford began to write material for a new program in Grades 7 - 9. As fast as the material came off the press it was sent to half a dozen pilot schools - often just a few days before it was needed. The two professors were also tireless leaders in in-service work with teachers. They spoke to teacher groups; led workshops and offered extension and summer school courses stressing newer approaches to the teaching of mathematics.

It was not until the early 60's that new approaches to teaching mathematics at the elementary school level began to infiltrate the schools of the Province. Interest in the Cuisenaire materials; Colour Factor Rods and new American programs began to grow in a few local areas. In 1963 an Elementary Mathematics Committee was established on the same model as the Secondary Committee.

The first province-wide change in the mathematics curriculum began in 1963 when the new program, developed by Drs. Rosenberg and Crawford, was introduced to Grade 7 on an optional basis with the traditional program. The following year it was introduced to Grade 8 on the same basis and made compulsory in Grade 7. The program has now reached the eleventh year on an optional basis. The first Departmental Examination on the new program will be offered in June, 1968. This past September saw the introduction of a new elementary program in Grades 1 and 2.

I said earlier Mathematics in New Brunswick at the present time could be described in bridal terms - something old; something new; something borrowed; something blue. We have the old program; the new program and the transitional program. Happily, the first and the last are on their way out. Perhaps, I can describe the present situation easiest in grade terms:

Grades 1 - 2	- new program	English and French
Grades 3 - 6	- old program	English and French
Grade 7	- new program	English and French
Grades 8 - 9	- new and old programs	English and French
Grades 10 - 11	- new and old programs	
Grade 12	- transitional and old programs	

Do you think this is complicated? We think it is too.

The implementation of the new elementary program will be completed over the next two years as follows:

1968 - Grades 3 and 5 English and French
1969 - Grades 4 and 6 English and French

The new senior high school program will go into effect in 1968.

One year ago the Minister of Education approved the reorganization of the structure of secondary education to allow for a wider variety of program for a wider variety of pupil ability. This reorganized structure will go into effect in all high schools over a three year period beginning with Grade 10 in 1968 in both languages and proceed in as many junior high schools that have the staff, guidance people and facilities. The new structure calls for a regular and a modified program in the junior high school and three programs in the senior high school: Regular, Enriched and General. Time does not allow me to enlarge upon this new structure for secondary education.

To sum up: As in other provinces of Canada, New Brunswick has begun the revision of its school mathematics program after years of neglect. The revision, after having started, will never end. Never again will a Mathematics textbook remain on the public school program for fifty years in its original edition.

MATHEMATICS IN NEW BRUNSWICK SCHOOLS - 1967

Grade	Course	Language
1	New	English and French
2	New	English and French
3	Old	English and French
4	Old	English and French
5	Old	English and French
6	Old	English and French
7	New	English and French
8	New and Old	English and French
9	New and Old	English and French
10	New and Old	English and French
11	New and Old	English
12	Old	English
		English

MATHEMATICS IN NEW BRUNSWICK SCHOOLS - 1970

Grade	Course	Language
1	New	English & French
2	New	English & French
3	New	English & French
4	New	English & French
5	New	English & French
6	New	English & French
7	New	English & French
8	New - Regular* & Modified*	English & French
9	New - Regular & Modified	English & French
10	New - Regular*, Enriched* General and Occupational*	English & French
11	New - Regular, Enriched General and Occupational	English & French
12	New - Regular, Enriched General and Occupational	English & French

*Regular - junior high course for pupils preparing for university entrance
*Modified - junior high course for pupils preparing for high school leaving
*Regular - senior high course for pupils preparing for university entrance
*Enriched - senior high course for pupils with particular ability and interest in Mathematics - preparing for university entrance
*General and Occupational - senior high course for pupils preparing for high school leaving

THE ATLANTIC PROVINCES

Newfoundland: Br. F. F. Brennan,
Newfoundland Teachers' Association.

In reporting to you on the development of the mathematics curriculum in the Province of Newfoundland, it is unfortunate that an official of our Provincial Department of Education is not here to take my place. One who has been connected with the Curriculum Division of the Department of Education would, I am certain, be able to give a much more comprehensive report of the development of mathematics in our schools. Such an official would have available reports of committee meetings, reports of pilot projects which have been conducted throughout the Province, and correspondence from various groups of teachers and individuals containing complaints and difficulties etc. of any new programme which has been introduced into the schools so far. Not being one who has been very careful to file reports and minutes of committee meetings, where I can always place my hands on them, this report must necessarily be limited to the experiences I have had and the information I have gained since the Fall of 1964, when I first served as a member of the Elementary School Mathematics Committee for the Province.

Work of the Elementary School Mathematics Committee

In the Fall of 1964, the Director of Curriculum Services, Mr. Gough, asked me if I would serve on an Elementary School Mathematics Committee. Previous to this date, little had been done I believe, with the development of the 'New' mathematics in our schools. To some extent, Mr. Gough, as the Director of Curriculum Services for the Province, was trying to interest local groups in some of the newer mathematics programmes which were being published. It was the task of the new committee, which Mr. Gough convened, to study various new programmes with the purpose of being in a position to be able to recommend to the proper authorities in the Department of Education, a suitable mathematics

programme or programmes for all our Newfoundland Schools.

Members of the committee represented the three bodies most actively engaged with education in Newfoundland - the Provincial Department of Education, the Memorial University of Newfoundland, and the Newfoundland Teachers' Association. Mr. Gough was the representative from the Department of Education, three members of the Faculty of Education, who are engaged in the teaching of Mathematics Education courses at the University served on the committee, and five school teachers representing the N.T.A. Among the five teachers were two Elementary School Teachers, two Elementary School Principals, and one High School Principal. One big drawback in the make-up of the committee was that all members were from the St. John's area. All members I think had some knowledge of the new approaches being developed in the teaching of mathematics either by having taken university courses or through private study.

From the very beginning the committee accepted the principle that it was not our purpose to develop a curriculum in mathematics for the elementary grades, but rather to examine programmes which had been developed in other areas. We felt that it was neither possible nor desirable for us to duplicate the experimentation that had gone into the preparation of the better programmes. However, we considered it our duty, having examined various programmes, to make the proper choice when the time came for the selection of a programme in mathematics for the schools of the Province as a whole.

The Elementary School Mathematics Committee, met regularly (approximately every two weeks from October to May) for a period of two years - 1964-66. During the first year, we concerned ourselves mainly with the selection of a programme suitable for Grades 1 - 6. In the early part of the second year, the committee made a definite decision on the programme for Grades 1 - 6. We then continued our work by examining programmes which we thought would be suitable for Grades 7 and 8. In May, 1966 the Elementary School Mathematics Committee concluded its study.

The following programmes for use in Grades 1 - 6 were recommended by the Committee in November, 1965.

1. Greater Cleveland Mathematics Programme - S.R.A.

2. Seeing Through Mathematics - Gage.

In May, 1966, the following programmes were recommended for adoption in the Province for Grades 7 and 8.

1. Exploring Modern Mathematics - Holt, Rinehart, Winston

2. Seeing Through Mathematics - Gage.

During the time the committee was meeting, i.e. from 1964 to 1966, the following activities were taking place either directly or indirectly as a result of the work which the committee was doing.

1. In September, 1964, the same year that the Elementary School Mathematics Committee was formed, one school system in the Province had started a pilot project in Grades 1, 2 and 3 with the 'new' mathematics programme. This project was actually the result of the efforts of Mr. Gough before he had convened the committee.

2. In September, 1965, twenty-five Grades 1, 2 and 3 classrooms were selected throughout the Province to use one of the four series of new programmes the committee were seriously studying for adoption. These programmes were: (a) G.C.M.P. (b) S.T.A. (c) Elementary School Mathematics and (d) Pattern in Arithmetic.

3. About a dozen classrooms were also selected in September, 1965 to introduce at the Grade Seven level, a new mathematics programme. Three series were used: (a) S.T.M. (b) Exploring Modern Mathematics and (c) Advancing in Mathematics.

While the above pilot projects were not carried out in any kind of a scientific manner, the committee did follow the reaction of the teachers who were using these new programmes. Actually, to the surprise of the committee, reaction on the part of the teachers was generally favourable.

In January, 1966, the Department of Education officially announced that beginning in September, 1966 all Grades 1, 2 and 3 classes had the option of using either one of the two series recommended by the committee. It was also announced that with the beginning of the 1967-68 School Year, one of the two recommended series would be compulsory in Grades 1, 2 and 3. This date was one year later than the time which the committee had recommended for the introduction of the new programme in these grades. I understand, however, that about eighty percent of the schools in the Province introduced the new programme in September, 1966, the year it was optional in Grades 1, 2 and 3.

During the Fall of 1966, the Department of Education announced that the new mathematics programme recommended by the committee would be compulsory also in September, 1967 at the Grade Seven level. This was the recommended date of the committee for its introduction in Grade Seven.

As of September, 1967 we find one of the new programmes in mathematics being used as follows:

(a) About a dozen schools are using the new programme in Grades 1, 2, 3, 4, 5 and 7.

(b) Approximately eighty percent of the schools are using a new programme in Grades 1, 2, 3, 4 and 7.

(c) The ramaining schools have the new programme in Grades 1, 2, 3 and 7.

The new programme will be introduced into all Grade Eights next year as well as in Grades 4, 5 or 6, depending on how far a school has introduced it to this date.

Preparation of Teachers

The committee realized from the very beginning that the mere introduction of new textbooks will not of itself guarantee an improvement in instruction. It was recognized that teachers had to be prepared to handle the new programmes. The Department of Education at Memorial University has done I believe an outstanding job in the preparation of teachers who were to handle the new programmes in the elementary schools. Beginning in the 1963-64 university year, a new course designed to assist teachers in the new approaches in the teaching of mathematics was introduced. This course was made compulsory for all full time primary and elementary student-teachers. Since then, this course has been offered each year in addition to the evening sessions conducted and summer sessions held for teachers who were in the field. Moreover, the University has offered evening sessions in this course at two other large centres outside St. John's for the benefit of teachers already in the classrooms. Approximately 3,000 teachers have now taken this course or are doing it during the present academic year. Among those who have taken it are many supervisors, supervising principals, as well as elementary and primary school principals.

During the 1964-65 and the 1965-66 School Year, a series of nineteen G.C.M.P. films were televised on Saturday mornings throughout the Island. In-service programmes have also been encouraged by the Department of Education, the University, and the Newfoundland Teachers' Association by getting local branches of the N.T.A. to organize Workshops etc. Consultants for some of the workshops which have been held have been invited from the mainland. The Audio-Visual Division of the Department of Education has purchased a number of films and slides on the new programmes in mathematics. These have been used extensively by groups of teachers and by Parent-Teachers Associations.

In addition to the above, the Annual Department of Education Supervisors Conference, to which a number of Schools Principals are invited, devoted a part of their session in 1964 to the new mathematics programmes being developed. Their entire Conference in 1965 was devoted to mathematics. These meetings gave supervisors and other administrators of education in the province, some idea of the job they had to do in conditioning teachers for the new programmes in mathematics.

Finally, Professor Brace of Memorial University, who served as chairman of the Elementary School Mathematics Committee, gave a series of thirteen lectures on T.V. designed to interest parents and to give them some insight into the new programmes.

High School Mathematics Committee

The work of studying the High School Mathematics Curriculum actually began in March, 1965. A High School Mathematics Committee was formed to act as a sub-committee of the Advisory Committee on Curriculum for the Province at their request. Members of this committee consisted of the Head of the Mathematics Department of Memorial University, three members of the Faculty of Education at Memorial, who had also served on the Elementary School Committee, one representative of the Technical College, and three High School Mathematics Teachers, one of whom had also served on the Elementary School Committee. After weekly meeting for a period of about three months, this sub-committee submitted its report to the Advisory Committee. The main points of this report were as follows:

1. Mathematics should be taught at more than one level in High School.

2. All students in High School should take some form of mathematics.

3. Up to and including Grade Nine, the first year of High School, the committee recommended a common course for all students.

4. A broad outline of topics for an A-level and an O-level programme in mathematics was drawn up on a tentative basis pending the results of the recommendations which the Elementary School Committee would make in its report.

5. The outline of topics for the A-level and the O-level courses in Grade Ten was such that it would not be too difficult for a student who shows unforeseen development to change from the O-level to the A-level at the end of Grade Ten.

Having presented this preliminary report, this committee did not meet again until the Fall of 1966 when the Elementary School Committee had completed its work and had made its recommendations for the up-dating of the mathematics programme in the first eight grades.

The High School Mathematics Committee has been meeting fairly regularly since last year. Meetings are still going on and the committee hopes to be in a position to submit its recommendation by the end of this present School Year. So far, the committee having studied what is expected of students before they are prepared for university work, have spent a great deal of time in examining the various programmes. In this way the committee hopes to be able to decide which one or combination of two or more programmes will be best suited for our Newfoundland Schools. Programmes which we have been or will be looking at are:

1. The Addison-Wesley Series - Algebra, Geometry, and Algebra-Trig.

2. The Copp Clark Series - Secondary School Mathematics - Grades IX, X, X1

3. Holt, Rinehart & Winston - Modern Elementary Algebra & Geometry, Exploring Geometry, and Algebra & Trig.

4. Houghton, Mifflin Series - Modern Algebra, Modern Geometry, and Modern Algebra & Trigonometry.

We are also thinking about the Gage Series - S.T.M.

It is the hope of the committee that a start in the new mathematics programme in High School will begin at the Grade Nine level in 1969 and be continued in 1970 and 1971 in Grade Ten and Grade Eleven respectively.

One of the difficulties which the committee feels that may be encountered with the introduction of new programmes in our Secondary Schools is the lack of preparation on the part of teachers. It is our feeling that since many of the teachers in the High School grades are on the average more mature than teachers in the Elementary Grades, the same interest in returning to University to take courses will not be present. At the moment, teachers who are preparing to become High School mathematics teacher, are required to take two methods courses. One is taken in their first year at university and the second is taken in their final year. These are, of course, in addition to the six courses they must take in mathematics. The number of students in this programme at university for the past number of years has been rather small - approximately ten to fifteen. The future however looks a little brighter, as the university has about forty students registered in first year during the present year. Up to the present, the university has not found it possible to offer evening classes which would be directly preparing teachers for the newer secondary school mathematics programmes. I feel however, that beginning next summer, the University will find it possible to begin a programme which will assist teachers in the field for the teaching of modern approaches in mathematics at the Secondary School level. Maybe there is some hope within the next couple of years.

THE ATLANTIC PROVINCES

Nova Scotia: Mr. W.M. Hall,
Department for Education for Nova Scotia.

In Nova Scotia, we are just completing a general revision of our entire mathematics program, Grades Primary through 12. The procedure we have followed has been to use two committees, one working in the area from Grades Primary through 6, and the other working in the area of Grades 7 through 12. These committees are made up of teachers, university people, and departmental officials. One of the teachers on each committee is named as a liaison person with the Nova Scotia Teachers Union. Committee members are selected because of their knowledge in the field of mathematics; and in the case of teachers, we selected those who were known to be successful classroom practitioners.

Our first procedure was generally to study the work of major curriculum developments in other provinces in Canada, the United States, and the O.E.E.C. When we had done this in a general way, we undertook to examine specifically the materials prepared by the S.M.S.G.

Our next step was to initiate some pilot studies in schools scattered geographically throughout the province. We examined commercial textbooks, and we recommended for try-out several programs which embodied the philosophy of S.M.S.G. About forty schools were involved in the pilot programs. At the end of a year of operation, we called the teachers who taught the programs together to meet with the curriculum committees and to report on their experiences in the use of the programs. During the course of the try-out year, schools involved in the project engaged in intensive in-service training programs. On the basis of reports presented to the curriculum committees, recommendations were forwarded to government requesting authorization of text materials for pupils and teachers in all grades.

One trial program is still in operation. I refer to Geometry in Grades 10 and 11. A recommendation for prescribed materials has been delayed because our initial try-out was not conclusive. Because students begin a Geometry program in our schools at the Grade 10 level and complete the program in Grade 11, the try-out program is of two years duration. At the Grade 12 level, the High School Mathematics Committee has undertaken to produce their own program. The course is made up of a half year of Coordinate Geometry and Trigonometry and a half year of Algebra with an optional Calculus unit. We are test-teaching the Algebra and Calculus this year, and it is still too soon to form any fixed opinion about it.

From the very beginning of our current revision, we have been concerned about the training of teachers. The principal means for doing this has been the Nova Scotia Summer School for Teachers where at the secondary level, the Department of Education has teamed up with the Canadian Mathematical Congress to offer a four-summer block program designed for high school teachers. Last summer we had 86 teachers enrolled in the junior high school block program and 44 teachers enrolled in the senior high school block program. At the elementary school level we have been fortunate during the past four years to have been able to secure the services of some "name people" as instructors in modern school arithmetic. In addition to the programs offered at the summer school, we have conducted in-service training workshops and institutes in every inspectoral division of the province. Some of these were sponsored by the Teachers Union and some by the Department of Education.

Another valuable asset in our teacher training program has been our ability to use television on a province-wide scale. In September, 1962, the Nova Scotia Department of Education began to use television to assist pupils in Grade 11 Algebra and Geometry. These programs of direct instruction, supplemented occasionally by enrichment programs, were an attempt to assist teachers and pupils by providing a continuing and well-organized mathematics program via television. Since 1962-63, there have been thirty telecasts of Coordinate Geometry and Trigonometry, sixty telecasts of Grade 9 Algebra; and, at present, we are producing sixty telecasts of Grade 7 and 8 mathematics. In addition to the telecasts beamed directly to the classroom, we have for the past three years televised a series of Saturday morning in-service training telecasts for teachers. Here we have used, among other things, the S.M.S.G teacher training films, the S.R.A teacher training films, and the Holt, Rinehart and Winston in-service training program for junior high school mathematics.

By September, 1968, we anticipate that we will have completed the introduction of pupil and teacher materials in the schools. A list of the currently prescribed materials is appended for reference. Our junior and senior high school programs are streamed. At junior high school level, our comprehensive program provides possibilities for school systems to offer four distinct programs:

1. A standard program for those students who will likely take the matriculation program in high school.

2. The remedial program for those students of normal ability with some subject disability. In the case of mathematics, we hope to be able to correct the disability through remedial teaching and then have these students move on to the normal stream.

3. The adjusted course program designed for students who have a history for over-ageness for grade and whose I.Q. appears to be slightly below average. For these pupils, a diagnostic and remedial teaching program attempts to bring them as far as they can go and to provide them with vital skills that will help them in the world of work.

4. Our auxiliary program which is designed for older age pupils who are mentally retarded.

At the senior high school level, Grades 10 through 12, we have opportunity for three programs. First, the standard or university matriculation program; second, the general course program which is designed to meet the needs of students who wish to complete high school education and who will possibly go on to trades or technologies but who will not enter university. For these students we provide a three-year sequence of mathematics which includes foundation mathematics in Grade 10, occupational mathematics in Grade 11 and business mathematics in Grade 12. Finally, we have an honors program which is only developing in a few high schools. We anticipate that in these schools, students will complete in their final year a ten-week unit in Calculus.

For a small province, we feel that this has been a most ambitious undertaking; and I would like, at this time, to express on behalf of the Department of Education our sincere gratitude to the dedicated members of the Canadian Mathematical Congress, the Nova Scotia Mathematics Teachers Association, the many dedicated teachers in the classrooms, the CBC and privately-owned stations that have carried our television programs, and the publishers and their agents who have helped us to bring this about.

MATHEMATICS TEXTBOOKS PRESCRIBED FOR GRADES PRIMARY TO TWELVE IN NOVA SCOTIA

Elementary School

Primary - The greater Cleveland Mathematics Program - K, (SRA)
The greater Cleveland Mathematics Program - K, Teacher's Guide

Grade 1 - The Greater Cleveland Mathematics Program - 1, (SRA)
The Greater Cleveland Mathematics Program - 1, Teacher's Guide

Grade 2 - The Greater Cleveland Mathematics Program - 2, (SRA)
The Greater Cleveland Mathematics Program - 2, Teacher's Guide

Grade 3 - Elementary School Mathematics, Book 3, (Addison-Wesley)
Elementary School Mathematics, Book 3, Teacher's Edition

Grade 4 - Elementary School Mathematics, Book 4, (Addison-Wesley)
Elementary School Mathematics, Book 4, Teacher's Edition

Grade 5 - Arithmetic With Meaning, Grade 5, (Nelson) to be replaced in September, 1968, by Elementary School Mathematics, Book 5, (Addison-Wesley)

Grade 6 - Arithmetic With Meaning, Grade 6, (Nelson) to be replaced in September, 1968, by Elementary School Mathematics, Book 6, (Addison-Wesley)

Junior High School

University Preparatory Program:

Grade 7 - Exploring Modern Mathematics, Book 1, (Holt)
Exploring Modern Mathematics, Book 1, Teacher's Edition

Grade 8 - Exploring Modern Mathematics, Book 2, (Holt)
Exploring Modern Mathematics, Book 2, Teacher's Edition

Grade 9 - Algebra 1 - A Modern Course (Merrill and Nelson)
Algebra 1 - A Modern Course, Teacher's Annotated Edition

Adjusted Course Program

Grade 7 - Basic Modern Mathematics, Book 1, (Addison-Wesley)
Basic Modern Mathematics, Book 1, Teacher's Edition

Grade 8 - Basic Modern Mathematics, Book 2, (Addison-Wesley)
Basic Modern Mathematics, Book 2, Teacher's Edition

Grade 9 - Modern General Mathematics (to be introduced in September 1968)
Modern General Mathematics, Teacher's Edition, (Addison-Wesley)

Senior High School

University Preparatory Program

Grade 10 - Algebra II - A Modern Course, (Merrill and Nelson)
Algebra II - A Modern Course, Teacher's Annotated Edition
A First Course in Plane Geometry, (Moyer-Vilas)
(Geometry by Moise & Downs and published by Addison-Wesley is being used in selected experimental schools.)

Grade 11 - Algebra III - A Modern Course, (Merrill and Nelson)
Algebra III - A Modern Course, Teacher's Annotated Edition
A First Course in Plane Geometry, (Moyer-Vilas)
(Geometry by Moise & Downs and published by Addison-Wesley is being used in selected experimental schools.)

Grade 12 - Algebra, A Senior Course, (Copp Clark)
Coordinate Geometry and Trigonometry (revised edition) (Queen's Printer) Teacher's Commentary and Guide for Coordinate Geometry and Trigonometry (revised edition)
(Mathematics, Grade 12, and Calculus are being used in selected experimental schools.)

General Program

Grade 10 - Mathematics, A Liberal Arts Approach, (Hayden)
Workbook in Arithmetic, (Macmillan)
Mathematics, A Liberal Arts Approach, Teacher's Manual

Grade 11 - Occupational Mathematics, (Dent)

Grade 12 - Canadian Business Mathematics, Books 1 and 2, (McGraw-Hill)

THE ATLANTIC PROVINCES

Prince Edward Island: Mr. A. J. Dowling,
Mathematics Department, St. Dunstan's University.

First let me express my pleasure at having the opportunity to participate in this meeting as a representative of the province of Prince Edward Island.

I hope that my few remarks will give you a picture of present developments in the mathematics program of our schools, and I look forward with great interest to hearing about developments in other provinces.

Before being faced with the question period, let me dispel any notion that I am an expert on every detail of the work being done by the Department of Education in my Province. I am Chairman of the mathematics department of St. Dunstan's University, and am presently Chairman of a curriculum committee that has been working for a couple of years on the mathematics program for grades 7 to 12. Another committee has been working on the program for grades 1 to 6, and there has been liaison between these two committees.

I have no first hand experience at teaching in the elementary or secondary schools, and will rely heavily on the assistance of Mr. Michael Buley, Chairman of the P.E.I. Mathematics Association, who has generously agreed to help in fielding questions from the floor.

I will begin with a sketch of what the mathematics program has been before recent changes. Previous to this year, grades 1 and 2 used a text entitled NUMBERS WE NEED; grades 3 to 6 inclusive used ARITHMETIC WITH MEANING; grades 7 and 8 used INTERMEDIATE MATHEMATICS (Copp Clark); grades 9 and 10 used

HIGH SCHOOL ARITHMETIC (Batstone) and ARITHMETIC FOR HIGH SCHOOLS (Opportunity work book); grade 9 Geometry used INTRODUCTION TO GEOMETRY (Siddons and Snell); grades 10, 11, 12 Geometry used A COURSE IN GEOMETRY (Weeks and Adkins); grades 9 and 10 Algebra, HIGH SCHOOL ALGEBRA (Crawford); grades 11 and 12 Algebra, MATH FOR CANADIANS (Bowers, Miller, Rourke); grade 12 Trigonometry, A FIRST COURSE IN TRIGONOMETRY (Oliver, Winters, Campbell) and SUPP. TEXT, TRIGONOMETRY (Holmes), (voluntary basis).

Until this year, in addition to the regular school exams, examinations were given at the completion of grade 12. These exams were prepared and read under the direction of the Atlantic Provinces Examining Board. There are Provincial High School exams at the end of grade 8.

As you can see, our school mathematics program has followed the traditional pattern of fragmentation into topics made to seem independent of each other. In the terms of modern mathematics, our program was the union of mutually disjoint sets: the arithmetic set, the algebra set, the geometry set, the trigonometry set. We felt that we must not continue to foster the false notion that the intersection of these sets is empty, and therefore looked for a more unified program.

As the result of recommendations, of the curriculum committees, a new program was introduced this year. It was decided to implement it over a three year period, so that in any given year, teachers not accustomed to the new approach, would not be faced with new preparations at all levels.

The texts adopted are: Grades 1 to 6: ELEMENTARY SCHOOL MATHEMATICS
(Addison Wesley)

Grades 7 to 12: Two series were recommended:
MATHEMATICS (Gage)
SECONDARY SCHOOL MATHEMATICS
(Copp Clark)

The choice was left to the schools regarding which series to use in grades 7 to 12.

The schedule of introduction is as follows:

1967-68	Grades 1, 6, 9, 10
1968-69	Grades 2, 3, 7, 11
1969-70	Grades 4, 5, 8, 12

Two years from now the whole new program will be in effect. Some centers have already adopted the entire program as an experiment.

Also, this year, a General Course directed mainly at those students who will not be proceeding to University was introduced for grades 10, 11, 12. The mathematical content of this course is primarily higher arithmetic pertaining to business and industry.

Training of teachers is naturally the immediate problem when introducing such a change. Over the past two years series of lectures have been given for teachers in various centers. Also a television series on the new mathematics was broadcast from Charlottetown. During the past summer a major effort was made to have all teachers who would be teaching the new program attend a summer course. This course was given at four Island centers. Two one hour lectures were given five days a week for six weeks. A written three hour examination was given and professional credit was granted by the Department of Education for successful completion of the course. Although it is too early yet to determine the effect of the course, it is felt that a profitable beginning has been made. More follow-up work is required.

With these remarks I will close my sketch of the present state of Mathematics Education in our Prince Edward Island schools.

THE ATLANTIC PROVINCES

Points Arising from Questions

External Examinations

In Newfoundland, grades 9 and 10 are externally examined in all subjects, but many schools have their own internal exams.

All schools present candidates for the grade 11 external exam. Some offer special courses and exams for weaker students, but the results of these, although accepted by trade schools, are not recognized for the provincial diploma. The grade 11 mathematics test examines Algebra, Geometry and Trigonometry, all in relation to traditional courses.

Beginning next year, Memorial University will adopt a new admissions policy. Those scoring 80% or more on the grade 11 examination will go directly into the first year of university. Those passing the grade 11 exam with lower percentages will take preliminary up-grading courses in various academic subjects.

In Nova Scotia, grade 12 will eventually become the official school leaving year. Up to now, the Atlantic Provinces Examinations Boa: has set papers in grade 11 and 12. The grade 11 exam may be eliminated by 1968, and the high school committee is pressing for the abolition of all external exams.

In Prince Edward Island, there is pressure to eliminate the present grade 8 provincial exam, and it will probably disappear in two or three years. In grade 12, the Atlantic Provinces Examining Board exam is written in Algebra and Geometry.

New Brunswick has a twelve year school system leading to junior matriculation. Four years of university lead to a degree. In the past there were three external examinations one in grade 11 Algebra, and two in grade 12, Geometry and Trigonometry. The new pattern will have two departmental examinations: one in grade 11, called Mathematics 11, and one in grade 12, called Mathematics 12.

We are hoping that the universities will agree to admit, to the arts and applied arts faculties, students with grade 11 Mathematics; but they will require the grade 12 math for students going into the science and applied science field.

We also plan, of course, to make use of the examinations developed by the Service for Admission to Colleges and Universities, which will be available in 1970 or 71. We would hope that by the 1970's the 12 year course will be approaching the level of the senior matriculation courses offered in such provinces as Nova Scotia, Saskatchewan and Alberta.

Textbook Prescriptions

Newfoundland at present gives financial support only for purchase of the one specified text in each subject. Approved alternatives may be purchased if money is available locally. There are hopes for a more liberal policy.

In New Brunswick, a combination of the Ryerson tradition and economic factors led to central control of selection and distribution of texts. The province is moving in the direction of lists of approved texts, with a per capita grant to schools for the purchase of those selected. This is seen as a step towards greater professionalism in the teaching force. The Department of Education is already prepared to supply copies of texts chosen as an alternative to the prescribed book if a convincing case is presented.

Prince Edward Island feels that individual teachers are not yet ready to make their own selection of texts. As an interim measure designed to increase teacher participation, committees have been set up to select approved texts.

In Nova Scotia, the importance at present attaching to the provincial television broadcasts carries with it the necessity for specification of a single approved text.

Assignment to Courses

The relatively rigid structure of alternative courses which is at present found in the Atlantic Provinces raises the question about the validity of selection of students for the various courses. In Nova Scotia, a high proportion of over age students seems to indicate that selection is at present imperfect. It is recognized that it is the democratic right of parents to make the final decision. Improved testing instruments are being developed as a basis for more reliable advice to parents.

Geometry

Nova Scotia provides a full year of geometry (half of grade 10, half of grade 11). Newfoundland is considering similar arrangements. In both provinces, the Moise & Downs program is being examined for possible adoption. Prince Edward Island is committed to the integration of geometry in the syllabus, but is not considering the adoption of non-euclidean courses (except in one school in Summerside, where twenty-five out of ninety-five students are voluntarily attending a series of Saturday morning lectures).

"Laboratory" and "activity" approaches

The question was raised whether any attempt was being made in the Atlantic Provinces to explore discovery techniques, the use of structured materials, the possibilities of re-organization of the classroom, and so on. In Nova Scotia, the Greater Cleveland Math program is popular because it is discovery-oriented. The use of Cuisenaire rods is advocated as a supplementary method, and there is provision in the department's financing policy for the supply of a generous variety of teaching aids if schools want them. Newfoundland also uses the Greater Cleveland program in most schools up to grade 6. In Prince Edward Island, the most recent texts incorporate built-in reforms in methodology. T.V. programs and summer courses are helping teachers to develop new approaches. New Brunswick is also adopting courses and programs which involve discovery approaches, and is making various supplementary materials available to teachers.

In Nova Scotia, some research was being carried out on new methodology such as that contained in the Nuffield program.

QUEBEC

Summary of Presentation: Monsieur Michel Girard, Mathematics Division, Department of Education of Quebec.

Mr. Ronald Paterson, Quebec Provincial Association of Mathematics Teachers.

With regard to the general context, the following developments are taking place:

1. Introduction of the six year ungraded elementary school is foreseen. Instruction will be individualized by the establishment of "functional groups" of children of similar ability.

2. A five-year secondary course with multiple options is planned. Streaming and subject promotion will be introduced.

Generally speaking, the first steps towards implementation of these objectives were taken in September 1967, and followed a variety of patterns in different school districts. In the English sector, however, experimental implementation, especially in subject promotion, began from three to five years ago.

The following are some specific observations:

1. Elementary education -- A factor of crucial importance was the introduction of cuisenaire materials in 1960. About 10% of classes are now using these. The introduction of these materials had two major consequences: first, it provoked among teachers a change of attitudes towards the teaching of mathematics (and, indeed, towards the child n the classroom); secondly, it influenced attitudes towards the teaching of other subjects. The change that these new techniques brought about in the approach to teaching is illustrated by the SEMA movement, begun about 1965, -- the systematic training of teachers for the "activist" approach to teaching.

Another valuable result of the new trend has been that it has led to the employment by school boards of forty or so people, spread through all the regions of the province, who are occupied full time in supervisory duties relating to various aspects of the teaching of mathematics. These people will be instrumental in bringing about a further stage in reform, planned for the school year 1968-69, of methodology and teacher education. They will provide the cadre for a program planned by the Elementary Mathematics Teaching Project Committee, which has been .... in operation for about a year and a half. This Committee was formed by Dr. Norman France, of McGill. It is a joint English-French venture, and its main objective is the retraining of mathematics teachers in elementary schools, through a program of workshops and television programmes. Teachers' organizations, including the several special interest groups and associations, are cooperating.

The presence in Quebec, at Sherbrooke University, of Professor Dienes, has had a great effect on French elementary school program. This year, Dr. Dienes is directing a program of about thirty classes operated by the school commission of Sherbrooke. This program concentrates on the development and use of physical materials in elementary schools.

In the Protestant English sector, remarkable work has been done, especially in the Montreal region, in developing the activist approach. A modified Cuisenaire method has been used through K-3, with materials such as modulated cut-outs used by the children to learn the concepts of the modern maths program. In the English Catholic schools, the American STA (Seeing Through Arithmetic) series has been in use for some time in K-6.

2. Secondary education -- The secondary program is in a period of transition, and at this stage there is considerable reliance on manuals from U.S.A and Ontario. Translation of these, however, presents some difficulties.

The in-service training of teachers, in this phase, is not planned on a province wide basis, but is locally organized.

In winter 1966, the Minister approved implementation of a plan for a long-term in-service program in both languages. This has two phases. The first is a preparation of a cadre, which will assist in the second phase (planned for September 1968). An essential element of the program is the series of workshops which will be coordinated with TV broadcasts. Teachers will work in small groups, and the content and the method will be developed together.

This year has seen the start of a transformation of programs in the teacher education institutions producing secondary teachers. A significant element in this reform program in the secondary school is the establishment of pilot projects, begun in 1967-68 in about fifty classes in the first

of secondary school, and involving about forty teachers. The program used in these projects is based on that which was drawn up about 1961 by OECD (and published in Canada by the Queen's Printer).

1970-71 should see the general introduction of new secondary school courses, beginning in the first year and spreading through the high school in the following years.

Up to now, the emphasis has been on the development of new approaches for students of relatively high achievement. Too little work has been done for pupils of moderate or low academic ability -- the students in technical schools, for example.

The Department of Education for Quebec is keeping in close touch with developments in other parts of Canada, in U.S.A and in several European countries. Groups of specialists have undertaken extensive tours to maintain this contact.

Points Arising from Questions

Computer assisted instruction is being studied in Quebec by a Committee, under the auspices of the Division of Specialized Instruction of the Department of Education.

It should be emphasized that change in methodology is not centered on the use of the Cuisenaire rods. Some pioneers, with considerable daring, explored the use of these initially, at a time when such departures from the authorized program were frowned upon. Influence spreading from these experiments led to changes in attitude, both in the schools and the Department of Education, favouring innovation of various kinds in all subjects.

Similarly, the association originally formed to promote the use of Cuisenaire rods has extended its interests to other approaches, and to combinations of various techniques.

BRITISH COLUMBIA AND ALBERTA

British Columbia (outline*): Mr. Roy Craven,
B.C. Association of Mathematics Teachers.

I. -- The Department of Education

A. Professional Committee on the Elementary School Curriculum and
B. Professional Committee on the Secondary School Curriculum

Functions

1. To advise the Department on specific proposals or plans for curriculum change.

2. To call to the attention of the Department curriculum changes considered necessary.

3. To review particular curriculum revisions and textbook changes being undertaken and advise the Department on them.

4. To study and report on special curriculum problems referred by the Department

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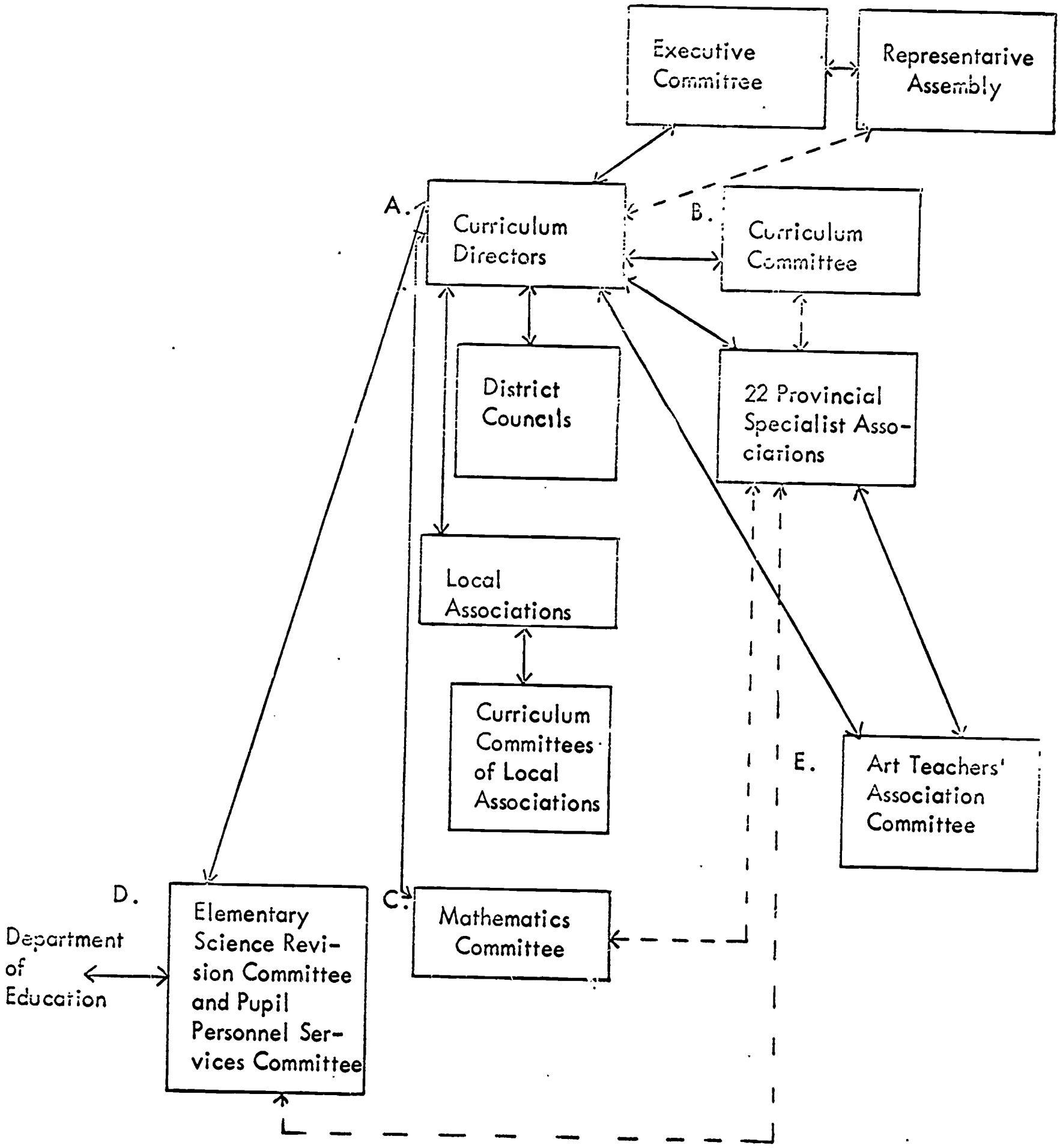
*Prepared by J.S. Church, Assistant Director



NOTE: The solid lines denote responsibility and communication. The dotted lines represent communication.

Membership on the Committees is a personal appointment though members so appointed represent professional groups.

Membership of the Professional Committee on the Elementary School Curriculum

From the Department

Mr. J.R. Meredith, Chairman
Mr. W.B. Naylor, Secretary
Mr. L.B. Stibbs, Acting Chief Inspector of Schools

From the B.C. Teachers' Federation

Mrs. I.A. Cull, Assistant Director of Professional Development
Miss B.D. Buchanan, BCTF Curriculum Director. Miss Buchanan directly represents the Curriculum Directors and elementary school teachers.
Mr. C. Withers. Mr. Withers directly represents the B.C. Principals' and Vice-principals' Association.

From the B.C. School Trustees' Association

Col. J.N. Burnett

From the B.C. School Superintendents' and Inspectors' Association

Mr. J.E. Beech, Assistant District Superintendent, Surrey

From the Faculties of Education

Simon Fraser University -- Mr. A. Vost
University of British Columbia -- Dr. F.H. Johnson
University of Victoria -- Mr. G.A. Brand

Membership of the Professional Committee on the Secondary School Curriculum

From the Department

Mr. J.R. Meredith, Chairman
Mr. W.B. Naylor, Secretary
Mr. L.B. Stibbs, Acting Chief Inspector of Schools

From the B.C. Teachers' Federation

Mr. W.V. Allester, Director of Professional Development
Mr. R.H. Temple
Mr. A.S. Colton
Both Mr. Temple and Mr. Colton directly represent the Curriculum Directors and secondary school teachers.
Mr. T.M. Chalmers. Mr. Chalmers directly represents the B.C. Principals' and Vice-principals' Association.

From the B.C. School Trustees' Association

Col. J.N. Burnett

From the B.C. School Superintendents' and Inspectors' Asscciation

Mr. S.J. Graham, District Superintendent, New Westminster

From the Universities

Simon Fraser University	-- Prof. F.F. Cunningham
University of British Columbia	
Faculties of Arts and Science	-- Dr. R.F. Scagel
Faculty of Education	-- Dr. J.R. McIntosh
University of Victoria	-- Dr. S.A. Jennings

NOTE: Messrs. House and Wilson, Curriculum Consultants to the Department of Education, meet with the two Professional Committees.

C. The Department's Advisory, Appraisal and Revision Committees

Committee	Area	Chairman	Consultant-Sec.
Chemistry	Chemistry 11 and 12 Chemistry units -Science 8 to 10	Mr. House	Mr. House
Elementary Language Arts	Grades 1 to 7	Mr. W.B. Fromson, Assistant Superintendent, N. Vancouver	Mr. Wilson
Elementary Social Studies	Grades 1 to 7	Mr. C.T. Rendle, Assistant Superintendent, Burnaby	Mr. Wilson
French	Appraisal-French 8 to 10 Revision-French 11 to 12	Mr. House	Mr. House
German	German 9 to 12	Mr. House	Mr. House
Intermediate Slow Learners	Intermediate	Mr. E.E. Hyndman, District Superintendent, Sooke	Mr. Wilson
Junior Secondary Science Committee	Science 8 to 10	Mr. Naylor	Mr. House

Library Book Selection Committee	--	Mr. Barr	Mr. Barr
Music Advisory Committee	Music K to 12	Mr. Wilson	Mr. Wilson
Physics	Physics 11, 12 and Senior Matric. Physics units - Science 8 to 10	Mr. House	Mr. House
Secondary Social Studies	Social Studies 8 to 12	Mr. Rendle	.r. Wilson

NOTE: Each committee consists of 8 to 12 members with approximately 6 to 8 of those being teachers, usually nominated by the BCTF Curriculum Directors. Frequently a committee will include one or two members from the Colleges of Education, and, in the case of a secondary school subject revision committee, a representative from an appropriate Department in the Faculty of Arts or the Faculty of Science.

D. Joint Committees of the Department of Education and the B.C. Teachers' Federation

1. The Elementary Science Revision Committee

Chairman - Mr. J.S. Church

Members

Dr. C.J. Anastasiou, Faculty of Education, University of British Columbia
Mr. G.W. Catherall, Coquitlam
Mr. G.A. Clarke, West Vancouver
Mr. S.S. Gill, Vancouver
Mrs. I.A. Labounty, Vancouver
Mrs. J.E.M. Little, North Vancouver
Mr. C.R. Moss, Duncan
Mr. A.W. Robinson, Alberni
Mr. J.H. Wainwright, Vancouver
Mr. W.J. McConnell, Burnaby

The Kamloops Sub-Committee

Mr. Moss, Chairman
Mr. Jan M. Maeland, Kamloops
Mr. Stewart A. Nanson, Kamloops
Mr. Ralph L. Shaw, Kamloops
Mr. Arnold C. Toutant, Kamloops
Mr. Delbert Turner, Kamloops
Mr. F. Braun, Corresponding Member, Birch Island

The Alberni Sub-Committee

Mr. Robinson, Chairman
Mrs. G. Davies, Alberni
Mrs. D. Booth, Alberni
Mr. J. Walsh, Courtenay

2. The Pupil Personnel Services Committee

From the Department

Mr. P.J. Kitley, Director of Guidance - Chairman
Mr. L.B. Stibbs, Acting Chief Inspector of Schools

From the Faculty of Education, University of British Columbia

Dr. M. Nevison

From the B.C. Principals' and Vice-principals' Association

Mr. J. Loucks, North Vancouver
Mr. E. Erricho, Richmond (Secretary of the association)

From the B.C. Counsellors' Association

Miss M. Nastich, North Vancouver
Mr. L.A. Wrinch, Vancouver (Vice-president of the association)

From the B.C. Special Counsellors' Association

Mr. J.A. Downs, Vancouver

Representative of the Elementary School Teachers

Miss Theresa Kratzer, Vancouver

Representative of the Secondary School Teachers

Mr. A.C. Hare, Vancouver

Secretary of the Committee

J.S. Church, BCTF Staff

NOTE: The Curriculum Directors appointed the representatives of the B.C. Principals' and Vice-principals' Association, of the B.C. Counsellors' Association and of the B.C. Special Counsellors' Association.

3. Secondary Social Studies Committee

Mr. J.S. Church, BCTF Staff, is a member of this Departmental Committee.

II. -- The British Columbia Teachers' Federation

A. Curriculum Directors

Function

The Curriculum Directors serve as the chief advisory, information-seeking and source-gathering committee of the Federation in all curriculum matters. The Directors, therefore, receive curriculum resolutions and refer them to the appropriate specialist associations for study and recommendation. The resolutions may then in due course be directed to the Department by the Directors acting on behalf of the Federation. The Directors and the full curriculum Committee (curriculum representatives of the provincial specialist associations) meet frequently with Departmental officials to maintain a flow of information on curriculum between the Federation and the Department.

The Curriculum Directors advise the Federation's representatives on the two Professional Committees.

The Curriculum Directors have recently established in conjunction with the Department two committees -- an Elementary Science Revision Committee to recommend improvements in the elementary science program, and a Pupil Personnel Services Committee to study all phases of pupil personnel services in the schools of the province. The Directors are also at present (January 1966) in the process of establishing a Mathematics Committee to identify a model scope and sequence of mathematics courses from Kindergarten to Grade 12.

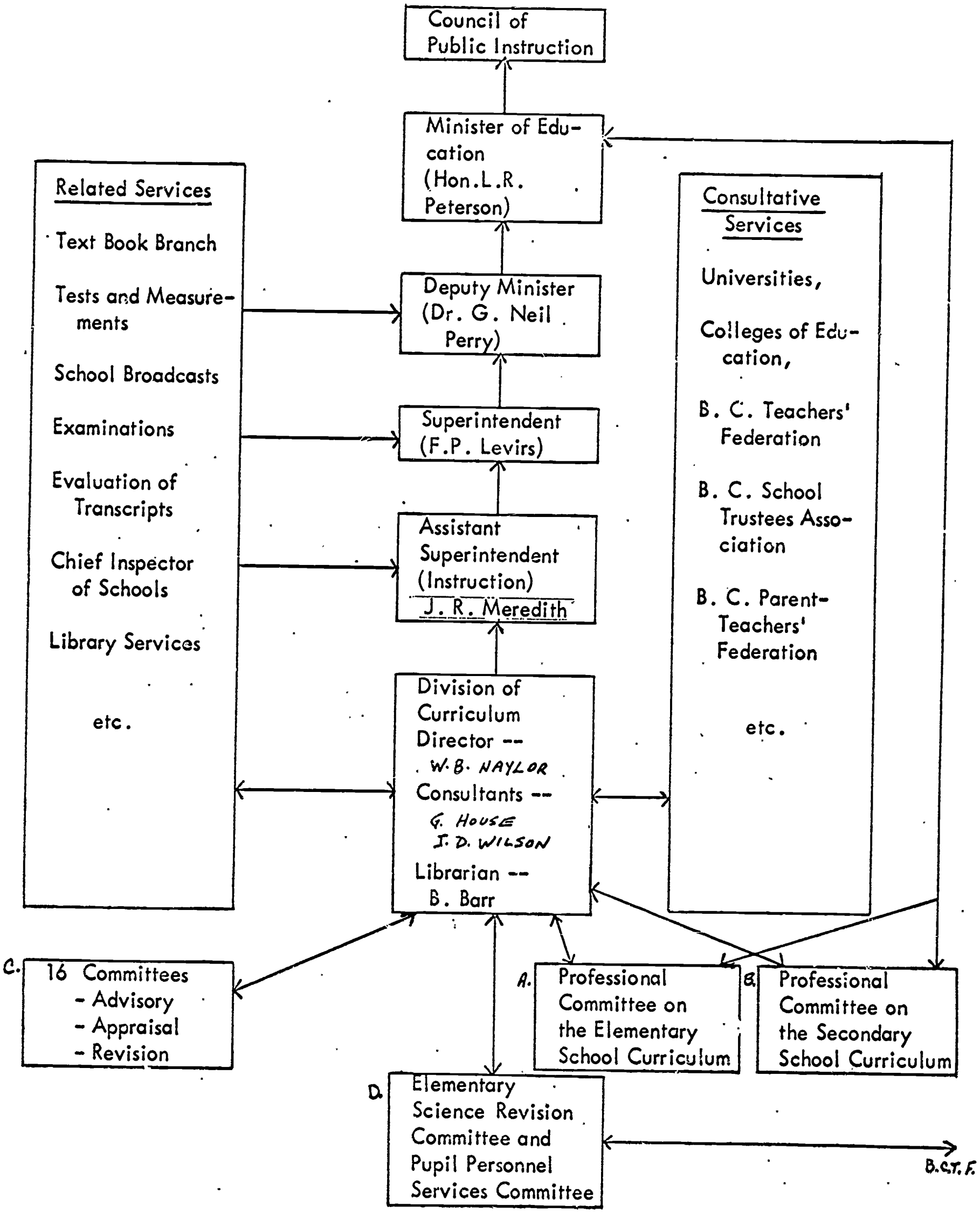
In order to increase the importance and the numbers of curriculum divisions which are made at the district, the school and the classroom levels, the Directors encourage and assist both local and provincial specialist associations in the study of all curriculum matters.

Members

The Directors are appointed by the Executive Committee for three year terms; usually two are appointed each year.

The present Directors are:

Mr. E.T. Tribe, Chairman, Coquitlam
Mrs. M. Curtis, Primary Representative, Burnaby
Miss B.D. Buchanan, Intermediate Representative, North Vancouver
Mrs. A. Maling, Vancouver
Mr. A.S. Colton, Secondary School Subject Representative, Vancouver
Mr. R.H. Temple, Secondary School Principal Representative, Victoria
Mr. T.M. Chalmers, Past Chairman, Burnaby
Mr. J.H. Wainwright, Vancouver



NOTE: The solid lines represent responsibility and communication.

B. Curriculum Committee

The Curriculum Committee consists of the eight Curriculum Directors and the Curriculum Representatives of the 22 provincial specialist associations.

Provincial Specialist Association

B.C. Principals' and Vice-principals' Association
B.C. Art Teachers' Association
B.C. Association of Mathematics Teachers
B.C. Association of Teachers of Modern Languages
Provincial Association of Teachers of Special Education
B.C. Counsellors' Association
B.C. Music Educators' Association
B.C. Physical Education Teachers' Association
B.C. Primary Teachers' Association
B.C. Shop Teachers' Association
B.C. Social Studies Teachers' Association
B.C. Special Counsellors' Association
B.C. Science Teachers' Association
B.C. School Librarians' Association
Provincial Intermediate Teachers' Association
Secondary Association of Teachers of English
Teachers of Home Economics Specialist Association
The Commerce Teachers' Association
B.C. Association of Teachers of Classics
B.C. Association of School Supervisors of Instruction
Teachers of the Occupational Program
The Association of Directors of Instruction of B.C.

C. Mathematics Committee

The Mathematics Committee has been asked to identify a model scope and sequence of mathematics courses, Kindergarten to Grade 12.

Mrs. H. McKinnon, Vancouver, will serve as the Chairman. Other members will consist of two or three representatives from each of the following associations: Primary, Intermediate, and Mathematics Teachers' Associations, and representation from one of the Faculties of Education.

D. Joint Committees of the Department of Education and the B.C. Teachers' Federation

See Section I. - D above.

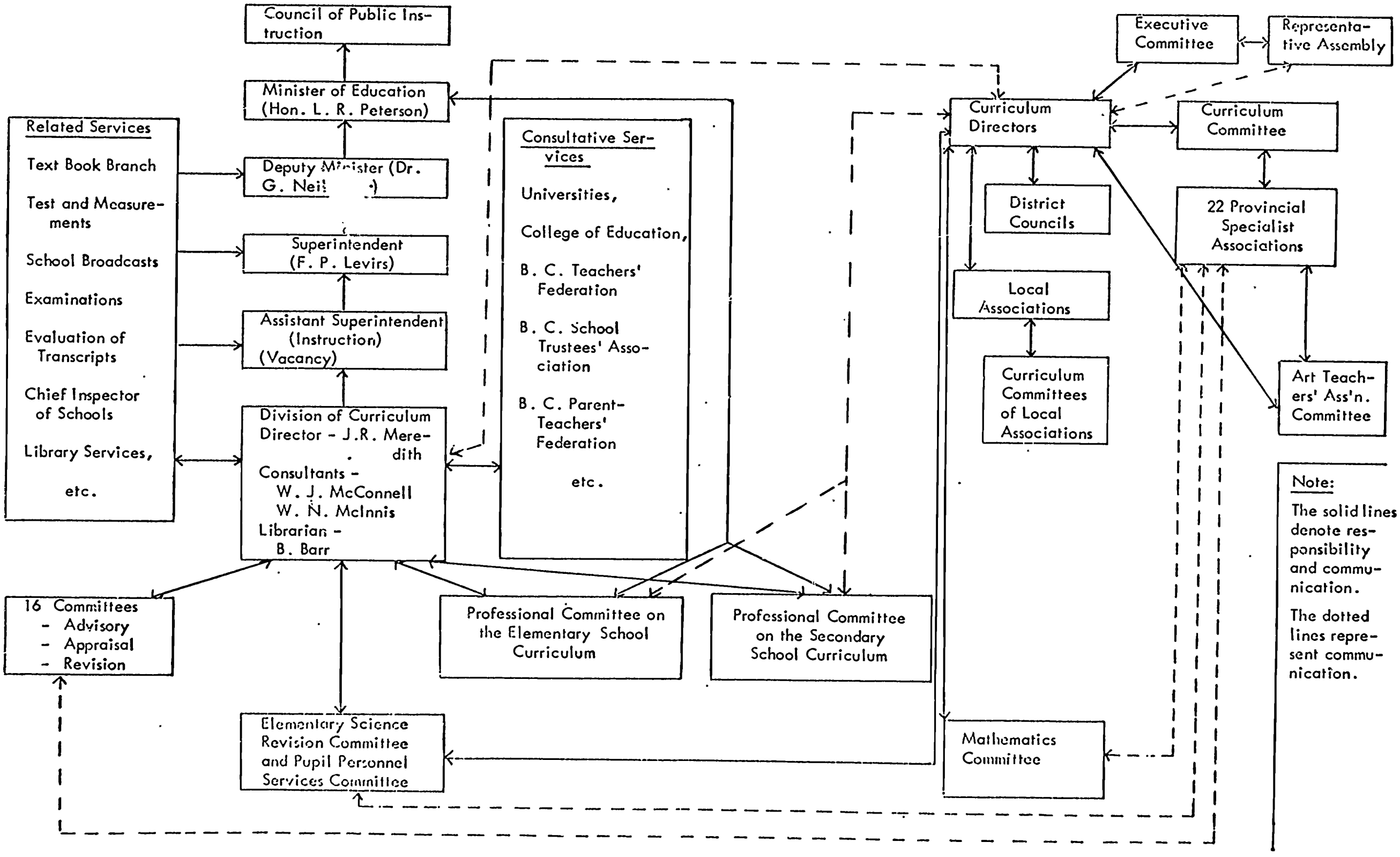
E. Art Teachers' Association Committee

A committee to recommend improvements in the provincial art curriculum has been established by the B.C. Art Teachers' Association. The committee is under the chairmanship of Mr. Blair Fulton, Vancouver. The committee will report to the Curriculum Directors.

Other members are:

J.U. Gray, Faculty of Education, U.B.C.
A.S. Colton, Vancouver, Supervisor, Art Instruction
J.N. Hardman, Burnaby
Professor Sam Black, Faculty of Education, U.B.C.
Miss L.C. Fleet, Burnaby
W.D. Greer, Vancouver
E.L. Watkins, Vancouver

III. THE RELATIONSHIP OF THE DEPARTMENT OF EDUCATION AND THE BRITISH COLUMBIA TEACHERS' FEDERATION



BRITISH COLUMBIA AND ALBERTA

Curriculum Development in Alberta: Dr. J.S. Hrabi, Director of Curriculum, Department of Education of Alberta.

What I would like to do in the next twenty minutes or so is about four things. I would like to review with you briefly the kind of programs that we have in Alberta. I would like to talk about some of the things that are going on in curriculum development. I would like to mention briefly what has gone on, and then I would like to conclude by referring briefly to what I personally consider are some of the significant issues that the people in Alberta (and, I expect, elsewhere) have to face in the realm of curriculum development, especially as it applies to mathematics. (Though it seems to me that a number of these issues go far beyond the field of mathematics.)

Before that, though, I would like to make one comment. I think the notion of this conference is an excellent one. I agree with Fr. Egsgard that we in Canada do not have very clear cut lines of communication, particularly from east to west. I am completely convinced that we in Alberta know more about what is going on in the 48 states to the south of us than we do of what is going on in many of the sections of this country. Just the fact alone that this group was able to prepare that duplicated sheet summarizing the developments that are going on and have gone on across this country is to me an interesting enterprise, and one which I think is valuable and informative to those of us who are engaged in the business of curriculum development.

Now, what kind of programs do we have in Alberta? First of all we do not have any kindergarten in Alberta. (Those of you who read or happen to read Alberta papers will realize that that is a political issue at this time, so I'll not talk about it since I am a civil servant.) In grades one to six there is no provincial direction as to the amount of time that should be spent on mathematics; so the time varies from one jurisdiction to another.

We have a single program in grades one to six. We have multiple authorizations, but in name only, since nobody is using the second authorization. Everybody seems to be using "Seeing Through Arithmetic".

In grades 7 to 9 (our junior high school: in Alberta we have the 6-3-3 organization) we also have a single program, but we have two series of authorized textbooks, the "Seeing Through Mathematics" program, special edition, and the "Exploring Modern Mathematics" program. You might be interested in the amount of time that is spent on mathematics in our junior high schools. Most schools spend from 5 to 6 periods a week, and a period is usually about 38 minutes.

Although I say that at the provincial level we have a single program, there are other programs developed by a number of our districts. For instance, in some of our larger school districts there is what is called the MPH program. That means Matriculation Program Honours, and what this signifies really is that about the top 5% of the students in this district have been grouped together and are receiving an extremely enriched program. Other districts have what they call Junior Vocational Programs at the junior high school level. These are not very common. They are found usually in the larger jurisdictions, the larger city districts, and they are designed to meet the needs of lower ability students -- probably the lower 5 to 10%.

We have another institution in Alberta in the junior high school that you may or may not have heard about. It is the grade 9 examination. The tenure of this particular institution is a matter of question at this time, and I have a sneaking suspicion that within the next three or four years the grade 9 examination will disappear. Although there might be some kind of an evaluation instrument at the junior high school level which might serve the needs of guidance and research, I expect there will be no instrument the main purpose of which is to determine who passes grade 9 and goes into our senior high school.

With respect to our senior high school program in the province of Alberta, it is rather difficult to say what any student in our province might be studying. The requirements for a high school diploma in the province of Alberta, which you get at the end of grade 12, are very flexible. You have to offer, sometime in your high school career, one mathematics course; you have to offer, sometime in your high school career, one science course; you have to offer, sometime, ten credits -- which means two subjects -- in the social science field. You have to offer a minimum of 15 credits -- three courses -- in English, one of which must be a grade 10 English course, and one of which must be a grade 12 English course. You have to offer a physical education program, and you have to take three of what we call grade 12 courses.

So within those broad general requirements, you can take any of the courses that we offer in our high school program; and I have not counted them lately, but there are a great many.

Now, what kind of mathematics courses do we have at the senior high school level? We have quite a few. First of all we have what is called our matriculation sequence, which have the numbers Mathematics 10, 20, 30, and then a special course which we call Mathematics 31. Students who aspire to an honours math program at university or who are going to enter the Faculty of Engineering are offered two courses at the grade 12 level, Mathematics 30 and Mathematics 31. Mathematics 31 at the moment is a trigonometry course, but we are trying some new things which I will talk about later.

A second sequence that we have at the high school level is called Mathematics 12, 22 and 32, and these courses are taken usually by students who are vocationally oriented. We have another sequence called Mathematics 11 and 21, which is our Business Education sequence.

We have two other sequences in some places. Two of our larger school districts, in Edmonton and Calgary, have developed a four-year matriculation program. The objectives of this particular program are that the number of students who are taking matriculation standing in mathematics should be increased, and essentially what happens is that these students take the content of mathematics 10, 20 and 30 over a four-year period, rather than over a three-year period. There are minor variations of that theme depending upon whether you live in Edmonton or in Calgary, but I think the theme is essentially correct.

We have another sequence called Mathematics 15 and 25. As you can see, we in Alberta really like to have a lot of courses, and we are engaged at the present moment in analyzing them so that the numbering system is intelligible to us. There are those who are suggesting that we could go to 3 digits. I am fighting that because it would give those who want to develop even more courses quite a bit more scope!

The mathematics 15 and 25 program is an interesting one for a number of reasons. It was locally developed in the larger jurisdictions of our province, for unique reasons. At one time we used to say that nobody could graduate to senior high school (to grade 10) unless he possessed a grade 9 diploma, which meant that he had passed our grade 9 examinations. Then we changed the regulation and said that if schools had what they considered a suitable program, they could accept students in grade 10 who in fact had not passed our grade 9 examinations. A number of schools did this, but they found that these people, because of the fact that they had not done so well in grade 9, had not achieved a great deal of mathematical maturity. In many cases they were not very interested in mathematics. So these schools developed what they considered was a unique program which they felt would be of interest to these students, and I might say that their efforts in this direction were quite successful. Perhaps it was because they used materials that were quite unique as far as the students were concerned, in that these students up to that time had been used to so-called "old" mathematics. The program that they used was the Adam Wesley series by Wilcox and Arnell followed by Wilcox, Wilcox and Arnell for Mathematics 15 and Wilcox for Mathematics 25.

Now I would say this: in the province of Alberta we are pretty well dedicated to the notion of multiple authorization of textbooks. We have not quite achieved that at the high school level in mathematics, but this is the direction in which we will certainly be heading, and we define multiple pretty broadly.

In the field of curriculum development I think it would be fair to say that as of this year the content has been updated in all of our mathematics programs at the elementary and junior high school level in the matriculation sequence, with the exception of mathematics 31, the trigonometry course. I say the content has been updated, and I say that advisedly. As was mentioned in our conversation of this morning, the updating of contents does not necessarily imply updating or changing of methodology to a substantial degree. I expect that methodology has been influenced to some extent, but that is a different kind of question.

At the elementary level we have a sub-committee at work which is in the process of analyzing virtually every mathematics program that exists.

Last year, in Mathematics 31, we tried half a year of trigonometry followed by half a year of either calculus, linear algebra or probability. We had a student at the University of Alberta whose master's thesis was an evaluation of the usefulness of this particular program that we were trying out. He sent a questionnaire to sixty professors at the University of Alberta, in an attempt to see whether there would be any consensus about the kind of content they thought would be suitable for students who were going to enter the University.

The conclusions of our study were few in number, but I suppose the significant ones might be these: students reacted rather favourably to the calculus, to the linear algebra and to the probability. There were no differences in their reactions to these particular programs. The teacher reaction to the texts that we used (Lang in calculus and Davis in matrices) was not particularly positive. The reaction to the probability section was quite positive; but the committee decided that they would not continue this experimentation during this current year, simply because there is now a unit on probability in our revised Mathematics 30 course.

The reaction of the University people to the programs was interesting and almost predictable. People in mathematics and science tended to favour calculus. The people in the social sciences and in the biological sciences tended to favour the half course in probability.

On the basis of this kind of evaluation we are now using a Holt, Rinehart and Winston text in calculus. Dr. Elliott is one of the authors. We are also using the same book for the vectors and matrices half of the course.

With respect to our senior high school mathematics program of the future, you will recall that when I discussed the various routes that we have in our high school, there were very many of them. Our senior high school Mathematics

Sub-committee has recommended that we try to do away with a few of those, and that we pursue the development of a three-level program at the senior high school level, beginning in grade 10. We now have sub-committees engaged in planning these three programs. The details have yet to be delineated, but generally speaking they will look like this: the first sequence will be what we will again refer to as our "matriculation sequence" -- 10, 20, 30 and probably a 31. We expected it would likely be taken by about the upper 35 or 40% of graduates of our grade 9 program. It will tend to be the most rigorous of our mathematics courses. Hopefully it will include trigonometry some time in the 10, 20, 30 sequence so that we do not have to have a special trigonometry course in our high school. It will include formal geometry of some kind.

The next sequence, which we are going to call 13, 23, 30, will not include formal deductive geometry, but the content otherwise will tend to be much the same as the 10, 20 and part of the 30 program. We expect that it will be less rigorous (and I know that word is hard to interpret).

The third sequence, mathematics 15 and 25, will tend to be rather broad courses with a basic mathematical content. They will have optional sections dealing with the applications of mathematics in a variety of situations in the physical sciences, in the social sciences, in business education and what have you.

To conclude with what I think are some of the issues that our committees, our teachers, everyone concerned with mathematics education are going to have to face: the first has to do with the area of individual differences. This is a topic that is very easy to talk about but very difficult to do much about.

At the moment we have, in the province of Alberta, people attempting to meet individual differences in the field of mathematics and in other fields through continuous progress plans at the elementary school level. However, our junior high school level does not really provide much of a possibility for meeting the needs of individual differences very well. At the senior high school level, though, we go to the notion of levels. But I do not think we come to grips very well with the problem of individual differences of students.

Another problem that we have to face, particularly in the development of mathematics programs, is this business of integration of the various fields of mathematics. In our more egotistical mood we like to say that we now have an integrated program at the junior high school level and at the senior high school level. But I think if we want you to use the scientific analogy at this time our integrated mathematics program more closely resembles a mixture than it does a compound. This I think is a real problem, the development of an integrated mathematics program, and I would be very interested in the ways that other people are looking upon what I think is a really significant issue.

Another question that we are dealing with, and do not have the solution to, is how to deal with the topic of geometry, and where to deal with it. I was

fortunate enough to spend a couple of weeks in England in September and had the good fortune to see some of their programs. I think they are less wedded to Euclidean geometry than we are. I am not sure that we won't continue to be. Even if divorce laws in Canada are going to be eased, I am not too sure that this will apply to our relationship with Euclidean geometry.

The place of computers, of calculators and of mathematics laboratories in mathematics teaching is not clear to us -- particularly the place of the computer. We have data processing courses, a couple of them as a matter of fact, in our high schools; but what is the impact of the computer on high school programs? Does it have any?

Another problem is that of methodology in mathematics instruction. Personally I don't get excited about any specific method as the solution to very many problems in mathematics or any kind of education. I have a feeling that if you took five or six or seven different teachers, those five or six or seven different teachers could achieve what they all agree upon as the significant objectives of mathematics by five or six or seven different kinds of methodology.

BRITISH COLUMBIA AND ALBERTA

Points Arising from Questions

Student Transfers

The question was asked whether, in Alberta, students could move between sets of courses, or whether they were locked in once they had started in one line. In reply, it was observed that mobility is highly desirable, but cannot be made the primary consideration in the design of courses without serious damage to the structure of the courses. Students are in fact moving; the ease with which they do so is affected by their motivation.

Desk Calculators

In Alberta, experiments are being conducted on the premise (not fully tested) that students tend to get lost in problems because they are side-tracked by the complexity of calculations. With calculators, they can think, analyze, master the problems solving approach, and reach high level thinking without the impediment and distraction of computation, which may be causing difficulties.

In Calgary, calculators are being tried in classes whose students are in the lowest 5% of academic attainment. Students in these groups are solving problems that are beyond the capacity of over and more able pupils who are working without the calculators. Experimenters feel that they are developing, in the students, new and improved attitudes towards mathematics. Plans for next year call for much larger numbers of classes, in higher academic ranges, to be so equipped.

The approach is partly modelled on the Cedar Falls Idowa project, but differs in substantial ways. The flow chart is the basis of the approach, but American experiments have been greatly modified to suit the local situation and purposes.

External Examinations

In British Columbia, there is still a need for an external examination for scholarship and bursary applicants, and also for border line cases who have to produce some objective proof of their fitness for university. A great many students, however, are proceeding to higher education on the recommendation of the schools. The provincial exam, in any case, counts only for half of the final mark: the school assessment provides the other half.

In Alberta there is a significant trend to the use of objective tests such as those being developed by SACU. When the SACU has established its own testing program, the Department of Education will probably seize to set external exams. At the present, many students receive diplomas without writing provincial exams; generally, only those who need university entrance standing write the grade 12 external exam. The Alberta Teachers' Association has expressed some misgivings about the adoption of the SACU tests.

SASKATCHEWAN AND MANITOBA

Saskatchewan: Mr. Harold J. Promhouse,
Saskatchewan Mathematics Teachers' Society.

Recently Saskatchewan introduced its plan for a reorganized school system. The traditional 8 - 4 grade organization is being replaced by four divisions each consisting of three years of school for a student making normal progress. In divisions I and II the principle of non-grading involving the concepts of continuous progress and flexible promotion, has been adopted. Division III Programs have been planned to meet the special needs of the 13 - 14 and 15 year olds at the crucial time when they are changing from children to adolescents. Several new areas of study are offered in division III as well as a guidance program in order to provide students with an adequate background for continuing satisfactory progress and for wise selection of courses in the senior years.

It is at the Division IV level that the new organization will begin to show its effectiveness. Major changes are contemplated in total scope of courses offered, and in the content and methods used within the particular subject areas. Such benefits will be realized fully in large schools, and to a lesser degree in smaller ones. The proposed Division IV Program thus becomes a matter of major interest.

The Division IV Program should provide learning opportunities for all high school age students to enable each to develop his greatest potential in accordance with his interests and abilities, and to prepare him to make his maximum contribution to the society of which he is a part.

The Division IV program offers a balanced range of courses to accommodate all adolescents who are able to profit from instruction at this level. University preparatory, technical institute preparatory, occupational preparatory leading

directly into employment. Additional provision is made for a co-operative school work training program, and for adults who desire further opportunities of education.

The range of courses include all basic academic subjects together with a variety of electives in the fine arts, in business education, technical industrial courses, home economics, vocational agriculture, and physical education.

In the light of the overall picture of education in Saskatchewan, we will examine the development of our mathematics program - past, present, and future.

Each Division has a separate planning committee of teachers and administrators appointed by the Department of Education on the advice of the S.T.F. and Special Subject Councils, and they are under the direction of the Curriculum Branch.

Modern mathematics concepts were phased in for Division I and II over a period of years. The Gage and the Holt, Rinehart and Winston Publishers were first in the field with their books, Seeing Through Arithmetic (STA) and Number Patterns - consequently these two books were adopted as texts. It was left to the local superintendent to decide on which book was to be used in his area. The Saskatchewan book bureau stocked both.

Each year the schools have moved up the line replacing Winston Arithmetic with the Modern Concepts. At the present time they have reached year 6 -- that is, to the end of Division II. A problem still exists in Division I and II at present since the revised edition of the above books have been adopted in years I and II and the old edition is still authorized for year 3. Continuity does not exist. (Why not authorize the revised edition for year 3? Perhaps it is a little matter of money for the book bureau - the old must be used up first.)

At the same time as Modern Mathematics was being introduced to the first graders it was decided not to wait eight years to introduce the Modern Concepts into the high schools so a High School Mathematics Committee was set up to plan a program and select a text for the high schools grades 9, 10, 11, and 12. In the summer of 1962 the Committee reviewed many Mathematics texts and decided to adopt the Dolciani Series as texts. These books were very traditional in content but at the same time did introduce many modern concepts. Dolciani's texts have now been used in the high schools of our Province for five years.

Since the modern concepts were established prior to the modern concepts reaching grade VII and VIII the Division III committee suggested that the schools begin to phase out Winston Arithmetic and use S.T.A. (Gage) and contemporary mathematics (Holt, Rinehart, Winston). This is being done at present although many schools in our province are still using Winston's Arithmetic in grades 7 and 8.

While this has been going on the Division III committee have been busy planning a program. They have developed a scope and sequence without any particular

text in mind. Although Gage and Holt, Rinehart and Winston were first in the field many other publishers moved in sending their books. The members of the Committee studied these and set up pilot courses on each of 8 sets of mathematics books at the grade 7 level in different schools throughout the province.

Half way through 1966-67 an evaluation questionnaire was prepared by the Committee. They brought in all the teachers involved in teaching the pilot courses and explained the meaning and importance of the questionnaire before they filled it out. The questionnaire was then analyzed and a report prepared. In fact there is a meeting on Saturday, December 16 in order to discuss this report and make a decision on what text or texts are to be recommended for use in Division 3. The content of the texts is very similar, however some are more sophisticated than others -- for example it is thought the S.T.A. is not for the below average student. As the Committee is very interested in providing for individual differences, it is possible they will choose 2 or 3 sets of texts. The Committee will then revise their scope and sequence in order to fit the text selected.

The high school Committee is now being renamed the Division 4 Committee. As soon as the Division 3 Committee makes its recommendations it is time to phase out the Dolciani series. Thought is now being given to this. The teachers this year have noted that the new crop of Grade VIII students entering our high schools this fall have covered and mastered a great many of the concepts that are presented in book I Dolciani. Consequently they have had to make adaptions and changes in the grade IX course.

The Division 4 Committee has much work to do and many decisions to make. The content of the courses taught in grade 11 & 12 at present should be able to be mastered by the grade X and XI students. Then what should be taught to grade 12, Vector Space? Calculus? Also if the philosophy of the division system is to be followed, 3 different mathematics courses must be developed. (1) A course for the University bound (mathematics & science oriented). (2) A course for the University (not math & science oriented) or Technical institute bound. (3) A course for the slow learner in mathematics.

The Division 4 Committee must also make a decision on the kind of geometry that will be taught in our high schools at present - traditional Euclidean Geometry is being taught. There is no correlation with the geometry that is being taught in Division 3.

Due to the way that mathematics has been introduced into our Province there has not been sufficient liaison between the different committees. This has to be corrected. All teachers must know what mathematics is being taught in our schools from kindergarten to grade 12. Thus a great deal of in-service education is necessary. The provincial mathematics society believe that if continuity is to be obtained there should be a mathematics co-ordinator at the department level. We have urged this for the past several years, but without success.

This in brief is the mathematics picture in our province. Many more things perhaps could be mentioned such as the training of teachers, in-service programs, but perhaps these can be answered during the question period. I am very happy to announce that Mr. Dawson, a member of the faculty of Teacher Training University of Saskatchewan - Regina Campus, is here today, so if you have any questions in that area I am certain he is capable and willing to fill you in. I might add I also will be happy to listen to any questions you have and attempt to answer them.

SASKATCHEWAN AND MANITOBA

Manitoba: Mr. Peter Luba,
Curriculum Consultant, Manitoba Department of Education.

New Mathematics in Manitoba was started at the Grade 8 level approximately four years ago. Since then Department of Education Mathematics Committees have developed new programs in Grades 1 to 7 and 9 to 11 inclusive.

The philosophy of the elementary (Grades 1 to 6) programs can be described as a modern approach to learning. This implies a program in which children are led to think in mathematical terms and to discover for themselves mathematical concepts. The emphasis in teaching is now more on meaning rather than memorization. The pupils are led to explore, discover, and experiment. As a result memorization follows understanding. This new approach makes mathematics a more vital, positive and dynamic subject.

The new mathematics programs in our elementary schools are designed to reflect on the modern trends of thinking in terms of the needs of mathematics education at the higher levels. They are based on the following objectives:

1. To provide experiences which will lead to increased understanding, knowledge and skills in mathematics appropriate to the needs and capabilities of children.

2. To develop mastery of the skills of computation.

3. To provide experiences which lead to understanding relationships between mathematics and other branches of learning.

4. To provide opportunities to increase understanding of problem solving, critical thinking and methods of inquiry and discovery in mathematics.

The elementary program is designed in such a way that it can be used in conjunction with the authorized textbooks or in conjunction with other methods of instruction, such as Cuisinaire. The concepts of mathematics are developed with the use of the following modern mathematics ideas and language:

1. language of sets

2. numbers and numerals

3. number lines

4. inverse operations

5. properties of numbers

    a) cumulative property
    b) associative property
    c) properties of zero
    d) properties of one
    e) closure or Law of Closure

6. number sentences.

The Junior High (Grades 7 to 9) programs extend the development of computational skills and understanding of the basic processes of mathematics through the study of the structure of the number system. Programs are being developed presently to account for wide differences in innate mathematical abilities of students making normal progress with enrichment for the mature student who handles mathematics easily, and minimum requirements for the student whose mathematical ability is developing slowly.

Many of the algebraic ideas, which are introduced intuitively in the earlier grades, are developed formally for the first time at the Junior High level. Concurrently, with the laying of a sound foundation for the study of Algebra, provision is made for:

1. deepening the understanding of the structure of mathematics,

2. an increased understanding of the numeration systems,

3. an understanding of the principles governing computation,

4. a meaningful understanding of the natural, integral, rational, and irrational number systems,

5. and a further development of understanding of the relationship between the ideas of a fraction and ratio,

6. an extension of the study of intuitive geometry.

The High School mathematics programs are twofold:. 1. University Entrance and 2. General Course. The General Course is less rigorous of the two and provides a sound mathematics program for students who are planning to enter the business world or continue their studies at the Manitoba Institute of Technology. It is hoped that in the not too distant future General Course mathematics will be recognized for admission to Arts in Manitoba Universities.

The General Course mathematics is designed to provide:

1. a basic core of mathematical knowledge necessary for every student,

2. an opportunity to develop the ability and willingness to apply problem solving techniques,

3. an awareness that mathematics is a vast, complex and rapidly changing field of knowledge,

4. an awareness and appreciation of the importance of mathematics in the natural and social sciences, and in business and government,

5. an understanding of the mathematics involved in personal and family finance, and willingness to use this understanding,

6. an opportunity for the development of a foundation on mathematics sufficient to permit further study if desired.

It is also designed for the development of sound judgment and a critical attitude in assessing mathematical reasoning, processes and results, and an appreciation of the value of mathematics in relation to other school subjects.

At the University Entrance level, new algebra courses are being taught in Grades 10 and 11. In geometry an S.M.S.G. approach is being piloted. A new Grade 12 mathematics course will be introduced provincially in the coming year.

The underlying reasons for introducing new algebra courses at the University Entrance level of education are:

1. to develop the skill of using algebraic techniques with understanding and accuracy,

2. to further develop an understanding of mathematical processes,

3. to further develop the methods of problem solving,

4. to become familiar with the fundamental processes in discovery of new generalizations,

5. to develop study habits for independent progress in mathematics,

6. to increase the use of one's creative and analytic powers in mathematics.

The mathematics programs in the Commercial and Vocational courses are traditional in nature. The basic mathematical requirements in these courses are:

1. to develop sound computational skills, and,

2. to apply these skills in the solution of related problems.

There is reason to believe that calculators may be used more in the future for computational purposes. As the mathematics background of students coming to these programs becomes predominantly new mathematics, the mathematics courses in the Commercial and Vocational programs will have to be modernized.

The Manitoba Department of Education has entrered recently, a second phase in its curriculum revision and improvement program. A Council for the Development of School Mathematics Curricula has been formed. The composition of this Council consists of representatives from Universities, Faculties of Education, Administration, and Teachers. Its main functions are:

1. to assess fully the current mathematics programs from K to 12,

2. to conduct a detailed study of existing new mathematics programs,

3. to prepare a report for the Department of Education in which recommendations are set out for the future structure of mathematics (K to 12) in Manitoba.

This Council is presently involved in an intensive study and assessment of all the mathematics programs in our province. Fourteen provincial organizations are by invitation, preparing briefs on mathematics education in Manitoba. A study of teacher education in mathematics, with the intention of presenting an interim recommendation to the Department of Education, is being carried out by the Council. The target date for the Council to complete its study is approximately two years.

Education of teachers at all levels in the concepts of new mathematics and in new methodology is a concern of the Department of Education and Manitoba Teachers' Society. A provincial coordination committee assists the ten regions of the province with their in-service education programs. Credit Summer courses are offered every year. In addition special short courses are planned continually as Saturday, Evening and/or Summer programs. The faculties of education offer carefully planned new mathematics programs and introduce new methodology. The general consensus in Manitoba is that more needs to be done in new mathematics education at all levels. This is particularly true with respect to new methodology.

MANITOBA AND SASKTACHEWAN

Points Arising from Questions

Responsibility for In-Service Education

In Manitoba, the teachers' training branch of the Department of Education receives recommendations from committees prior to and during the first year of new programs. The Manitoba Teachers' Society is taking more and more responsibility for in-service training; more regional planning, in cooperation with regional administrators, is to be foreseen. At present, costs are born locally; sometimes boards make contributions, sometimes teachers pay fees.

In Saskatchewan, the Department of Education does not take the initiative in in-service training. At the elementary level, this is left to local superintendents and teacher groups. In the larger centres, especially, several courses have been organized on this basis.

There is some difficulty being experienced at present in organizing in-service training for teachers of grades 7 and 8. This problem is being studied in Regina at the present moment.

At the secondary level, the Saskatchewan Teachers' Federation Mathematics Society has been very much involved for several years. It has sponsored one and two day workshops, and has arranged for ten week series of lectures to be given by university personnel. The chief superintendent of the Department of Education has cooperated in organizing these projects.

University Entrance Standards

The point was raised that mathematics programs are remarkably similar up to

the end of junior high school, then show great divergence. It was asked whether it was possible to imagine a university entrance mathematics program which would be valid across Canada.

Dr. Dulmage stressed the distinction between school leaving standards and university admission standards. School leaving standard was reached by passing, in the school, on a combination of term work and whatever examinations the school might set. The three Manitoba universities, he thought, were moving towards a more open policy, with readier acceptance of school leaving standard in approved courses; but there was debate as to which mathematics courses should be approved for this purpose, and some external exam would still be needed.

It was observed that the Canadian Mathematics Congress had been working, and continued to work, towards the definition of some minimum basic requirements. It was hoped that these, while sound enough for general adoption, would leave room for provinces to add their own extra features to avoid an unneccesary and undesirable uniformity.

It was pointed out that, even within one province, the trend to more open, more varied entrance requirements was creating problems. In effect, these allowed the student a degree of specialization which made it difficult for him to change his direction and the emphasis of his studies after entry into university. This was a problem that would have to be solved within the universities by the development of some means of re-orientation and transfer.

It was suggested that part of the difficulty arose from an excessive concentration on content. There would be no problem in student mobility if a completely rigid uniformity were imposed, but this was obviously undesirable. The ideal alternative was the creation of a genuinely free and ungraded learning situation - the recognition that what counted was not so much the mastery of a particular body of knowledge as the mastery of a mode of inquiry. Reform must lead to the change of the process, and above all to the transformation of teacher behaviour. The first revolution was in content; the second must be in methodology, so that mathematics became a process of exploration and discovery which was fun for the student.

In the meantime, there was some evidence that the more able students tended to benefit from variety, rather than suffering adverse effects from transfer from one system to another.

For the purposes of objective evaluation, which was an administrative necessity, the approach being pursued by SACU was that of seeking a set of common measures by which the quality of out-put of various systems could be assessed, rather than identification of the specific content of the courses completed.

ONTARIO

Introduction: Mr. G.A. Kaye,
Associate Superintendent of Curriculum,
Ontario Department of Education.

There has been a significant evolution in the operation of the curriculum section of the Ontario department in the last two or three years. This reflects the evolving philosophy that is apparent now in Ontario.

If we go back to the thirties, we find that the entire curriculum development operation in Ontario was the responsibility of two men (and also that the names of the two men were Watson and Holmes!). In those days it was a matter of two men telling every teacher in every school in the province exactly what they should teach on the 13th of November, and it took only two people to tell the whole province what to do. Now our staff consists of approximately forty assistant superintendents of curriculum, and it is taking all 40 of us and more to try and help all the teachers of the province to make up their own mind about what they should do.

Involved in this is a definition of curriculum which has been appearing in the literature I think more frequently in the last ten to fifteen years. It is something entirely different from the courses of study. This is my definition; and it is typical, I think, of the type of definition that is accepted by the staff of the Curriculum Section of the Ontario Department of Education. The curriculum is the totality of the experiences a child has in the environment of the school.

There are some very interesting implications in this definition. First of all there are no longer any "extra-curricular" activities in the school. Football games are part of the experience and school dances are part of the experience. Breaking the window at recess is part of the experience.

All this is "curricular" when we accept this broad type of definition of curriculum. The writing and preparation of courses of study is a very small part, as we see it, of our operation.

Two of the main aims of the curriculum section are to provide what we are calling horizontal and vertical integration of our school system. We cannot stand the chasm that has been between grade 8 and grade 9 in Ontario any longer. To produce an educational system from kindergarten to grade 13 is one of our main aims.

We are concerned also about the horizontal separation - the artificial barriers that stand between the various disciplines - and there has been a recent development in our section to take more positive steps towards providing horizontal integration. The section has been reorganized and the staff divided into four main groupings. The first grouping is generally called the humanities, the second the social sciences, and the third, general and applied science. The fourth has had a variety of names. It is sometimes referred to as aesthetics, or electives. We are using the word "general". We are attempting through this to provide more communication between the disciplines.

We feel very sincerely that the Department of Education has to move away from a directive role. We have to move out of the course of study business and adopt a leadership resource role. We want now as little as possible to be in a position where we tell people what to do. We want to be able to encourage them to initiate and experiment, and to show them that the resources of the Department are at their disposal. This is a real move in Ontario right now. We are calling it the decentralization of curriculum responsibility. It was tried once before, but it happened so suddenly (in 1951) that it didn't really catch on. I remember that as a young teacher, I was at a first committee meeting in September 1951: and I am still waiting for the second meeting to be called.

We hope that we are going on a little more intelligently this time in a slow relaxation of central control and a slow decentralization of curriculum responsibility.

This implies an acceptance of belief in a teacher in the classroom. As long as we put fences around teachers and say "Thou shalt not, thou shalt not" the teacher is not going to accept responsibility for curriculum development. And I maintain that there is no one but the teacher in the classroom who knows what the kids in that classroom should be doing, or knows how to help them best. And so as long as we insist on hedging the teacher with rules and regulations and courses of study and everything else, we are not going to progress in education.

It is going to take us a long time to establish this. We have to accept the teachers that are presently in the classroom; and some of them today, because they are products of the system that we have all come through, are not willing to accept this responsibility, so it has to be a slow relaxation of this control and a slow turnover of this responsibility.

We have somewhere in the vicinity of 35 to 40 curriculum committees of various types operating now. We do not have standing committees in Ontario. Each committee that is appointed has a specific objective - it may be the revision of an existing course of study, or it may be the preparation of a teaching guide. Or it may be what we call an advisory committee which is meeting to recommend solutions to a particular problem. The lifetime of these committees might vary from one meeting to two or three years. Each of them has a time objective associated with it.

There is a slight difference I think in the constitution of these committees. Any committee which is working directly with a present course of study or a curriculum guide will have a majority of classroom teachers among its members. In those committees which are working on courses in the university-bound stream, particularly the senior levels, there will be representation of the universities and the colleges of education. If we are dealing with our non-university bound people, there will be representation from the Institutes of Technology or Colleges of Applied Arts and Technology. In certain situations, we have representatives from business and industry. These committees come and go quite rapidly, and some of them do take a considerable time to do the job. You will have two or three of these committees described to you in a little detail by Mr. G.A. Scroggie and Mr. G.C. Bonham.

We have at the moment a multiple listing of textbooks in Ontario. We have an odd rule which causes some publishers trouble. We cannot in Ontario list books which are not by Canadian authors, Canadian produced. So you won't find American textbooks in use in the Province of Ontario. You may say that is simple, because Ontario has a market large enough to do this. And so we have. But we feel that this has been a good thing for teachers in all of Canada because it is providing authorship opportunities which would not exist if we did not have this rule in Ontario. The skills of Canadian authors have been developed because Canadian publishers know that they have a fairly good chance of sales in the Ontario market, and it is a considerable market.

But I want to see us get rid of this whole concept of textbooks. I don't think there is anything more limiting to the development of a curriculum than a single textbook concept. We are working right now towards an elimination of the textbook. We are encouraging publishers to publish booklets to segment the material for courses of study in a small handy type of pamphlet or booklet. But I think we must relegate the textbook to what I claim is its proper place as one - and only one - of a wide variety of aids to the teacher to develop a programme in his or her classroom. And for too long it has been the aid. For too long it has meant that we as teachers have not really accepted our responsibility.

We have a long way to go in this type of thinking in education, but I believe that it is a type of thing that must catch on if we are going to make progress and develop the type of education system we must.

As many of you know, we have just recently eliminated the last of the provincially set of examinations in Ontario. We now no longer have departmental examinations. This again i another necessary step if we are going to trust the judgement of teachers in the classroom. If we say to them "you are wide open to do as you wish - but at the end of grade 12 or 13 you have to have the kids ready for that examination", this controls the teaching and the curriculum right down through the grades. I am not suggesting that evaluation of student progress disappears. Not at all. I am not suggesting that examinations should disappear. But I think it should be the responsibility of the teacher to examine, to test, to evaluate what has gone on in that classroom for that student. I think that the student himself should have a greater part in the evaluation. I think that our evaluation procedures in education should be helping to instill self-evaluation in the pupil, rather than being something completely external to him which he tries to con and does so quite successfully. I maintain that all that our examinations have done and do at the moment is to find out if a student has learned how to con an examination; and his mark proves only one thing - that he has written an examination.

Now, a lot has been said about in-service training. I am going to make only a brief comment. Our department does accept some responsibility for assistance with in-service programs. I like to think of in-service training in two parts which I will call up-dating and up-grading. In the up-grading aspect, I include anything which would cause a change in certification of a teacher. Additional university courses, what have you, I believe this to be the responsibility of the universities and colleges of education and teachers' colleges. The up-dating aspect of it is the responsibility of the teacher, and our acceptance here is a matter of providing some financing, providing resource for those areas or municipalities which indicate a desire to have that assistance.

ONTARIO

Elementary Mathematics (K-6): Mr. J.R. McLean,
Assistant Superintendent of Curriculum,
Department of Education of Ontario.

I feel that most systems are much like dynosaurs. It takes a long time for a message from the brain to get the whole organism moving. I think this is true even in Ontario, where the elementary schools are responding at some speed to the message which has been transmitted with increasing urgency for more than fifty years. It is a simple message: that schools should be organized not for teachers to teach (which as you know grows into a solemn mechanical stage which we call administration) but for children to learn; and it has been voiced by the great leaders in western life over three thousand years.

I think that messages of this kind have been incorporated into curricula all over Ontario for at least the past thirty years, but for some reason or other, they have not been implemented with any particular success. If classrooms are to be learning centres rather than teaching centres, then provision must be made for learning, or doing, or more briefly, experiencing; and we have had several comments on this aspect already here during this conference.

In my opinion, this involves two rather substantial changes -- a much more flexible program, and a new role for the teacher.

In practice, the two cannot be separated. While groups of teachers and others can design a course of study, only the individual classroom teacher can make it work. Mr. Kaye referred to "a pile of courses of study". I would make one exception. You have a pile of courses of study and you have a curriculum guide. The curriculum guide of course is for kindergarten to grade 6 at this stage. It is significant, I think, that this program for the first time, has begun with children -

with the young children - and it will develop towards the adult, rather than having the adult determine the program for the young children. Flexibility of program, I think, is provided for in this interim revision of mathematics; and the word interim really refers to the fact that because of the present situation in Ontario, where we have a committee studying the aims and objectives of education, we felt it would be presumptuous to come out with a final program while they were still studying and deliberating about new curricula.

I feel that much of the impetus to this development has been given by teachers themselves, because of their discontent with the previous course of study. It has existed relatively unchanged for over 30 years, and while the philosophy of the 1937 course or program of study was excellent (and we have taken quotations from it and included them in our new program), the designers didn't have much faith in teachers. The first 30 pages of this course were full of beautiful philosophy, but at the back they listed "Arithmetic", and "Grade 1, October, November, December" and so on. These were "suggestions" mind you: but "suggestions" have a way of becoming regulations.

We have attempted to avoid this kind of thing - but I am not going to analyse in any detail the thinking or the preparation of this guide, since you have it and can read it for yourselves.

I would point out that this new program is for optional implementation. Any school system within the province has the choice of making use of it or staying with the old. It is in this way that we are operating -- on a broken front. If communities want help in adopting or making provision for this program, then the resources of the department are available to them.

Basically, the program is simply a broad framework within which teachers working alone or in groups, may develop a suitable program for children from age 5 to 11 or 12. We simply say "Here you have them at the age of 5: at the end of the seventh year at school (which would be equivalent to grade 6) you should be somewhere in this vicinity.

This acknowledges the unique responsibility of the individual teacher in identifying and meeting the needs of each of his pupils. For example, it states in this guide that no specific assignments of topics to grade levels is desirable. Now I think many traditionalists would recoil with horror from a statement like that. Mathematics has always been treated as a very orderly and sequential subject: but I think that recent experience has indicated that this is not as true as we tend to believe.

Mathematics should develop its concepts and its applications from real situations. No longer can our energies be directed to fitting each child into a stereotype curriculum with the omnipresent examination and threat of failure serving as the goad to more intensive efforts. The program must be tailored to the individual; and that natural instinct, curiosity must be carefully nurtured to a deep and abiding love of learning.

The new approach we are attempting is a licence for every teacher to perform as a professional and this means greater freedom and greater responsibility.

Certainly, when you are guided or controlled by slavish adherence to a text, or by a detailed prescriptive course of study, then you are really letting someone else do your teaching for you. And if we are truly going to deserve the label of professional, then we must feel, confident that we can take and adapt material to meet the needs of each and every child in the class. And of course, if we are really going to provide for individual differences and continuous progress, then we must inspire in teachers the confidence in their own ability to adapt and revise and develop programs that are more significant for the pupils in their class. I think that the new role of the teacher is not authoritative but inspirational.

With this sort of new approach to courses, to programs, the attempt to give the teacher more freedom, there is often a reaction away from it. Teachers are not accustomed to so much responsibility. They have traditionally worked in the context of set time-tables designed according to someone else's ideas.

I recall teachers telling me that they could only take ten minutes of a particular subject in the morning and ten in the afternoon, because the children got tired quickly and learning was not effective. So their daily program was separated into boxes 30 minutes long or 20 minutes long or even 10 minutes long. But children in their daily experiences don't stop and say "now I am talking, now I am walking, now I am doing this, doing that"; and the time-table is no better prepared, better qualified to make the best use of every minute.that the child is in school than the teacher herself is. This means, for instance that instead of having recess at 10:30 in the morning you may have a recess when you feel the children may need it.

However, as I said, if we are really going to provide a sound educational experience for the children then we must not transfer to the teacher, the anxiety we are trying to remove from the kids.

But certainly, the atmosphere in any classroom is due to the personality of the teacher. And when traditional patterns of organization and performance are being altered, teachers are really concerned about their own ability to perform their new role. I think they must be convinced of the value of the change to the pupil, but they also need to be assured of the full support of the principals, supervisors, trustees, parents and others.

Now in terms of the implementation, the department has provided opportunities for teachers to up-date themselves in the fourteen or so months since this program has been introduced. Over 4500 have voluntarily enrolled in summer or winter courses in elementary mathematics, and hundreds more have participated in other programs provided by the Ontario Institute for Studies in Education, the Ontario Mathematics Commission, the teachers' federations and others. Educational television has been of some help in getting teachers to start up-grading this new

environment of learning. Generally, the anxiety that has been generated in the teachers has perhaps triggered a positive response, in that they are anxious to equip themselves to develop this kind of program and atmosphere in the classroom.

And it is no good just telling teachers what to do and how to do it. I think perhaps our most successful in-service activity has been directed this past four months by Miss Edith Figgs, one of Her Majesty's Inspectors from Great Britain, and I think one of the most outstanding authorities in the world in assisting teachers to develop techniques that encourage learning. The structure of these workshops is I believe unique on this side of the Atlantic. Teachers, supervisors, principals, program consultants representing kindergarten to grade 13 work together for a period of six full days, six full school days.

Apparently, the boards of education are becoming more receptive to the idea that rapid changes are demanding too much of their teachers for them to update themselves on Saturdays, in the evenings and in summer courses. Of more than 100 boards of education that I have approached, 97 accepted the responsibility of providing supply teachers for the people that are taken from the classroom.

In these workshops, we try to bring together 80 to 100 people, divided up into groups, and they really learn by doing. They are put in a position that we hope they will create for the students in the classrooms. Imagine a large auditorium or gymnasium with 10, 11 or 12 tables with 8 or 10 people to each one. At every table there would be a representative from the primary division, which is grade 4-6, the intermediate and the senior division. Along with them are principals, program consultants and advisers in one stage or another.

In the first round, the first three days, we divide the program into day sessions with a six weeks interval in between, in which we visit the classrooms of some of the teachers who were at the workshop.

The first round is largely on presentation of methods. The second round is an attempt to reinforce and extend the mathematical background of the participants. For a change we have had people from south of the border looking to Canada for some assistance in programs of this kind. We had visitors from many of the states and we have had many requests to carry this program out south of the line.

I am going to say now briefly what we anticipate. This is the stage we are now entering. It would certainly be incorrect to suggest to you that if you visited any classroom in Ontario you would find children actively experiencing mathematics. There are areas that are moving ahead rapidly, and we are providing them with every assistance that we can. There are other areas that are not moving at all, and we don't go in and say "you must do this", but we wait for them to ask for assistance. As a result the broken front is becoming perhaps a little more exaggerated each week.

But nevertheless, even the areas that are quite content with maintaining the status quo are at least beginning to indicate some interest by sending representatives to workshops and summer courses.

We did keep the interim provision courses in separate booklets, but I think that as you read through the program we are suggesting, you will find that gradually the subject boundaries become blurred or blend. As a matter of fact, the workshop experience that we have just been engaged in could just as easily be labelled science as mathematics. And I would anticipate that eventually, at least in the kindergarten to 6 area (and I might emphasize that we do have a program for kindergarten) a child centered program will emerge in which the subject boundaries will blend or tend to disappear altogether. I would anticipate that before long we shall have groupings such as "communication" which might include mathematics, science and language, "social sciences", and so on. But there would be large blocks of time within which a teacher would be free to create this stimulating environment that enables the child to think for himself.

Very frequently, when we introduce new ideas, we subject them to some very critical analysis, but I suggest that we do not as a rule subject the traditional ideas or existing programs to the same kind of analysis. If we did, we might be more inclined to throw out some of the old as well as discard some ideas we might have for new approaches.

Of course, in evaluating any of these programs it becomes very difficult to decide what your objectives are. And once you have decided on your objectives, how do you measure them? We have heard reference to the lack or loss of computational skills (although I feel that this is not always the fault of the program as much as the slant the teacher has given it. Very often new topics, because they generate interest on the part of the students, are over emphasized.). But perhaps our assessment of the skills of the youngsters has not been really accurate. I think of a group of 10 year olds where the teacher had just completed a very carefully developed program of her lesson on area. They could answer all the questions in the textbook, and she seemed quite delighted. They had a nice display of maple leaves on the side wall. I picked up a maple leaf and I asked a little boy if he could tell me the area of this leaf. One little boy raised his hand and said "Sir, it has no area - it doesn't have any length or width".

Perhaps the new atmosphere is reflected in another little story. A group of 8 year olds and 9 year olds had experienced this approach for a while. The regular teacher had to be away for some time at a conference, and a supply teacher was assigned to the class. After two days she came to the office of the principal and said "these kids can't add or subtract". The principal was quite concerned about the tales that the supply teachers bring from school to school. He said "How do you know?" She said "I tested them". "What was the test?" "Well, here it is: in the textbook there are 27 addition

questions on this page, and 27 subtraction questions on this page. I gave them enough time and they didn't finish." The principal investigated in the classroom. He selected one of the more reliable students, and said "Bill, what happened to you - you only did seven addition questions?" The boy looked at him and said "Sir, I did the first seven additions. How many must I do to show her I can add?"

The transmission of the message referred to earlier has been given considerable emphasis by these developments in Ontario. The schools are responding in a positive way, and I feel the future is bright.

ONTARIO

Secondary Mathematics (7-13): Mr. G.A. Scroggie,
Assistant Superintendent of Curriculum,
Department of Education of Ontario.

Mr. Kaye, in his introductory remarks, has described the procedure by which curricula, or more precisely courses of study, have come into being in Ontario, i.e. the formation of curriculum committees to develop courses of study, and the subsequent development of textbooks, thanks to the fine cooperation of the publishing companies in Ontario. In my presentation, I shall deal specifically with the philosophy and the content of the courses which are now in use in Grades 7-13, and with the revisions which are expected in the near future.

I shall attempt to describe the philosophy which has pervaded, and is pervading, curriculum change in Ontario. Certainly part of this philosophy revolves about the desire to introduce into our courses some of the significant mathematical ideas which have crystallized in the last century or two; such as, an understanding of structure in number systems, and of the use of the vocabulary and unifying concepts of sets, in a natural way, to improve the precision in the statement of mathematical principles. More details of the actual content and the intent of our courses can be obtained from the courses of study which have been distributed to you earlier. Perhaps more significant in the evolving philosophy, however, is our desire to effect an improved understanding of the basic concepts of mathematics, coupled with an avoidance of certain routine procedures, which were common in the past, had very little logical meaning to the student - but which were used repeatedly by the student in situations about which he had little understanding. The emphasis is now on an understanding of a smaller core of basic principles, and the application of these principles to a wider range of applications.

The revised courses essentially endorse the integrated, or spiral, development of topics, in which mathematical concepts are first introduced by an "experience approach" in the early grades, ideally through practical or concrete situations.

The initial goal is to form a foundation for an increasing study in depth in later years. In this way, the same principles are revisited over and over again, each time broadening and deepening the students understanding of them. To put it another way, we no longer have courses in Ontario in which the student studies only algebra for an entire year, or Euclidean Geometry, etc. - instead our courses now attempt to draw together many aspects of mathematics into one year, and to bind these wherever possible with the common threads which weave throughout them.

As of today, there are three levels of courses offered in Ontario:

the 5-year program, leading toward admission to university, with approximately 45% of the students in this program.

the 4-year program, which does not prepare students for university - but does prepare the student for entrance to C.A.A.T.'s (with some restrictions) and many other post-secondary institutions. Approximately 35% of our students are in this program.

the 2-year program, or terminal program.

In each of the five-year and four-year programs, three branches exist: Arts and Science; Business and Commerce; and Science, Technology. We are tending to move toward eliminating the boundaries between these branches, and between the five- and four-year programs; i.e. to introduce more flexibility into the individuals right to select courses to meet his particular needs - for example, it would seem to me to be more reasonable, if a prospective engineer, now in the 5-year Arts and Science program, could choose an option or options now offered only in the 5-year Science, Technology, and Trades Branch, and could choose, say a course in English now offered at say the four-year level.

I would now like to discuss briefly the courses in the 5-year program - (projectual). Curriculum change is continual, we are now in the midst of the second phase of revisions.

Let us back track, and examine the evolution of phase 1. In 1963, permission was given to the schools by the Department of Education to teach new material in Grade 9 - there was no official course published at that time, but at least two textbooks were available based on material similar to that in an experimental course developed earlier by the Ontario Mathematics Commission. The following year permission was given to teach new material, found in three Grade 10 texts, using the new approach. In this same year, 1964 new courses were simultaneously introduced in Grade 11 (S.12A) and Grade 7 (I.12A) - the Grade 11 for compulsory introduction, and the Grade 7 for optional introduction.

Let us examine briefly the content of S.12A, S.12B, S.12C, all developed by the Senior Mathematics Committee (projectuals on the screen).

The I.12A course in Grade 7 is the beginning of phase 2 of the revisions, and is followed by I.12B, C, D. These courses were developed by the Intermediate Mathematics Committee. Note that these courses were introduced first on an optional basis, and that compulsory introduction was delayed by two years. Revision work is now under way in Grades 11 and 12 leading toward a full implementation of S.12C in Grade 13.

I have here a summary of the content of these courses, (projectuals). Work is now under way for a minor rewrite of I.12A and I.12B, based upon opinions expressed on these courses in a survey of the teachers of the Province.

It should be obvious that, when phase 2 is completed, we must once more consider the revisions necessary sequential to the implementation of PI, JI, and the ungradedness and individual student progress inherent in it.

Let us now examine revised courses in the 4-year program. There are revised courses now published for Grade 9, and Grade 10. The Grade 9 course is common to all three branches, whereas the Grade 10 course involves five core topics for all branches, supplemented by two optional topics from a list of seven.

The optional topics offer the opportunity for specialization in topics of particular interest to the students. The new courses being planned for Grades 11 and 12 have a smaller core, with a much wider choice of options, and will enable the individual teacher to tailor for his classes a custom made garment.

In the 2-year program, no courses of study are published - the needs of these students are varied, and are best met by the local development of individual curriculum which will differ from class to class, and year to year.

The future at all levels would seem to indicate a growing freedom at the local level in the interpretation of the courses of study. This freedom to vary and adapt the course to best suit the needs of the students is being encouraged by the Department of Education.

ONTARIO

Computer Use: Mr. G.C. Bonham,
Assistant Superintendent of Curriculum,
Department of Education of Ontario.

Curriculum has become involved with the electronic computer in two separate subject areas as of the present time. A course of study has evolved, in the Business and Commerce branch, that introduces the student to data processing through a study of manual, electromechanical and finally electronic means. The student is also introduced to commercial programming and to systems analysis, either of which represents a potential career for him if he chooses to follow up these introductory courses with further study.

The second subject area, which is more pertinent this morning, is mathematics. Computer studies in the mathematics and science disciplines have been tagged with the name Cumputer Science in order that they may be distinguished from the commercially-oriented term, Data Processing. It is Computer Science that I would like to discuss with you today.

In the fall of 1965 a Computer Science Study Committee was formed which consists of people competent in the field of Computer Science. Members of this committee have been drawn from universities, business and other educational institutions. Under their guidance an experimental program in Computer Science was first introduced at the Grade 12 level in the fall term of 1966. Fourteen schools across the province participated in the experiment and the teachers involved have been most cooperative in supplying the kind of feedback necessary to evaluate an experiment of this kind.

Largely because of the experiences of the teachers involved in the experiment last year, it was decided to expand the program this year to Grades 11 and 12. In

addition, a large expansion in the number of participating schools also occurred -- from fourteen to thirty-six.

The material being used by all the participating schools as a guide in the program is called "Algorithms, Computation and Mathematics," prepared by the School Mathematics Study Group. The National Science Foundation provided substantial funds for the support of the endeavour.

To give you some idea of the intent of the SMSG, I would like to quote from the preface to the student edition:

"An introduction to computer science is much more than a quick "how to do it" on the use of computers. Among other things, it is based on and is an extension of the mathematics you now know. Developing an understanding of the relationship between mathematics, computers and problem solving is the main objective of this book".

As visualized by the committee, a course in Computer Science is not to be regarded as a course in computer programming. Instead the emphasis should be on the study of algorithms. An algorithm must be an unambiguous sequence of instructions that carry out a process in a finite number of steps. Herein lies the value of a computer. The computer cannot tolerate ambiguities; it cannot be told, for example, to "either add or subtract." Instead it must be told -- "if specific, detailed conditions are satisfied, then add; if these specific conditions are not met, then subtract." Consequently the computer is an ideal device for proving the validity of an algorithm, and of course computer programming is necessary to enable the student to communicate with the machine.

Part of the preface to the SMSG material that I quoted said that computer science is based on and is an extension of the mathematics that the student now knows and that the objective of the material was to develop an understanding between mathematics, computers and problem solving. At the last meeting of the study committee, several members expressed the opinion that computer science problems should not be only mathematics problems. Instead, the material should be expanded to include physics and chemistry problems and perhaps business problems such as producing a cash flow report. Queuing problems and simulation studies were also suggested as being ideally suited to an algorithmic approach. As a result of this discussion the committee is endeavouring to compile as many varied problems as possible in order to supplement the SMSG material. These problems will be compiled, edited and distributed to all the teachers participating in the experiment.

Unfortunately, it has not been all "peaches and cream" in the implementation of the computer science experiment. Teachers have had difficulties with "turn-around" time which is the interval from completion of the problem by the student to the time when he gets back either his results or his list of errors. Ideally, turn-around time should be very small, even instantaneous, but in some cases students have had to wait up to three weeks for results. This is highly

undesirable since interest and initiative can be quickly killed by such a situation. Anyone considering the teaching of computer science should make sure that a computing facility of some kind is at his disposal and that the facility can provide a turn-around time that is realistic. One day is fine, but anything longer than three or four days will certainly discourage and frustrate the students.

To give you an idea of how the program is being received by the students, I would like to quote some comments made by the teachers involved in the experiment. One teacher reports -- "It was the students' opinion that the problem-solving techniques used in the computer course definitely increased their problem solving ability in other fields. The course taught them to be very precise in formulating the solution to a problem, and to consider and check out all possibilities."

Another says, "The students seemed to enjoy the course, and six (out of nine) of them have indicated a desire to study further in this field. They seemed to feel the course should be continued, even with the present administrative problems". (He was referring to a long turn-around time.)

"The students were very interested and actually had fun." (It is interesting to note the use of the word "actually" -- it implies surprise that the student can have fun while learning.)

"The course proved helpful in regular Mathematics classes."

"Students were highly motivated." (We wonder how much the novelty of the computer contributes to the high motivation. It will be interesting to find out if the motivation still exists after the novelty wears off. Hopefully it will.)

"Out of the 20 students that completed the course, 19 indicated they would gladly take it again and 15 desired further courses in the subject."

I think these reactions speak for themselves as to the success of the experimental program. As mentioned before, the experiment is being continued this year and we are very interested in receiving further reports from teachers. The Computer Science Study Committee will continue to meet during the year with their objectives being twofold:

- first, to assist the teachers in any way they can. For example, supplying supplementary problems, providing bibliographies, assisting in an interchange of ideas, and so on.

- second, to arrive at a recommendation for the Superintendent of Curriculum as to the advisability of establishing a Computer Science Curriculum committee.

I have personally become extremely interested in the experimental program and I

am very optimistic about its outcome. In my opinion, and in the opinion of many others, computer education is a necessary part of a student's education because of the high probability of encountering a computer outside of school life. If nothing else, he should learn that the computer is not all-powerful, nor is it an intelligence. It has no mystic or magical power. It is merely a device or a tool for us to use. Granted, a computer is a tool that operates quickly and accurately but it cannot function unless directed by man, just as a hammer cannot drive a nail by itself.

A computer is not an electronic "brain". It has no "memory", merely devices that can be magnetized in a way that represents information.

A computer has no judgement. It can make no decisions except to choose one of two alternatives presented to it. Even the most complicated logic must be broken down into yes-no situations or the computer simply cannot handle it.

A computer has no discrimination. It will add apples to oranges without hesitation and do it incredibly fast. The old axiom of GIGO (Garbage-In - Garbage-Out) has always held for computers even from the very first machine. The only change that has occurred is that the computers of today can process garbage much faster than the computers of yesterday.

Computer Science has shown that it can improve the problem-solving ability of the student. But even if it doesn't and instead only removes some of the awe and fear of the computer, then it has, in fact, accomplished a great deal.

ONTARIO

Curriculum change -- influences outside the Department of Education:

Mr. A.W. Harris,
Professor of Mathematics Education,
Althouse College of Education,
(University of Western Ontario).

I want to say a word or two about the history of curriculum change in Ontario since 1958, as far as it has been effected by groups outside the department of education.

This presentation should be really given by the President, Mr. Lloyd D. Auckland, of the Ontario Association of Teachers of Mathematics, as OATM has had a significant role in the history of curriculum form in the past in Ontario.

Mr. Kaye has already mentioned that the Ontario Association of Teachers of Mathematics is not affiliated with the Ontario Teachers' Federation. The Ontario Association of Mathematics Teachers, in fact, pre-dates the formation of the teachers' federation. It goes back to the Ontario Educational Association, which held its centennial in 1960. The OAMT itself observed its 70th anniversary in 1962. I thought you might be interested in one or two quotations from a booklet published to mark the former event.

In 1873, Thomas Kirkland, Science Master at the normal school and later as principal, spoke on Euclid as a textbook. It had been largely abandoned, he said, in Europe and the United States but was still retained in England and Canada. Subsequent discussion on the topic was more for retention than for abandonment. (That was long before the association of teachers of mathematics was formed.)

In 1891 there were preliminary meetings to consider the formation of an association of teachers of mathematics. On April 21, 1892 the first meeting of the Mathematical and Physics Association of Ontario was held. There were 37 members.

At the meeting of the Association in 1895, Mr. McDougall, Principal of the Ottawa Collegiate, noted a certain decline in interest in mathematics, including arithmetic, in public schools. "There is a growing tendency" he declared," to introduce the Yankee idea of getting over difficulties by leaving them out." And more of the same..

In 1900 we find a study of Euclid. This seems to have been a recurring thing. In 1904, a recommended syllabus was sent to the Department of Education, in which current thinking was reflected. The first part of the syllabus for the lower school would be practical geometry. In the middle school students would start with formal deductive geometry, and there was the recommendation that analytical geometry be put in the upper school.

In 1922, at the annual meeting, there was a paper on Einstein's theory of relativity. In 1925, there was another resolution to the Department of Education suggesting changes in the courses of study. In 1931, the President of the Association gave a paper on the desirability of having calculus in the upper schools. This was followed up by references in the meetings up to 1936.

In 1946, we come into the modern era. Robert Rouke addressed the meeting on the significance of the Canadian Mathematical Congress for secondary school mathematics. In 1953, there is an interesting paper called "A new Canadian's impressions of secondary school training in Ontario". In 1958, Professor Tucker, a native of Toronto, was at Princeton University and a member of the College Entrance Examination Board, and his talk was "Why Sets?" So those minutes in a way reflect the growth of mathematical reform in Ontario.

The OATM now has 700 members. Its annual convention is usually a stimulating affair. The influence of the Association on curriculum innovation has always been great. However, its effectiveness has been limited both by the lack of funds to carry on any thorough trial of materials and by the lack of diversity in the programs. Of course, by listening to the speakers, you will see that there has been much improvement in recent years in this regard.

With regard to the Ontario Teachers' Federation, my experience with influence on curriculum reform dates back to the immediate post-war years. I thought then that the secondary affiliate, the OSSTF, was mainly concerned with salaries and working conditions, and that committees on mathematics didn't particularly influence the department's thinking. In recent years, however, the category salary system established by OSSTF has done much to stimulate the up-grading of secondary school mathematics teachers. The University of Waterloo deserves a lot of credit for the part it has played in providing summer programs for teachers wishing to qualify for specialist certificates.

The universities in Ontario have always been very active in curriculum reform. For example, the meetings of the OATM were held at the Ontario College of Education, at the University of Toronto, for many years, and the professors of

OCE have always played a leading role in promoting reforms.

In 1958, the Association for Curriculum Development was formed. It has annual meetings and usually has sessions on mathematics. This body was sponsored by the Ontario Teachers' Federation.

In 1959, an organization called the Mathematics Commission of the Ontario Teachers' Federation was set up and held a conference at Lakefield, Ontario at which I was present. Mainly we studied the recommendations of the college entrance examination board. Out of this grew an agreement to write material for trial in the grade 9 of 1959-60 (Mr. Scroggie has referred to these trials). The following year in order to broaden its base and improve its prospects of getting funds, it was decided to call this body the Ontario Mathematics Commission. It had a founding meeting in August of 1960, and set up a constitution.

Now the Ontario Mathematics Commission is an independent body of about 70 members appointed by sponsoring organizations - universities, colleges of education, teachers at all levels appointed by OTF, the department of education and other interested bodies like, for example, the Ontario Association of Teachers of Mathematics.

The OMC developed curriculum proposals from grades 9 to 13 and submitted them to the Department of Education. It got permission from the department to try out the materials in grades 9 to 12. I think these trials helped the Department of Education to decide what direction to move in. A significant step was the listing of the experimental textbooks in a circular of the Department in the fall of 1962 for grade 9, and in 1963 for grade 10, and in the spread of their use through the school systems.

In 1962 when the Department of Education set up its curriculum committees to make some of these things official, it was significant that they turned to such people as Professor Elliott, a member of the executive at that time and later the President of the Math Commission. I can't say too much about Dr. Elliott's contribution to curriculum reform in Ontario. It has been simply magnificent.

It is plain then, that the Ontario Mathematics Commission has had a significant influence on the things that were going on.

It is very significant that the Department and educators and teachers have accepted the principle that curriculum innovation is continuous. I feel that the Mathematics Commission has had a very strong influence on these changes, although I would stress that when a curriculum committee was set up by the Department of Education it took an independent line - it did not slavishly adopt everything that the Math Commission threw at it. It simply used this as a starting point, in many cases, for its discussions.

In recent years, particularly when the Mathematics Commission became interested in developments for the elementary schools, it looked for new sources of funds and set up an interesting relationship. The Ontario Mathematics Commission approached an organization called the Ontario Curriculum Institute for working agreements to instigate some trials of mathematical materials. This resulted in some fine reports and had influence, I believe, on developments in the setting up of departmental curricula.

The Ontario Curriculum Institute was an independent body that got its funds from foundations; but in November 1965 it was absorbed by the newly formed Ontario Institute for Studies in Education, a body set up by the Department of Education. The Ontario Institute for Studies in Education is a research institute with graduate programs in education; but it has a particularly interesting office called the Office of Development, under Dr. K.F. Prueter to whom you should write if you want copies of materials produced. The Ontario Mathematics Commission has been accepted into partnership with the Office of Development in connection with the sponsoring of trials of materials and other experimentation affecting mathematics.

An advisory committee of the Institute was set up, with members of the Executive of the Math Commission on it, and also a member from the Department of Education. The Department's role in this, as I understand it, is to encourage the Institute for Studies in Education to do pilot projects which can then be taken over by the Department's curriculum section for development when the time is appropriate.

Roughly the way it works now is that the teacher committees on the Ontario Mathematics Commission get together and think up ideas for areas to be explored through their Advisory Committee with the Institute for Studies in Education. They recommend to the Institute that they spend some money in this area, and the Institute looks to this advisory committee for advice. The result of this has been the writing of some very fine reports. I don't like to single out one report, but I think that the report on geometry from K to 13 is especially timely and significant. This is a two dollar item you can get from the Institute for Studies in Education.

Essentially, the Ontario Mathematics Commission is a small deliberative body that is committed, not to any social goal, but to the stimulation of innovation and improvement in the teaching of mathematics.

It has a grass roots concept because of the representation of practising teachers. The observation has been made that the Mathematics Commission can afford to be wrong about things where perhaps the government can't; and we hope that even if we continue to make mistakes we shall help to show others the right direction in which to go.

A word or two now about teacher education as involved in curriculum change. There are the two phases of this, of course, pre-service and in-service. Mr. Kaye has mentioned the problems of in-service training. It is difficult to talk about

pre-service teacher education in Ontario at the moment because the situation is likely to change very shortly. It would seem to me probable that there will be at least partial integration of elementary and secondary school teacher training, with the eventual bringing of the teachers' colleges into the universities. There has already been announced the intention of eventually requiring a degree for all teaching at all levels.

With regard to curriculum change in Ontario, I think it has been very difficult for the elementary teachers' colleges to play a leading role in curriculum reform. They had a very high pupil-teacher ratio for one thing, and over the years their budget has been somewhat limited. I don't think their role at the start, when these changes began back in the 50's, was a very significant one. I believe there was an important part played by the Ontario College of Education in Toronto through experimentation with new ideas at the University of Toronto Schools, where they do laboratory teaching of various kinds.

In the later phases the teachers' college masters have been playing a very strong role in assisting in the implementation of these new ideas for the kindergarten to grade 6 stage.

I don't propose to take time to tell you what we do in our pre-service training at the secondary level: but our secondary school teachers are being made very much aware of new methods.

I believe that the in-service training of teachers is the really critical problem, and it is a tremendous problem. Last year the Mathematics Commission did a sampling of the K to 6 teachers to determine the extent to which they really had been involved in a first hand contact with some kind of in-service training that would prepare them for the new program. It was discouraging to find what a small percentage really had had effective in-service training, in spite of the fact that everybody that is involved with this is working their heads off to achieve it. I'm sure that if you examine the situation in your own province honestly and frankly you will find that it is much the same.

In-service training is something like trying to change a flat tire without stopping the car. I don't know how you can solve some of these problems. I wonder if CAMT is looking for something to get its teeth into. It might find a useful role in trying to convince the departments of education of the need to put money into in-service work, and in persuading bodies introducing changes to accept some responsibility for in-service training. Secondly, it might try to convince the people concerned that much more of it should be done in school time. I think we all agree that Saturdays, weekends, and summer should not all be pre-empted for self-improvement.

If the regional in-service training centres are as good as they claim they are in Japan and Britain, we might press for regional in-service training centres.

I don't know whether you have read about one aspect of Russian experience with in-service training, due to de-stalinization when the Russian biologist who favoured environment over heredity, writing his theories to fit the party line, fell from favour during the de-stalinizing process, they ceased teaching biology in the schools of Russia for one year so that they could re-write all the textbooks. This problem of in-service training is such a fantastic one I wonder sometimes if maybe we should do the same thing.

APPENDIX A

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APPENDIX B

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