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Canada

BRITISH COLUMBIA SECONDARY MATHEMATICS CURRICULUM: 1876 TO 1990

by

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B.Sc., University of Edinburgh, 1964

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THE BRITISH COLUMBIA SECONDARY MATHEMATICS CURRICULUM: 1876 TO 1990

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ABSTRACT

The purpose of this study was to examine the Secondary Mathematics curriculum as followed in the Public Schools of British Columbia from 1876 to 1990 with a view to identifying the underlying reasons for what is currently taught. Since the curriculum is the product of the society in which it is found, an historical approach was taken. The history of the development of the public schools was examined together with educational and social changes occurring during this time.

The prescribed mathematics curricula were examined in parallel with the development of the high schools. The courses of study prescribed by the Ministry of Education were examined along with the Annual Reports of the Public Schools. Histories of British Columbia and of education in the province were studied and important themes identified. Newspapers and teacher magazines were consulted and teachers interviewed to document what the climate of opinion was when change occurred.

It appears that while the format of the curriculum guides has changed over the years, little change has occurred in content at the high school level. The reasons for this are that universities control the content, at least indirectly; that secondary mathematics teachers are by nature conservative; that the subject matter is perceived as being of an abstract nature; that mathematics is assumed to be an unchanging and rigid body of knowledge. Rarely are students encouraged to be mathematicians. The development of the curriculum is cyclical in nature with swings towards making it relevant and then back to drill and practice. The underlying theme is one of timelessness in mathematics.

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CHAPTER ONE

INTRODUCTION

Background

Much concern has been expressed in the media concerning the perceived lack of ability of high school graduates in mathematical operations: "Many Canadians flunk simple math" ("Many Canadians," 1990). It is expected that students who have spent twelve years in an educational environment will possess the basic minimum of skills in both mathematics and English to operate in today's society and yet the Statistics Canada survey discussed in the Vancouver Sun indicates that this is not necessarily so.

For people entering the twenty-first century, mathematical literacy is as important as language literacy. Secada (1990), in discussing the changing social and economic order states:

> The level of mathematical literacy needed to participate fully in that world, its jobs, its economic and social orders, and its democratic institutions is steadily increasing. New jobs will primarily be in the service sectors of the economy. The fastest growing job areas require highly skilled workers: natural scientists, lawyers, engineers, managers teachers technicians. (p. 137)

Secada goes on to quote from Norton Grubb that the:

> variety and complexity of scientific issues in the political realm will surely increase, [hence] the prerequisites for informed *citizenship* now includes the basics of math and science. (p. 138)

Yet students do not see the relevance of mathematics. Coleman (1962) says:

> The traditional approach to high school mathematics leaves the average student (and teacher!) with the feeling that it is a bag of unrelated tricks constituting a fascinating game but with no over-all understanding of what mathematics is or why it is important. (p. 358)

Coleman also states:

> the courses in mathematics in Ontario have not changed in any significant fashion in the past thirty years. Indeed it would be no exaggeration to say that nothing is taught in the high school curriculum anywhere in Canada that was not known in 1800. (p.358)

Historically schools have been used as a means of transmitting the cultural values of a society to their young and to train them to fulfill their rightful plac. in that society. Schools are a reflection of the perceived needs of society and the needs of the students. The National Council of Teachers of Mathematics (NCTM) states:

> All industrialized countries have experienced a shift from an industrial to an information society, a shift that has transformed both the aspects of mathematics that need to be transmitted to students and the concepts and procedures they must master if they are to be self-fulfilled, productive citizens in the next century. (NCTM, 1989, p. 3)

It enumerates four new social goals for education: i) mathematically literate workers, ii) lifelong learning, iii) opportunity for all, and iv) an informed electorate. These goals imply that there is in existence a school system organized to serve these purposes.

To what extent do the public schools of British Columbia, and in particular the mathematics curriculum of British Columbia high schools, exemplify these goals? To understand what is taught it is also necessary to understand why the topics have been chosen and so deemed important for the development of mathematically literate citizens.

Any curriculum is a product of the society in which it is taught, the society which preceded it and the society which will succeed it. A measure of its success is

the extent to which it imparts concepts which will continue to provide a base for life-long learning and will allow a flexibility and adaptability to new situations.

The size of the undertaking for the schools today is a much larger one than that of one hundred years ago. The total enrolment in Victoria High School in the opening year was 60 students. By the school year 1987-1988 the number of high school pupils in B.C. had increased to just over 200 000 (Statistics Canada, 1988). The society being served has also changed from one which was mostly agrarian, mercantile (Hudson's Bay Company), and non-industrial, to one now which is highly industrialized and moving into a post-industrial society where information and technology are the predominant driving forces.

At no time is it possible to separate the various parts of the historical puzzle and say definitively that thus and so caused this change. However, by examining what was occurring in the society, it is possible to identify economic, political, social and educational forces acting at that time, and to determine if the conjunction of events was favourable to change or no change in the schools.

Over the century, the concept of education has changed from an essentially elitist one for the rich to a democratic one which says that education should be available to all. In 1925, the Survey of the School System by Dr. J.H. Putman and Dr. G.M. Weir said that high schools in the province were lacking in appeal because they had a narrow and rigid curriculum:

> Outside a few large centres where type of school, and number of teachers and number of students make some differentiation of courses possible, these schools are meeting the genuine or fancied needs of at most two classes of students -- those who expect to enter a university and those who wish to teach.

> In the natural order of things these two classes put together form an insignificant proportion of the total number of pupils in high schools. (p. 112)

In 1990, the Graduation Program Response Draft suggests certain goals for graduating students:

> At the same time, it should prepare students for the immediate challenge they will take on following graduation, whether it be further education, employment or some other experience. This preparation involves helping students attain specified levels of knowledge, skill and attitude development. In essence, education at the Graduation level must balance the needs of individual students to achieve their own goals with society's need to have graduation represent a meaningful level of educational qualification. (Ministry of Education, 1990, p. 15)

In 65 years, not much seems to have changed as both seem to be stating that schools have to serve the needs of more people than the strictly academic students who will be going on to further formal education.

There is a real question as to the extent the mathematics program as taught in the public high schools of British Columbia meets the need to prepare students for the challenge they will meet after graduation. In order to determine answers to this question the actual curriculum and its development must be studied.

Purpose of the Study

This thesis will document the historical development of the mathematics curriculum in public high schools from 1876 to 1990 with particular regard to the topics the department of education required to be studied. It will also examine the political, economic, pedagogical and social influences on the development of the curriculum. Finally it will, in the light of what is uncovered, identify trends or conjunction of events which occur.

Several studies of the curriculum have been pursued over the years. Particular acknowledgement must be made to G.H.E. Green's Ph.D. thesis for the University of Toronto (1944), G.A.V. Thomson's M.A. thesis for the University of Victoria (1972) and also D.L. MacLaurin's Ph.D. thesis for the University of Washington (1936) which has a chapter on the general outline of curriculum development in British Columbia. Taken together these documents provided excellent summaries of the secondary curricula in British Columbia.

Reference will also be made to the major reports on education produced in the past century: the Survey of the School System (1925), the Report of the Royal Commission on Education chaired by S.N.F. Chant (1960) and the Report of the Royal Commission on Education chaired by Barry M. Sullivan (1988). Other sources will consist of the documents of the Department of Education (or Ministry of Education) such as the Courses of Study, Programmes of Study, curriculum guides, and the annual reports of the public schools of British Columbia; articles written by teachers at the time of changes stating their point of view; newspaper reports; and histories of education. A final source is interviews carried out with teachers who taught at times of significant change.

Structure of the Thesis

Chapters Two and Three of the thesis discuss the history of secondary education in the province from 1872 until 1960 together with significant movements occurring at the time. In the Chapters Four, Five and Six, the early developments of the mathematics curriculum in British Columbia are examined and they are tied in

with the educational climate in the province in the 1930s. In Chapters Seven and Eight, both the history of the growth of the educational system and the actual mathematics curriculum are examined. In Chapter Nine, trends are identified and conclusions are drawn regarding the mathematics curriculum.

CHAPTER TWO

History of Secondary Education in British Columbia: 1876 to 1900

The history of education in British Columbia follows quite clearly the development of the settlement of what is now the province of British Columbia. Although the existence of what is now called British Columbia had been known from the late eighteenth century, when the Spaniards discovered British Columbia, until 1849 it was controlled by the Hudson's Bay Company (Begg, 1894, p. 111). Immigrants travelling from England to Vancouver Island did so in the supply ships of the Hudson's Bay Company (Ormsby, 1971, p. 111).

In 1849, Vancouver Island was known as the Crown Colony of Vancouver Island and what today is known as the mainland of British Columbia, was termed New Caledonia. New Caledonia remained totally under the control of the Hudson's Bay Company until 1858, at which time it became known as the Crown Colony of British Columbia. In 1866 the two crown colonies of Vancouver Island and British Columbia united under the name of the Crown Colony of British Columbia. This it remained until 1871 when the colony joined the Dominion of Canada and was known from then on as the Province of British Columbia.

The First High Schools

The education system in British Columbia developed differently from that elsewhere in Canada primarily because of its geography and the social prejudices of the original settlers. The original settlers at the Hudson's Bay Company's Fort Victoria, established in 1843, brought with them and retained a British lifestyle which included a fairly rigid class structure.

> The overriding aim of education in the British outpost, as in Britain itself, was to maintain an existing social order. (Barman, 1984, p.5)

The schools operated by the Hudson's Bay Company were influenced by both the English and the Scottish education cultures. In the latter tradition, all students could attend the same local school despite social distinctions; in the former tradition the children of the poor attended simple charity schools while the children of the rich had a variety of schools from which to choose, provided always they could afford the fees. In Fort Victoria the children of the Hudson's Bay employees attended the school but were given only rudimentary literacy training while the children of the company officers were given a much more extensive education as was fitting for their class. They were in effect being trained for their rightful place as leaders of the next generation (Barman, 1984, p. 5).

In 1852 the first colonial school opened to the children of settlers was begun under the direction of Charles Baillie. A second school was opened in 1853 in Nanaimo, a coal-mining settlement, while a third was opened in 1855 at Craigflower on the outskirts of Victoria. These schools were subsidized by a government grant towards the schoolmaster's salary. In addition the government provided a

schoolhouse, a teacherage and garden. These schools were co-educational and fee-paying.

It was not until the passage in 1865 of the Free School Act that a centralized system of free schools financed entirely by the Colonial Government and operated by a new General Board of Education appointed by the Government was established (Johnson, 1968, p. 64). In fact parents had to pay six shillings a month per child towards the teacher's salary. Within a year, six of the eleven schools had closed through lack of funds (Department of Education, 1872b, p. 2). Meanwhile a debate was ensuing over the value of free education. Significantly the more vocal members against free schooling were members of the upper-class one of whom, Frederick Seymour, referring to himself in the third person, said:

> He thinks that any man who respects himself would not desire to have his children instructed without some pecuniary sacrifice on his part ...else it may happen that the promising mechanic may be marred, and the country overburdened with half-educated politicians or needy hangers-on of the Government. (Barman, 1986, p. 250)

On the mainland, several mission schools were established by the Church of England, the Methodists and the Roman Catholic Oblate fathers. Schools were established at Fort Simpson, Sapperton, Yale, Port Douglas on Harrison Lake and at Mission. The necessity of these schools was brought about by the discovery of gold in the Fraser sandbars in 1857. The mainland population grew to somewhere in the region of twenty thousand. By 1866 the mining explosion had abated leaving behind a serious recession. This recession had been a contributing factor to the failure of the Free Schools on Vancouver Island. By 1869 enough public pressure had been

brought to bear on the Legislature that the Common School Ordinance was passed. While this did not provide free schooling it did establish public education in British Columbia on a firmer footing, and it provided $500 a year for each teacher's salary. The Crown Colony of British Columbia was divided into ten regions or school districts. The education system was greatly centralized with control in the hands of the Governor-in-Council which could create or remove school districts, appoint teachers and establish the rules of operation. In theory, local boards were to be elected -- in New Westminster and Victoria this authority was given to the municipal councils. Parents still had to pay towards the education of their children and so the ordinance was not successful in providing universal education. The Inspector-General's Report (Department of Education, 1871) stated that about one-fifth of the children in the Province were in fact receiving some education and that the schools were distributed ten on Vancouver Island, ten on the mainland and one on Saltspring Island.

The next fourteen years saw a maturation of the education system in British Columbia. Barman (1986), in discussing the education system in British Columbia, feels that British Columbia remained separate from the rest of Canada until the completion of the railway. All changes which came into the Province from elsewhere were worked through and modified to suit the particular social and economic circumstances and priorities of the province. In this she is at odds with Johnson (1971) who feels that the changes were better explained by the larger political shift caused by British Columbia becoming a province of the Dominion.

In the period from 1872 through 1886, the strong feelings of the settlers in the province for free, universal, non-sectarian education were acted on. Barman states:

> Not only were its central premises firmly entrenched, but attempts by major denominational groups to secure special treatment were repulsed. As well the role to be accorded to non-public schools was defined. The consequence was an educational consensus so well suited to British Columbia that it would endure virtually unaltered for almost a century. (Barman, 1986, p.242)

In the 1872 Act, schools were to be free, non-sectarian and open to all children aged six to thirteen. A Board of Education of six members was appointed by the Lieutenant-Governor in Council and the schools were to be managed by a Superintendent of Education. In 1876 a clause was added to the act stating that all children from age seven to twelve were to attend school for at least six months in the year. Up to this point, there had been no move on the part of the Government to provide any education other than an elementary school level education in basic matters. Governor James Douglas had said in 1852 that colonial schools for the labouring and poorer classes should provide moral and religious training and a good sound English education (Johnson, 1968, p. 62). Any more advanced education was to be provided by the denominational or private institutions. In 1872 there were fewer than 20 of these in the province providing education for around 500 students (Department of Education 1872, p. 31). The Board of Education was given the authority:

> to establish a High School in any district where they may deem it expedient so to do, wherein the classics, mathematics, and higher branches of Education shall be taught, and such schools shall be Public Schools generally (Department of Education, 1872 (a), p. 13)

By 1874, the Board of Education which until then had been setting out the rules and regulations for the government of public schools, the rules for the examination of public school teachers and the issuance of certificates of qualification, advocated the establishing of high schools:

> The question of High Schools is one that ought not to be left any longer in abeyance. Boys and girls in many parts of the Province are getting ahead of the public school curriculum... Provision should be made, whereby those who are desirous of prosecuting their studies further, can have the privilege of doing so without being obliged to leave the Province. The time has fully come when two High Schools -- one in Victoria and the other in New Westminster -- - should be established. (Department of Education, 1874 p. 21)

Dr. John Jessop, Superintendent of Education, stated further on the same page that they would:

> do good service as Training Institutes for teachers until such time as the number of our school districts would warrant the establishment of a Provincial Normal School. Dependence upon immigration for a supply of teachers is very precarious as past experience fully proves... These proposed establishments would, therefore, for the present, answer the purpose of High Schools, Training Schools, and Model Schools. (Department of Education, 1874, p. 21)

On August 7, 1876 the first high school in the Province was opened in Victoria. It was the first public secondary school west of Winnipeg and north of San Francisco. The curriculum was left to the discretion of the principal who was the sole teacher, and apart from the reference above to the fact that classics, mathematics and higher branches of Education be taught, no curriculum is defined in the Annual Reports before the opening of the first high school. In 1879 some major amendments were introduced to the Public Schools Act which altered the rules and regulations for the government of the public schools. Regulations for admission to high school were

listed, textbooks were prescribed and a Course of Study was introduced (Department of Education, 1879, pp. 207-218). Previously the only reference to the curriculum was a terse reference by Dr Jessop:

English:	Geography, Ancient and Modern; Grammar, Rhetoric and Composition, Mythology.
Scientific:	Botany, Physiology, Natural Philosophy, Astronomy. and Chemistry.
Mathematical:	Arithmetic, Algebra, Mensuration, Euclid, and Bookkeeping.
Classical:	Latin and Greek.
Modern Languages:	French, together with Map drawing, vocal music etc. (Department of Education, 1877, p. 13)

In 1884 a second high school was opened in New Westminster followed in 1886 by a third in Nanaimo. Victoria High School completed its first decade at the same time as only the third high school was opened. In his annual report, Principal J.N. Muir stated that:

> During the past ten years this school has sent forth a large number of young people to begin the battle of life in varied avocations ... That the province as well as its children has very materially benefitted by the establishment of this school is shown by the fact that it has yearly added names to the list of certificated teachers whose success has not been inferior to that of instructors from the older provinces. I may further add that nearly one-third of those holding certificates of qualification to teach in public schools of the Province are indebted in part, at least, to this school for their education and, at the present time, to more than one-half of the staff of the teachers in the graded schools of Victoria, this institution is their Alma Mater. (Department of Education, 1886, p. 151)

At this point the high school probably consisted of two years since the first reference to a three year program was made in 1889 when a third teacher was appointed to Victoria High School. Students progressed from the Third division, through the Second division and graduated at the end of the First division (Department of

Education, 1889, p. D iv). The progression was not carried out annually but was governed by the regulation issued a few years earlier:

> Pupils shall be arranged in classes corresponding to the respective degrees of proficiency, and each pupil shall be advanced from one class to another with reference to attainments as shown by semi-annual official examination, without regard to the time he may have been in such class or division. (Department of Education, 1885, p. B xxxviii)

The introduction of a Third division was seen as an improvement by the high schools as it allowed pupils to review the basic English subjects thus freeing the higher divisions to pursue those parts of the curriculum which were more closely related to the actual content of the high school curricula. At this time, concern was frequently expressed that the curriculum was too full for proper teaching and learning. Frank H. Eaton, Victoria's Superintendent, is reported to have said to the Victoria School Board:

> The energies of the teachers are frittered away in the attempt to cover the whole field of possible secondary studies. The interests of the few who demand special subjects for university or professional examinations disparage the interests of the many who do not have these examinations in view. ("School Board", 1899)

In 1889 Vancouver had the requisite twenty potential high school students to justify establishing a high school. Consequently in January 1890, Vancouver High School opened with twenty-five students registered. This was the last high school to be established until the turn of the century. The total high school enrollment in 1900-01 was 584 pupils in contrast to the 23,031 enrolled in B.C.elementary schools.

Examinations

In 1879 when the Public Schools Act was revised, a Board of Examiners was set up to administer the examination of teachers and grant certificates of qualification to teach (Department of Education, 1878-79, p. 163). Eventually this evolved into the Board of Examiners which is in existence today although its role is completely different. Until the first Normal School opened in 1901 in Vancouver, the primary purpose of the high school system in British Columbia was to graduate teachers. While high school examinations were set between 1879 and 1901 and administered at the end of June each year, the primary function of the high school was to prepare the students for the teachers' examinations held in early July.

As noted earlier, the original high school had no set curriculum but with the amendments to the Public Schools Act in 1879, the first external high school examinations were held in both the Junior and Senior Divisions. Some papers were given at both junior and senior levels, some at only the junior and some at the senior only. The range of subjects examined was wide. Both divisions had to sit examinations in mensuration, spelling and punctuation, natural philosophy, geography, English history, and arithmetic. The junior division had an additional paper in French. The senior division had in addition, papers in bookkeeping, grammar, Roman history and Euclid and also a first or second class Latin paper. In Latin, an additional paper was offered for junior division, first and second class or senior third class (Department of Education 1878-79, pp. 220-228). Since all subjects taught in a division were taught by one teacher, the task of preparing students for the

examinations was a taxing one. Examinations were held twice a year, in December and again in June. These examinations were both oral and written and it would appear that they were open to the public as witness the report in the Victoria Colonist:

> In the morning, after the rolls had been called, the examination of the two divisions were commenced in separate rooms under their own teachers, Messrs. Muir and Offerhaus. The curriculum of the senior division comprises 22 subjects, and that of the junior division 21 subjects. The morning examinations comprised advanced arithmetic, geography, French, spelling, mathematics, book-keeping (slate Journalising), and English history, in all of which subjects the scholars exhibited a marked proficiency. ("High School", 1885)

In all the official documentation, the examinations are referred to in the singular as High School Examination. No wonder the reporter for the Colonist was confused as to whether to refer to them as singular or plural. By 1888 the list of papers to be taken read: Arithmetic; mental arithmetic; mensuration; algebra; geometry; trigonometry; natural philosophy; bookkeeping; geography; English grammar; composition; Canadian history; English history; one composite paper for anatomy physiology and hygiene; botany; Roman history; Grecian history; English literature; rhetoric; geology; education; music; latin; and french (Department of Education, 1888).

A curriculum as extensive as this obviously caused much concern among the principals of the high schools and it is in increasing numbers that they expressed their concerns. Principal E.B. Paul of Victoria High School stated that:

> It would be of great advantage to the High School if it were distinctly understood that a certain course would be followed without deviation. As matters stand at present, parents wish their children prepared for matriculation in any university, or for the teaching or other professions, send them to high

> school and expect them to be got ready for the necessary examinations often in an inadequately short time. (Department of Education, 1897, p. 227)

Until the changes were made in 1900, comments and complaints about the emphasis placed on the semi-annual Departmental examinations were common. These comments are recorded in the Annual Reports for the period as well as reference to the discomfort felt that the high school courses were too restrictive. Only a very few students in the public schools prepared themselves for university matriculation examinations or preliminary examinations of universities outside the province and so few students were encouraged to take the High School Examinations rather than the Teachers' Examination.

Extensions to the High Schools

In 1898, recognizing that the province would not create a provincial university in the near future, Vancouver High School and Victoria High School affiliated with McGill University to provide the first year of an Arts program. Instruction was provided by the staff of the high schools, and courses duplicated those of McGill. The examination papers were set and marked by the McGill Examining Board and successful students were accepted with standing at McGill University in Montreal. In a period of ten years, the Vancouver High School had evolved from a two division school of twenty-five to a four division college offering the first two years of university courses. In the fall of 1899, a deputation of all the trustees of the Victoria School Board met the Superintendent of Education to present suggestions to improve the efficiency of the High School. In the Annual Report of 1899, Superintendent of Education, Alexander Robinson, recommended to the government that:

1. The subjects of the examination for the Teachers' Certificates be thoroughly revised.
2. The authorised list of textbooks be revised and modernised.
3. A Provincial Normal School be established. (Department of Education, 1899, p. 269)

In the face of mounting criticism from both the schools and the public, significant changes were introduced in 1900. Both the external examinations and the courses of study were reformed in an attempt to rationalize the conflicting demands of those who wished to enter the universities, those who wished to enter the professions, and the majority who would do neither. From this time on, it was possible to use the marks gained in the High School Examinations to gain Teachers' Certificates and also to satisfy the general academic standing required by the universities for matriculation. The last set of Public School Teachers' Examinations was held in July 1901.

Educational Influences

For the last 25 years of the 19th century, British Columbia went through a major growth period both in population and in political maturity. It changed from a Crown Colony to a fully fledged province of the Dominion of Canada. It went from a "company town" of the Hudson's Bay Company to a boisterous gold rush invaded land. It went from dependence on the British homeland for decision making to being a part of Canada negotiating its share of the political pie. Throughout all of this, British Columbia kept working at molding its education system to fit the needs of the fast changing population in the light of educational changes occurring elsewhere in the world.

Influence of Egerton Ryerson

The British Columbia educational system began with the narrow British view of education that was really elitist, an idea that education for the masses was only to be given in as far as it would help them better understand how to keep their place in society (Barman, 1986, p. 242).

Probably one of the most important early influences on British Columbia education was indirectly that of Egerton Ryerson, an Ontarian Methodist preacher and Superintendent of Education in what is now known as Ontario (1844-76). Ryerson was not a scholar or a teacher other than any Methodist preacher was a teacher. Methodists believed that ignorance was sin and knowledge was virtue (Johnson, 1971, p. 2) and so it was natural for him to be a believer in education for all. He saw in education a solution to many social ills and claimed that scarcely any of the delinquents who passed through the courts "was or ever had been a regular pupil of the schools" (Phillips, 1957, p. 527). Ryerson is an enigma in that he was not a scholar, a politician, an educator, or a businessman and yet he influenced early education throughout Canada.

His strength was that he was interested in anything that had a bearing on human virtue. After his extensive visit to Europe to examine the education systems, he wrote:

> By Education, I mean not the mere acquisition of certain arts, or of certain branches of knowledge, but that instruction and discipline which qualify and dispose the subjects of it for their appropriate duties and appointments in life, as Christians, as persons in business, and also as members of the civil community in which they live.

> A basis of an educational structure adapted to this end should be as broad as the population of the country; and its loftiest elevation should equal the highest demands of the learned professions; adapting its gradation of schools to the wants of the several classes of the community, and to their respective employments or professions, the one rising above the other--the one conducting to the other; yet each complete in itself for the degree of education it imparts; a character of uniformity, as to fundamental principles, pervading the whole: the whole based on the principles of Christianity, and uniting the combined influence and support of the government and the people.
> The branches of knowledge which it is essential that all should understand, should be provided for all, and taught to all; should be brought within the reach of the most needy, and forced upon the attention of the most careless. The knowledge required for the scientific pursuit of mechanics, agriculture and commerce, must needs be provided to an extent corresponding with the demand, and the exigencies of the country; while, to a more limited extent, are needed facilities for acquiring the higher education of the learned professions. (Ryerson, 1883, p. 368)

He did not introduce original ideas or legislation but his genius lay in adapting what worked elsewhere to fit the needs of Ontario.

> In one department of work Ryerson stood in a class by himself. He was without a peer as an administrator. His intensely practical mind was quick to discover the shortest route between end and means. His energy, his system and attention to details, his broad personal knowledge of actual conditions, his capacity for long periods of effort, his thrift, his courteous treatment of subordinates and even his sensitiveness to criticism were factors which enabled him to administer the most difficult Department of Government with ease and smoothness. (Putman, 1912, pp. 267-268)

The basis of any system of education, he believed, was well trained teachers. To have such a base it was necessary to train them. To this end he set up one of the first normal schools in Canada in 1846. This was based on the Irish and perhaps the German models with which Ryerson had been favourably impressed when he visited Europe (Putman, 1912, p. 232). In order that the normal school be developed along the same lines as the Irish school in Dublin, Ryerson employed Thomas Jaffray Robertson as the first principal (Johnson, 1971, p.4). Within ten years of opening,

Ryerson's Normal School had established a high reputation throughout North America and the United Kingdom.

One of the early students attending the Toronto Normal School was John Jessop who eventually moved to British Columbia where he was a teacher and later Superintendent of Education for the province. Jessop was a proponent of a free and non-sectarian school system. From 1865 Jessop tried hard to produce free schooling for the citizens of Victoria both under the Common School Act of 1865 and the Public Schools Act of 1869. To teach in a free school in those times was an event hazardous to the financial health of the teachers. In September 1870, John Jessop and the other teachers in the public school in Victoria, withdrew their services as they had not been paid for more than a year. This was the first teachers' strike in Canada and to date the longest in duration. The schools in Victoria remained closed for two years.

The desire to provide a free system of basic schooling for all students motivated the educational system in British Columbia for the first 25 years. Jessop, through his friendship with the Provincial Secretary, A.R.Robertson, assisted in drawing up the Public Schools Act (1872) which drew freely from Ryerson's Ontario legislation. However, like most moves in British Columbia the legislation differed from that of Ontario in that British Columbia's system was non-sectarian with no allowance for separate Catholic schools, district superintendents or teacher training schools (Normal Schools).

Influence of John Jessop

As a reward for his diligence in working to maintain the free schools and in recognition of his qualifications as a teacher, Jessop was appointed Superintendent of Education in April 1872. Under Jessop's tutelage a list of textbooks was authorized, all Ontario texts, the certificates of all teachers were confirmed at least temporarily and a system for examining the documentation of aspiring teachers was set up. As part of his duties as Superintendent, Jessop visited every school in the province during his first full year in the position. He felt that in order to provide education to the children in the less populated districts of the province, a central boarding facility should be constructed. In this endeavour, he had the support of many of the families in the interior. During his incumbency he had to:

> consider the central problem of what should be the social function of the school system within the context of the province's development. He had to recruit teachers, certificate them, train and advise them and see to their welfare. He had to develop a curriculum, inspect the schools and cope, almost single-handedly, with the multitude of administrative details. (Johnson, 1971, p.109)

When Jessop took up the challenge of the first Superintendent of Education, the province had 25 school districts; by the time he left the office (1878) the province had 20 more districts. By this time power was centralized in the hands of the Board of Education and the Superintendent, and this was contrary to Ryerson's idea that the control of education should rest in the hands of the people:

> that the machinery of education should be in the hands of the people themselves, and should be managed through their own agency. (Ryerson, 1883, p. 370)

Local boards in British Columbia were expected both to report to the Board of Education and to the Superintendent any infringements of the rules and to act as enforcers in persuading parents to send their school age children to school on a regular basis.

Jessop believed that good behaviour was of paramount importance. In his diary of his first trip to the schools he records of one school in Nanaimo that the children were not punctual and kept arriving throughout the day; that they were somewhat disorderly and but little attention was paid to the teacher. Discipline and arrangement of studies were very deficient. That students should be taught the basic subjects of reading, writing, grammar, spelling, composition, arithmetic and history and Geography seems to have been the norm, but Jessop also set out a plea for vocal music:

> This branch of instruction is not generally taught in our schools as it ought to be. It should be considered an essential, instead of an unimportant unessential... Probably nine out of ten persons of both sexes will find far more use for, and derive greater benefit from, a fair knowledge of this subject than from mathematics beyond the simple rules of arithmetic. (Department of Education 1873, p. 9-10)

This suggests that while the official ideal of education was academic in nature, there still was the acknowledgement that more was required.

In all his work Jessop tried to carry through the ideas which he had learned in Ontario and to put into practice the ideas of Egerton Ryerson. He attended to his responsibilities with a missionary zeal which was understandable in a Methodist. His strong belief was in the perfectibility of humanity and he saw the provision of universal education as working towards this goal. He worked for free good schooling

to which all parents would want to send their children in order to receive the blessings which would make them approach more closely the perfect state.

Summary

High Schools in British Columbia were established for two reasons. First, they were to provide more advanced studies beyond the elementary level and, second, they were to be the teacher training institutions for the province. In the nineteenth century, schools offered mostly two-year programs which evolved over time to three-year programs. They offered a highly academic program of studies which at first was defined only in the sketchiest of terms. As the system grew with the population, the gold rush and the coming of the railway, the Department of Education clearly defined the course of studies even if only to the extent of naming the textbook to be used.

The greatest emphasis was placed on English and communication skills with emphasis also on Latin and French at the senior level. An inordinate number of subjects were required and while electives were available they tended to be of an advanced type such as geology, astronomy or Greek. Despite frequent requests for revision or modification to the content from the field, little major change occurred until the turn of the century.

Though influenced by Ontario and Egerton Ryerson in the form of Superintendent Jessop and Great Britain from its early heritage, the system evolved into one which was uniquely western. In the 25 years from 1876 to 1901, the

secondary school system moved from essentially a teacher training school to one beginning to offer universal educational opportunities. In the beginning, its primary purpose was to provide teachers for the schools of a rapidly growing province. By the turn of the century, it offered a more open curriculum with diplomas as well as a graduation certificate.

CHAPTER THREE

History of Secondary Education in British Columbia: 1901 to 1960

In 1873 Superintendent Jessop stated that "a training school will soon become a necessity in this Province" (Department of Education, 1873). This sentiment was frequently echoed through the years until the opening of the first Normal School in Vancouver in January, 1901. The legislation allowing a Normal School to be established was enacted in 1891 in the form of the Public School Act.

The Act established a Council of Public Instruction with many of the powers which used to reside in the Lieutenant-Governor-in-Council. Additional powers granted to it were the following:

1. power to appoint one or more Inspectors,
2. power to select, adopt and prescribe a uniform series of textbooks to be used in Public Schools of the Province, as well as the courses of instruction and study for schools,
3. power to establish a Normal School with Model Departments and to make regulations for its conduct and management. (MacLaurin, 1936, p. 155)

This Act centralised public education administration in British Columbia. Since that time, many additional powers have been subsumed by it strengthening the centralisation of education in British Columbia.

High Schools

By the power given to the Council of Public Instruction in 1891 high schools could be established in any school district that the Council deemed appropriate if there were at least 20 pupils duly qualified and available for attendance. Until 1903 the only high schools in the province were in city school districts, however, not all cities had a high school and no rural school district had a high school.

In 1905 the Act was further amended to allow two or more rural school districts to join in supporting one high school for both geographic areas. This provision tried to address the inequity of educational access for the rural student. The amendment was repealed the next year when the Act was again altered to create rural municipal districts. The required number of pupils for establishing a high school was still set at twenty where it remained until 1921 when the number was reduced to fifteen. Throughout this time, the changes, which viewed from the 1990's seem somewhat arbitrary, were genuine attempts to address the needs of the province's students while still maintaining the overall centralised control of the education system.

Since the education system was still evolving rapidly a clear picture had not yet emerged the high schools chose a variety of final examinations for their students. The Public Schools Act allowed high school principals to select the final examinations for their students, as long as they were the entrance examinations of a university in the Dominion. These were, according to the Act, to be equivalent to those set by the Education Department (Department of Education, 1921, p. A67). The Superintendent of Education expressed concerns that these were not necessarily on

equal standing with the Department's examinations and over the next few years, steps were taken to clarify this anomaly.

With a broad curriculum, teachers found it difficult to give adequate instruction to all students. Classes contained students enrolled in different programmes -- commercial, various matriculation and teacher preparation. Teachers faced similar problems of addressing the needs of the individual student as today. At this stage students were not promoted by subject and could only progress to the next grade in the annual advancement if they had successfully passed all the examinations.

In 1901 the Department of Education announced that all high schools should be divided into three grades -- Junior, Intermediate and Senior. These grades do not correspond to the grades which are in common use today. At that time, a student might remain in a grade for several years. In fact the quantity of material in the syllabus for the Junior Grade required it to be taught over two years. By 1909 the Department of Education officially recognized that the Junior Grade was taught over two years and established both the Preliminary Junior examination for those with one year of high school, and the Advanced examination for those who had finished two years of high school.

The introduction of the Intermediate Certificate, and McGill's acceptance of this pro tanto (on a subject by subject basis) in lieu of matriculation, meant that the Department's courses beyond Intermediate Grade were not necessary. McGill allowed students to re-sit one or two subjects that had been failed in contrast to the

provincial regulation which forced a student to re-take all subjects. At the start of the 1923-24 school year, both high schools and elementary schools were reorganized. The course of study in elementary schools was reorganized into an eight grade system while the high school became the grades IX, X and XI. The final, or fourth year of high school, preserved the old name of senior matriculation. Frequently in the 1960s older teachers would still refer to the final year of high school as senior matriculation (B.E. Deuel and R. Haddon, personal communication, 1988). In 1924 the Department issued two Programmes of Study, one for the eight grade elementary school system, and a second one for the "High, Technical and Normal Schools".

The structure of the school system was changed by three reports commissioned by the government. The first was the Survey of the School System by Putman and Weir in 1925, the second was the Commission of Inquiry into Educational Finance by Cameron in 1945 and the third was the Report of the Royal Commission on Education by Chant in 1960.

The Putman and Weir Report

In 1924 the Superintendent of Education announced the appointment of a commission to enquire into the state of education in the province. This was in response to the rapid if somewhat disorganized growth of the school system. The number of high school enrollments almost doubled in the seven years from 1916-17 through 1922-23. The two Commissioners were Dr. J.H. Putman, the chief inspector of schools in Ottawa, and Dr. G.M. Weir professor of education at the University of British Columbia, assisted by Dr. Peter Sandiford of the University of Toronto. They

were charged with looking into "questions of school finance, school administration, training of teachers, courses of study as well as all other phases of our educational system" (Department of Education, 1924, p. T10). It was a very far-reaching mandate. Unlike many other commissions into education in Canada whose results sometimes appear to be ignored, this commission produced a report that was not only the most comprehensive look at any school system in Canada but also had recommendations which were quickly acted on. British Columbia seems to have a history of having their education commissions treated seriously while this is not the case in other provinces, for example Ontario in 1950 and also Nova Scotia in the same year (Phillips, 1957, p. 262).

This commission produced its report by May 30, 1925 just less than a year after it began its work. In speaking of this 500 page report, Dr. S.J. Willis, Superintendent of Education said:

> The Commissioners have submitted an exhaustive report covering almost every aspect of our educational problems and have made recommendations which, if carried into effect, will result in material improvement to the school curriculum, the training of teachers, and the inspection and supervision of schools, will make more equitable the incidence of school taxation and will provide for the superannuation of teachers, They emphasize the importance and value of domestic science and manual training as regular school subjects and recommend that a policy of paying bonuses to rural school districts be adopted with a view to securing and retaining the services of good teachers in rural schools. In the matter of curriculum the Commission recommends the establishment of middle schools, or junior high schools, for pupils between twelve and fifteen years of age, embracing Grades VII and VIII of the elementary school and Grade IX of the high school, and suggests that a more elastic programme of studies be provided for those grades as well as for senior high-school classes. The survey which has just been completed has been the most thorough examination of a school system ever made in Canada, and the educational worker will find the report a chart of progress for the next decade. (Department of Education, 1925, p. M10)

The report looked at education in Canada and said:

> In Canada, as might be expected, we have pursued a middle course. Influenced on the one hand by conservative English tradition and on the other by contact with our radical and progressive neighbor, we have evolved a type of secondary school English in its background but progressive in its outlook. The strongest single factor shaping its curriculum has been the Canadian Universities. Naturally these institutions, largely dependent on the high schools for the preparation of their raw material, have seized every opportunity to mould the curriculum and make these schools preparatory for the university itself. This influence has tended to establish in the Canadian secondary school high ideals of scholarship and a wholesome respect for the traditional cultural subjects. (Putman & Weir, 1925, p. 111)

They discussed in detail the influences on curriculum and what they saw as ways of overcoming the inequities of the curriculum.

> So long as the present widespread allegiance is, consciously or unconsciously, paid to the formal disciplinary theory of studies, there can be little prospect of substantial improvement, academic or professional, in the school system of British Columbia. (Putman & Weir, 1925, p. 45)

For the physical organization of the school system the report recommended:

> 1. That the high schools provide a three-year course beyond the middle school for (a) a graduation diploma; (b) normal entrance for second-class diploma; (c) commercial course; (d) university matriculation...
>
> 2. That existing superior schools be reorganized either as middle schools or as high schools with at least two regularly qualified teachers.
>
> 3. That the high school syllabus of studies be reorganized to provide for the courses and options as outlined ... (Putman & Weir, 1925, p. 117)

The first recommendation changed the number of grades in the total school system from the eight-three to a six-three-three system. This structure was implemented by the Department of Education from 1926 to 1931 with the terminology of elementary, junior high school and high school. Penticton opened the first official

junior high school in the province in the fall of 1926, although Vancouver had been operating one since 1923 unofficially. By 1931 eleven junior high schools had been opened.

In 1927, the Department of Education issued a Programme of Studies for Junior High Schools which defined the purpose of the junior high school as:

> The provision of a suitable educational environment for children of the early adolescent period (approximately 12 to 16 years of age). To carry this out involves;
>
> a) An enlarged and extended background of experiences....
> b) Ample provision for common integrating education....
> c) Abundant facilities for the progressive discovery and experimental direction of pupils' interests, aptitudes and abilities...
> d) Adequate provision for individual differences....
> e) Increased opportunities both for the development of leadership and for learning social cooperation and democratic citizenship....
>
> The organization of Junior High Schools even under conditions far short of the ideal will frequently be found to be better than the continuation of the traditional school. **This course of study is a tentative one. Criticism of it, when based upon a thorough knowledge of the Junior High School, will be welcomed.** (Department of Education. 1927, pp. 6-7, emphasis in original.)

The programme of studies was in fact revised in 1932 to reflect the experiences of the teachers who had been using the 1927 programme.

Some school districts for reasons of cost adopted an eight-four system or even a six-six arrangement. This latter format was popular in urban areas where land was either scarce or expensive so that three buildings could not be constructed. It was also popular in rural areas where one combined elementary-secondary school was constructed for a small school population. Whatever way the districts chose to arrange the schools, an extra year was added to the school system. Twelve years is

still the structure of the public school system, although, with the addition of kindergarten, the system now has thirteen years of public schooling.

An extremely important recommendation of the Putman and Weir report was to extend the school programme by a full year.

> The proposed plan for a middle school covering the work up to the end of grade nine, and for a three year high school covering grades ten, eleven, and twelve, is really adding a full year to the present high school course. It seems to us that this change is imperative. Everywhere throughout the Province we are told that the present high school course is too heavy; that the work is not thoroughly done; that the burden of homework on the student is oppressive and that the young people are entering normal schools and the University immature and ill-prepared. The extra high school year should meet all these objections and more than compensate for any additional expense. (Putman & Weir, 1925, p. 115)

In the light of this recommendation the Department of Education set up a committee to revise the curriculum for British Columbia high schools. The membership of the committee represented large and small high schools, rural high schools, and the University. In 1929 this committee believed that it was impossible to revise the curriculum if it was based on the current three-year high school structure. Accordingly, they advocated that it be re-structured on the basis of a four-year high school. Such a programme would lead to a general graduation diploma, normal school entrance or University of British Columbia admission standards.

In the area of examinations, The Survey of the School System recommended that:

> promotion in the high school from grade to grade be by subjects and that a pupil who has completed Algebra I or French I be not required to repeat these even though a low standard of work makes it necessary for him to repeat English I. We know that promotion by subjects makes more difficult the organization and classification of the school, but the rights of the pupil are

> paramount and must have precedence over the mere convenience of those who manage schools. (Putman & Weir, 1925, p. 115)

The greatest impact of the Survey of the School System was in the area of curriculum change and these changes will be discussed in a later chapter where a detailed examination of the curriculum will be undertaken.

The Cameron Commission

The Cameron commission appears at first to have little to do with the direct operation of the schools themselves since its purpose was to inquire into the existing distribution of powers and responsibilities between the provincial government and the school districts and to appraise the fiscal position of the school districts in British Columbia. As one of its main recommendations, it stated that discussion about consolidation of school districts be encouraged, but that implementation of consolidation should proceed without seeking local approval. At the time of the report, British Columbia had some 600 school districts. Some of them were very small and could not support the quality of education the province wished to offer its children. With increasing demands on the school system from increased population and changed perspectives as a result of the war, these small school districts were no longer viable. The consolidation of the 600 districts into about 80 units for administration allowed much larger secondary schools to be established in the province. This gave greater flexibility of educational opportunity:

> The creation of the large administrative units, with the consequent improvement in school plants and facilities, is having a beneficial effect on the types of educational opportunity which are being made available throughout the province. There may exist differences of opinion concerning some of the financial results of implementing the report of Dr M.A. Cameron, but any

> competent and well-informed observer must be impressed by the vast improvement which has been effected Provincially in the quality and extent of education. (Department of Education, 1948, p. 27)

As a result of the consolidation, many children who, for reasons of isolation, had been deprived of secondary education were now able to take advantage of the new high schools. Economy of size allowed more efficient transportation to and from larger and more comprehensive high schools. The secondary school population grew from about 59,000 in 1950 to more than 121,000 by 1960.

The Chant Commission

The final major report in this time period was that of the Royal Commission on Education chaired by Dr. S.F.N. Chant in 1958. This commission was struck to alleviate some of the anxiety engendered by the USSR's achievement of putting Sputnik into space in 1957. This had caused much concern about whether, in Canada, the schools were producing graduates who were capable of competing with such an achievement. Moreover questions had been raised by Hilda Neatby in So Little for the Mind (1953) and others, about the quality of the education system. The Chant report took almost three years to write and in February 1961 the Minister of Education adopted the Chant Report in principle but wished to study intensively some of the recommendations.

Examinations

With the opening of the University of British Columbia in 1915, much confusion occurred in the field of final examinations. The admission requirements were modified over the next several years. Since principals of high schools could

select which examinations would be taken by their students and also McGill allowed pro tanto acceptance, provincial standards were not uniform. High school students taking either Junior or Senior Matriculation examinations were allowed to take supplemental examinations to remedy subject deficiencies while their confreres following other programmes still wrote the school examinations for which no supplementals were allowed. In these latter cases, a student failing one subject had to rewrite the whole examination again the following year to obtain standing.

In 1924 the Board of Examiners appointed a committee to consider the question of uniformity of marking the examination papers at the Junior Matriculation level. This committee worked for several years as it seemed that not only did the failing rates vary from subject to subject, they also varied from year to year in the same subject. In 1925 the practice of publishing the provincial averages in each subject was introduced. This information was to be used by principals to estimate the relative standing of their students. Frequently they were used as a measure of teacher competence, an unjust method of evaluation since the averages never took into account the scholastic ability of those sitting for the examination.

In 1926 the Board of Examiners endorsed the idea of promotion by subject. They allowed standing in all papers in which 50 percent was attained if only part of the examination was taken. If all of the examination was taken, credit was given for an average of 50 percent with no individual paper being less than 40 percent. In 1927, objective test items were introduced for Junior Matriculation and high school entrance examinations. At this time too, the practice of raising borderline marks such

as 49 percent and 39 percent to 50 and 40 percent respectively was introduced. Adjustments to the scoring practices have continued in the Department of Education.

In 1928-29 the Superintendent of Education invited a number of teachers to meet in Victoria to evaluate the Grade XI papers for the Matriculation and Supplemental examinations. These specialists reviewed the papers set in their own discipline. This is the first time that educators from the field were involved in reviewing the Junior Matriculation papers. In the 1934-35 school year, external high school examinations for all grades below grade XII were abolished. The Department of Education continued to set matriculation examinations (Department of Education, 1933, p. M 23).

Once the four-year high schools were more or less established in the province, another recommendation of the Putman-Weir report began to take effect. It had been suggested that the Provincial examination system could be improved if:

> the Department of Education and the University authorities consult as to the possibility of partially and gradually substituting a system of accredited high schools in place of the present matriculation examination. (Putman & Weir, 1925, p. 173)

It was felt that such a system would remove the idea that schools were teaching for examinations. It was also felt that some high school principals retarded or in some way eliminated weaker students in order that the examination average for the school might appear better. The new system would allow weaker students to attempt subjects on which they might not perform well. It was not until the 1937-38 school year that accreditation actually came into practice in British Columbia. In that year 45 percent of the province's high schools were given the privilege of recommending

60 percent of their students enrolled in subjects prescribed by the Department for Junior Matriculation.

In the school year 1955-56 all senior secondary schools were given a copy of the new accreditation procedures. Using these regulations 129 schools applied for accreditation and of that number 82 were granted it for either one, two or three years. In 1961 ten schools were granted accreditation for a period of four years.

The suggestion that matriculation examination marks be scaled scientifically had been talked of in the 1920's and continued to be discussed in through the 1930's.

> What are the facts? ... Well over twice as many candidates failed in 1920 as in 1924. Why should this be so? To say that candidates were much better prepared in 1924 than in 1920, but that again in 1930 they were much worse prepared, is patently ridiculous...
> It is grossly unfair to both teachers and pupils. How on earth is a teacher to know what standard of preparation will satisfy the examiners?... As for the pupils, one year a given student passes but the next year an exactly similar student fails. This is rank discrimination and is utterly indefensible.
> (Towell, 1930, p. 9)

By 1932, the unofficial practice of bonusing students to offset an unacceptable failure rate in a subject was recognized. Chairmen of the Marking Committees were allowed to scale the papers when the marks varied too widely from the normal standard of marks. By 1937 acceptable scaling techniques were employed. The reason was to try to keep the failure rate reasonable constant over the years. Mr. Robert Straight of the Vancouver school system carried out this work. Any marks more than minus one standard deviation would be assigned a pass. A score of minus one standard deviation would thus be assigned a pass mark of 50 percent. Any mark which was more than one standard deviation below the mean was a failure.

This method of scaling continued to be used to 1950. Unfortunately it had two major difficulties. First, that scaling worked only in an upward manner and, second, scaling occurred only when it was felt that the failure rate was going to be unacceptably high.

In 1951 a more sophisticated method of scaling was introduced by Dr. C.B. Conway, of the Research Standards Branch in the Department of Education. The scale developed allowed 85 percent of university entrance candidates to pass in all subjects by setting the fifteenth percentile raw score on all examinations to a scaled score of 50. In the years after 1953-54, the scale was changed in a manner which related the rates to the scholastic aptitudes of the students. Failure rates for university entrance courses were grouped and given differing failure rates -- from 12.5 to 20 percent. With this scaling it became more difficult to pass the "easy" courses and easier to pass the "hard" courses.

In 1959 the Department carried out an extensive investigation of the supplemental examinations for University entrance held in August of each year. As a result, it was decided that they would be held for the last time in August 1962.

In the same year the government announced an extensive scholarship programme based on four Departmental examinations to be held each June. Students wishing to be considered for these awards had to attend an accredited school and write all the examinations. It was not possible to be eligible for an award if the student's final mark was determined solely by teacher, that is by recommendation. This regulation led to a significant increase in the number of students writing the June

examinations. These scholarships were available to offset the fees for the next year of study.

Educational Influences

Scientism and Progressivism

For the first half of the 20th century two major influences on education were scientism and progressivism. These two movements, while not the only influences acting on the education system, appear to have had lasting impact on the structure and content of public school education. They did not view the education of children as analogous to filling an empty pot with water. Children were not seen as small adults but rather as potential adults, adults in chrysalis form who would develop naturally through the stages to adulthood at the correct time for each step.

The impact of new developments in psychology began to have an effect on education in the United States at the turn of the century, particularly on mathematics education. Mathematics was no longer seen as a necessary condition for training the will or developing reasoning. The need then arose to decide why teach mathematics at all. The reason given was that mathematics is required by adults in their everyday working lives (NCTM, 1970, pp. 420-421). While education seemed to be moving towards developing the idea that a child should learn only that for which he or she was ready, in mathematics it was still learning for the future not the present -- to prepare students for future usefulness. Major developments in the discipline of mathematics had no effect on what was being taught in the schools either elementary or secondary. In general, scientism wished to apply scientific principles to education,

to treat examinations and testing as the primary measure of knowledge. Opponents of this view, and on the whole they were those who had no scientific background or interest, believed that education had as its main aim passing on of cultural values, beliefs and concepts which were not susceptible to scientific analysis. This debate had little effect on the elementary schools but was of importance to the curriculum in secondary schools. At the turn of the century, education adopted a scientific attitude and adopted Pestalozzian theories, somewhat modified, into a logically organized pedagogical system. Pestalozzi and Froebel both believed that the child had to develop clear ideas through sense impressions. This led to the use of the concrete in mathematics education before moving to the abstract. In secondary level education this idea did not appear until the late 1930s.

Among the major proponents of the scientific approach to education were Thorndike, Binet and Simon all of whom were involved in the testing movement. The fact that the American army was actively involved in educational testing gave considerable support to this movement in the age of the progressive education movement.

John Dewey

Probably the biggest influence on 20th century education was and still is the progressive education movement. It owes its beginnings to John Dewey even though many of the proponents of progressivism were not applying Dewey's philosophy fully, and in fact many applications were in no way related to Dewey. By the middle of the century, the term progressive education seemed to be applied to all types of education

which were not traditional, classical education. Much of what was espoused as progressive in that it turned from rote learning and attempted to get children to think had been voiced several times in previous years.

Dewey said in the preface to Democracy and Education:

> The following pages embody an endeavour to detect and state the ideas implied in a democratic society and to apply these ideas to the problems of the enterprise of education..... As will appear from the book itself, the philosophy stated in this book connects the growth of democracy with the development of the experimental method in the sciences, evolutionary ideas in the biological sciences, and the industrial reorganization, and is concerned to point out the changes in subject matter and method of education indicated by these developments. (Dewey, 1916, p. iii)

When Dewey was writing, Herbart was considered an important educational leader especially in mathematics education. While Herbart's contribution was important and was espoused by many teachers, his was a teacher's view of learning. His philosophy emphasized the responsibility of the teacher and said little of the role of the learner. It emphasized the influence of the intellectual learning environment and ignored the influence of inter-personal experiences. Teachers were responsible for the selection of the right material to build on previous learning and to provide the base for future instruction. There was no room for the unforeseen or totally new experience which might allow for learning to occur. It was a theory of education based on the past in that the mind was developed by patterning itself on the spiritual heritage of the past (NCTM, 1970, p. 110).

For Dewey, education was a series of experiences which allowed the pupil to be freed from an outdated past.

> The past is a great source for the imagination; it adds a new dimension to life, but on condition that it be seen as the past **of** the present, and not as another disconnected world. (Dewey, 1916, p. 76, emphasis in original)

He goes on to say:

> The idea of education advanced is formally summed up in the idea of continuous reconstruction of experience, an idea which is marked off from education as preparation for a remote future, as unfolding, as external formation, and as recapitulation of the past. (Dewey, 1916, p. 80)

When Dewey discusses at length the concept of democracy in education, he rejected the Platonic idea of democracy as it was based on the class as the social unit rather than the individual. Next, the individualism of the eighteenth century was rejected since it lacked the means of attaining its ideal. Finally, he rejected the institutional idealistic philosophies of the nineteenth century since they again subordinated the individual to the institution. He believed that a democratic society should:

> have a type of education which gives individuals a personal interest in social relationships and control, and the habits of mind which secure social changes without introducing disorder. (Dewey, 1916, p. 99)

This is not directly applicable to the public school system but in the chapter on the democratic concept in education Dewey does indicate that he felt that all groups in society would pursue shared concerns in a cooperative manner. Dewey also had an idealistic view of science which he saw as embodying the principles of democracy. In the period after the Great War, society began to move towards a more open view and more participatory state for all aspects of life. It is not surprising that the school system was seen as being in need of change.

The Progressive Education Movement

In 1918, the Progressive Education Association was founded in the United States in order to promote and support those who wished to implement the educational ideas of progressivism. This gave strength to the movement in the United States where progressive ideas of cooperation and development for the individual became the norm in the 1920s and 1930s.

In British Columbia, it was not until the late 1930s and later that the ideas of progressive education were implemented to any extent though they were being talked about by many before this time. The move was underway to change from education as the acquisition of useful knowledge to education which would make students into good citizens as well as citizens with an adequate knowledge base. Frequently the progressive education movement is thought of as:

> embodying a commitment to child-centred, relatively unstructured curriculum allowing a considerable degree of freedom of choice to pupil and teacher alike, the expression of a humane, egalitarian democratic philosophy of education. (Mann, 1980, p. 91)

In British Columbia, one of the most important educational influences of the first half of the century was the Putman and Weir report in 1925. This document is hailed as a great progressive education document. Dewey is never quoted in the report, although acknowledgement is given to the debt the commissioners owed to American educational theory and practice. They showed their debt to other writers like Bobbit, Sneddon and Thorndike whom they quoted. These were people who, while they must have been influenced by Dewey, often held views which were not closely attuned to Dewey.

The Putman and Weir report is therefore a mixture of educational movements and is another example of how British Columbia took ideas and melded them into a form peculiar to this western province. Despite all of this, the document is a conservative one and this may explain why it had such a deep effect on education in British Columbia over the next 25 years. That George Weir became the Minister of Education for British Columbia in 1933 also might have been a contributing factor to its acceptance. The report did not advocate that the education system be the sole means of social change but saw the schools as potential leaders for change. It suggested that social change should be one of education's aims but that change was a slow process: "Its increment during the span of a single generation is scarcely perceptible" (Putman & Weir, 1925, p. 83). This report is the first official document of a Department of Education in Canada to recommend adopting progressivist ideas.

The progressive education movement continued to spread throughout British Columbia and this was helped by the major curriculum revision which occurred in the 1930s. With the establishing of junior high schools in the province, it was possible to handle the individual differences of the adolescent group more effectively. In British Columbia the move towards having separate junior high schools gradually diminished in favour of the more economical secondary school which encompassed grades VII through XII or XIII. This did not really suit the needs of the adolescent so by the time the attack on the progressive movement reached Canada, many years after it had reached its peak in the United States, the school system was ready for restructuring.

Summary

The organization of high schools in British Columbia presents a confusing scenario, one which appears to be haphazard in its changes. At the turn of the century, an attempt was made to organize on the basis of graded divisions with three being introduced initially --junior, intermediate and senior. Within ten years the work of the junior division had been spread over two years, preliminary and advanced. Senior matriculation was offered in many high schools to give students standing for first year Arts. Students had to pass all papers in the examination to achieve standing in a division. When the University of British Columbia opened in 1915, a number of changes occurred in the school final examination system. By 1918, a Joint Board of Examiners had been established which gradually managed to eliminate extraneous examinations, ending up with one set of final matriculation papers. In this period, too, marking of examination papers was centralized in Victoria.

After the Great War, high schools were still predominantly academic institutions. Students had to obtain an average of at least 50 percent in all subjects and no subject could be less than 40 percent. The three-year high school programme was approved in 1923 and by 1931 a four-year programme was in place. The most significant influence on education in the province was the Survey of the School System which formed the basis of many changes which took place in high school education over the next 25 years. Schools went through structural and organizational changes as well as major curriculum revisions. A committee made up of teachers was

appointed to help with the complete revision of the programme of study which took place in the 1930s.

In the early 1930s, middle schools recommended in the Putman and Weir report had been introduced and were known as junior high schools. Instead of an eight-three arrangement, a six-three-three system was adopted. This was not universal, and local boards used several variations depending on the circumstances. Some retained the old eight-four grade structure, some a six-six arrangement while others had one school for both elementary and secondary schooling.

In the mid 1940s, as a result of the Cameron Commission Report, much larger administrative units were devised. This made much more sense both economically and educationally. The arrangement provided for a revised programme of studies which accommodated many students who did not wish to have a purely academic education.

In 1959, the Department introduced extensive scholarships. To be eligible for a scholarship students had to take the Departmental Examinations in June. Many more students now took the June examinations.

The British Columbia public schools did not arrive at their position without being affected by other educational changes. Throughout this time there was a strong movement towards altering educational goals from mental training for further education to education of the child as a whole person. This meant that students would learn only that for which they were ready and any other learning was simply

memorization. Testing as a means to measure knowledge was refined and applied in schools.

The influence of John Dewey on British Columbian education was most noticeable. He influenced Drs. Putman and Weir whose report would have a long lasting effect on education in British Columbia. His influence, together with the Progressive Education movement, affected British Columbia about 15 to 20 years after it did the United States. The middle school concept espoused by Putman and Weir was officially introduced in 1932 in British Columbia.

CHAPTER FOUR

Secondary Mathematics Curriculum in British Columbia from 1872 to 1932

In discussing the mathematics curriculum in British Columbia, it must be made clear what is being examined. The definition of curriculum is not precise. Generally it can be thought of as a programme of activities designed so that students will acquire knowledge by achieving specific objectives or specified ends. The programme as defined is acted on by both the instructor and the student. Activities, as well as their organization, affect learning and are part of the curriculum. Typically it is in the official documents that the objectives are found and in the classroom that the methods and activities are found. The purpose here is to identify what was defined in the documents issued by the Department of Education as the necessary and sufficient objectives for secondary school students in British Columbia who wish to achieve mathematical competency.

Influence of Psychology

Both in British Columbia and elsewhere there was a strong belief in the mental disciplinary value of languages and mathematics which meant that mathematics was considered an essential subject for university bound students. This idea of the brain

as muscle which needs to be exercised was a strongly held belief for many years and supported the drill and practice regime of many educational institutions.

In the 19th century, faculty psychology was a major consideration in justifying why mathematics should be taught in the 19th century. This theory considered the mind to consist of several separate faculties: imagination, memory, perception, reasoning and will being some of them (NCTM, 1970, p. 99). It was held that will could be strengthened by a student mastering difficult and distasteful tasks. One such task was considered to be arithmetic, it being particularly suited to developing reasoning and strengthening the will. This led to the commonly held belief that mathematics was taught to strengthen the mind.

The organization of instruction was actively considered in the 19th century. The child was considered to be an adult in miniature with the teaching being directed towards the young adult. The idea that the child was different from, and required instruction in a different manner to, the adult was often not realized in practice by the educator (NCTM, 1970, p. 104). The impact of Pestalozzi and Froebel were gradually felt and began to affect teaching methods. It was in this period that the first "methods" text for elementary schools, The Philosophy of Arithmetic (Brooks, 1880), was published. Pestalozzi believed in the importance of the child developing clear ideas and consequently recommended that children be encouraged to use concrete devices to develop the desired concepts. He viewed mental arithmetic as an excellent way of developing the power to form clear ideas. The idea of postponing drill until

after understanding had been accomplished was one of the instructional goals of the leading advocates of Pestalozzi and Froebel (NCTM, 1970, pp. 104-105).

The Mathematics Curriculum

1872 to 1920

There does not appear to be a written prescribed course of study prior to 1880. In the First Annual Report a list of texts and their prices is given. For mathematics the texts are:

> Elementary Arithmetic (Smith & McMurchy).....$0.25
> Advanced Arithmetic (Smith & McMurchy).....$0.50
> Algebra Part I (Colenso).....$0.50
> Algebra Part II (Colenso).....$0.50
> Euclid Book I (Young).....$0.12½
> Euclid Book II (Young).....$0.12½
> (Department of Education, 1872, p. 31)

The students bought these texts from the teacher who had received them from the Board of Education. These texts were authorized when the province had no high schools. With the introduction of high schools in 1876 an addition was made of Pott's Euclid, six books, for which the price was $0.75.

In the Annual Report of 1880, what might be described as the first course of study appeared. Amongst all the other subjects mathematics, under the title of Arithmetic is listed as one of the subjects for the admission examinations for high school:

> Arithmetic -- to be able to answer questions in numeration, notation, the four simple and compound rules, reduction, vulgar and decimal fractions, proportion, simple interest and percentage, and in mental arithmetic. (Department of Education, 1880, Appendix D)

In the same document the course of study for high school both junior and senior divisions appears. It states the following for the junior division:

> 2. Mathematics
> a) Arithmetic including simple and compound rules, vulgar and decimal fractions, proportion and interest, percentage in its various applications; and square root.
> b) Algebra, including elementary rules, factoring, greatest common measure, least common multiple, square root, fractions, and simple equations of one , two, and three unknown quantities.
> c) Euclid, Books I., II., with easy exercises.
> d) Mensuration, including lengths of lines and areas of plane figures.
> e) Natural philosophy, including proportions of matter, composition and resolution of forces, centre of gravity, mechanical powers, pressure of liquids, specific gravity and modes of determining it, the thermometer, barometer, siphon, common pump, forcing pump, air pump.

For the senior division Mathematics included the following:

> 2. Mathematics
> a) Arithmetic generally, with duodecimals and metrical system.
> b) Algebra, quadratics, equations, surds, proportion, progressions, permutations, and combinations, Binomial theorem, cube root and properties of numbers.
> c) Euclid, Books I., II., III., IV., definitions of Book V., and Book VI., with exercises.
> d) Trigonometry, plane trigonometry.
> e) Mensuration, volumes and areas of surfaces of solids and surveying.
> f) Natural Philosophy, static, hydrostatics, and dynamics. (Department of Education, 1880, Appendix D)

In the following years, the prescribed textbooks changed, sometimes only to list the new version of a text by the same author as in 1919 when School Geometry by Hall and Stevens replaced Euclid by Hall and Stevens. This minor change in text was despite the fact that the administrative structure changed from a two division to a three division education system. One interesting curriculum development occurred in 1919 with the introduction of the Course in Drawing where one of the three headings

was that of Art Geometry. The use of such a title shows that the idea of patterns in geometry was considered important even though in the mathematics curriculum pattern formation was not considered important. This may well be due to the overwhelming academic nature of the mathematics curriculum.

During this period too, the nature of arithmetic taught changed in emphasis from an area strictly of a computational nature to one of a more concrete nature with the development of understanding from the concrete to the more abstract.

1921 to 1932

The high school was now organized on a four-year graded system. The four courses were Preliminary Course (Junior grade), Advanced Course (Junior grade), Junior Matriculation and Senior Matriculation. The high school was a three level programme with Senior Matriculation being the equivalent to first year university.

The 1921 revision of the curriculum, which overall was quite lengthy, listed only minor changes in the mathematics Course of Study. A new textbook was authorized for the first year course while a short review course in arithmetic was inserted into the third year. In algebra, the fourth year course was somewhat lightened by omitting the chapters on notation scales, logarithmic series and miscellaneous equations. In the fourth year of study the trigonometry course was augmented by the addition of the chapter on inverse functions and general values, the study of the nature of logarithms and their use as well as the deletion of part of the chapter on the properties of triangles and polygons (Department of Education, 1921, pp. 21, 24).

In 1923, the grade placement system was reorganized to add a year to elementary schools. The public schools were now organized with eight years for elementary school and three years for high school. They were designated grades I through XI. The fourth year of high school retained the name Senior Matriculation. Senior Matriculation still gave the student first year university standing (Department of Education, 1923, p. F10).

In the 1923 Course of Study the mathematics curriculum did not undergo a revision of content but rather a revision of presentation. At the grade IX level, the geometry course now was split under two headings, experimental and theoretical (see Appendix A). In each case the work was outlined in some detail. The introduction of experimental application was based in part on the ideas of child development current at that time, specifically, that learning progresses from the concrete to the abstract. By learning in this way it was hoped that a sound grasp of elementary geometrical concepts would be obtained. The change in philosophy was evidenced by the change in textbook from Hall and Steven's School Geometry to Godfrey and Siddons' Elementary Geometry. A perusal of the new textbook and the required examples, shows that although the student exercises were less abstract in nature, they did not involve the use of manipulatives (see Appendix A for sample).

For the first time the grade IX Geometry course was outlined in great detail. No longer was it stated in global terms. The arithmetic course for grade IX was dropped while an arithmetic course was added at the grade X level which used the prescribed text the Dominion High School Arithmetic. New textbooks were

introduced for the senior matriculation year. For algebra, Crawford's Senior High School Algebra and for trigonometry Practical Trigonometry by Plane and Fawdry. These texts replaced Hall and Knight's texts which had been the prescribed texts to that time. Also introduced was the use of five-figure tables instead of four-figure tables for computations at this level. Apart from the geometry changes, the mathematics curriculum did not change.

In the 1924 Programme of Study for High, Technical and Normal Schools of British Columbia, Senior Matriculation was referred to as Grade XII for the first time. The practice of detailing the curriculum continued in the grade IX course as well as starting in the grade XII course. In the grade XI algebra course, variation, ratio and proportion were added. In this Course of Study, the grade XI students were informed that they would be expected to know all the elementary processes of arithmetic such as square roots, and vulgar and decimal fractions and could be examined on them.

Course content in senior matriculation geometry was now detailed minutely. As well, it was listed under the two headings of synthetic geometry and analytical geometry. Synthetic Geometry contained almost a page of statements such as:

> To divide a given straight line internally and externally in medial section.
>
> In a right-angled triangle any rectilineal figure described on the hypotenuse is equal to the sum of the two similar and similarly described figures on the other two sides. (Department of Education, 1924, p. 33)

This is quite some way removed from the Annual Report of 1872 which only stated Euclid Books I & II. Yet again a textbook change was made with Hall and Stevens'

School Geometry being replaced by MacDougall's Advanced Geometry for High Schools.

In 1927 the Department issued a Programme of Studies for the Junior High School in which it was asserted:

> represented a further step in the improvement of the provincial system of education in conformity with the recommendations of the British Columbia School Survey Commission. (Department of Education, 1927, p. 6)

In the document it is stated that the school day will consist of eight periods of 40 to 45 minutes and the school week will have 40 periods. Since the number of periods a week is listed for each subject, the relative importance of a subject can be estimated.

The courses were divided into "constants" and "variables". The constants were supposed to provide "ample provision for common integrating education" (p. 5) while the variables were designed to provide a broader enriching experience for the students. In grades VII and VIII, English, Social Studies, and Mathematics are all accorded five periods a week, the highest of any constant courses. In the variables only General Language at grade VII and General Language, Latin and French are accorded as much time. This gives a broad view of the society's attitude to subjects. The Foreword also requires:

> Ample provision for common integrating education. The "constant" subjects have this aim. More particularly English and the Social Studies give that common background of ideas and experience necessary for the attainment of social solidarity. (Department of Education, 1927, p. 6)

Mathematics is deemed by society to be important and yet the expression of why it is important is rarely articulated. Certainly in this document there is no apparent reason for having mathematics as a constant course on the grounds of it providing an integrating education, and so it must have been included as a constant at the grade VII - VIII level for other reasons.

In that section of the programme related specifically to mathematics it states that the aims are:

> 1. To apply the fundamentals of arithmetic to a variety of situations which children are capable of appreciating and to provide sufficient drill to maintain a high degree of speed and accuracy in these computations.
> 2. To lead the individual from operations on particular numbers, which occur in arithmetic, to the concept of operations upon numbers in general, which occur in algebra.
> 3. To study algebra as a tool subject, the linear functions arising out of the activity of linear measurement, the quadratic functions arising from surface measurement, and the cubic functions from the study of volumes.
> 4. To study relationships by intuitional, experimental, and concrete geometry. To express relationship by formulas, equations, and graphs.
> 5. To develop a high degree of skill in the use of ruler, compasses, and squared paper, as measuring instruments, as a basis for intuitional and constructional geometry.
> 6. The course should make life in and out of school more meaningful to the pupil by leading him to see something of the part mathematics are playing in our social life today.
>
> The course emphasizes drill for speed and accuracy, applications to commerce and industry, and solving problems. It introduces the equation, graph, formula, intuitive and constructional geometry, and elementary notions of trigonometry. It breaks away from the traditional course inasmuch as its content is chosen for its social value and not as a preparation for higher mathematics. (Department of Education, 1927, p. 42)

The content of all three grade levels is then listed and, taken together, fills about three-quarters of a page. It is not detailed minutely as is the case in later Programmes of Study.

In grade VII, one of the five content descriptions is concerned with practical problems. Since this is one of the new areas of the curriculum as defined in the last sentence above, what is actually stated is:

> 3. Practical problems covering: owning, buying, selling, earning, spending, saving, profit and loss, trade discounts, commission, simple insurance, borrowing and lending, interest. (Department of Education, 1927, p. 42)

These applications seem to be aimed at a society which is commerce based and not aimed at industrial applications or farming applications. At the grade VIII level, this changes and the applications listed are concerned with business both public and private, the home, science and industry and finally the first steps in algebra with expressing problems as equations.

By grade IX, Mathematics is no longer considered a constant course. It becomes a variable course offered in the form of three options: General Mathematics, Business Arithmetic, or Shop Arithmetic. The content of the General Mathematics course is a further development of the mathematics programme of grades VII and VIII. It continues with developing algebraic concepts and introducing the idea of the algebraic expression of geometry with straight lines being described by an algebraic equation. This then connects geometry with algebra and arithmetic allowing the opportunity to show mathematics as a unified system of thought. At the end of the grade IX content listing, cautionary notes are added:

> a) This course should be made as practical as possible and should not involve a difficult treatment of the subject.
> b) The work as covered in Thorndike's Junior High School Mathematics, Books I., II., and III., gives a good content and fairly well marks out the extent of difficulty to be expected in such a course. For pupils below the

> average in mental ability to grasp mathematics, omissions may be made as indicated in these Thorndike Books. (Department of Education, 1927, p. 43)

For Business Arithmetic the aims and purposes state among others, that the emphasis is on how rather than why and that it is desired:

> To give a frankly vocational training to those boys and girls who must leave school to seek employment as office-boys, messenger-boys, time-keepers, juniors in banks, salesgirls, cashiers, etc. (Department of Education, 1927, p. 94)

The course listing identifies skills such as reading and writing large numbers up to a million, Roman Numerals, foreign money, and measurements. No textbook is needed and no home study should be required. That this is perhaps out of touch with the reality of the lives the students for whom the course was designed is shown by listing as one of the resources for teaching, the daily stock quotations. The last statement is:

> Oral arithmetic exercises in rapid calculation should form a part of every lesson. (Department of Education, 1927, p. 96)

It would appear that the Department of Education was trying to respond to the Putman-Weir commission report:

> So long as the widespread allegiance is, consciously or unconsciously, paid to the formal disciplinary theory of studies, there can be little prospect of substantial improvement, academic or professional, in the school system of British Columbia. (Putman & Weir, 1925, p. 45)

At this stage the course of study for mathematics still had not undergone a thorough revision.

In 1929 a major reorganization of the high school curriculum was begun. Unfortunately, the economic conditions of the 1930s meant that it was not until 1935 that this was implemented. It had been realized for many years that the transition

from elementary school to high school was a very difficult one for students. The courses were all of an academic nature, perhaps too much so for many of the students. Students who were transferring from the new junior high schools often found that the curriculum in the high school did not articulate well with that at the junior high school. Many students became discouraged with the course load of so many new subjects or found they had to repeat the work which they thought they had already covered and so, becoming disheartened, left school (Thomson, 1972, p. 58). The Programme of Studies for 1929-30 listed two different textbooks to be used for grade IX algebra. One was for students who had taken the Elementary School Course in grade VIII Mathematics and another one for those who had taken the Junior High School Course in grade VIII Mathematics. In this document, the caution is issued to teachers as it was in 1928-29, that:

> Teachers are not expected to make an attempt to do all the exercises given in the textbook with their classes, but should make such selections as may be necessary to give the students a sound knowledge of geometrical ideas. (Department of Education, 1929, p. 10)

In 1932, the following statement concerning teaching and learning in the province was made:

> In the following course in mathematics more than the usual consideration is given to the social values of the subjects and at the same time the minimum requirements for the advanced study are provided for. Accordingly, both the practical and the cultural values are kept in mind. But no course, however complete, can compensate for the lack of a thorough and practical teacher who uses every opportunity to relate his subject-matter to the life of the community and to adjust it to the actual needs of the citizens.
> Any course in mathematics will fail to lead to the best results unless great stress is laid upon thinking logically, and recording results with precision and accuracy.

> It is therefore almost impossible to overestimate the value of drill to fix in the mind the fundamental operations and to maintain speed and accuracy at such a level that the work is a pleasure and not a drudgery.
> In all grades stress should be laid upon the use of formulae and the solution of suitable problems.
> Sufficient drill should be given to keep up accuracy in the ordinary arithmetical calculations. (Department of Education, 1932, p. 55)

In 1935, work was begun on the major curriculum revision which was strongly influenced by what was happening in the United States in mathematics teaching and also was influenced by the progressive education movement in education.

Summary

In the 60 years discussed in this chapter it can be seen that the directives to teachers changed in emphasis. In the beginning, the directives merely listed textbooks which were to be purchased by the student from the Province. It might be assumed that there existed a commonly held view of the objectives and the methods of teaching. Thus there was no need to detail what had to be taught. An alternative interpretation might be that the public school system was struggling to establish itself and so neither the time nor the manpower was available in a fledgling province to produce detailed instruction.

With the increase in population which occurred in the period after the World War I, and the variability in the teacher's background, the government began outlining the course content in greater detail. Of all areas, mathematics at the high school level appears to have been one of the slowest to respond to educational change. The course content was and remained extremely abstract and academic until after the

Putman and Weir Report of 1925. The subsequent revisions to allow for the introduction of the middle school, or Junior High School, tried to tailor the subject matter to the needs of the student but still remained out of touch with the real lives of the majority of the students.

CHAPTER FIVE

Society in Change: 1930 to 1945

In the 1930s, the country was in an economic recession with much unemployment. Financial support for the educational system was not available from the tax payers. In 1934 the province constituted a commission on school finance, the members of which were Dr. Weir of the Putman-Weir commission, John Hart, the Minister of Finance for the province, and Major H.B. King as technical advisor. Again, in the interests of involving the community, which seemed to be the philosophy of the Department of Education at that time, they were to be assisted by about 30 members drawn from a variety of public organizations involved in education. The chairman of this committee was the General Secretary of the British Columbia Teachers' Federation (BCTF) thus ensuring a strong voice from the profession. As well, a revision committee was to sort through and interpret the information produced by the larger wider-ranging committee. When the report was published in 1935 as School Finance in British Columbia it was seen to be really the work of the technical advisor, H.B. King who wrote it and so is commonly referred to as the King Report. In it, King recommended that the schools be arranged in much larger units, schools be centrally financed perhaps by levying a sales tax and, as an obvious consequence of centralization, school boards would not be needed. Teachers would be appointed by a board on which BCTF would have representation and so teachers would be placed wherever the appointments committee would wish, which

was the system used in the states of Australia. Indeed this system continued in Australia until the mid-1970s.

While this report made eminent sense financially, it was not popular with the population. The British Columbia School Trustees' Association (BCSTA), naturally, found it difficult to accept and complained that the large districts were "geographically impossible." Again a predictable reaction from the population was against the imposition of a sales tax. The argument being that if a tax was imposed it would stop new industry coming to the province and what little industry was already here would leave. In the face of such opposition, it was natural that the Minister of Education would say that the Government had no intention of legislating current school boards out of existence.

In order that his report become more acceptable, Major King frequently went out to many parts of the province to evangelize. In April 1936 he is reported to have had the following message for the Victoria Real Estate Board:

> A school curriculum should be vital, representing life values and dealing particularly with matters of social import. ... In educational matters, conservatism must be overcome, Mr King asserted. Many parents, he said, thought their children should learn what they themselves took up in school. He believed it would be fully possible to choose aspects of science which would be particularly useful to British Columbia.
> He said that the presence or absence of a school had a great deal to do with property values of a community, stating that an undue burden of taxation was undoubtedly placed upon land. ("Curriculum", 1936)

This is an intriguing report in that it hints that Mr. King, who was both the Principal of Kitsilano High School and also technical advisor to the Provincial Department of Education, was not only interested in talking about the funding of schools but also

about educational values. Most of what is reported in the newspapers was on his work implementing the recommendations of the King Report and yet the hints are there that when he was evangelizing the bottom line was educational value for money invested. For example he did not display the view that there should be a return to what used to be, instead, he said that the educational community should be changing to fit the needs of the future; progressivism rather than conservatism.

Mr. Sheffield, Director of Education for Matsqui Sumas Abbotsford school demonstration area, is reported to have given to a fund raising meeting of municipal and business leaders the following statistics:

> One thousand boys and girls passed into Rossland high school during the present principal's charge. The prescribed course of studies, as in all our high-schools, is preparatory to the university or normal school. Yet only 21 students entered the higher institutions. The proportion of 'failures' -- even regardful of the various causes -- constitutes 979 reasons why educators and adults should give serious consideration to the need for useful technical training of high school boys and girls. ("School auditorium," 1936)

At this time too, a report from Penticton says:

> Demand that motion pictures and radios might brighten the schoolroom learning of British Columbia's students was made by the School Trustees Convention at its annual meeting here. A resolution requesting authorities to investigate possible use of radio and movies to help pupils in mastering certain subjects was passed by the delegates in session last night. ("Trustees urge", 1936)

As well as the reports in the popular press, the teachers were certainly aware of the problems of what the education system should or should not be doing. A perusal of The B. C. Teacher for the five years from 1934 through 1938 shows a mixture of reactions to the new ideas. It also highlights the general apathy which must be combatted if any change in educational outlook is to be accomplished. In an

editorial reprinted from the Victoria Daily Times regarding the cost of education, it emphasizes that while there is much to be improved, so too must all the ills of society not be placed at the doors of education.

> We agree that our educational systems can be improved by the elimination of much dead-wood and their readjustment to the requirements of the times. The very fact that so many disabilities exist, both in government and in the conduct of private business, indicates the need of such a reform. A properly-educated people would not permit many of the evils which have grown up in numerous activities, both public and private, in this country. ("Cost of Education", 1934)

In the very next article on the page it goes on to say:

> High school teachers either shun publicity, prefer to be apathetic or do not read the Magazine. Last month the Senior High School Section thought to introduce several controversial subjects, but no paeans of praise or tirades of bitter criticism have yet reached our letter box. We conclude that our colleagues do not think about uniform tests, refuse to consider queries about the Latin course, are not interested in the pros and cons of gown wearing, and do not particularly wish to argue publicly about anything (except salaries). We wish (we can't hope) that they would begin to find their fence a little uncomfortable. There is no Mussolini to keep them there, and we are quite sure that many of them, if they hopped off, might make these columns much more vital and interesting. ("In Senior High", 1934)

Certainly these comments would not be made if teachers were thoroughly interested in what was going on in the education. Later, when reporting on Mathematics, the B.C. Teacher relates how the Mathematics Section was at work on a course of study to be submitted to the teachers of the province for their consideration. This was before the Department of Education had officially set up its curriculum revision process. Obviously, at least in Mathematics, some teachers were keenly aware of the way in which education was moving in the province and were not going to have a new curriculum mandated from above. (B.C.Teacher, March 1936, p. 3).

In 1935 the B.C.Teacher reported in detail the recommendations of the King Report so that teachers could not really claim ignorance of what was going on.

In general, the B.C. Teacher seemed to support the King Report and even though the government really did not implement the King report at that time, it presaged the larger school districts which were to be formed after the 1945 Cameron Commission of Inquiry produced its report.

Meanwhile the Mathematics Section of the British Columbia Secondary Teachers' Association was continuing to work on its curriculum revision. This revision had been started as a result of dissatisfaction with the lack of definition in the Grade XII course of study. When work was completed on it, a committee was struck to study the course work of Grades IX, X and XI to determine if it could be rearranged in a more evenly distributed load over the years. As with so many other revisions, they found that they could not progress without some representation from the Junior High Schools. Naturally that meant that teachers from Elementary schools should be involved as they taught grades VII and VIII. These teachers insisted that teachers from Grades I through VI should also provide assistance as they fed into the larger system. Thus the final recommendations sent to the government were the result of province-wide discussions throughout all teaching levels. While the recommendations themselves would be of value, perhaps a more interesting realization was the differences between teaching in the cities and teaching in the interior. As H.M. Robertson, the secretary of the mathematics section of the B.C. Secondary Teachers' Association said:

> This brings us to the present research being carried out by the lower mainland group. One of the greatest drawbacks to teaching in the interior is the inability of instructors to gather together and discuss their problems.... (Robertson, 1936, p. 31)

In the same article he requested participation by all teachers in the province in

> a proposed general course in Mathematics for those who may not intend to enter University. The intention would be to make the work more interesting and of greater practical value (Robertson, 1936, p. 31)

It goes on to point out that diverse opinions arise from the concept of courses of a practical nature.

> It was argued by one member that there is no "practical" work in the High School with the possible exception of English. In other words, no person on leaving school at the end of Grade XII would ever have cause to use the actual subject matter of the courses studied in High School (Robertson, 1936, pp. 31-32)

This is probably true when the mathematics curricula are examined. While attempts had been made to introduce more reality into the curriculum on the part of teachers, at this time it was still a very academic curriculum aimed at university or normal school entrance. Further on this same article lays out the positions held by teachers in the province:

> Then there are some who believe that there is a large transfer from the study of mathematics to everyday life. Those holding this traditional opinion believe that the reasoning power is developed, that the student will be able to arrange facts logically and will be able to accept or reject material according to its importance, as a result of the work done in school. It is also argued that geometry gives a person valuable ideas regarding distance and space which he otherwise would not have. The great majority of the teachers who have expressed their opinions feel that a course can be prepared in practical mathematics which will in itself be of real value to the average citizen. One thing on which we all agree is that a more interesting course can be formulated, and to arouse interest is in line with modern tendencies. However, here again we still have those who feel the subject matter should be like a dose of medicine, preferably of the castor oil variety; that students

> should be trained to do a more or less disagreeable job well and like it. One teacher said, "If, when I was a boy in England,I was set a task and made a mistake, I got a damn good licking. I became accurate." Another teacher explained that he had been teaching the course in its present form for a long time and felt that it would be a shame to change it!
> (Robertson, 1936, p. 32)

This meant that mathematics would remain as one of the compulsory subjects to be studied if a student were to be thought of as an educated citizen.

In British Columbia at this time the Minister of Education was Dr. G.M. Weir. It is not surprising to see him supporting the "new" ideas of curriculum design as he was known to believe that the school should suit the social needs of the people (Putman & Weir, 1925, p. 111). This could not be so without a drastic curriculum revision on the dimensions of the 1936 revision. In addressing the joint meeting of the committees engaged in the construction of the Course of Studies for the Junior and Senior high schools, he pointed out that:

> the curricular revision now in progress is a challenge to the teaching profession. Other sections of the citizen body could make valuable contributions, but obviously the teachers themselves should be better equipped than any others to determine what the objectives of our schools should be and how these objectives may be attained.
> Social reforms of all sorts encounter many obstacles, chief among which are group selfishness and unreasoning resistance to all change. Teachers have to fight in themselves the tendency to become static and to ignore the implications of educational research. It is easier to settle things on the basis of opinion and prejudice and precedent than on the basis of scientific enquiry. To combat such handicaps on future progress, the schools of tomorrow must teach co-operation rather than selfish competition. Their principal task must be recognized to be that of socializing the youth of the nation. Ill-informed criticism must be replaced by criticism based on knowledge and trained insight. The necessity of securing for the state a critical and constructive attitude toward its institutions is so urgent that we cannot afford to await the new generation whom we hope to equip in the ordinary schools; we must make such provision for adult education as will in some measure indemnify the

> present adult generation for the imperfections of traditional educational methods and institutions. ("British Columbia Teachers", 1936)

In that statement he was certainly willing to voice his disenchantment with traditional educational methods. He continues to address the curriculum revisers saying:

> At every step in their task, the revisers of the curriculum should be thinking primarily of the learner rather than of any of the more or less arbitrarily segregated groups of experiences traditionally familiar as 'school subjects'. ... From the limitless wealth of human knowledge, material for school use must be selected primarily for its functional value and with social utility in mind. ("British Columbia Teachers", 1936)

A significant will to achieve change was present in the school community to allow the curriculum change to be carried through enthusiastically. Both the Department of Education and also the BCTF were willing. This willingness was not just an intellectual willingness on the part of a few, but a realistic willingness even though it was understood that many did not hold that change was necessary.

Despite the movement towards a new curriculum which was supposed to be driven from the bottom up rather than the top down, many still believed that the University had too much influence on the curriculum. The University of British Columbia was to be looked on as the apex rather than the foundation of the educational system. This perhaps was the ideal but in reality all the academic mathematics curriculum had to feed into matriculation and university entrance. Thus while method of presentation might change and topics might be added or subtracted, in the end the university demanded then as now, a certain knowledge base which forced the teaching in the final years into a traditional mode.

Hugh Morrison writing in the B.C. Teacher says that:

> the present form of the junior matriculation examinations, if maintained, will militate against much of the good intentions of the curriculum committees. This is the great barrier, that must be profoundly modified, ere a proper articulation can be achieved. ("The Barrier", 1936)

He goes on to point out that in 1880 only about 3% of the school enrolment was in high school, in 1900 it was about 2% but by 1934 it was 20% and showed little sign of diminishing. Since British Columbia, through legislation, had decided that education should be at no cost to the student up to 18 years of age, it implied:

> a mandate from the people to the schoolmen that the youth of the province be given an adequate education, through these institutions, which the people have provided, an education that will adjust them harmoniously with this complex society. It is a profound recognition, that old selective ideas of education, which perhaps fitted an earlier stage of society, will not do today. It is an approval of the principle, involved in a democracy, that there must be an *adequate* educating of 'all the children of all the people'.... The university is a selective institution, and the present system of junior matriculation examinations tends to pull the senior high school into selective lines along with the university. The senior high school should not be a preparatory school for that institution. To be sure it has an entrance opening into the halls of Point Grey, but it also has many other doors leading into the bruising realities of life, through which, by far, the majority of its pupils travel. ("The Barrier", 1936)

The fact that teachers recognize this is seen that in the 1930s graduation was encouraged by other than junior matriculation. This did not receive a resounding vote of approval since "tradition still flaunts its worth, not only among those in education but among the public at large" (p. 130). People had always thought of junior matriculation as being the ideal and so were unwilling to have their children given anything but what they perceived as the best.

The B.C. Teacher of the 1930s provides many interesting insights to the minds of teachers of that time. It has statements from a wide range of opinions so that while sometimes they are extreme positions, positions which have been stated for the purpose of generating comment, they do reflect the range of attitudes among the professionals. An editorial in the February 1937 issue says:

> Those responsible for the schools -- parents, teachers, trustees, governments -- have been content to live in such a mental fog as precludes intelligent recognition of the purposes for which schools exist. We have said that schools are maintained for the propagation of knowledge, because knowledge is power. So it is, as many a grafter and blackmailer has abundantly demonstrated, with misfortune to those who educated them. Too frequently we have treated the passing of examinations as the be-all and end-all of education. Sometimes we have said that schools exist to prepare children for life, as if they were not already more profoundly alive than most of their elders, and we have forgotten that the only safe effective preparation for living a normal life in the future is to live a normal life in the present. We have said that schools exist to produce good men and women, but we have been very misty and shifty in our concepts of what good men and women are like. As a rule we have meant good aquiescers, good 'yes-men'. We have taught content where we should have taught discontent, and those who refused to be contented we have taught to be 'go-getters'. We built up whole school systems on a theory of formal discipline based on wishful thinking. We have aimed at cultivation of faculties that, in isolation and abstraction from the world of concrete reality, every well-informed person knows to be entirely mythical. (p. 259)

This is in no way a balanced statement of opinion but rather one which is designed to provoke. It is however a reflection of the debate which was going on at the time, a reflection of the turmoil in the school system and also in society. Later on in the same editorial the writer quotes the opening sentence from the new Programme of Studies which states

> the schools of any state exist to develop citizens or subjects, according to the prevailing or dominating ideas of the state or society. (p. 260)

and supports this by pointing out that the schools of Italy exist to produce good Fascists, in Germany Nazis and in Canada to produce citizens capable of functioning

> happily, effectively and for the public weal in a democracy. Maybe one day schools will exist simply to produce good human beings. (p. 260)

This shows that in British Columbia at least, some teachers were aware of the greater issues involved in teaching and not only the daily routine of the classroom.

At around the same time the supervisor of schools in Alberta was delivering a similar message:

> In the light of our present knowledge, he would be a bold person who would maintain that three units of mathematics, a laboratory science, and a foreign language constitute the best curriculum that could be devised for young people who are going into business, industry, farming, or garage work, housekeeping or even teaching at the elementary level. (Phillips, 1957, p. 444)

Education was in transition. The Progressive education movement was becoming of age in Canada's west. People were talking of integration as the way to go. Subjects as individual specialties were out and combinations of two or more "subject areas" in the form of projects or units were considered desirable. The subjects were integrated to provide an interesting education for the student. H.B. King, who by 1940 was the chief inspector of schools, discussed the word integration in his report:

> The word 'integration' is used today so much that it is in danger of becoming a cliche and there is danger of it being overlooked that in its proper or at least its most important meaning, the word refers to the integration of the personality. But even though words suffer this kind of decay through constant use, the idea represented by the word is as important as it was when first given a name. Things which are related should be brought into conscious relation, and should be used in significant applications. For several years the Inspector of Technical Classes has been stressing the fact that the teaching of English, Mathematics, Science and Art would have more vitality if these

> subjects were linked with the practical activities of the Industrial Arts instead of being studied in the isolation of the classroom or laboratory. The Trail Junior High School has been notably successful in effecting this kind of integration. In this school the teachers of the subjects which have been named plan and correlate their work effectively. This demonstrates that such cooperation is practicable. The results of the cooperation show also that it is desirable. (Department of Education, 1941, p. D42)

By the end of 1941 then, in British Columbia the new curriculum was in place and teachers in some schools were working positively towards providing an enriching experience for their students at least at the junior high school level. H.B. King recognized that while the changes in curriculum and philosophy as laid out in the Programme of Studies made British Columbia schools the best in Canada, British Columbia was just part of a larger trend in education all over the world. He says that

> the principles laid down in our own bulletins have a remarkable resemblance to those appearing in the most recent 'Handbook of Suggestions for Teachers' of the English Board of Education. (Department of Education 1940, p. 32)

Throughout the war years the schools had to cope with a reduced number of teachers, a reduction in the money available for buildings because of the war, and the prospect of a mushrooming enrollment in 1946. All that could be done was plan for a rapid building programme when the influx of babies born in 1939 hit the public school system in 1946.

Summary

With the changes which were occurring in society and the general unrest, re-evaluation, and reassessment which occurs in times of economic depression it is important to look at what was happening in education at that time. Much of tne thrust for curriculum change was brought about because Dr. Weir (Survey of the School

System) was Minister of Education in the 1930s. This together with King's Report (School Finance in British Columbia), which argued the case for reorganization of the many small school districts into larger administrative units focussed attention of the public on the public schools, their function and their operation. In most of the articles examined, it can be seen that although many people were in favour of change since what was in operation was not working to everyone's satisfaction, there was a common acknowledgement that not everyone agreed on what the change should be. Generally it was felt that a curriculum should be vital and relevant to the students. While most people agreed that this was true for younger children and perhaps for junior high school students, many were not sure if that was the case for senior high schools. There was still an impression that senior high schools should be more oriented towards the university-bound student although only a small number progressed to university. The university was seen to have an undue influence over what was taught despite the view that the new curriculum was supposed to be organized on a bottom-up format rather than top-down. The B.C. Teacher, the official organ of the BCTF provided numerous opinions on the state of education and this meant that even the teacher in the most remote and isolated school could have information concerning the educational scene. It published summaries and comments on most of the official documents and reports issued by the government as well as reports on what its specialist groups were doing. It also carried some thoughtful comment on the usefulness of mathematics.

That the university had too great a hold over the senior high school curriculum was believed by many teachers and discussed in The BC Teacher. Especially in British Columbia where the University of British Columbia was an outgrowth of the high school rather than a separate entity as it was elsewhere, the relationship was seen as one between a parent and a child.

CHAPTER SIX

Secondary Mathematics Curriculum in British Columbia: 1932 to 1945

While in the early 1920s and early 1930s much valuable work had been done in terms of small changes or partial revisions to the curricula in the province, it was not until 1933 that a total revision of the curricula of the province was undertaken. This took into account all the most recent contributions to the science of education.

Revision of the Curriculum

The revision process was carefully structured with a series of committees and sub-committees which would report to the Superintendent of Education. The overall structure was of a central committee which had three sub-committees: General Elementary, General Junior High and General Senior High. Each of these was then split into School Committees which were further broken down into subject committees. This structure allowed for an active participation of many members of the community, but in order that no committee would become too large for useful work, the numbers were limited. In the total curriculum revision at least 250 members of committees were selected from among teachers, supervisors, teachers of teachers and school inspectors.

Contributions from other members of the community were sought through an invitation to teachers, school trustees, parent-teacher associations, industrial leaders, and local councils of women to submit ideas for an improved curriculum. Many

others participated by sharing their thoughts on what should be included or excluded from the curricula. This policy of the Department of Education of community involvement in the curriculum-building process was an improvement on previous practice. Unfortunately it became lost over the years as can be seen in the 1970s review where the proceedings were shrouded in secrecy. It was revived again for the revision of the 1980s.

The underlying principle for all three curricular divisions in 1933, was that changes should be made based on all the new ideas and research which had taken place over the years. As Harrop said:

> The first step in curriculum making is to set up a basic philosophy .... Then all selections and organization of curriculum materials should be in terms of the basic philosophy. (cited in Green, 1944, p. 183)

Each group commenced with a review of the literature on curricula and a study of other curricula in different jurisdictions. British Columbia wished to produce the best curricula for its students and so was willing allow the time required to study what was happening elsewhere. The new courses of study were introduced over a period of years with the final year of the high school programme introduced in the 1939-40 year.

Purpose of Education in British Columbia

Each new programme of studies began with a lengthy and important preamble. In the programme of studies for the junior high schools this section was 22 pages long. In it the aims and philosophy of education in British Columbia were reiterated

in detail. Three pages were devoted to the social nature of education in which it states in the section called The Nature of the Curriculum that:

> The materials of a curriculum should be a selection of subject matter and experiences chosen and arranged to stimulate the growth of the child and to assist him in fitting his environment. Subject matter is not educative in and of itself, but only as it is made meaningful to the pupil. (Department of Education, 1936, p.9)

It talks of child *versus* adult needs in which no essential opposition is seen between the demands of social living for either. Language and the rules of health are seen easily to have immediate usefulness so should be included in any curriculum. Other subjects which might not have such obvious utility should be included:

> On the other hand, a great deal must be included which is beyond the child's present need. The meaning of this can be revealed by intelligent teaching. Studies and occupations the full significance of which can be appreciated only at a much later time should be included only if necessary for indispensable learning to follow.
>
> The makers of the school programme, therefore, should select content and experiences which are important for life, including adult life, and assign them to the years of childhood in which they will have the greatest immediate significance. These materials should be brought into relationship with the pupil by providing a setting out of which arise problems which call for their use. (Department of Education, 1936, p.9)

The definition of a problem is not quite the same as traditionally used in mathematics. It says that "Problems are difficulties in thinking" (p. 9) and goes on to state that:

> The ability to work in the imagination and build up systems of ideas is essential in education. To limit the curriculum to that which has immediate practical application is to overlook this truth. Practical projects form the starting-point of learning and the first step in method, but they are not the goal. (Department of Education, 1936, p. 10)

It also states clearly an idea which is in vogue in the 1990s, that "education is continuous throughout life" (p. 10). Thus the public school system is only one of the early steps in the total education of a society. Of the school and the outside world, it says:

> The pupils should not regard school-life as an artificial existence unconnected with normal living. The activities in school should derive their meaning, in the main, from their relation to the world outside. ... To summarize, school should be thought of as a life to be lived where there is action, co-operation, and opportunity to develop desirable attitudes, habits, and ideals. (Department of Education, 1936, p.11)

In the section headed Education as Individual Development it discusses social adjustment and individual development, individual development, education for health and physical development, education for moral character, education for aesthetic development and finally education for intellectual development. It is in this last section that it has much to say which is relevant to mathematics education.

> The education of the intellect is not for storing of the mind with inert items of knowledge, but providing the child with the tools of thought and training him to use them....
> Skill in thinking comes from the use of one's equipment of ideas in solving real problems. Thinking calls for deliberation and reflection. Pupils should be given systematic practice in thinking through significant problems not only in the secondary school, but in all grades of the elementary school. They soon come to enjoy the mastering of difficulties and to scorn evasion and ready-made solutions.
> Learning may be thought of too much in terms of acquiring ready-made responses through mechanical repetition. Most of the significant learning is not of this sort. Mere repetition apart from effort and intelligent purposes gives negligible results. Furthermore, life does not provide detached stimuli to which to respond, but complicated situations which call for a grasp of their meaning. There is little opportunity for intelligence to operate in exercises of purely formal character. This accounts for the small amount of transfer from mechanical drills. Where intelligence is given greater scope, learning is easier and the carry-over to useful applications is greater. There is evidence to show that much that was formally taught by laborious drill is now accomplished with

> less effort and greater effect in meaningful settings. (Department of Education, 1936, pp. 12-13)

The programme of studies next devotes half a page to the learning process in which it states that "Interest is the foundation of learning" (p. 13). The teacher is exhorted to start with the native interests of the student and progress to those interests which are "the product of human thought" (p. 13):

> When an interest becomes attached to an imagined future accomplishment and the will to achieve is aroused, a purpose results. A continuing purpose tends to direct the pupil's actions. External motivation is less necessary. The immediate and transitory interests of pupils should be transformed into enduring purposes. ... The spirit of play should be utilized in the early years and lead gradually to the disciplined labours of adulthood. Learning is facilitated by the satisfactions which accompany it. The greatest satisfactions are those which come from the overcoming of difficulties through strenuous effort in well-disciplined surroundings. The satisfactions of the learning process will be greater when the school is well governed and ably directed. (Department of Education, 1936, p. 13)

The aims and philosophy of education goes on to discuss the role of the Junior High School. It again reiterates that the purpose of the Junior High School curriculum is of an exploratory nature. It is designed to enable the student to:

> discover his tastes, aptitudes, and needs. Provision for individual differences becomes increasingly the function of the school. (p.14).

It then summarizes all of the foregoing. The final statement in the summary says that at the Junior High level, individual growth will be stimulated by cultivating "habits of critical and independent thinking, evaluation of propaganda, and to strengthen further the ability to study" (p. 16). A curious final table in the very short section on Differentiation of Instruction summarizes the major differences between dull pupils and bright pupils.

Dull Pupils

	Bright Pupils
1. Require material to be presented in short, simple units, having immediate ends.	1. Need large exclusive units having more remote ends.
2. Require work of a concrete nature.	2. Require work of an abstract generalized, and complicated nature.
3. Are satisfied with a knowledge of the skills and facts fundamental to learning such as handwriting, arithmetic facts, and geography facts.	3. Use symbols of learning as tools for a more comprehensive meaning.
4. Are often found to possess narrow and individualistic points of view.	4. Usually possess a thoroughly social point of view.

This terminology would certainly not be used in a document produced in the second half of the 20th century although unconsciously, perhaps, the concept still exists in the minds of the teachers.

This lengthy introduction to the Programme of Study for the Junior High Schools is almost identical to that at the start of the Elementary School Programme of Study and also the High School Programme of Study. This then gives a united front, a coherent approach to education to be shared throughout the whole of the public school system.

If it is seen that education is an ongoing process which involves the community, as this curriculum review did so see it, then it is not sufficient to let the professionals know what the philosophy and aims of education are in the schools. The population at large should be made aware of why the changes are being made. This the Department of Education did in a series of bulletins one of which was Bulletin VII or the Parents' Bulletin. In this, much of what forms the forward to the "professionals" documents is stated verbatim. The work that went into trying to

ensure that everyone involved in the education of children either directly or indirectly was informed, was gratifying. With so much thought and effort being put into the preparation of the community for acceptance of change it is interesting to see whether or not change occurred.

The Mathematics Curricula

Each subject was explained in a detailed curriculum. For Mathematics, in the Junior High School Programme of Study, 47 pages cover the mathematics options. Since "the content of the course can be justified only by its value to society" (p. 374) the introduction states for mathematics that:

> The increasing complexity of our activities in every aspect of business and of most professions and vocations calls for an ever-growing number of men and women with mathematical training. A greater justification for including mathematics in our curriculum lies in the fact that the children themselves, in their social contacts, are continually faced with problems which require the application of mathematical principles. (Department of Education, 1936, p. 374)

Teachers are asked to make a conscious endeavour to create a desire on the part of the student for further mathematical knowledge.

> This is of particular importance when it is remembered that, beginning in Grade IX., mathematics becomes an optional subject. ... it is hoped that students entering other fields will choose to study mathematics for its own sake as a result of interest created or supplemented during these intermediate years. To accomplish these ends, the teacher should make himself thoroughly familiar with the material of the grades immediately preceding and succeeding that in which his own work lies. (Department of Education, 1936, p. 374)

The guide goes on to suggest that the General Mathematics course should be considered an exploratory course and should be:

> taught in a way that will make it possible for the simple, significant principles of arithmetic, algebra, and constructional geometry to be inter-related to the

> fullest extent. By such a treatment a pupil is enabled to broaden his application of mathematical principles and is led to the realization that many of the problems in his environment can be solved only by the co-ordination of these principles. (Department of Education, 1936, p. 374)

This suggests that problem solving and integration learned in mathematics will automatically translate to other areas of learning. What might translate is the method of thought which continuous problem solving develops in a child. The idea of analyzing the information, reformulating a situation in their own words and identifying clearly that which is required both for solving the problem and for resolving any situation in a satisfactory manner may well be a useful skill.

The guide suggests that one of the underlying principles of education is that the subject matter should be related to the student's experience. However, it goes on to say that despite this, some topics are included which have no immediate value to the students (p. 375). The pragmatic nature of this statement is important. Little attempt is made to justify the topics covered. Their usefulness lies in helping students "adjust themselves more adequately to their future environment" (p. 375) and enticing students to take mathematics. This implies that in Grade IX few would otherwise study mathematics. Items are included in the Grade IX course because many pupils will have no schooling beyond this point. It criticizes the over-emphasis on socialized classroom activity of previous years for overlooking the value of systematic drill and review. Teachers and students think drill is boring and results in monotonous procedures and lack of a sense of progress. It is suggested that if drill cards, progress graphs or self-improvement tests are used then interest will be added to "this very necessary phase of the learning process" (p. 375). Why drill is considered

necessary is not discussed. It is, perhaps, part of the cultural values that society holds unquestioningly; mathematics, to be seen to be good and true, must contain a substantial amount of drill.

Teachers are expected to handle individual differences and are told to use diagnostic tests to provide remedial work. Also stated is the idea of continuous progress.

> Promotion may be continuous, from unit to unit, just as growth is continuous. The failure of pupils often is due to hurrying over the year's work too rapidly. New topics are reached before old ones have been mastered. In many cases slow pupils are capable of learning the subject-matter of a course if the pace is not too rapid. They may be able to master, for example, three-fourths of the units comprising the work of the grade. The remaining units may then be completed at the beginning of the next year and formal promotion occur then. Similarly, more rapid learners may have mastered the allotted year's work in some subject or subjects in less than a year's time. Instead of wasting weeks or months in repetition and review they should begin the next year's work as soon as they are ready for it. This involves some individualizing of instruction. (Department of Education, 1936, pp. 18-19)

Of interest in this document is the tension between the socializing philosophy of Dewey and the atomistic theory of Thorndike. Although the fundamental philosophy stated that the subject matter should be meaningful to the student and should be taken from social situations known to the student, the prescribed mathematics text for the Grade VIII programme is Thorndike's Book II. Thorndike's approach to the psychology of learning mathematics was a commitment to mathematics as a tool. He felt that there was little point in establishing bonds of learning unless there was a return in the usefulness of the skill. This orientation showed the effect of business management on the educational field. The analogy frequently used was that of schools as factories (NCTM, 1970, p. 190). Students

were the raw materials on which teaching/learning, the process of manufacture, acts whereby the final products, graduating students, are transformed to suit the differing demands of society. For Thorndike mathematics was a tool subject while many educators thought of it as a way of thinking. Thorndike's texts emphasized the importance of establishing specific bonds by means of much drill. This psychological approach led to the fragmentation of arithmetic into a series of disconnected facts drilled and tested separately. Often it also led to a conscious effort not to teach related topics close together in time as that might lead to the establishing of unsuitable specific bonds. At the grade VIII level at least there appears to be an inherent contradiction between the avowed principle of teaching the child rather than the subject and the text selected.

In the grade VIII General Mathematics unit on the Arithmetic of the Environment, the general objective is "To have the pupils understand the application of mathematics to their home, community, and the industrial environment" (p. 398). Most of the suggested problems for this unit were to do with industry and appeared tailored to the British Columbia economy. One such problem was:

> In a government experiment in reforestation, it was found that 7% of the fir cones planted failed to grow. How many cones should be planted to ensure a growth of 3,162 trees? (p. 399)

With this type of application, a very conscious effort was being made to overcome the effects of teaching mathematics as a series of rules, each of which existed in isolation. Since the textbook was not designed for British Columbia, this was a commendable effort on the part of the Department of Education to localize the curriculum.

Unfortunately it consisted of only eight problems in the unit. Nevertheless, considering the undertaking of rewriting a new curriculum for all subjects, this provided an excellent guide to the type of thinking that the province wanted followed.

Implementation Difficulties

If a teacher had access to the 14 supplementary materials listed in the Bibliography (p. 416), then the course would not have had to be one of drill and practice. Much of the supplementary material was published by the National Council of Teachers of Mathematics (NCTM) who had over the previous 20 years been publishing excellent material illustrating the problems involved in teaching mathematics. The Mathematical Association of America's document The Reorganization of Mathematics in Secondary Education had an very important influence on mathematics teaching.

For at least 20 years this 1923 Report, as it was commonly known, continued to be a reference used by writers of articles on the topics in mathematics education. One of the major issues of discussion was the relative importance of aims or objectives. These debates caused teachers to modify their teaching strategies according to the maturity of the student learner. The 1923 Report suggested that drill could be overdone and that many topics could perhaps be overdone. These ideas are reflected in the 1936 revision in British Columbia.

Unfortunately not all teachers would have had access to the supplementary material and in fact probably few would. However, the Programme of Study spells out quite clearly both the general and the specific objectives of the courses. It lists

both the practical and the cultural aims with equal emphasis. It does not come down publicly in favour of one over the other. Listed equally are the objectives:

> To develop and maintain at a high level of efficiency, speed and accuracy in the fundamental processes with whole numbers, common decimal, and per cent. fractions

with:

> The development of an appreciation of the historical significance of mathematics as a factor in the progress of civilization. (Department of Education, 1936, p. 376)

This total review of the curriculum was, on the whole, a well thought out document, based on sound research and a very clearly defined philosophy of education at the middle school level. It encouraged teachers to use the resources available to them regarding background material in educational practice and in testing and evaluation. It suggested several sources of reference materials. It encouraged teachers to use an exploratory approach to the learning of mathematics. Yet all through the almost two thousand pages it retained a British Columbian approach to education. It was neither American in totality nor Ontarian. It was not English nor was it European. It tried to combine the best from each and change it to suit the province. This is noticeable in the mathematics curriculum where the problems are to do with lighthouse keepers and sinking boats, imported goods and the duty assessed, cables and logging-donkeys, harvesting fruit, lumber mill employee wages, salmon canneries, and mine shafts and the circulation of air through them. While for many pupils, these questions would still be removed from the reality of their lives if given directly to them, the idea was that this would provide a stimulus to teachers to

generate problems or applications which would be meaningful for the students in their particular geographic area.

The course in Business Arithmetic was outlined in 1936 in keeping with the view that students who would be leaving school at the end of grade IX should have a firm grounding in arithmetic. The course had seven aims:

> 1. To train for accuracy,and speed in simple arithmetic calculations.
> 2. To form correct habits in making symmetrical and legible figures...
> 3. To emphasize 'how' rather than 'why'
> 4. To give the arithmetic technique necessary for efficient work in the office, the store, the home, the bank.
> 5. To secure speed and neatness...
> 6. To give students..... an elementary training in preparing sales slips...
> 7. To give a frankly vocational training to those boys and girls who must leave school to seek employment as office boys, messenger-boys, time-keepers, juniors in banks, sales-girls cashiers. (Department of Education, 1936, p. 418)

The aims and purposes had not changed from those listed in the 1927 programme of studies for Business Arithmetic with the exception that the layout used letters to list topics in the course instead of numbers. It was in essence a course to train people for commercial enterprises. It added nothing to the new view of mathematics education.

The new curricula were drawn up with two points of view in mind, that of society and that of the individual. As was stated in the Aims and Philosophy of Education in British Columbia which appeared in all the programmes of Study:

> From the point of view of society, the schools in any state exist to develop citizens, or subjects, according to the prevailing dominant ideals of the state or society. Any society desires to transmit its culture. All states seek to ensure their safety, stability, and perpetuity. The people of a democratic state such as Canada aim at more than this. They wish to have citizens able to play their part in a democratic state, but able also to make adjustments in an evolving and progressive social order, so that social stability may be united with social progress. For these purposes they have established schools.

> From the point of view of the individual the schools exist to aid him in his own growth or self-realization, in making adjustments to this environment, and, it may be, in modifying this environment, which is at once a social and a physical environment. These two processes, of adjustment and of growth, are largely complementary, but at times they involve conflict. From their reconciliation comes individual-social balance and the development of an integrated personality, socially efficient and capable of further growth and progressive adjustment. This capacity for progressive adjustment requires the development of critical thinking, of open-mindedness and freedom from prejudice, unimpeded by ill-regulated emotion.
> Character, therefore, may be said to be the main objective of education. The school and its curriculum should be organized to achieve this end.
> (Department of Education, 1937, pp. 21-21)

This could just as easily have been quoted from the Elementary or the Junior High School Programme of Studies. The main purpose of education was the development of character which would be carried out by the careful choice of experiences chosen to act in one of the following ways:

1. By contributing directly to knowledge, attitudes and ideals, as in health, citizenship, and literary and artistic appreciation.
2. By arousing new interests which may become influential in later life.
3. By yielding as by-products such qualities as thoroughness, persistence in the face of difficulty, and the satisfaction of mastery. (p. 432)

The Mathematics curricula as designed in the mid-1930s and implemented in the late 1930s certainly fits the aims set down by the Department of Education. It contributed directly to knowledge, it could arouse interests which might be influential in later life and, because of the emphasis on drill, it could foster persistence in the face of difficulty.

Summary

During the mid 1930s, a total curriculum review was undertaken by the Department of Education. It tried to take into account all the most recent

developments in education. The final product was lengthy and highly detailed. It communicated the philosophy and ideals which underlay the subject matter of the curriculum and attempted to show how they could be implemented in the actual subject areas. In mathematics, the curriculum attempted to implement the ideals of teaching only that which was relevant to the student's life but was not totally successful in "that it has been necessary to include in Grade IX. material which is of no immediate value" (Department of Education, 1936, p. 375). Why this was so was not clearly stated. It talked of promoting students by subject and being flexible in the time taken for a student to achieve mastery. It emphasized the need for individual programming but did not address the difficulty of so doing.

It asked that the teachers begin to use commercially available tests to assess students and provide remediation. Teachers were encouraged to make the course more meaningful to the students by producing problems which were seen to be of use to students, and by using local examples for applications of mathematical strategies. It tried to move from the abstract, formalistic and the practical to the cultural aspect of appreciating the significance of mathematics historically and also the aesthetic value of Mathematics as a subject to be studied for its own inherent value.

The curriculum change of 1936 and subsequent years had a lasting impact on the education of British Columbian children and it was not until the 1960s that any more significant educational change took place, at least in the area of mathematics. As Henry Harrap said:

> Whether he will or no, every curriculum-maker inevitably influences the direction in which the next generation moves. My thesis is that he should do so consciously and intelligently. (Harrap, 1937, p. 57)

The changes proposed in the late 1930s were indeed conscious and intelligent.

CHAPTER SEVEN

History of Secondary Education in British Columbia: 1960 to 1990

With the publication of So Little for the Mind by Hilda Neatby in 1953, the increasing doubts felt by the public about the quality of the educational system received a focus. As she said

> Nowadays the school seems to be doing the job of the homes, and the home has to do the job the school was supposed to do. (Neatby, 1953, p. 202)

Neatby focussed the feeling that school work should not be simply enjoyable but should also extend the intellect. She was a strong and thoughtful proponent of the ideal of a liberal education which involved planned rational learning -- learning new facts with a view to intellectual mastery. Neatby felt that self-education in any shape even in the most restricted sense, was preferable to a system of teaching which did so little for the mind. Neatby's view of education was attractive as it insisted on an intellectual component which was demanding. However it was elitist and exclusive.

Another factor was the launching of Sputnik and Lunik, the Russian satellites. Feelings of despondency regarding the effectiveness of secondary schools were felt throughout the western world. In British Columbia, the reaction was to appoint a Royal Commission. On January 17, 1958 the government of British Columbia passed an Order in Council appointing a Royal Commission on Education. They were instructed to make a comprehensive study of the elementary and secondary education system. While the appointment of the commission "did not arise from any

widespread or exceptional discontent with the existing educational system of the Province, or from any concerted public demand for drastic changes" (Ministry of Education, 1960), it is certainly the view of the people who were active in the education system at that time that the public reaction and speeches made at the annual meeting of the trustees did not provide the government with reasons **not** to appoint a commission.

The Chant Commission Report

The commission, under the chairmanship of Dean Sperrin N.F. Chant, handed its report to the government at the end of 1960. It was released to the public on December 29, 1960.

Few of the nearly 400 briefs submitted to the Chant Commission were highly critical of the school system. The tone of the report can be found in the first recommendation of the commission:

> that the primary or general aim of the educational system in British Columbia should be that of promoting the intellectual development of the pupils, and that this should be the major emphasis throughout the whole school programme. (Chant, 1960, p. 17,18)

From an examination of the briefs submitted, it can be seen that many in the profession were unhappy at the esteem or lack of it with which the public held the General Programme. The ratio of pupils enrolled in the University programme to those in the General Programme in one school district was 3:2 which "was the reverse of the ratio generally advocated by leading educationists" (J.LLoyd Crowe Senior High School, 1959, p. 21). It was felt that parents and students preferred the risk of failure in the University Programme to assured success in the General Programme.

This was driven by the perception that employers favoured the academic nature of the programme and that the parents themselves wanted an academic quality to the education their children received.

The reason for student failure in the University Programme was in part caused by the large number of students enrolled in the programme who were not really academically fitted to the programme. Inevitably, standards were lowered but despite this, the failure rate still remained high. Also, because of the over-enrollment in the University Programme, "the standard which could reasonably be expected of the small number of students which did follow the General Programme made that programme of little worth" (J.LLoyd Crowe Senior High School, 1959, p. 21). With a few exceptions, secondary students were thought to possess little initiative and little responsibility for their own education.

As its main recommendation, the Commissioners stated that the public school system should promote the intellectual development of the students and this aim should be emphasized throughout the programme. Intellectual development was seen to be important as society depended more than ever on finding more intelligent ways of dealing with problems which threatened the human race and also because intellectual development was traditionally the foremost aim of any education system throughout history.

When the report addressed the programmes of study it established priorities for the subjects by arranging them as central or core subjects; inner subjects; and outer subjects. The central subjects were the "word" and "number" subjects, language

arts, because "these are the foundations on which all education is based" (Chant, 1960, p. 282) and mathematics, because "one can employ this knowledge to perform many important reckonings, and to learn facts that are otherwise undiscoverable" (Chant, 1960, p. 283). This is the first time that mathematics is seen as a required course beyond grade VIII. Inner subjects were those which were rightly considered to be school subjects and which were not taught elsewhere. These were history, geography, social studies and languages. The subjects comprising the outer subjects were mostly elective courses such as art, drama, commerce, physical education, home economics, industrial arts and health. These were thought to be able to be included in the school curriculum but were also taught outside the school system.

While this was an important change from the developments of the 1936 curriculum, which were based on the results of the Putman and Weir Survey of the School System, the major implications of the Chant Report were those of reorganizing the whole public school system. The reorganization was based on the following rationale:

1. To ensure that basic skills and knowledge are acquired by all pupils to the extent of their ability

2. To make full use of examinations to assess pupil achievement

3. To provide a suitable education combined with vocational training for pupils whose level of achievement is not sufficient for normal progress in the regular school programme

4. To establish and maintain educational standards throughout the regular school programme that will demand the best effort on the part of the pupils

5. To intensify the instruction in basic subjects in the regular school programme by reducing the number of elective subjects

6. To give an increased emphasis to the subjects of the curriculum that have the most direct bearing upon the intellectual development of the pupils in the regular school programme

7. To provide a choice between an academic and a technical programme at an advanced level, each of which will lead to further educational opportunities in accordance with pupils' objectives. (Chant, 1960, p. 255)

For reasons of economy and in the light of another of Chant's recommendations, in September 1961 Grade VII pupils were returned to elementary school. The reasons given to support this move were :

i) school enrolment was growing rapidly

ii) the cost of increasing an elementary school building was less than the same increase in a secondary school building

iii) grade VII students were considered too young to be part of the secondary school.

The whole idea of the middle school had disappeared. No longer was the philosophy to give the emerging adolescent exposure to a wide range of subjects. Rather it was to develop the intellect of the student whenever possible. The two programme system of previous years -- University and General -- was replaced by a six programme arrangement. The University programme became the Academic and Technical programme while the General programme became five new programmes: Commercial, Industrial, Community Service, Visual and Performing Arts, and Agriculture. All programmes had four basic parts called General Education

Constants, Programme Constants, Programme Specialties, and Free Electives. The constants were required courses while the other two could vary with the student's interests. This immediately counteracted the criticism that high schools just graduated students who had the correct number of credits regardless of whether or not the combination made sense. From the point of view of giving a direction and a coherence to a programme of study, this move certainly improved the perception of what education was all about. The Department believed that the changes were

> based on the belief that where students are provided with a meaningful sequence of courses directed towards a particular purpose which they themselves consider valuable and which lies within their abilities, they will respond with a serious commitment to their studies. (Department of Education, 1967, p. 6)

Implementation of the Chant Commission Recommendations

The reorganization of the secondary curriculum was implemented starting with Grade VIII in September 1962 with the first graduating class of the new programme being the class of 1967. Because the number of programmes offered increased, smaller schools and school districts found that they did not have the resources to provide for everything. As a result some of them amalgamated with neighboring school districts to provide larger catchments. This allowed them to offer all the programmes.

Many administrative changes took place at this time with a rationalization of the naming and numbering of the courses most of which are still in use today. From this point on, the credit system was completely eliminated. To complete successfully

a programme, a student had to complete the general education constants, the programme constants and the specialties. The results of all of these along with the electives taken were recorded with the achievement in them on the student's transcript for all grade XI and XII courses.

In the Academic and Technical Programme students needed to graduate with complete standing in order to meet the university entrance standards. While the nature of this programme was to gain entrance to the universities, it also satisfied the requirements of the Colleges and the Institute of Technology. Mathematics was required up to the grade 11 level for all students in the Academic and Technical programme as was Science. If a student wished to pursue either the science or the technical specialty, an additional year's study was required. The importance of both mathematics and science had been recognized, and this recognition was, no doubt, influenced by the Russian technological achievements of the past decade. Standing was granted if marks of A, B, C+, or C were earned if the student attended an accredited school. If a student did not have at least a C in a non-examinable course, then the student was required to write a final year school examination and would receive a grade of Pass or Fail depending on the result. In the case of examinable subjects, a student who had not received at least a C, had to sit the Department exam.

The reorganized curriculum was more prescriptive than the old University programme. In the new, once a student had selected a specialty, this had to be followed through in order to graduate. No variations were permitted. This was known as Corridor Programming once the student entered, he had to continue along

it. With judicious choices, a student could manage to satisfy the requirements of two specialties thus graduating with standing in, say, both Arts and Science or Science and Technology. This was in line with the Commission's view of the aim of education.

In the area of mathematics education, the commission felt that it required a balance between drill in calculation and an understanding of the mathematical principles involved (Chant, 1960, p. 304). As usual, when criticism of mathematics teaching is criticized, neatness assumes an inordinate importance. Neatness of presentation is required in any final presentation, but in the intermediate stages of thinking through a situation, frequently neatness only encourages convergent thinking and perhaps limits divergent thinking. Finger counting was considered reprehensible.

> There was no evidence in the course of this lesson of the children doing any finger counting in order to arrive at their answers. (Chant, 1960, p. 306)

In the epilogue the report does say that while concern has been expressed that students in the province were deficient in the use of their native language and arithmetical skills, this was not unique to British Columbia. Educational authorities from Great Britain, the Commonwealth, the United States, France, Holland, Belgium and Japan all expressed the same concern. In the Commission's view, the schools of the province compared favourably with any other country. (Chant, 1960, p. 442).

The Report of the Royal Commission on Education had an important impact on both the organization of the schools and on the organization of the programmes of study offered in the schools. Its recommendations had little effect on the style or content of mathematics education in the province. It did re-emphasize the importance society placed on the value of compulsory mathematics education. It was more an

effect of emphasis rather than content. The content did not change at the secondary level to any noticeable extent. Some little change did occur in that set theory was being taught even if at a very rudimentary level.

In the 1970s provincial examinations at the grade 12 level were eliminated and then, in view of the perception of no or too low standards, were re-introduced in 1983. Much controversy resulted in both cases. To drop them was seen to be a liberating influence for education. Teachers would not have to teach to the examination and should in theory be able to teach ideas and thinking instead of having to worry about the provincial examination results. Theoretically, many more students would be permitted to take a course even if they were not going to do very well. Their results would not reflect on the performance of the school. In fact the public's perception was one of failing standards. Students were seen as being passed without the necessary knowledge. Universities were claiming that students were not coming to them with the necessary skills and that the academic standards had fallen.

The Sullivan Commission

When the provincial examinations were re-introduced the traditional criticisms were voiced. Teaching would be to the examination. Students would not learn to think but only conserve the present standards. Too much pressure would be placed on students to have an accurate measure of their knowledge if the assessment was carried out by a single examination.

The government asked Barry Sullivan to undertake another Royal Commission study of provincial schooling. This was to help determine the kinds of schooling

required at that time and to provide a picture of what kinds of schooling would be required in the years ahead. As might be expected, the announcement brought mixed reactions. The feeling in the community was one of wary and sometimes hostile disinterest. As was accurately observed

> The fundamental problem with education is that it is seen as an 'issue'. Issues have adversaries -- winners and losers. Unfortunately, in this case, the wins are short term and superficial and the losses are profound and affect us all. (Sullivan, 1988, p. 5)

The Sullivan Commission tried, through a consultative process, to change attitudes so that the hostility diminished and true communication took place. In the final analysis, the effect of this report will not be realized for many years. At this stage, it appears to be a forward-looking document which is sensitive to all interested parties. The major focus of the report was in the area of school/curriculum reorganization.

It discussed the needs of students at different stages of development and advised that the primary grades be arranged as ungraded classes. When students reached grades 4 through 10 it suggested that they be treated to what it called a common curriculum. This common curriculum included four categories of subject matter.

1. The Humanities (English, Social Studies, French as a Second Language);
2. Fine Arts (Music, Visual Arts, Theatre, Dance);
3. Sciences (Mathematics, General Science, Technology); and
4. Practical Arts (Physical Education, Industrial Education, Home Economics, Lifespan Education) (Sullivan, 1988, p. 95)

This was a controversial suggestion in the arrangement of the curriculum and had far-reaching implications for the curriculum directly and for the structure of the school.

> We see this Common Curriculum structure of such potential value that we believe every child who is capable should complete it in order to establish a solid foundation for the various programme alternatives available in the senior secondary school years. (Sullivan, 1988, p. 104)

If this direction were followed, then it would mean that at the grade 8-10 level the teaching could no longer be carried out in the traditional five by eight timetable now typical in the grade 8-10 junior secondary school. The proposed integrated curriculum would require students to meet with subject specialists less frequently than at present and more with interdisciplinary teams.

The report recommended that throughout the years of the Common Curriculum from grades 1-10:

(1) teachers use an interdisciplinary approach in their teaching;
(2) teachers instruct in a minimum of two different subject areas and work in interdisciplinary teams, at any given grade level;
(3) the Ministry of Education develop and distribute curriculum documents which provide examples of interdisciplinary relationships and articulation among subjects, and between course content and life experiences of the learners;
(4) faculties of education develop methodological courses which emphasize and facilitate these integrative and instructional approaches. (Sullivan, 1988, p. 100)

Schools were asked to meet the needs of the young adolescent by not exposing them to too many different teachers in a school year. Students need a teacher-mentor who will know them and remain with them throughout their school years.

Beyond the Common Curriculum, in grades 11 & 12, the recommendation was that the Ministry re-examine its secondary school graduation requirements with a view to expanding the student choice in course selection.

The report suggested that more flexibility be granted schools to adapt to local circumstances; that a core programme be established which is not aimed strictly at university entrance; that since the general academic programme will be the choice of the majority of students and their parents, in addition to the compulsory core, students should have a variety of electives to choose from; and that alternative programmes be set up which are not necessarily of an academic nature but which may involve a practical component. In summary the report suggests that the compulsory core subjects be English, History, and Science, Technology and the Environment and that the additional subjects be the ones required for specific post-secondary or career programmes.

The report also addressed the issue of lifelong learning as well as addressing the issues facing the teaching profession, gender equity and school administration.

Summary

As a reaction in part to the general unrest and dissatisfaction with the public's perception of the efficacy of the public system, and in part to the impression that the West was losing the space race to the Russians, the British Columbia Government appointed a Royal Commission on Education. This was only the second such

commission in the history of the public education system in British Columbia. The commission was chaired by Dean Chant of the University of British Columbia.

Its first recommendation was that schools should return to what for the commissioners was the primary purpose of education, that of promoting the intellectual development of the child. The briefs submitted to the Commission showed that there was a feeling that the school system was not operating as it should. The University programme was attracting too many students and the General programme too few. This led to the inevitable lowering of standards in the former and almost abandonment of the students in the latter. To counteract this, the Chant report tried to rearrange the subjects taught into core, inner and outer subjects. Core subjects were those considered foundations of all education (mathematics and language arts); the inner subjects those not foundational but not able to be readily acquired outside the school system (social studies, languages and history and geography); and outer subjects which were available outside the school system (art, music, drama and other electives). More importantly the Chant report tried to reorganize the school system from an six-three-three system to a seven-five system. This eliminated any idea of a middle school. The reasons behind this were partly pragmatic (lack of available finance) and partly developmental (students of grade VII age were considered too young and immature to mix with the older students in a comprehensive 7 - 12 high school). It cost less to expand an elementary school than a high school.

Academically the recommendations were seen to be more prescriptive than the previous structures. Mathematics was raised to a compulsory course which had to be taken to the grade XI level. Curriculum revisions took place but these were more in the nature of rationalizing the current courses, splitting them into various options and renumbering them for ease of identification.

From 1960 to 1973, provincial examinations were carried out in specific grade XII academic subjects. It was still possible to be recommended by the school in a subject and not have to sit the examination. In 1983, the system of examinations was reinstated without a system of recommendations.

The government appointed Barry Sullivan commissioner of the third Royal Commission on Education on March 14, 1987. The report entitled A Legacy for Learners was presented to the government on July 15, 1988.

The recommendations, if implemented, will have far reaching consequences for the school system. The delivery of education is split into three areas of Kindergarten, Common Curriculum, and beyond the Common Curriculum. It is in the Common Curriculum that the school programme requires most attention. The Commission divided it into the primary level equivalent to grades one through three where it would be ungraded, and grades four through ten which should be taught in an interdisciplinary manner. Grades eleven and twelve would have several programmes having a common core of English, Social Studies, and Science,

Technology and the Environment and then various options which would be adapted to the post-secondary institutions or the workplace.

Some of the commission's recommendations have been implemented but it remains an open question as to whether or not the report will have a long reaching effect on public schools.

CHAPTER EIGHT

Secondary Mathematics Curriculum in British Columbia from 1946 to 1990

In the revision of the curriculum it must be remembered that Mathematics was a required course only as far as Grade VIII. After that it became an optional course, one of the Variable courses. For High School Graduation, and the terminology is of interest as it shows the Department of Education's determination to change the focus from Matriculation, that is, University entrance to High School completion, 112 credits were required over the four years of grades IX to XII. Of these credits the maximum earned by Mathematics was 20. This is the same as the number of credits which were earned through taking English, a constant or compulsory course. No other subject could earn as many credits. This implies that while mathematics was not considered essential for the student, it was held in high regard. On the whole the new programme was designed to produce a well rounded student rather than an academic one only.

Changes in Mathematics Curricula

Mathematics from 1946 to 1960

The new programme was fully implemented by the end of 1940. High School Graduation was now possible on one of two levels, the University Programme which still remained under the Department of Education and the High School Graduation Programme which was under the control of the school. The school could award the

diploma on completion of the correct number of credits. By this time the high schools no longer offered a Normal School Entrance Programme. From now on, students would have to have at least university entrance qualifications with the addition of some extra subjects such as Art and Geography.

Despite all the changes in curriculum and the real enthusiasm expressed for the new progressive curriculum, any students intending going to university were cautioned by the Department of Education to include in their course selection all those required by the province and also those designated by the University of British Columbia. For University Entrance the required credits were English, Social Studies, General Science, Mathematics, a Foreign Language, and Health and Physical Education. Thus the university was controlled the high school choice of courses for students.

By the time the Programme of Studies was issued in 1945, many school districts had decided that for lack of adequate finance they would operate on a six-six arrangement rather than a six-three-three. It was possible that this could be beneficial to both the junior and the senior levels. The section entitled The relation of junior and senior high schools of the Programme of Studies it cautioned that the union is advantageous provided

> the principal of the combined school understands the programme and purposes of the Junior High School and has the organizing and administrative ability and powers of leadership needed for the task. In such a case the life of both upper and lower school is enriched. (Department of Education, 1945, p. 24).

It also states that a Senior High School may have a depressing influence upon a Junior High School when they are distinct entities. In order to avoid the criticism that their students "are not properly prepared, or do not know the fundamentals", the

Junior High School teacher "resorts to drill and cram" (p. 24). This would negate the philosophy of the Junior High School and might cause the school to become less progressive and creative than it would otherwise be. That this is stated in the Programme of Studies and that the Department of Education should have found it necessary to reiterate the ideals set out in the 1936-39 curriculum bulletins would suggest that throughout the war years, while the ideals were still there, the reality was that education was again being controlled from the top down. The University entrance requirements were forcing education back into the drill and examine form.

The 1945 Programme of Studies stated that the content of a course can be justified only by its value to society. It goes on to say that mathematics has such a value which is

> evidenced by the fact that man is with increasing frequency, solving his problems by the application of scientific methods, and hence quantitative knowledge has become more essential to the material progress of our civilization. (Department of Education, 1945, p. 382)

There was, however, no change of curriculum accompanying this statement. This is odd; the United States had found itself to be at a disadvantage at the start of World War II for lack of its appreciation of the Applied Mathematics field, and so a strengthening of the more liberal attitudes to mathematics education might have been expected. Since Canada had followed the United States in mathematics education it too was inclined towards the pure rather than the applied mathematics in school mathematics.

When the curriculum guide for Mathematics was issued in 1950, the preamble to the listing of general objectives contained nothing that was not in the 1936 revision

and in fact contained much less. The 1950 document stated that the growth in popularity of mathematics over the past decade had led to the over-emphasis on the socialized classroom activity with the result that systematic drill and review had been overlooked. It still emphasized the importance of neatness and precision, speed and accuracy in fundamental processes. It remained based on the idea of mathematics as a pure subject with a very formalized structure. The influence of Hilbert and formalism was still to be seen in the course.

The Department of Education wanted the new composite high schools to be non-selective and general in nature rather than of a highly academic nature. This was naturally a serious challenge to educators of British Columbia. Was it possible to provide a very general education and vocational training for the majority of the students while still providing an education for the small number of truly gifted students to whom society would look in the future for solutions to its problems? The curricular adjustment of 1950 carried out by the Department of Education had little affect on the mathematics teachers of the province (R. Haddon, personal communication, June 1989). Apart from the renumbering the courses and changing the electives required for graduation, the changes brought about concerning the new composite high schools did not alter what went on in the mathematics classroom. It would appear that mathematics educators were either not able to or were not aware of the need to change.

In 1946, the text books had been changed from separate discipline textbooks to Education through Mathematics by McLeish and Smith. This textbook, authorized for

grades X and XI, attempted to integrate mathematics. Its theorems were embedded in long discussions instead of being laid out in the traditional manner. It tried to give interesting applications for the theorems, for example, to find the latitude for a place using either the position of the pole star or the sun, finding the earth's diameter and the principles behind the pantograph. This move was reversed in 1954 when the authorized textbooks were again separate ones for algebra and geometry.

In Canada, educators did not adopt the American model of algebra in grade 9, geometry in grade 10 and then another year of algebra in grade 11. Rather they seemed to favour the idea of continuous development of algebraic and geometric ideas in parallel. Perhaps this was because they believed that time was needed to assimilate the knowledge. If the course content was crammed into too short a space of time, then mastery of the fundamental concepts would not occur. Also if there was a long gap in instruction, as there was in the American model, then students would forget all they had been taught and have to be instructed again.

Mathematics from 1960 to 1973

The effect of the Chant Commission report can be seen on the mathematics curriculum by the mid 1960s. The curriculum guide for Secondary School Mathematics for 1966 is certainly very different in presentation from those issued from 1936 to 1939. In the objectives for Mathematics 11 it states that:

> Because it is a constant in the Academic Programme, the course is designed to complete the general cultural education in mathematics of the 'college capable' student who is in the 'better than average ' ability group, the grade XI population. (Department of Education, 1966, p.34)

The course content was set down as a series of chapters in the prescribed text with a possible time allocation, the prescribed pages, enrichment if there was any and suggestions to teachers. The suggestions to the teachers were of an extremely rudimentary nature, for example, one of the few suggestions was "Section 5-6 should be completed by Christmas" (p. 36). The whole secondary mathematics curriculum, Grades VII through XII took only 49 pages. The Mathematics XII course had several objectives which were stated briefly as

> This course is designed to extend the cultural background of the student.
> The student is introduced to algebraic systems with an axiomatic structure different from that of the real numbers.
> Opportunities are provided for students to explore, to develop creativity, and acquire facility in the use of these techniques. (Department of Education, 1966, p. 46)

The course was not designed for the average student. Indeed the guide says that it was designed for "those students with above-average ability" (p. 34). Again the guide listed chapters to be covered with no rationale for inclusion or exclusion of topics. Students were to be taught extreme formalism which would suit them admirably for entering a university mathematics department. The use of set theory notation and axiomatics in the curriculum of the high school was a reflection of a philosophy of mathematics which reduces all mathematics to axiomatic systems. For this approach, details of proofs are demanded and definitions are memorized but no time is left for the discussion of why a particular topic should be studied, why a problem is interesting, or why one method of proof should be used over another. Little time was spent discussing the relative merits of one method over another or the value attached to elegance in a mathematical solution. The majority of students over

the next 20 years developed the idea that mathematics was something not necessarily of value in and of itself, for its interest, but something to be endured (Ministry of Education, 1982,p. 151). For it was seen as something that saw itself as the source of truth whereas mathematical truth is like all other truth fallible and corrigible (Hersch, 1979, p. 43).

From a mathematical viewpoint, the changes brought about by the Chant report were not very noticeable at the secondary level except that the required textbooks all used set notation. Not all teachers of mathematics were knowledgeable in set theory and so, instead of it becoming a tool to increase understanding of the ideas on which mathematics is based, it became yet another drudgery for students. Students, and in many cases teachers too, felt it was a waste of time to give reasons for all the basic operations which they were carrying out and had been carrying out for many years. They could see no reason for saying that they were using the distributive principle of multiplication over addition, when they knew how to carry out the operations (B.E. Deuel and R. Haddon, personal communications, April 1989).

Modern mathematics failed in British Columbia as it failed elsewhere. Structure, proof, generalization and abstraction were the essence of the modern mathematics. Emphasizing these ideas required precision and care in all mathematical statements. In teaching mathematics then, these essentials had to be clearly evident to the student because of their inherent importance. To make mathematics applicable to

problems, the student must understand the underlying structures inherent in both the application and the mathematics used. (Jones & Coxford, 1970).

A fundamental principle of the modern mathematics movement was that if a student was well prepared in mathematical theory, he or she would be better prepared to apply mathematics to a new, possibly non-mathematical situation with more facility than a student not so trained. This belief was more than just another way of supporting the idea of mathematics for its mental discipline effects. It also showed a belief that there was a transfer of training across disciplines. This grew out of observations that during the war people had to do things for which they had never been trained.

Most mathematics teachers, however, never were given the training be necessary for them to be completely comfortable and familiar with the ideas before they had to teach them in the classroom. While some teacher re-education did take place, for many teachers this was just another set of rules to be learned by the students. Even those who were involved in preparing the documentation for upgrading teachers in the sixties, now express disillusion with the 'new math' movement.

> If I was back there now, knowing what I do of the disastrous effects the new math had on many bright students, I would never take part in promoting it. Too many teachers had no concept of what was behind the ideas. Instead of gaining a better understanding of mathematics, students were given theory that they were not ready for. In the end they ended up with not only no understanding of the theory but also no straight arithmetic computational skills which the 'old math' gave them. At least then, they could use math. Now they can't even do that. (Moira Schulte, personal communication, 1991)

Mathematics from 1973 to 1983

By the time the mid 1970s arrived, the mathematics curriculum was in need of a revision. The modern mathematics movement was not as successful as had been hoped and there had been no really major revision of the secondary curriculum, apart from the introduction of set theory, for close to 40 years. All the other revisions had taken place more as adaptations of the old rather than a total rethinking of the teaching of mathematics in the light of developments in mathematics over the current century. In British Columbia the rewriting of the mathematics curriculum began in 1973, and the new curriculum was issued in 1976.

This time the proceedings of the curriculum review committee were shrouded in secrecy. No input was publicly sought from teachers. When it was finally produced, nothing either good or bad, could be attributed to any one person.

The general statement underlying the Mathematics Curriculum Guide Years One to Twelve (1978) asserts that before any formal mathematics can be understood, there must be a wealth of manipulative experiences.

> The intuitive understanding of mathematical concepts and relations is not sufficient. A child must be able to perform or 'do mathematics'. At the elementary level, it is important the mathematics programme include facts, computation and processes. (Ministry of Education, 1978, p. 2)

It goes on to describe the eight stages in the sequence of learning from exploratory experiences to constructing generalized mathematical models for future use.

The statement is made with respect to grade 11 and 12 that the new courses are designed with elective courses for students in mind. These would be selected with regard to the student's post-secondary goals in mind, the secondary school programme

which the student was intending to follow, or simply student interest and ability. The electives offered were: Algebra 11, Algebra 12, Consumer Mathematics 11, Trade Mathematics 11, Computing Science 11, Probability and Statistics 12, and Geometry 12. Enriched Algebra 11 and 12 courses were suggested:

> If students are to be encouraged to study mathematics at a level best suited to their abilities it is important that appropriate grading procedures be established. In particular, students whose studies are chosen from the enriched formats should not be penalized in the assignment of final grades in Algebra 11 and 12 for undertaking work of a more challenging nature. (Ministry of Education, 1978, p. 43)

The detailed curriculum for Algebra 11 and Algebra 12 took 11 pages to describe all four courses. A scope and sequence chart identified the topics and the pages of the text on which the topics were addressed. Occasionally the remarks column had a cryptic comment such as "Complex numbers are not in the Algebra 11 core" (p. 44). It was, in fact, not too much different from the guides produced during the first 30 years of this century. The information given could either be interpreted as giving the teacher total freedom to teach how he or she liked or as an indication to teachers that this was exactly what should be taught, a minimalist approach.

In Geometry 12, teachers were told the text and given a list of 11 learning outcomes together with the statement that Geometry 12 had been developed to provide the student with the opportunity to study in depth concepts already established in the earlier years using a more sophisticated approach. One of the learning outcomes required the student to develop an understanding of geometry of the real world -- two and three dimensions. This was an absolute gift to a knowledgeable teacher who

could then bring in many new mathematical ideas and concepts and move away from the strictly Euclidean approach of the course. The teacher might discuss non-euclidean geometries and other newer mathematical ideas which otherwise would not appear in the course.

Mathematics from 1983 to 1990

The next major review of the mathematics curriculum began in December, 1983 with the first meeting of the Mathematics Curriculum Revision Committees. The membership of the committees was chosen to reflect expertise from among mathematicians, mathematics educators, and generalist teachers from elementary, secondary and post-secondary levels. They drew on their own personal knowledge and experience, provincial briefs, and other sources such as results from the British Columbia Learning Assessment Program. No money was available for the committee to research the developments which were taking place in Australia and Europe and so new approaches, especially in Australia, went largely ignored.

The four committees (elementary, 7/8 sub-committee, secondary and coordinating) met together to decide on a statement of philosophy, rationale, goals and to determine the necessary changes and overall structure of the school mathematics programme. Throughout the process, teachers in the field were consulted and the British Columbia Association of Mathematics Teachers (BCAMT) were active in publishing information on the proceedings of the committees. Teachers' opinions were actively canvassed.

The membership of the co-ordinating committee consisted of a school trustee, a member of the Department of Mathematics and Science Education at UBC, a retired member of the Department of Mathematics at UBC, a member of the Department of Mathematics at BCIT, and two mathematics teachers. This gave the deliberations a top-down focus although, since the actual writing of the curriculum was done by teachers, it did not control too much the direction of the changes. It did have a noticeable effect during the early deliberations, where the idea of an alternative Mathematics course at the grade 12 level was met with statements that the university and BCIT would not accept it for entrance. The feeling was that students from such a course of a more general nature would not have the detailed skills, such as logarithm manipulation, so necessary for the university courses. Also perhaps the underlying idea was that students in a more general survey mathematics course might need to have a different type of mathematics course designed for them at the university level. Despite the initial disagreements, the new curriculum was introduced in the schools optionally in the 1987-88 school year. The first provincial examination was held in January 1991.

Two curriculum guides were published; one for grades 1 through 8 for the elementary school, and the other for grades 7 through 12 for the secondary school. This was meant to provide a bridge for teachers so that at each level, at least to a minimum degree, they had knowledge of what was being taught before or after their level of teaching. It tried to break down the barrier between that which occurred in the elementary school and that which was taught in the secondary school. It also tried

to destroy the false distinction that 'real mathematics' was taught at the secondary level, and probably only at the grade 12 level, while arithmetic was taught in elementary schools. The statement of philosophy read:

> Mathematics is an integral part of human experience. The reasoning skills developed through the study of mathematics are necessary for all citizens to function productively in society. Also important is the human satisfaction that arises from understanding mathematics as an extension of the concrete world. For these reasons, mathematics is an important component of education and therefore it should be the right of every student to receive a level of mathematics instruction appropriate to his or her needs and abilities. (Ministry of Education, 1988, p. vii)

In the rationale section, the following are posited

> 1. Mathematics is the study of number relationships and spatial forms as related to physical phenomena.
> 2. Mathematics is a tool (applied mathematics) or a study of the properties of number and form (pure mathematics)
> 3. Positive attitudes to mathematics should be generated.
> 4. Mathematical and technological literacy are required of citizens in our society.
> 5. Understanding develops from the concrete to the abstract and at different rates for each student. The depth of understanding and abstraction should be tailored to the individual student. (p. viii)

The basic ideas that mathematics is both a tool subject and a pure subject are the same as those stated in 1936-39. The 1988 curriculum guide recommends calculators for use at all grade levels but the following caution is there:

> **It must be strongly emphasized that calculators are not to be used in such a way that they would replace the need for students to learn the basic facts and skills necessary to become proficient with mental arithmetic calculations.** (Department of Education, 1988, p. xi, emphasis in original)

This is highly reminiscent of the 1930s revision where teachers were cautioned not to forget that drill and practice were a necessary part of mathematics learning. In this area at least, things do not seem to have changed.

The new programme emphasized the need for all students to be provided with a balance of mathematical experiences. To do this, the guide was organized into five main strands: Number and Number Operations; Data Analysis; Geometry; Measurement; and Algebra. Problem solving was an additional strand at the elementary level. These content strands were followed throughout all grade levels with problem solving being integrated throughout from grades 7-12. It was expected that teachers at the secondary level would naturally use problem solving as an integrated part of their teaching.

After two years of the mathematics programme being fully introduced, some observations can be made on the success of its implementation. Since Data Analysis is not being examined on the provincial examination, teachers tend not to teach it at the grade 11 level. As a result, this attitude percolates down through the secondary system. Data Analysis is not required for university or college entrance or for first year courses. Teachers on the whole are not familiar with the concepts of probability, interpretation of non-mathematical graphs and so leave this unit out if they run short of time. It is a natural behaviour to leave to the end anything which may involve extra work and learning before teaching it. Nevertheless, because communication across the elementary-secondary interface is not great, data analysis is still being taught at the elementary level.

The design of the curriculum is different from its immediate predecessor. Previously, there was one main series of courses mostly of an academic nature. Local schools and school districts employed varying strategies to offer alternative

courses for students who were not of average ability; "honour" courses for above-average students, or, "modified" courses for below-average students. Entry to these courses was usually through assessment of the student on school performance. Frequently modified courses were filled with students who did not lack ability but had not performed well in the previous school year. The result was that some students placed in the modified section even there were unable to learn because of their many behavioural problems. Some schools restricted enrollment in modified courses to students who were of low academic ability with the condition of entry being that they would return to the regular class if they misbehaved. All of this type of streaming was unofficial.

Under the new curriculum, after an initial year in grade 8, the programme split into two streams: an "A" series of courses and the regular series of courses. In the regular series of courses a student progressed through Mathematics 9, 10, 11, and on to either Mathematics 12 or a new course, Survey Mathematics 12.

In the alternate series of courses after grade 8, a lower-achieving student would move on into Mathematics 9A followed by Mathematics 10A. At this stage the student who is more mature than in grade 8 may be ready to transfer back into the regular stream. This is achieved by next taking Introductory Mathematics 11 followed by Mathematics 11 in the regular stream. If at the end of Mathematics 10A, a student having neither the desire nor the ability to move into Introductory Mathematics 11, may continue into Mathematics 11A since a mathematics course at the grade 11 level is a requirement for graduation from high school. This design does

not have any provision for honour courses and in fact there have been rumours that offering these courses unless in a specially defined programme like the International Baccalaureate or Advanced Placement Programmes might be ruled to be against the Canadian Charter of Rights.

Changes to the Curriculum at Grades 11 and 12

When deciding what changes should be made to the curriculum in order to allow the time required teach both data analysis and geometry to the committee reviewed all topics for their relevance in a technological society, their importance as pre-requisites for further studies in mathematics and the type of reasoning they demanded (Ministry of Education, 1986 p. 185).

The introduction of Euclidean Geometry is problematic because many secondary teachers have never taken a formal course in geometry. The topics in the 1966 Mathematics 12 course then included no geometry. This has meant that teachers will have to be retrained if they are going to teach the course effectively rather than as a series of propositions to be memorized. One of the ways devised by the Ministry to overcome this problem was to produce a book of geometry examples which took the student through a series of guided proofs. Unless used discriminately, there is a danger that a student begins to think that there is only one way to reason through a geometry proof. Guided proofs are especially difficult for above-average students who find it frustrating to have to go through someone else's proof when they can see their own way through.

The major development in the Mathematics 12 course has been the introduction of an introductory calculus unit. This unit takes about one-seventh of the course time. The idea behind this unit was to give students an appreciation of calculus as a tool and also to give them an opportunity to apply the algebraic and geometric concepts they had already learned. This is a positive step but since universities are demanding that high school students entering science should have a calculus course, this may not be enough as it covers only a small part of Differential Calculus and no Integral Calculus. Two topics, Vectors and the Binomial Expansion, from the old Algebra 12 course have been dropped completely. Other changes were made in placing topics at more appropriate points to develop students' mathematical concepts. One of the greatest difficulties for the teacher, at least at the senior levels, is that topics are no longer to be covered in as great a depth as previously. Topics such as trigonometry cannot be easily developed in depth, and this is difficult for teachers who have been used to teaching using the old textbooks.

The new textbooks were supposedly designed for British Columbia but the changes made were minimal. Since the senior programme is only in its second year it is not possible to pass judgement on the success or failure of the changes. The potential is there for an improvement for the majority of students but whether the minority who are destined for university will find it an improvement, is still unknown. Some teachers are in fact "enriching" the course with the topics from the old Algebra 12 curriculum. These teachers feel that the students are not going to be well prepared for a Calculus course at university if they do not know all the

derivations of trigonometric functions, and have not had sufficient practice at proving trigonometric identities and logarithmic manipulations. At this stage, the grade 12 curriculum, the actual implemented curriculum, is controlled by the idea of university demands. If this is so, little time or energy can be spent on developing positive attitudes towards mathematics or on attempting to develop the cultural values of mathematics.

Summary

Following the major curriculum revision and reassessment of the aims and philosophy for a public school education (1939), few major changes occurred. Mathematics was required only as far as grade VIII, after which it was an optional subject.

As a result of the recommendations of the Chant report, mathematics became a compulsory subject to the grade 11 level, for all students who wished to graduate. While the New Math was an attempt to bring the schools more in tune with developments in mathematics over the past century, the curriculum changes brought about by Chant for mathematics were not of lasting significance. It was 1976 before there was a total revision of the mathematics curriculum. The deliberations went on behind closed doors. In the final guide, the information given to teachers was not even as good as that which was given in the 1930s curriculum revision. It was more aligned with that of the 1920s.

The next major curriculum revision began in 1983 and the implementation began in the 1987-1988. This was a consultative process which involved teachers

throughout. The philosophy and rationale emphasize that mathematics can be taught at any level, at varying degrees of abstraction. The emphasis is on the use of manipulatives throughout, although much less so at the upper ages than at the lower ages. Calculators are to be used throughout, but at the elementary level children should still learn the basic number facts. The major change in emphasis is in the introduction of problem solving as a strand at the elementary level and the exhortation that problem solving should be integrated at all levels of the curriculum. Alternate programmes have been designed and structured so that students can re-enter the academic mathematics programme at the grade 10 or 11 level. The feeling was that not all students develop mathematically at the same rate.

The potential value of these curriculum changes is quite important for the development of attitudes and understanding rather than just memorization of algorithms for application in mathematics class. There remains, however, the danger that senior levels manage to force top-down modifications into the middle school on the basis of what the universities want.

CHAPTER NINE

COMMENTS AND CONCLUSIONS

The purpose of this chapter is twofold. It is to draw together the main ideas developed in the document and to provide some speculations as to what conclusions might be drawn from the past experiences with the Mathematics curricula in British Columbia. The past 120 years has seen the growth of public education in British Columbia from a few schools providing rudimentary elementary education to a large complex of schools situated all over the province whose aim is to provide education to every child. The system was essentially democratic in intent, in that it was hoped that no deserving child would be barred from at least an elementary education.

Much of the growth and the changes in structure have been controlled by the economic and social growth of the province. At the start of the public school system in the second half of the 19th century, society was much more elemental in nature. The family was the basic unit and much time and energy were spent on survival and the needs for formal education was less direct. With the growth in population, the movement from the land to urban centres, the ease of transportation over large distances, technological developments and international trade and travel, people have become in some ways more interdependent. The growing complexity of society has caused a corresponding growth in the public school system. For most of the time this growth has been of a positive nature and always it has been implemented with the

intent of providing the best education for the children of the province within the economic constraints of the times.

It has grown from a curriculum based on the different perspectives of teaching a subject and teaching a student. It has passed through a period centred on the child, in the 1930s, to one which again became subject oriented in the 1960s to yet again a child-centred one.

Influences on the Education System

Important People

In the 19th century, there existed a vocal minority who felt that what they had been taught had to be good enough for their children. This conservative group in the early years were in the majority, for there were few who even thought of changing the curriculum. They had a strong influence on the curriculum (Barman, 1986, p. 242). Of the first three superintendents of education, John Jessop and S.D. Pope had received their training in Ontario and Alexander Robinson, the fourth superintendent had received his education in New Brunswick and Nova Scotia. Influence on the curriculum was thus felt from Ontario, New Brunswick and Nova Scotia from within Canada, and from England and Scotland from outside Canada.

Population Growth

The non-native population of the province, about 36 000 in 1881, came mostly from England and Scotland. By the beginning of the First World War in 1914 it had grown tenfold to close to half a million. The construction of the CPR in 1885

brought an influx of settlers from the east of Canada. Next the federal government promoted immigration to western Canada to try to populate the agricultural lands. This brought thousands of settlers to British Columbia. This increase in population put a great strain on the education system.

Examinations

In the beginning, the final examinations from high school in British Columbia served as the matriculation examinations for the universities. From British Columbia the students who did not pass all of the examinations at the end of high school were able to enter McGill on a subject pass basis and sit an entrance examination in only the failing subjects. The university-school interface became more difficult to discern when the high school in Vancouver, and eventually the one in Victoria, began to offer first, first and second year courses for McGill. This had a direct influence on what was being taught in the school at the lower levels as the teachers were all teachers in the high school. Since the University of British Columbia grew out of the high school, both Vancouver and Victoria high schools, the university was an outgrowth of the high school. This is different from the universities of Eastern Canada and Europe. McGill and Queens, for example, were both founded before the public high schools were established

Pressures for Equality of Access

The attitude to schooling changed over the century. Equality of access to education was not equitable in the province. Disparities between urban and rural access to facilities were noticeable and the Depression of the 1930s emphasized the

precarious position of many of the smaller rural school districts. Experiments were undertaken by the government in forming larger units as can be seen in the Peace River and the central Fraser Valley in the 1930s.

In 1945 the Cameron Commission of Inquiry into Educational Finance recommended consolidation of the school districts into about one hundred larger administrative areas. This consolidation brought rural education into line with the urban model. Many communities were affected by the closing of the school which had been a cohesive force in the society. Many communities lost the base for their existence. With the building of new schools with excellent facilities throughout the province, more students remained in school. The school system had to change and adapt to the changing demographics of the province.

Effect of the Putman-Weir Commission

The first and possibly the greatest influence of change on the curriculum and the structure of the public school system was the Survey of the School System by J.H. Putman and G.M. Weir published in 1925. This report took into account the changing directions in education elsewhere in the world especially in the United States. The report felt that there was in the minds of many in education, an inherent conservatism which disclosed itself in a reluctance to depart from the traditional practices despite the overwhelming evidence, scientific or practical, to the contrary. The Progressive Education movement was well established. John Dewey's ideas of educating the child were being implemented elsewhere. The report urged that since the child does not change directly from being a child to an adult as it goes from

elementary school to high school, so should the educational structure not have an abrupt change. It advocated the introduction of the middle school where there would be an intermediate period of transition. The effect of this direction became apparent when junior high schools were established and the six-three-three structure was introduced. Many school districts could not afford to build three buildings and in those cases, the structure became that of six-six with the grade VII level being moved into the high school.

The middle school concept gave the structure the flexibility which would allow the child the opportunity to explore subjects in an integrated manner. Gradually over the three years the student was to move from an elementary school approach of one teacher for all subjects, through an integrated subject matter approach to topics with a team of teachers, to the direct individual subject approach of the senior high school with many unrelated teachers. This philosophy formed the basis of the major curriculum revision of the late 1930s. It could be said that the junior high school movement was in effect a curricular movement. Junior high school was seen as a time for exploration and experiment.

The idea of having a system of constant courses with many variable courses was first introduced at the junior high school and later extended to the senior high school. In the 1920s, the senior years of public school were still prescribed by the university demands. An attempt to mitigate this influence was taken in 1930 with the introduction of the High School Graduation Diploma. The course of studies for this allowed students a liberal range of options so that those who did not intend going on

to university or normal school could obtain an education which would fit them better for the life they were to lead. The attempt was made with reasonable success in the 1940s to develop a curriculum which would accommodate individual differences. The curriculum became more democratic in nature in that it was more accessible to more students and tried to provide equal opportunity for all students.

Effect of World War II

In the decade from the end of the Second World War the public realized that a sound secondary education was a necessity for entry into the workplace as well as for university entrance. This resulted in the demand for a wider variety of courses. At the same time, dissatisfaction with the public school system was being expressed by Hilda Neatby and others who were reacting against the progressive education movement. They felt that despite the obvious improvements in education over the century, much had been lost in the move to accommodate all children no matter what their ability. She and many others felt that any self-education was preferable to a system of teaching which really did so little for the mind.

The opponents of progressive education argued that it was denying students the benefits of a sound liberal arts education by assuming a utilitarian direction. As a direct consequence of this there had been a decline in the standards of achievement in the core or basic subjects, language arts and mathematics, which were so necessary for the study of all other subjects. This was a focus for discontent, which, taken together with the feeling that the West was losing the scientific and technological war

to Russia, forced British Columbia to reassess the position of education in the province by setting up a Royal Commission on Education.

Effect of the Chant Commission

The Chant report was published at the end of 1960, three years after it began its deliberations. Curriculum changes were suggested that would perhaps encourage the more able students who were intending going to university for further studies. Indeed students were encouraged to take more advanced courses in high school, even first year university courses if that was possible while still at high school. The Chant Commission believed that the primary purpose of the school was to stimulate the intellectual development of the child. To that end the academic programme was to be improved in content and the standards raised while the more general studies option was to be broadened and made more acceptable to the public as a real educational programme of value to the non-academic person.

The recommendation which was acted on immediately was that of moving grade VII back to the elementary school. The argument for this was that the comprehensive high schools had become so large that it was too difficult for a student at the younger end to become comfortable in it. The split into two schools would be better achieved on the grounds of development if it occurred at the end of grade VIII. Also, with the tremendous increase in demand on the physical plant of the schools, it was less expensive to add to the elementary school than it was to add on to the secondary school.

This move caused the death of the middle school concept in British Columbia. Although the name Junior High School remained attached to many three year schools, over the 20 years until the mid-1980s, these schools became mini senior high schools with more and more specialist teachers and more compartmentalism of subjects. Teaching in the junior high school became controlled by what the senior high schools needed the students to know. Over the years the senior high schools had their curriculum directed by what the universities required. Because of the direction taken towards a more academic curriculum, the gap between the academically gifted student and the non-academically inclined student widened.

The Mathematics Curriculum

The changes in the mathematics curriculum appear tied not only to changes and new developments in the field of mathematics but to changes in educational philosophy or to changes in society itself. Mathematics seems to be a subject which prides itself in being the keeper of the truth and yet does not seem to update its view of what the truth is.

The subject matter covered in the curriculum grew in quantity in the period from 1876 through to the 1920s. An important influence on the early secondary curriculum was the demand of the universities. They set their own entrance requirements and, since most students who matriculated -- left high school with the qualifications allowing them to enter second year university studies -- would go on to university, the entrance requirements had an important effect on, if not complete control over the curriculum.

Offering university courses at the Vancouver and Victoria high schools certainly had an effect on the mathematics curriculum. By nature, the subject, apart from arithmetic, is abstract and so it was natural not to think of anything else except university as the end product. Even after the major curriculum revision of the mid-1930s, mathematics was not compulsory beyond grade VIII until the 1960s. Since mathematics was required as a prerequisite for so many other opportunities, many students studied mathematics beyond the grade VIII level.

With the introduction of the junior high school, the attitudes towards teaching mathematics changed even if the content changed little. The whole emphasis was on making mathematics more relevant to the student and using illustrations from life around British Columbia. The programme of study for mathematics even gave examples which could be used and although not many were given, it provided sufficient stimulus for teachers to move outside the classroom to seek relevance for the subject.

While mathematics was not required for graduation, it was always considered to be of importance to society. Always it has been thought of as a core subject fundamental to a sound education. Why this should be so is not clear. Parents even today do not wish to have their children in the applied programmes of mathematics, be they called modified, alternate, or trades mathematics. The public perception remains that mathematics is a good training in logical thinking and problem solving. Or even that the work that is put in memorizing basic number facts is somehow good for the brain -- it exercises the brain. Faculty psychology is still around today. No

studies have been conclusive in providing support for either of these ideas and yet they persist.

Mathematics has been taught as a part of school courses for approximately two centuries, although it consisted only of arithmetic to begin with. The gradual development over time into arithmetic, algebra and geometry with trigonometry appearing in different places has depended on the needs of society. In British Columbia, in later years the curriculum has developed along the same lines as the United States. There was an attempt to make it "relevant" to students at the junior high level in the late 1930s through the 1950s but that ended with the demise of the junior high school ideal in the early 1960s.

While lip service was paid to making the senior high school curriculum relevant to students, it would appear that all that was done was to make sure that the students realized that they would need all the topics covered when they moved on to some other subject, time or place (Department of Education, 1936, p. 375). Even the newly revised curriculum of the 1980s has little relevance to the student, especially when Data Analysis, one of the few topics which might be interpreted as being relevant, is mostly not taught because it is not examined on the final provincial examination. Perhaps it is not examined because it is not required by university calculus courses.

Little that is new in mathematics appears in the current curriculum that was not known 100 years ago. Is it the case that the nature of mathematics excludes it from being a "subject can be taught to anybody at any age in some form that is

honest" (Bruner, 1973, p. 133)? Or is it the nature of mathematics teachers and curriculum makers that makes it impossible to keep up with mathematical developments in high school teaching?

One point of view is that students do not have the necessary mathematical background for any of the more interesting new mathematical developments. Topics such as fractals and chaos theory are fascinating topics which students find interesting and can be pursued in the classroom to varying levels of mathematical sophistication. These topics are very rarely discussed since the argument goes that if time is wasted on them then the curriculum will not be covered in time for the examination. If the students do not do well on the examination, then they will not obtain entrance to university.

For this reason, the university controls the curriculum perhaps not directly but in a very real indirect manner. It does not matter whether the University directly dictates the curriculum or whether the teachers themselves think that they know what the university expects. The end result is that the curriculum is driven by an external perception of what is required. Most participants on the most recent committees to revise the curriculum were practitioners. People external to the education process participated to a small extent. This might be an excellent idea if the practitioners were well versed in developments in mathematics. The results of an exploratory study of teacher's conceptions of mathematics (Brochmann, 1991), however, show that it may be that many secondary mathematics teachers are unaware of any

mathematics developments since they left school. Also he suggests that, based on his study, mathematics teachers might be resistent to change.

When compared with other disciplines the body of knowledge in mathematics defined in the curriculum is relatively finite and unchanging; hence it is not as necessary for mathematics teachers to keep up-to-date with developments in their content area. Teachers of Science, Social Studies and English, of necessity, have to keep at least a newspaper awareness of what is going on in their field. Admittedly there is little reporting of what is happening in mathematics in the popular media. Perhaps it is part of the nature of the profession to attract people who do not remain mathematically curious. If this is the case, then while the methodology proposed by the new curriculum is innovative and exciting the content will remain the same as it has always been. A cursory examination of the current Grade 11 text shows essentially the same examples as are given in A School Algebra (Hall, 1934). The 1934 text gave many more examples, but the algebra has not changed so much that a teacher would be unable to teach the algebra part of the current course using Hall for examples.

Concluding Comments

Free public secondary education has existed in British Columbia since 1876. It has developed from a highly academic programme satisfying the needs of a few, to one which offers an education leading to high school graduation for about 60 percent of the school-age population.

In high school mathematics, the curriculum has not changed in content appreciably and is still extremely traditional in content. The answers to why this is so are not clear and simple. Mathematics is regarded by many as a "tool" subject for other subjects such as Physics. The topics to be covered to make it of use to the physics teacher are relatively simple. Other uses are complex and are perhaps not of interest to high school students and may be beyond the abilities of the current teachers to teach. If content is assumed to be all that is to be learned, then an adequate method of teaching consists of chalk and talk. This limits both content and method. This appears to have occurred in mathematics. The subject is understood by many students to consist of a series of rules to be memorized for testing purposes and not necessarily understood. In high school, mathematics is thought of as the unthinking subject.

In the 1920s, since high schools had evolved rapidly over the previous decade, the structure of courses and examinations had not yet solidified. The principals of the high schools were free to select the examinations which their students would sit as long as they were the entrance examinations for a university of the Dominion. This gave the principal a much greater control over his school and its learning climate. Many different organizations of courses offerred were possible giving a life and flexibility to the school system.

Periods of change in British Columbia appear to be cyclical. In the 1920s and 1930s when the climate was conducive to change, teaching mathematics, among other subjects, became more open in its approach to innovation, at least in methodology if

not in content. This corresponds to a time when society was forced by economic conditions to re-evaluate its aims. In times of economic downturn, society must become more flexible if it is to survive.

In the 1960s as a reaction to the perceived threat from the Soviet Union, the curriculum became more academic and less flexible. At this time, economic conditions were excellent. For the high school graduate, it was a case of which employment opportunity to take and not would there be an employment opportunity. Again in the 1980s, there was an economic downturn with an associated turning to the schools for the solutions.

Always there has been the influence of the final examination on the curriculum. In the 1960s the mark on the final examination for high school was averaged with the school mark. In 1973, final examinations were eliminated and so the school assumed a greater control over the teaching and learning climate. In 1983, examinations were reintroduced laying more stress on teaching for the examination. Even with the Mathematics curriculum revision of the 1980s, the content was still directed to the examination, or post-secondary requirements.

Several periods of review have occurred. Currently problem-solving is emphasized. This too was the emphasis of the revisions of the 1930s and 1940s. The idea of educating the child from where he or she is, was the expressed desire in the 1930s, and is being reiterated now. This leads to individualized instruction and continuous promotion. However, until the advent of relatively inexpensive computer technology, the difficulty of record keeping made it impractical to any great extent.

Keeping track of so many different levels in all classes, and reporting on a class to parents was a difficult administrative problem. Currently, the Thomas Haney Centre in Maple Ridge, is about to try to do this for grades 8 to 12 starting in September, 1992.

Again, cyclically, the complaint is heard that there is too much in the curriculum to allow for adequate coverage of the topics. Putman and Weir stated this, teachers in the 1930s stated it, the Chant report stated it and now classroom teachers in Mathematics at the secondary level are stating it. Even though teachers had a strong influence in selecting the topics to be covered in the current curriculum, the need to provide for students going on to post-secondary institutions, made the exclusion of many topics impossible. Mathematics teachers often find themselves under extreme pressure to cover the curriculum so that the students will perform well on the final examination.

Society, as a group, may not understand mathematics as anything other than a series of algorithms which have no application outside the classroom. Society sees it as a useful exercise to have students carry out the same algorithms as they did as children. Somewhere, the idea of mathematics as an art rather than a science has been lost. For example, as recently as the 1960s mathematics was taught only in the Faculty of Arts in the University of Edinburgh. It would appear that the Mathematics curricula over the years have not changed substantially even though the ideas of the student and how the student learns have changed. These changes have manifested themselves as changes in emphasis and in presentation rather than as

substantial changes in content. It would appear that until teachers believe that they have control over the design of the curriculum and feel that they are not compelled by the universities to teach certain topics, the content will not evolve in a meaningful manner. High school mathematics so far has changed little with the introduction of graphing calculators and computer technology. It is only to be hoped that with a more technologically literate society, pressure will come from both the community and the teachers to change what is taught. If no change occurs, teachers must assert that what is taught and has been taught for the past 120 years is the truth of mathematics for high school students, that is, a body of unchanging truths.

APPENDIX A

Excerpts from Elementary Geometry by C. Godfrey and A.W. Siddons,(1945)

¶Ex. 297. Suppose the end of the lake is formed by a wall built up out of the water; what would you call the boundary which separates the wall from the air and water? Has it any thickness? Has it any length? Has it any breadth?

A surface has length and breadth, but no thickness.

¶Ex. 298. Part of the surface of the wall is wet and part dry; is the boundary between these two parts wet or dry? Has it any thickness? Has it any length? Has it any breadth?

This boundary is really the intersection (or cutting place) of the air-water surface and the wall surface.

The intersection of two surfaces is a **line**. A line has length but no breadth or thickness.

We cannot represent a line on paper except by a mark of some breadth; but, in order that a mark may be a good representation of a line, it should be made as narrow as possible.

¶Ex. 299. Take a model of a cube; what are its edges? Have they any length, breadth, or thickness?

¶Ex. 300. If you painted part of your paper black, would the boundary between the black and the white have any width?

¶Ex. 301. If part of the wall in Ex. 297 were painted red and the rest painted black, would the boundary between the two parts be red or black?

¶Ex. 302. Suppose that the red and black paint were continued below the water as well as above, the line bounding the red and black would be partly wet and partly dry; has the boundary between the wet and dry parts of this line any length?

The intersection of two lines is a **point**. A point has neither length, breadth, nor thickness, but it has position.

We cannot represent a point on paper except by a mark of some size; the best way to mark a point is to draw two fine lines through the point.

We have now considered in turn a solid, a surface, a line, and a point. We can also consider them in the reverse order.

A **point** has position but no magnitude.

If a point moves, its path is a **line** (it is said to **generate** a line).

A pencil point when moved over a sheet of paper leaves a streak behind, showing the line it has generated (of course it is not really a line because it has some thickness).

If a line moves, as a rule it generates a **surface**.

A piece of chalk when laid flat on the blackboard and moved sideways leaves a whitened surface behind it. Consider what would have happened if it had moved along its length.

If a surface moves, as a rule it generates a **solid**.

The rising surface of water in a dock generates a (geometrical) solid.

¶Ex. 303. Does a flat piece of paper moved along a flat desk generate a solid?

A **straight line** cannot be defined satisfactorily in a simple way; the idea of a straight line however is familiar to everyone.

¶Ex. 304. How can you roughly test the straightness of (i) a billiard cue, (ii) a railway tunnel, (iii) a metal tube?

¶Ex. 305. How does a gardener obtain a straight line?

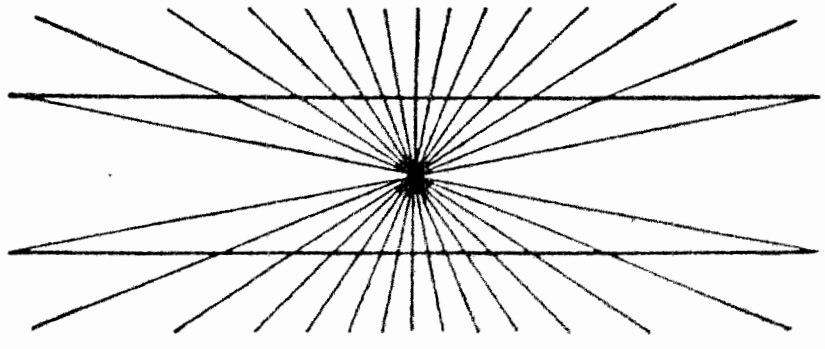

fig. 74.

¶Ex. 306. Test whether the two thick lines in fig. 74 are straight.

Make a careful tracing of one line; move the tracing along and see if it can be made to fit on the line everywhere else; turn the tracing over and try again. If it is impossible to find a position in which they do not fit on one another, then the line must be straight.

The above assumes that the paper is plane.

¶Ex. 307. Test the straightness of the lines in fig. 74 by means of a stretched thread.

Ex. 304–7 lead us to a conclusion which may be stated in various ways as follows:—

(i) *Two straight lines cannot enclose a space.*

(ii) *Two straight lines cannot intersect in more than one point.*

(iii) *If two straight lines have two points in common, they must coincide.*

(iv) *One straight line, and one only, can be drawn through two given points.*

(v) *Two points determine a straight line.*

A surface which is such that the straight line joining every pair of points in it lies wholly in the surface is called a **plane surface**, or, briefly, a **plane**.

¶Ex. 308. Push a straight knitting needle through an apple; does the straight line joining the two points where the needle cuts the surface lie wholly in the surface of the apple?

¶Ex. 309. Test whether the surface of your desk is plane.

Place a straight edge (e.g. the edge of your ruler or set square) against the surface and see if the straight edge touches the surface all along its length; if it does so in all positions, the surface is plane.

¶Ex. 310. Is the lid of your instrument box plane?

¶Ex. 311. Is the glass of your watch plane?

¶Ex. 312. Are the faces of your cuboid plane?

¶Ex. 313. Could you find two points on the surface of a garden roller such that the straight line joining them lies wholly in the surface? Is the surface plane?

Parallel straight lines are defined to be straight lines *in the same plane* which do not meet however far they are produced in either direction.

¶Ex. 314. Can you explain why the words in italics are necessary?

¶Ex. 315. A five-barred gate is half-open; there is one of the gate-posts which the line of the top bar does not meet; is the top bar parallel to this post?

¶Ex. 316. Give instances of pairs of straight lines which are not parallel but do not meet however far they are produced.

¶Ex. 317. Would a set of telegraph poles along the side of a straight road be parallel to one another? Would they be parallel if the road were crooked?

¶Ex. 318. Are the upright edges of a box parallel?

HEIGHTS AND DISTANCES (*Continued from p. 50*).

Ex. 318*a*. The shadow of a tree is 30 feet long when the sun's altitude is 59°; find, by drawing, the height of the tree, taking a scale of 1 inch to 10 feet.

Ex. 318*b*. A telegraph pole standing upright on level ground is 23·6 feet high and is partly supported by a wire attached to the top of the pole at one end and fixed to the ground at the other so that its inclination to the pole is 54° 22′.

Find the length of the wire.

Ex. 318*c*. The angle of elevation of the top of a tower on level ground is read off on a theodolite. Find the height of the tower from the following data:

Reading of theodolite = 15°.

Height of theodolite telescope above ground = 3′ 6″.

Distance of theodolite from foot of tower = 372 yards.

APPENDIX B

Excerpts from Programme of Studies for the Junior High Schools of British Columbia (1927)

MATHEMATICS.

Aims.

1. To apply the fundamentals of arithmetic to a variety of situations which children are capable of appreciating and to provide sufficient drill to maintain a high degree of speed and accuracy in these computations.

2. To lead the individual from operations on particular numbers, which occur in arithmetic, to the concept of operations upon numbers in general, which occur in algebra.

3. To study algebra as a tool subject, the linear functions arising out of the activity of linear measurement, the quadratic functions arising from surface measurement, and the cubic functions from the study of volumes.

4. To study relationships by intuitional, experimental, and concrete geometry. To express relationship by formulas, equations, and graphs.

5. To develop a high degree of skill in the use of ruler, compasses, and squared paper, as measuring instruments, as a basis for intuitional and constructional geometry.

6. The course should make life in and out of school more meaningful to the pupil by leading him to see something of the part mathematics are playing in our social life to-day.

The course emphasizes drill for speed and accuracy, applications to commerce and industry, and solving problems. It introduces the equation, graph, formula, intuitive and constructional geometry, and the elementary notions of trigonometry. It breaks away from the traditional course inasmuch as its content is chosen for its social value and not as preparation for higher mathematics.

Content for Grade VII.

1. Review so as to bring up and maintain standard speed and accuracy in simple rules of arithmetic.

2. Computations with integers, fractions, percentages, and measures, problem-solving.

3. Practical problems covering: owning, buying, selling, earning, spending, saving, profit and loss, trade discounts, commission, simple insurance, borrowing and lending, interest.

4. Geometry of form, size, and position; making frequent use of compasses, protractor, set-squares, measurements of lines and angles.

5. Simple equations, simple ratios and formulas.

Content for Grade VIII.

1. The arithmetic of private business, involving home problems, use of money, keeping a bank account, keeping account of borrowed money, wages and overtime, commissions and bonuses, shares in business, dividing profits, investing in real estate, notes, stocks, bonds, and mortgages.

2. The arithmetic of public business—municipality as a business firm, obtaining money to pay its bills, etc., spending money; graphs.

3. Arithmetic of the home—family budgets, etc., problems pertaining to the home.

4. The arithmetic of science and industry — squares, cubes, circles, cylinders, wheels, wells, pipes, tanks, etc.; the use of equations and formulas; metric system of weights and measures.

5. First steps in algebra, equations, literal numbers, negative numbers; expressing a problem as an equation.

Content for Grade IX.

1. Algebraic expressions and formulas; addition and subtraction; multiplication and division; products and simple factors.

2. Fractional equations and formulas; expressing important mathematical relations; variation; equations of straight lines.

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3. Powers, roots, graphs, quadratic equations.

4. Simple ratio and proportion, tangents, sines, and cosines.

To express relationship by formulas, equations, and graphs.

3. To develop a high degree of skill in the use of ruler, compasses, and squared paper, as measuring instruments, as a basis for intuitional and constructional geometry.

6. The course should make life in and out of school more meaningful to the pupil by leading him to see something of the part mathematics are playing in our social life to-day.

The course emphasizes drill for speed and accuracy, applications to commerce and industry, and solving problems. It introduces the equation, graph, formula, intuitive and constructional geometry, and the elementary notions of trigonometry. It breaks away from the traditional course inasmuch as its content is chosen for its social value and not as preparation for higher mathematics.

Content for Grade VII.

1. Review so as to bring up and maintain standard speed and accuracy in simple rules of arithmetic.

2. Computations with integers, fractions, percentages, and measures, problem-solving.

3. Practical problems covering: owning, buying, selling, earning, spending, saving, profit and loss, trade discounts, commission, simple insurance, borrowing and lending, interest.

4. Geometry of form, size, and position; making frequent use of compasses, protractor, set-squares, measurements of lines and angles.

5. Simple equations, simple ratios and formulas.

Content for Grade VIII.

1. The arithmetic of private business, involving home problems, use of money, keeping a bank account, keeping account of borrowed money, wages and overtime, commissions and bonuses, shares in business, dividing profits, investing in real estate, notes, stocks, bonds, and mortgages.

2. The arithmetic of public business—municipality as a business firm, obtaining money to pay its bills, etc., spending money; graphs.

3. Arithmetic of the home—family budgets, etc., problems pertaining to the home.

4. The arithmetic of science and industry — squares, cubes, circles, cylinders, wheels, wells, pipes, tanks, etc.; the use of equations and formulas; metric system of weights and measures.

5. First steps in algebra, equations, literal numbers, negative numbers; expressing a problem as an equation.

Content for Grade IX.

1. Algebraic expressions and formulas; addition and subtraction; multiplication and division; products and simple factors.

2. Fractional equations and formulas; expressing important mathematical relations; variation; equations of straight lines.

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3. Powers, roots, graphs, quadratic equations.

4. Simple ratio and proportion, tangents, sines, and cosines.

5. Logarithms and other labour-saving devices.

NOTE.—(*a.*) This course should be made as practical as possible and should not involve a difficult treatment of the subject.

(*b.*) The work as covered in Thorndike's Junior High School Mathematics, Books I., II., and III., gives a good content and fairly well marks out the extent of difficulty to be expected in such course. For pupils below the average in mental ability, or ability to grasp mathematics, omissions may be made as indicated in these Thorndike Books.

(*c.*) "Instructional Tests in Algebra," with goals for pupils of varying abilities, by Schorling, Clark and Lindell, published by the World Book Company, is a booklet that would be of great service in improving the pupils' speed and accuracy in the simple operations required in a course in Elementary Algebra.

APPENDIX C

Excerpts from Programme of Studies (1929).

PROGRAMME OF STUDIES.

ADMISSION TO HIGH SCHOOL.

To be eligible for admission to a High School in this Province a candidate must hold an Entrance or higher certificate issued by the Department of Education. A pupil holding an Entrance or higher certificate obtained in another Province or country and also any pupil who writes on the Grade IX. examinations of the Department and obtains an average of at least 40 per cent. on the papers may, with the approval of the Department, be admitted to a High School on probation.

HIGH SCHOOL.

GRADE IX.

A.—English.

1. READING AND ORTHOEPY.—Oral reading, with special attention to expression and pronunciation.

2. WRITING AND SPELLING.—Legibility and precision in writing and accuracy in spelling will be required in manuscript-work of all subjects.

3. ENGLISH LITERATURE.—(*a*.) MacDonald: English Prose Selections, Part I. (Macmillan Company of Canada, Ltd.), price 60c. Students will be expected to cover in one year only half the "Essay" section, half the "Miscellaneous" section, and half the "Short Stories" of Part I.

(*b*.) MacDonald and Walker: Narrative English Poems, Part I. *or* Part II. (Dent & Sons, Ltd.).

(*c*.) *One* of the following: (i.) Stevenson's Kidnapped (McClelland & Stewart, Toronto), price 45c.; *or* (Nelson & Sons, Toronto), price 35c. (ii.) Blackmore's Lorna Doone, World's Classics (Oxford University Press, Toronto), price 60c.

4. COMPOSITION.—High School English Composition, Western Canada Series (Copp, Clark Co.), Chapters I.–IV., inclusive. Price, 60c.

B.—History.

1. The World before the Greeks, The Greeks, The Graeco-Oriental World, as in West's World Progress, Canadian Edition (Allyn & Bacon), Parts I.–III., inclusive. Price, $1.75.

2. HISTORY OF CANADA.—The History of Canada from the earliest day to the movement for reform as covered in Chapters I. to XIII., inclusive, of McArthur's History of Canada for High Schools; also the story of Canada's development since the Great War and Canadian Literature and Art as covered by Chapters XXVII. and XXVIII.

C.—Mathematics.

1. ARITHMETIC.—General review of the simple rules, factors, measures, fractions, square root; compound quantities, metric system of measures, longitude and time, aggregates and averages, percentage and its applications, stocks and shares, bonds, as in the first *ten* chapters of the Dominion High School Arithmetic, Revised Edition (Gage & Co., Ltd., Toronto). Price, 80c.

2. ALGEBRA.—The following chapters of Hall & Knight's Elementary Algebra: I.–XII., inclusive; XIII., examples (*a*) and (*b*) only; XIV.; XV.; XVI., omitting exercises on cube root; XVII., examples (*a*), (*b*), (*c*), (*d*) only. Price, $1.50.

3. GEOMETRY.—Godfrey & Siddons' Elementary Geometry (The Macmillan Co. of Canada, Ltd., Toronto). Price, $1.50.

Experimental Geometry.—Exercises 1-68; 85-104; 122-138; 152-162; 293-318, inclusive.

Theoretical Geometry.—Theorems 1-14, inclusive. Construction: Construction of a triangle given the three sides; construction of an angle equal to a given angle; bisection of a given angle; bisection of a given straight line; construction of perpendicular to a given straight line from a given point inside or outside the line.

NOTE.—In dealing with Experimental Geometry, teachers are not expected to make an attempt to do all the exercises with their classes, but should make such selections from the given lists as may be necessary to give their students a sound knowledge of elementary geometrical ideas.

D.—Classics.

Students who elect the science option outlined in F must take one language; all other students must take two languages.

1. LATIN.—Hamilton: Latin for Young Canadians (Gage & Co.), Lessons 1-45, inclusive.

2. FRENCH.—Siepmann's Primary French Course, Part I. (Macmillan), price 90c.; or The New Fraser and Squair Elementary French Grammar (Copp, Clark Co.), price $1.50; *or* any of the text-books recommended on pages 27 to 29.

REQUIREMENTS.—*See* pages 20 to 23.

E.—Drawing and Design.

OBJECT DRAWING.—Object or group of objects treated in outline, outline plus simple shadow and full light and shade on white or tinted papers—in pencil, pen and ink, crayon or water-colour. Application of object drawing to posters and other commercial work.

NATURE DRAWING.—Nature forms in outline of pen or pencil or pencil finished in flat colour tones.

DESIGN.—Problems in space filling of geometrical areas and as applied to posters, boxes, book-covers, etc., using nature forms as motifs. Colour harmony.

LETTERING.—Roman alphabet, capitals and small letters. Lettering of verse, prose, poster, and cards.

(*See* Teachers' Manual of Drawing and Design (Department of Education).)

F.—Science (Optional).

Students may substitute General Science for one foreign language.

Caldwell & Elkenberry: General Science, Revised Edition. Pupils should also supply themselves with the accompanying Laboratory Problems in General Science by Caldwell, Elkenberry & Glenn, and should perform the suggested experiments and keep careful notes; *or* Caldwell & Elkenberry: Elements of General Science with Experiments, New Edition.

Alternative text-book. Wood & Carpenter: Our Environment, How we use and control it (Allyn & Bacon), Chapters I. to VIII., inclusive, and Chapters X., XVI., XVIII., XIX., XX., XXI., XXII., XXIII.

Books of reference:

Snyder: General Science (Allyn & Bacon). Price, $1.60.

Van Buskirk and Smith: The Science of Everyday Life (Copp, Clark Co., Ltd., Toronto). Price, $1.25.

Bowden: General Science (Oxford University Press, Toronto).

G.—Physical Training.

Normal Entrance candidates may substitute Music for Geometry or for one of the Science subjects. *See* "Music Syllabus for High School Students, 1928," issued by the Department of Education.

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GRADE X.

A.—English.

1. READING AND ORTHOEPY.—Oral reading, with special attention to expression and pronunciation.

2. WRITING AND SPELLING.—As in Grade IX.

3. ENGLISH LITERATURE.—(*a*.) MacDonald: English Prose Selections, Part II. (Macmillan Company of Canada, Ltd.), price 60c. Students will be expected to cover in one year only half the "Essay" section, half the "Miscellaneous" section, and half the "Short Stories" of Part II.

(*b*.) MacDonald and Walker: A Selection of English Poetry, Book I., Part I. *or* Part II. (Dent & Sons, Ltd.), price 55c.

(*c*.) *One* of the following three: (i.) Scott: Quentin Durward (Thomas Nelson & Sons, Ltd., Toronto), price 35c. (ii.) Shakespeare: Julius Caesar—Stevenson (Copp, Clark Co., Ltd.), price 30c.; *or* (Longmans, Green & Co., Toronto), price 30c; *or* (Gage & Co.), price 30c. (iii.) Shakespeare: A Midsummer-Night's Dream (Copp, Clark Co., Ltd.), price 30c.; *or* (Longmans, Green & Co.), price 30c.; *or* (Nelson & Sons, Toronto).

4. COMPOSITION.—High School English Composition, Western Canada Series (Copp, Clark Co., Ltd.), Chapters I.–VIII., inclusive The examination on this subject, besides testing the pupil's knowledge of the prescribed text, will consist of an essay on one of four specified subjects, three of which will be from the English Literature prescribed for the year. Frequent and systematic practice in essay-writing throughout the year is imperative. The value attached to the examination paper will be apportioned by giving 25 per cent. to the questions on the work of the prescribed text and 75 per cent. to the essay.

B.—History.

1. Rome, The Roman Empire, Romano-Teutonic Europe, Age of the Renaissance, The Protestant Reformation, as in West's World Progress, Canadian Edition, Parts IV.–VIII., inclusive.

2. HISTORY OF CANADA.—The History of Canada from the movement for reform to the present day as covered in Chapters XIV. to XXVIII., inclusive, of McArthur's History of Canada for High Schools.

C.—Mathematics.

1. ARITHMETIC.—Dominion High School Arithmetic, Revised Edition (omitting Appendix B). Price, 80c.

2. ALGEBRA.—The following chapters of Hall & Knight's Elementary Algebra: I.–XV., inclusive; XVI., omitting cube root; XVII.–XXII., inclusive; XXIII., examples (*a*) and (*b*) only; XXIV. Price, $1.50.

3. GEOMETRY.—Godfrey and Siddons' Elementary Geometry. Price, $1.50.

Experimental Geometry.—Complete Part I.

Theoretical Geometry.—Books I. and II.

Teachers are not expected to make an attempt to do all the exercises given in the text-book with their classes, but should make such selections as may be necessary to give the students a sound knowledge of geometrical ideas.

D.—Classics.

Students must take two foreign languages and one of the science options outlined in E or *one* foreign language and *two* of the science subjects. Students who elect the science option in the first year should continue the language already chosen.

1. LATIN.—Robertson & Carruthers' Latin Lessons for Beginners, pages 1–824 (omitting the B exercises, both Latin and English, in Lessons XL.– LXXX., inclusive, and omitting also Reading Lessons VIII.–XV., inclusive), together with the following Supplementary Reading Lessons: Caesar's First Campaign in Gaul: (*a*) The

GRADE XI. (JUNIOR MATRICULATION).

The subjects for Junior Matriculation for 1929 and subsequent years are as follows:—

1. ENGLISH.
2. HISTORY.
3. MATHEMATICS.
4. LATIN or FRENCH.
5. CHEMISTRY or PHYSICS.
6. *One* of the following: Greek, German, Botany, Home Economics (either part), Agriculture, Technical High School Subjects, or a subject from 4 or 5 not already taken.

NOTES.—(*a.*) Three languages without a science may be taken. (*b.*) Until High Schools which are equipped to teach Botany, and are not equipped to teach Physics or Chemistry have this latter equipment, Botany may be included in 5.

For 1929 students may take the examinations in accordance with former requirements as follows:—

1. ENGLISH.
2. HISTORY AND HISTORICAL GEOGRAPHY.
3. MATHEMATICS (Algebra and Geometry).
4. FRENCH, or GERMAN, or LATIN.
5. (*a.*) The *two* languages in 4 not already taken.

Or

(*b.*) *One* of the languages in 4 not already taken and *one* of the following Sciences: Chemistry, Physics, Botany, Agriculture.

Or

(*c.*) *Two* of the following sciences: Chemistry, Physics, Botany, Agriculture.

NOTE.—Greek may be taken in place of one science, but only by students offering Latin.

REQUIREMENTS IN EACH SUBJECT.

English.

1. COMPOSITION AND READING.—The principles of English composition, as in High School English Composition, Western Canada Series (Copp, Clark Co., Ltd.), with short essays on a general subject and other subjects based on works prescribed for reading, as follows: (*a.*) Prose (two books to be selected)—Stevenson, Travels with a Donkey and An Inland Voyage (Macmillan *or* Nelson *or* Everyman's Library); Scott, Kenilworth; George Eliot, Silas Marner (ed. Stevenson, Copp, Clark; *or* Macmillan; *or* Dent; *or* Nelson); John Drinkwater, Abraham Lincoln (Copp, Clark), price 30c. (*b.*) Poetry (one to be selected)—Shakespeare, As You Like It (ed. Stevenson, Copp, Clark; *or* Macmillan; *or* Gage): Tennyson, Gareth and Lynette (Macmillan *or* Ginn).

The editions are merely recommended, not required.

The books to be selected should be read carefully, but the student's attention should not be so fixed upon details that he fails to appreciate the main purpose and beauty of the work.

Frequent practice in composition is essential.

2. LITERATURE (FOR CRITICAL STUDY).—Shakespeare, Merchant of Venice (ed. Stevenson, Copp, Clark) *or* Macbeth (Junior School ed., Blackie & Sons); A Selection of English Poetry (ed. MacDonald and Walker, J. M. Dent & Sons), Book II., Part I.

Candidates will be expected to memorize some of the finest passages.

Two examination papers of two hours each—one on Composition, the other on Literature.

Spelling will be tested by the candidate's papers in English. Examiners in other subjects will also take note of misspelled words and will report flagrant cases to the Board.

History and Historical Geography.

From the Peace of Westphalia to the conclusion of the World War, including the Treaty of Versailles and the work of the Leage of Nations, as in West's World Progress, Canadian Edition, Parts IX.-XVI., inclusive. Teachers should emphasize and develop the sections treating of British and British Empire History during the period prescribed.

The geography required will be that relating to the history prescribed.

One paper of two hours. (One question on the League of Nations will be obligatory for all candidates.)

It is recommended that candidates make a special study of the following list of topics of the school-year 1928-29: (*a.*) The French Revolution (five chapters). (*b.*) England and the Industrial Revolution. (*c.*) The Revolution in the Lives of the Workers. (*d.*) Reaction, 1815-1848. (*e.*) Continental Europe Rearranged, 1848-1871. (*f.*) Britain, 1815-1914. (*g.*) The British Empire of To-day. (*h.*) The French Republic. (*i.*) The German Empire. (*j.*) Russia. (*k.*) Results of the World War. (*l.*) The Treaty of Versailles and the League of Nations.*

Mathematics.

1. ALGEBRA.—As in the first thirty-two chapters and the graphical work of Articles 411-428, inclusive, Hall & Knight's Elementary Algebra, omitting the whole of Chapter 29 and omitting also articles and examples on variation in Chapter 32. Questions may be assigned which will test the candidate's accuracy in the elementary processes of arithmetic, vulgar and decimal fractions, and square root.

One paper of two and a half hours.

2. GEOMETRY.

A. Constructions.—Use of such simple instruments as graduated ruler, compasses, set-squares, protractor, etc., in the accurate construction of figures; some leading propositions reached by induction as a result of these constructions.

To bisect a given angle, a given straight line.

To draw a perpendicular to a given straight line from a given point (*a*) in the line, (*b*) not in the line.

Locus of a point equidistant from two given lines.

To construct a triangle with sides of a given length.

To construct an angle equal to a given angle.

Through a given point to draw a straight line parallel to a given straight line.

To divide a line into any number of equal parts.

To describe a parallelogram equal to a given triangle and having one of its angles equal to a given angle.

To draw a triangle equal in area to a given quadrilateral.

To describe a parallelogram equal to a given rectilineal figure, and having an angle equal to a given angle.

The plotting of points on squared paper.

The areas of rectilineal figures on squared paper.

To find the centre of a given circle.

To circumscribe a circle about a given triangle.

To draw a tangent to a given circle from a given point on or without the circle.

On a given straight line to construct a segment containing an angle equal to a given angle.

In a given circle to inscribe a triangle equiangular to a given triangle.

To inscribe a circle in a given triangle.

To draw an escribed circle of a given triangle.

About a given circle to circumscribe a triangle equiangular to a given triangle.

* For publications dealing with the activities of the League, write to "The League of Nations Society," 279 Wellington Street, Ottawa. The pamphlet entitled "A New World" or "The League of Nations" will be found useful. Copies may be obtained free of charge from the Text-book Branch, Department of Education, Victoria.

To find the fourth proportional to three given straight lines.

To divide a given straight line internally and externally in a given ratio.

To find the mean proportional between two given straight lines.

Exercises on the preceding.

B. Theorems.

If two triangles have two sides and the contained angle of one respectively equal to two sides and the contained angle of the other, the two triangles are congruent.

The angles at the base of an isosceles triangle are equal, with converse.

If two triangles have the three sides of one respectively equal to the three sides of the other, the triangles are congruent.

Relations between angles formed by a transversal cutting two parallel lines, with converse.

The exterior angle, made by producing one side of triangle, equals the sum of the two interior and opposite angles; and the sum of the three interior angles is two right angles.

The greater side of a triangle has the greater angle opposite it, with converse.

If two triangles have two angles and a side of one respectively equal to two angles and the corresponding side of the other, the triangles are congruent.

If two triangles have two sides of one respectively equal to two sides of the other and have the angles opposite one pair of equal sides equal to each other, the angles opposite the other pair of equal sides are either equal or supplementary.

Any two sides of a triangle are together greater than the third side.

If two triangles have two sides of the one respectively equal to two sides of the other, but the contained angle in one greater than the contained angle in the other, the triangle which has the greater contained angle has the greater third side, with converse.

Straight lines which join the ends of two equal and parallel straight lines towards the same parts are themselves equal and parallel.

In any parallelogram the opposite sides and angles are equal, the diagonal bisects the area and the diagonals bisect each other.

Parallelograms on the same or equal bases and between the same parallels are equal in area.

Triangles on the same or equal bases and between the same parallels are equal in area.

If two equal triangles are on the same side of a common base, the straight line joining their vertices is parallel to the common base.

The complements of the parallelograms about the diagonal of any parallelogram are equal to each other.

Algebraic and geometric proofs of areas of squares and rectangles in connection with the segments of a straight line.

The square described on the hypotenuse of a right-angled triangle is equal to the sum of the squares on the other two sides, with converse.

In an obtuse-angled triangle the square on the side opposite the obtuse angle equals the sum of the squares on the other two sides increased by twice the rectangle contained by either of these sides and the projection on it of the other.

In any triangle the square on the side opposite the acute angle is equal to the sum of the squares on the other two sides diminished by twice the rectangle contained by either of these sides and the projection on it of the other.

If from a point within a circle more than two equal straight lines are drawn to the circumference, that point is the centre.

Equal chords of a circle are equidistant from the centre, with converse.

Of two chords in a circle the one which is nearer to the centre is greater than the one which is more remote from the centre, with converse.

The angle at the centre of a circle is double the angle at the circumference on the same arc.

The angles in the same segment of a circle are equal, with converse.

The angle in a semi-circle is a right angle, in a major segment is acute, and in a minor segment, obtuse.

The opposite angles of any quadrilateral inscribed in a circle are supplementary, with converse.

The radius drawn to the point of contact of a tangent is perpendicular to the tangent; the perpendicular to the tangent at the point of contact passes through the centre; the perpendicular from the centre on the tangent passes through the point of contact.

If two circles touch one another, the centres and the point of contact are in one straight line.

The angles made by a tangent to a circle with a chord drawn from the point of contact are respectively equal to the angles in the alternate segments of the circle.

Triangles of the same altitude are to one another as their bases.

A straight line drawn parallel to the base of a triangle cuts the sides, or the sides produced, proportionally, with converse.

If the vertical angle of a triangle is bisected internally or externally, the bisector divides the base into segments which have the same ratio as the other sides of the triangle, with converse.

If two triangles are equiangular, their corresponding sides are proportional, with converse.

If two triangles have one angle of the one equal to one angle of the other, and the sides about the equal angles proportional, the triangles are similar.

If two triangles have two sides of one proportional to two sides of the other, and the angles opposite one pair of corresponding sides in the proportion equal, the angles opposite the other pair of corresponding sides are either equal or supplementary.

If two chords intersect within a circle, the rectangle contained by the segments of one is equal to the rectangle contained by the segments of the other.

If from a point without a circle a secant and a tangent be drawn, the square on the tangent is equal to the rectangle contained by the secant and the part of it without the circle.

The areas of similar triangles are proportional to the squares on corresponding sides.

At the examination, questions may be given in making the actual constructions in the prescribed course. Candidates will therefore provide themselves with a graduated ruler, compasses, set-square, and protractor.

Exercises on the preceding.

One paper of two and a half hours.

Text: Godfrey and Siddons' Geometry or Hall and Stevens' School Geometry.

Chemistry.

As in Practical Chemistry—Black & Conant, edition adapted by R. H. Clark. At least forty of the experiments in Black's Laboratory Experiments in Chemistry, edition adapted by R. H. Clark, must be performed by the pupils themselves. The pupils are expected to keep a note-book which may be asked for at any time. The principal will be asked to certify that Junior Matriculation and Normal Entrance candidates from his school have performed the required number of experiments.

NOTE.—The optional work of Experiment No. 12 in the laboratory manual should be omitted.

One paper of two and a half hours.

Physics.

The general principles of physics as given in any standard text-book of High School Physics. The examination will the based on Merchant and Chant's High School Physics, *revised edition*, and Laboratory Manual in Physics, revised edition.

GRADE XII. (SENIOR MATRICULATION).

Mathematics.

ALGEBRA.—Equations, progressions, ratio, proportion, variation, surds, theory of quadratic equations, interest and annuities, permutations, combinations, binomial theorem.

Text: Wilson and Warren's Intermediate Algebra (Oxford), Chapters II. to IX., inclusive, and XI., sections 88 to 92, inclusive; *or* Crawford's Senior High School Algebra (Macmillan), Chapters II. to VIII., inclusive, and XI. to XIV., inclusive; *or* the same subject-matter in similar text-books.

GEOMETRY.

A. Synthetic Geometry.—Loci, maxima and minima, Simpson's line.

To divide a given straight line internally and externally in medial section.

To describe a square that shall be equal to a given rectilineal figure.

To describe an isosceles triangle having each of the angles at the base double the third angle.

To inscribe a regular pentagon in a given circle.

To describe a polygon similar to a given polygon and with the corresponding sides in a given ratio.

To divide similar polygons into similar triangles.

The areas of similar polygons are proportional to the squares on corresponding sides.

To make a polygon similar to a given polygon and such that their areas are in a given ratio.

In a right-angled triangle any rectilineal figure described on the hypotenuse is equal to the sum of the two similar and similarly described figures on the other two sides.

If the vertical angle of a triangle be bisected by a straight line which also cuts the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the segments of the base together with the square on the straight line which bisects the angle.

If from the vertical angle of a triangle a straight line be drawn perpendicular to the base, the rectangle contained by the sides of the triangle is equal to the rectangle contained by the perpendicular and the diameter of the circle described about the triangle.

The rectangle contained by the diagonals of a quadrilateral inscribed in a circle is equal to the sum of the two rectangles contained by its opposite sides.

Two similar polygons may be so placed that the lines joining corresponding points are concurrent.

If a straight line meets the sides BC, CA, AB of a triangle ABC in D, E, F, respectively, then BD.CE.AF=DC.EA.FB, and conversely (Menelaus' Theorem).

If straight lines through the angular points ABC of a triangle are concurrent and intersect the opposite sides in D, E, F, respectively, then BD.CE.AF=DC.EA.FB, and conversely (Ceva's Theorem).

Exercises on the preceding.

B. Analytical Geometry.—Rectangular co-ordinates, distance between two points, the co-ordinates of the point dividing the line joining two given points in a given ratio, the area of a triangle.

Plotting equations of the forms, $ax+by+c=0$, $ax^2+by^2=c$, $ax^2=by+c$, $by^2=ax+c$.

Equations of the straight line in the forms $x/a+y/b=1$ (intercept form), $y=mx+b$ (slope form), $y-y_1=m\ (x-x_1)$ (general slope form), $x\cos\alpha+y\sin\alpha=p$

Text: Wilson and Warren's Intermediate Algebra (Oxford), Chapters II. to IX., inclusive, and XI., sections 88 to 92, inclusive; *or* Crawford's Senior High School Algebra (Macmillan), Chapters II. to VIII., inclusive, and XI. to XIV., inclusive; *or* the same subject-matter in similar text-books.

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A. Synthetic Geometry.—Loci, maxima and minima, Simpson's line.

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If a straight line meets the sides BC, CA, AB of a triangle ABC in D, E, F, respectively, then BD.CE.AF=DC.EA.FB, and conversely (Menelaus' Theorem).

If straight lines through the angular points ABC of a triangle are concurrent and intersect the opposite sides in D, E, F, respectively, then BD.CE.AF=DC.EA.FB, and conversely (Ceva's Theorem).

Exercises on the preceding.

B. Analytical Geometry.—Rectangular co-ordinates, distance between two points, the co-ordinates of the point dividing the line joining two given points in a given ratio, the area of a triangle.

Plotting equations of the forms, $ax+by+c=o$, $ax^2+by^2=c$, $ax^2=by+c$, $by^2=ax+c$.

Equations of the straight line in the forms $x/a+y/b=1$ (intercept form), $y=mx+b$ (slope form), $y-y_1=m\ (x-x_1)$ (general slope form), $x\cos\alpha+y\sin\alpha=p$ (normal form), $(y-y_1)/(y_1-y_2)=(x-x_1)/(x_1-x_2)$ (two point form). The interpretation of the different constants in these equations.

The angle between two straight lines, condition of parallelism, condition of perpendicularity.

The length of the perpendicular from a given point to a given straight line.

The equation of a line passing through the intersection of two straight lines.

The equation of the circle with centre at origin and with centre at (h, k). Finding the radius and the co-ordinates of the centre from the general equation $x^2+y^2+2gx+2fy+c=o$. The equation of a circle satisfying certain conditions.

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