INTRODUCTION TO MATHEMATICS TEACHING AND LEARNING IN THE 1970s

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Reviews of and changes to the curriculum are absolutely essential if it is to remain relevant and effective in achieving the educational goals set by the province. Curricula are very much influenced and shaped by past developments. Such things as content, instructional methods, developments in other fields, development of the psychologies of teaching and learning, and even the political climate in a province or country at the time are considered when curriculum reviews occur. The mathematics curriculum of the 1970s was no exception to this rule.

It can be said that though particular attention was being paid to program revisions during the 1960s, the major concern in the 1970s was problems evidenced almost exclusively in test scores. Different schools or school systems responded to this concern in a variety of ways, but a clear-cut direction that looks toward the future was lacking during both decades. It should also be noted that the mathematics curriculum was of a relative low standard, and rote learning was the flavour of the day. This concern was addressed

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during the later years of the 1970s and will be dealt with toward the end of this introduction.

The 1970s mathematics curriculum was never subjected to a comprehensive review, but the changes that occurred were significant and reverberated through the entire range of grade levels. Though the New Math was introduced in the 1960s, it continued to be the central focus in the 1970s. Teachers struggled with the New Math, particularly at the elementary and junior high levels, because of their inadequate mathematics background and their inability to shift from the basic-skills movement and rote learning to teaching for conceptual understanding. Eventually, dissatisfaction with the New Math was expressed at many levels. Parents expressed doubt about whether the New Math really prepared students for the future. Teachers did not fully embrace the New Math either because the university math courses they took did not prepare them for it. The result was that teachers advocated for changes as well. Mathematics educators and mathematicians were divided on the effectiveness of the New Math curriculum. Some experts expressed dissatisfaction with the decline of rigour and discipline, the poorly written textbooks, and the inadequate preparation of students for university, while others felt that students achieved a much better understanding of mathematical concepts and the logic and structure of mathematics.

The mathematics curriculum of the 1970s added new content, issued new textbooks or pamphlets, and presented teachers with new challenges. Canada's adoption of the metric system of measurement was one challenge that teachers had to confront. Schools needed textbooks that were written using the metric system of measurement. However, many teachers needed assistance in bringing about this change, which was provided through in-services and the Mathematics Council of the Alberta Teachers' Association (MCATA) conferences and conventions. In addition, the National Council of Teachers of Mathematics (NCTM) and MCATA prepared a very helpful metric kit for teachers. However, many teachers, instead of focusing on teaching the metric system, focused on converting imperial to metric, making the metric system look cumbersome and disorganized. Only after teachers stopped converting from one system to the other did they begin to embrace the metric system.

Curriculum changes in the 1970s were largely approached in piecemeal fashion. The B-options at the junior high level are a case in point. In 1969, the Alberta Department of Education revised the curriculum and its program of electives and implemented the B-options in junior high schools. In addition to the core mathematics program that students were required to take and which was based on a clearly defined program of studies, the academic electives, like mathematics B-option, were completely unstructured courses with no course outline. As with all B-options, teachers were expected to develop a mathematics B-option program based on students'

interests, the teacher's strengths, and the availability of resources. In addition, teachers were expected to be mindful that the content of the B-option would not substantially overlap with the core mathematics program. Again, the B-options were introduced in isolation, not as part of the larger picture. Schools that offered the mathematics B-option experienced a variety of challenges. Unfortunately, teachers encountered difficulties understanding the nature and philosophy of the B-option program and, indeed, the reasons for the implementation of such a program. The program, being completely unstructured, also raised questions about teachers' ability to develop curricula. The departure from the traditional approach, with respect to content and instructional activities, raised additional questions about students' perception of and adjustment to the mathematics program. The evaluation of the mathematics B-option in Alberta revealed that, by their very nature, B-options were subject to instances of high success and failure.

At the high school level during the 1970s, revisions of the program of studies were undertaken as well, often with little regard to the overall mathematics program. However, the Math 31 program remained largely unchanged. In Math 30, the statistics and probability units were expanded, and a revised unit on conic sections was introduced using a completely modified approach. Both changes were accompanied by textbook changes and, in the case of conics, a booklet dealing with conic sections was authorized. The 1970s also witnessed a reduction in Euclidian geometry and ultimately the removal of Euclidian geometry from the curriculum altogether. This was viewed by teachers as an unfortunate move, as many students excelled in geometry but struggled with algebra and trigonometry. Again, teachers were left to their own devices to implement these changes because there was no sound implementation plan for the changes.

The implementation of calculators in the classroom and computer-managed learning (CML) also had their start in the 1970s. The use of calculators in the classroom certainly initiated a debate that has continued to the present day. CML was just another teaching methodology for which teachers were ill prepared, and this lack of preparation meant that teachers would have to upgrade to meet new expectations. So, they attended summer sessions at university and organized and participated in workshops after school and on weekends as they struggled to implement CML in their classrooms. Software for conic sections was developed for teachers' use in the classroom, but only a few teachers were able to use it. The use of calculators, too, raised many questions by teachers, parents, and other stakeholders. Essentially confusion and concern arose over how, when, and where calculators should be used, and many questioned whether such use would further diminish students' acquisition of basic skills. Parents in particular were fearful that the use of calculators would impair students' acquisition of basic skills and impede their comprehension of mathematical concepts,

and generally they opposed the use of calculators in the classroom. Despite this, teachers were asked to integrate calculators into math classes and to make them useful tools in the hands of students.

The mathematics curriculum of the 1970s truly lacked direction. The program of studies for mathematics at all grade levels was largely pure mathematics, theoretical in nature, rigorous, and narrowly confined to concepts that had to be taught. Consequently, the teaching methods were primarily teacher presentations and demonstrations, with students engaging in drill and practice and doing the textbook exercises. Teachers also looked for opportunities to participate in math contests and competitions, thus providing students with further opportunities to hone their math skills. Needless to say, during this time period students developed excellent algebra and computation skills, but whether they understood the concepts is another question. They certainly were quite capable of regurgitating their skills on departmental examinations (called diploma examinations today), which accounted for 100 percent of their final mark. Departmental examinations were discontinued in the mid-1970s, and now teachers are responsible for preparing their own final examinations and determining the students' final mark.

The 1970s saw the emergence of numerous instructional modes. Teachers were encouraged to use such things as manipulatives, games and puzzles, student projects, math lab experiments, class projects, field trips, and audiovisual resources in their classrooms. The intent was to motivate students and develop their interest in mathematics and help them become active participants in the learning process. Another intent, though, was to decrease students' boredom with the rigorous mathematics program. This required a considerable amount of adjustment by teachers—their past practice was quite different from what was now expected. Teachers took advantage of workshops, in-services, MCATA conferences, and seminars to learn about these teaching methodologies. Schools or school systems that had math leaders in their midst were the lucky ones because these people would organize in-services and workshops to keep teachers up to date. Many rural schools and systems lacked such leaders, and their teachers were literally on their own.

Throughout the 1960s and 1970s, there was considerable ferment in mathematics curriculum and instruction. It was not until the late 1970s that discussions began at the provincial level about the direction of the mathematics program. At the same time, the NCTM began to develop an overarching document called *An Agenda for Action* that contained eight recommendations for school mathematics of the 1980s. It was recommended that:

1. problem solving be the focus of school mathematics in the 1980s
2. basic skills in mathematics be defined to encompass more than computational facility

3. mathematics programs take full advantage of the power of calculators and computers at all grade levels
4. stringent standards of both effectiveness and efficiency be applied to the teaching of mathematics
5. the success of mathematics programs and student learning be evaluated by a wider range of measures than conventional testing
6. more mathematics study be required by all students and a flexible curriculum with a greater range of options be designed to accommodate the diverse needs of the student population
7. mathematics teachers demand of themselves and their colleagues a high level of professionalism
8. public support for mathematics instruction be raised to a level commensurate with the importance of mathematical understanding to individuals and society (these recommendations are from NCTM, *An Agenda for Action, Recommendations for School Mathematics of the 1980s*, 1980)

Specific actions were identified for each recommendation to ensure that the intended direction was being achieved. MCATA and the Department of Education adopted these recommendations as well as the subsequent *Standards for School Mathematics* documents and began an extensive review of the mathematics curriculum for Alberta that produced a new mathematics curriculum ready for implementation in 1982. Diploma examinations for grade 12 students in specified subjects were also implemented. The reinstatement of diploma examinations, now accounting for 50 percent of the students' final mark, was spurred on because public support for teacher-developed exams was waning because of the belief that students' final marks were being inflated and there was a surfeit of eligible students applying for scholarships. Universities also considered the introduction of entrance exams. When studies showed a very high positive correlation between teacher-assigned marks and diploma exam, diploma exams were here to stay. And as of this writing, in October 2012, they are still with us.

One final thing to mention about teaching and learning of mathematics in the 1970s is the dearth of trained mathematics teachers. At the elementary level there was an acute shortage of trained mathematics teachers. The overwhelming majority of teachers teaching mathematics had either no math background or, at best, a minimal number of math courses. At the junior and senior high level, the situation was only marginally better. Many teachers who taught mathematics at the various levels were clearly outside their field of expertise. This situation was particularly critical in rural schools and systems. It should not surprise anyone that these teachers called for support and guidance when changes in the mathematics

curriculum were introduced. This notwithstanding, these teachers and their students achieved remarkable results.

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