1960s INTRODUCTION

THE '60s—EVENTFUL AND MEMORABLE

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It's been said, "If you can remember the '60s, you weren't there." That is unlikely to apply to anyone involved in education or mathematics education during that decade. The ideas that were introduced and the changes that took place have been the source of many distant but unforgettable memories.

In the early 1960s, it was possible to begin a teaching career with a professional certificate from the University of Alberta, which was awarded after two years of study and the successful completion of practica at the elementary, junior high, and secondary levels. After attaining a professional certificate, I completed a bachelor of education degree in 1964, through evening and summer school classes. Here, I share memories from my experiences as an elementary teacher (1961–1967) and a graduate student (1967–1970). The latter included roles as faculty consultant, teaching assistant, and research assistant.

Any discussion of the 1960s should mention 1967, Canada's 100th birthday. A Centennial Train visited towns and cities. Students were given special flags, which they waved as they sang "Ca-na-da... now we are 20 million," the lyrics to Bobby Gimby's centennial song.

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Some of the changes of the 1960s can be directly attributed to what took place in the 1950s. In 1957, the Russians sent the dog Laika into space. The *Edmonton Journal* informed its readers when it would be possible to view the Russian satellite Sputnik (launched October 1957) crossing the Alberta night skies. These events contributed to the belief that the Russians were far ahead and that changes in education were warranted that would enable us to catch up. Mathematics education was at the top of the list. For some, the need for change was reinforced when Russian astronaut Yuri Gagarin became the first man in space on April 12, 1961.

One major change that occurred while I was teaching Grade 5 students in Edmonton was the province-wide adoption of a new elementary mathematics program—*Seeing Through Arithmetic* (STA) (Van Engen & Hartung, 1958). The publisher also printed a little reference booklet for teachers that explained the structure of the arithmetic on which the program was based: *Foundations of Elementary School Arithmetic* (Van Engen, Hartung, & Stochl, 1965). STA included several new ideas and procedures, which resulted in some lively staff room discussions. The use of the repeated subtraction algorithm for long division had many colleagues puzzled. Even more puzzling was the distinction made between quotitive (measurement) division ($a \div b = [\ ]$) and partitive (partitioning) division ($a \div [\ ] = c$). STA outlined a specific marking procedure for word problems, with five possible marks for each problem: two marks for translating a word problem into an equation, two marks for calculating the correct answer, and one mark for a meaningful answer sentence.

The adoption of this mathematics program included support services offered by central office. A series of films about the structure of mathematics (i.e., numeration, properties of the operations) was shown. One film included a scene from a grade 1 classroom that made us smile. It showed a student answering a question posed by the teacher with, "Three plus two is equal to two plus three because addition is commutative." One teacher commented, "Is this for real? Will this allow us to catch up with the Russians?"

Consultation visits from resource teachers could also be requested. These teachers would arrive at the school with a trunk full of manipulative materials, which included Dienes Blocks—base 10 blocks designed by Hungarian mathematician Zoltan Dienes. For many of us, this was our first exposure to these blocks.

Around this time, Encyclopaedia Britannica (Canada) asked teachers from across Canada to submit ideas for activities that could be used in elementary mathematics classrooms. These activities appeared in a publication called *Mathex* (Sawyer & Nelson, 1966). An excerpt from the program's statement of aims reveals, in part, why the 1960s were eventful: "Mathematical education is at present in an unstable state. Everyone knows that it is due for many changes. These changes may be good or bad, wise or foolish;

the one thing we can be sure of is that things are not going to stay as they are" (Dobson, 1966, p. 2). *Mathex* had two main aims: to ensure that changes were indeed improvements and to make it possible for these changes to come with a minimum of discomfort for teachers.

During this time, open-area schools were being built in Edmonton. Teachers and their students were invited to tour these schools. During the visits, aspects of what were identified as active learning, discovery learning, and the laboratory approach were illustrated. The open area in these schools was well suited to the active learning approach and to many of the mathematics projects illustrated in the book *Freedom to Learn* (Biggs & MacLean, 1969). New equipment provided to all elementary schools in the 1960s included televisions, overhead projectors, and radios (along with schedules of special programming, such as the Alberta School Broadcasts program *Speech Explorers*).

I had the privilege of being the first student to complete the MEd and new PhD in mathematics education offered by the University of Alberta's Department of Elementary Education. My advisor, L. D. Nelson, would repeatedly show his enthusiasm for the early stages of learning when he reminded me, "Working with young children, that is where the action is!"—a very new perspective for someone with a secondary mathematics and science background. No doubt this enthusiasm was due to the many books and articles published in the 1960s about young children's thinking, particularly their thinking about aspects of mathematics. Below are selected examples of such books:

- Jean Piaget's *The Child's Conception of Number* (1952), *Logic and Psychology* (1957), and *The Child's Conception of Geometry* (coauthored with Bärbel Inhelder and Alina Szeminska, 1960), as well as his articles "Development and Learning" (1964) and "The Genetic Approach to the Psychology of Thought" (1967)
- John H. Flavell's (1963) *The Developmental Psychology of Jean Piaget*
- Millie Almy, Edward Chittenden, and Paula Miller's (1966) *Young Children's Thinking*
- David Paul Ausubel's (1967) *Learning Theory and Classroom Practice*
- Shmuel Avital and Sara Shettleworth's (1968) *Objectives for Mathematics Learning: Some Ideas for the Teacher*
- Jerome Bruner's (1960) *The Process of Education*
- Zoltan Dienes's (1960) *Building Up Mathematics*
- Edmund Sullivan's (1967) *Piaget and the School Curriculum: A Critical Appraisal*

My advisor's enthusiasm translated into the projects I worked on as a research assistant, including designing activities and problems for young children; testing the activities and problems in a preschool setting and with students in the early grades; filming children as they solved problems and interpreting their responses and moves; and analyzing, recording, and sharing observations about young children's thinking and problem-solving strategies.

As a graduate student, I was able to visit and observe students in elementary schools that offered different programs. These observations included group projects in an open-area school and students working on activities identified as math labs. An attempt to individualize curriculum and instruction led some schools to adopt programs created at the University of Pittsburgh. *Individualized Programmed Instruction*, or IPI, for elementary mathematics was based on detailed task analyses and hierarchies of specific cognitive objectives for each skill, procedure, and idea. Subsets of the objectives were translated into questions and tasks for students, which were recorded in small pamphlets. These pamphlets, along with several parallel tests for each pamphlet, were stored on shelves along a whole wall in the classroom. A test was administered upon completion of each pamphlet.

Most of the grade 2 students who were observed attempted to complete the tasks in different pamphlets. Upon completion, these attempts were marked. A score of 80% or more resulted in moving on to a pamphlet with tasks at the next level. A score lower than 80% meant that students had to repeat tasks at the same level until the desired score was reached. In this classroom were six adults who were marking students' booklets and steering the students to the next booklet of tasks—six managers, and not one who was teaching.

Part of the statement of aims from *Mathex* (Dobson, 1966) quoted earlier—that "mathematical education is . . . in an unstable state" and "it is due for many changes" (p. 2)—is illustrated by the ideas, comments, and questions from the authors of the articles written during this decade.

Kunelius predicted a gradual change for the geometry taught in high school and encouraged teachers to depart from the traditional approach.

McCall pointed out the shortcomings of the newer mathematics that had been introduced in American schools and that was coming to Canada. The author observed that the new mathematics appearing in Alberta was more for the mathematics philosopher, rather than mathematics for the scientific world, and suggested that a final test for students in grade 4 should be "how many kinds of problems each individual pupil can solve after having completed the course."

Krider suggested that the focus be on "transfer of learning" and cautioned about moving ahead slowly—while guarding against discarding good and valuable material merely for the sake of newness. The author asked, "Should changes stress pedagogy at the expense of content or should the preparation of future mathematicians be considered?" and concluded that "in education, if you're old-fashioned long enough, you'll be modern."

Coulson discussed approach versus content and suggested that in high schools, the emphasis should be on the former (i.e., "modern concepts such as group and field theory; topology; symbolic logic should be taught from a modern postulational and set-theory approach"). Coulson compared student discovery of relationships and structure with a programmed approach and concluded that in the latter there is little room for the role of a teacher.

Galeski addressed the dilemma that exists when new mathematics is introduced and the term *modern* is used as a descriptor. The author concluded that the meaning of *modern*—today, this year, or in this century—cannot be discussed in a logical and precise manner. According to the author, a discussion about "thinking mathematically" versus "knowledge of learning important facts" would be more appropriate.

The summary of research conducted by graduate students at the University of Alberta presented by Cathcart and Liedtke shows that the books and articles published about children's thinking and thinking about mathematics at this time had a great impact. New ways of gaining insight into children's understanding of aspects of number and geometry were probed, and implications for classroom teachers were discussed.

Falk's random notes would have been helpful for those who were being introduced to the overhead projector as a new teaching aid.

Larson used rate ratio examples to illustrate that new problem-solving strategies should not become the only problem-solving strategies.

Cleveland's main question—"How do students learn the language of mathematics?"—is relevant in any decade.

Werner Liedtke is a Professor Emeritus at the University of Victoria, BC. He is interested in strategies that foster early numeracy strategies related to: confidence/risk taking, sense making/number sense, and mathematical reasoning/flexible thinking in young children (especially his grandchildren!).

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