# Rationale Gone Missing: A Comparative and Historical Curriculum Search

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Whether it is appropriate or not, there is an implicit hierarchy in the subject areas taught in public schools. Educational institutions are notoriously underfunded and have limited resources. Educators, particularly those in nonacademic subjects such as fine arts or physical education, need to simultaneously defend the importance of their subject areas and actively lobby for their fair share of time, money, equipment and personnel. As a mathematics educator, I often feel I am letting my subject area down. I usually leave my soapbox tucked neatly under my desk and keep quiet. Yet, even in my silence there is an assumed value and importance given to school mathematics by educators, parents, policy makers and most citizens. I have listened patiently to people explain how horrible they are in math but in the next breath say how important mathematics is for such things as everyday calculations, postsecondary institution admission, future job prospects and future income possibilities. Not satisfied with any of these reasons, I examined the front matter of the *Alberta K–9 Mathematics Program of Studies* (Alberta Education 2007)[1] in search of a rationale for teaching mathematics. Perhaps it would provide me with a thoughtful reason to dust off my soapbox.

As I read, I was bemused by the fact that the introduction included the heading, "Purpose of the Document," but the purpose of the content or of the entire subject was not clear. I read through the program of studies, asking the question, "Why is mathematics important for children?" Nothing in the early pages answered the question. Instead, the document provides goals for students such as, "to prepare students to use mathematics confidently to solve problems" (p 4). But what are the problems to be solved? If the main goal is to solve the problems that mathematics educators give students in the course of learning mathematics, then this goal is a self-referencing and self-serving. The goals chosen must be based on a rationale of some sort, but I couldn't find it.

I continued to sift through the document asking myself, "Why is mathematics important?" I found one sentence under "Nature of Mathematics" that was at least a partial response: "Mathematics is one way of trying to understand, interpret and describe our world" (p 10). This statement could form the basis for a rationale. It is, in fact, similar to the rationale provided in the science program of studies (1996) which appears under the explicit heading, "Rationale." It states: "Learning about science provides a framework for students to understand and interpret the world around them" (p 1). The statement in the mathematics program of studies is very similar, but it was buried on page 10 and no further explanation is given. Nowhere in the document is an explicit rationale provided.

On one hand, I was relieved that no attempt was made to pinpoint a rationale. Mathematics educators certainly do not agree on a singular, appropriate reason to teach mathematics—especially to all children (eg, Davis 2001; Huckstep 2000; Noddings 1994). If a rationale had been written, it surely would have been criticized by several stakeholders. On the other hand, I was dismayed. With no clearly defined vision for why mathematics is important, what assumptions are hidden beneath the choice of goals for students, content inclusion and exclusion, authorized resources, and so on?

Perhaps an explicit rationale in a program of studies is passé. I continued to think about my colleagues in other subject areas and their ability to put forth a united front regarding the purpose of their subject areas and their insistence that their subject is a vital component of schooling—at least in elementary schools. Out of curiosity I opened the Programs of Study (Core Curriculum) site from Alberta Education.

[1] All references to programs of studies are to programs produced by the Department of Education (1914–68), Alberta Education (1975–85; 2000–08) and Alberta Learning (1997).

Because I am a former physical education teacher, I opened the *K–12 Physical Education Program of Studies* (2000b) to see if it still included a rationale. It does. In fact, in contrast to the mathematics curriculum, the physical education document starts with **"Program Rationale and Philosophy"** in big bold letters. I asked the question, "Why is physical education important for children?" Part way through the first page I read:

> Physical activity is vital to all aspects of normal growth and development, and the benefits are widely recognized. Students do not develop automatically the requisite knowledge, skills and attitudes that lead to active, healthy lifestyles. Such learning should begin in childhood. Schools and teachers can be prime facilitators in providing opportunities for the development of the desire for lifelong participation in physical activity. (p 1)

Although we can critically dissect this statement and find faults, unlike the mathematics curriculum, the physical education document places a strong rationale for the subject up front. Not only does the document provide a justification for physical education, it also addresses the vital role that schools and teachers can (or should) play.

I also opened the programs of study for other marginalized subjects, including drama (1985b), art (1985a), music (1989) and health (2002). Each one started with "Program Rationale and Philosophy." Other academic subject areas begin the same way. Science, as I mentioned, starts with an explicit rationale. Social studies (2005), the program of studies that has been most recently revised, also provides extensive information on rationale, a program vision, a definition and the role of social studies in schools.

The remaining core subject, English language arts, arguably tops the hierarchy of subjects, particularly in elementary schools. As I had done with other subjects, I opened the document and started searching with the question, "Why is learning language arts important?" The word *rationale* is not used in the *K–9 English Language Arts Program of Studies* (2000a). Instead, the document begins with "The Importance of Language" followed by the subheading, "The nature of language."

> Language is the basis of all communication and the primary instrument of thought. Composed of interrelated and rule-governed symbol systems, language is a social and uniquely human means of exploring and communicating meaning. As well as being a defining feature of culture, language is an unmistakable mark of personal identity and is essential for forming interpersonal relationships, extending experiences, reflecting on thought and action, and contributing to society. (p 1)

Although the subheadings "the nature of language" and "the nature of mathematics" are parallel, their treatment and placement in the two documents are not at all equal.

Regardless of where the subject area was on the perceived hierarchy, all current curriculum documents, except mathematics, provide a (more or less) persuasive response to the question of why that subject matter is important.

Why, then, is no rationale for mathematics education provided? Is the justification so obvious that inclusion is not needed? Is it simply an oversight? Or were the writers not able to reach an agreement? Has an explicit rationale for teaching mathematics to children ever existed? This last question prompted an examination of the 1996 program of studies, then the 1982 curriculum, and compelled me to look through the dusty historical collection of almost a century of curriculum guides for elementary mathematics.

## A Century of Rationales for Mathematics in Schools

Beginning in 1914, most Alberta programs of study for elementary schools begin with a general introduction and aims or guiding principles for education in schools. The introduction is then followed by pages devoted to individual subject areas, usually with their own set of aims that are usually aligned with and reference the general goals of education previously stated. In arithmetic/mathematics, several common aims seemed to resurface throughout the nearly 100-year history that I reviewed. The following discussion highlights a few recurrent aims and assumptions pertaining to the importance of mathematics.

Perhaps a place to start is with the assumption that mathematics sits at or near the top of the hierarchy of school subjects. In 1918, the *Course of Studies for the Public Schools Grades I–VIII* includes "academic subjects" along with nature study, art, manual and household arts, physical training, hygiene and music. The teacher is advised to follow the outline in each subject, "but should give each pupil a thorough training in Reading, Writing, Spelling, Oral and Written Composition, and Arithmetic, as these subjects form the basis for future progress of education" (J T Ross, introductory note).

The supposed supremacy of literacy and numeracy has existed without change since the inception of public schooling. This viewpoint is expressed clearly in 1918, but similar views are expressed several times in the historical documents: "From the earliest times mathematics has occupied an honored place in the courses of study that have been pursued" (Department of Education 1924, 144). Also, "[f]rom time immemorial mathematics has played, and will continue to play, an important role in the history of man's existence and for this" and other reasons provided, "mathematics is considered to be one of the 'basics' of education" (1982, 2). In many respects these statements claim that mathematics is and has always been important in education, but without explicitly stating why. Why does mathematics occupy an "honored place in the courses of study"? The reason that mathematics is more important than hygiene or physical training, for example, is never explained or questioned.

Most Alberta curricula through the years do provide some form of rationale for why learning mathematics is important. Perhaps the most common reason stated is the utility of mathematics to solve everyday problems. However, there appeared to be a shift with respect to what and whose problems were important. The early years of public schooling emphasized "training" in and "mastery" of the four operations to solve "concrete problems" (1918, 7) and "problems ordinarily met within the activities of life" (1924, 144). Also, in Grade VIII (1924), the pinnacle of education for many students, the aim was training in "the genuine problems of life met within ordinary occupations of the community" (p 158). Throughout the years, mathematical skills are valued as a means to solve concrete problems, everyday problems and problems related to community occupations. However, I wonder why the problems related to mathematics are more important than the problems of, say, manual and household arts or hygiene?

Occasionally, the perspective on problem solving in mathematics shifted to a focus on problems arising from the children's present needs and interests. This trend was particularly evident in the "progressive" era of the 1930s, which emphasized a Deweyan perspective. That is, learning should be interesting and relevant for children "in the life they are living as boys and girls (1936, 4). A similar emphasis also appears in 1982: "The [mathematics] program should be focused on the child's world .... An awareness of some real-world applications of mathematics and some of the technological advances *which will directly affect the child's life*, should be imparted to the student" [italics added] (p 5).

The 2007 mathematics curriculum is sufficiently vague in its position on the utility of mathematics to solve problems. While students are expected to be confident problem solvers, the type of problems and their relevance are never specified.

Another common assumption is that learning mathematics is justified because it is required for future learning of mathematics. For example, "[o]f equal importance [to the growth and development of the child] is the aim of providing pupils with the background they will require for the study of mathematics in the later years of their school life (1962, 31; 1963, 24; 1968, 19). Even in Grade 1, "[t]he major objective of a primary number curriculum is to provide through enriching experiences a background of attitudes, appreciations, facts, and skills that will aid in the understanding of the formal Arithmetic of later grades" (1936, 89; 1940, 255). Rationalizing the learning of mathematics in the present for the learning of mathematics in the future is self-serving and rarely convincing.

Mathematics is also said to be important for future careers. In 1997, mathematics is justified because "a greater proficiency in using mathematics increases the opportunities available to individuals" (p 2). Although this rationale appears only once in the documents, it is one of the most common notions I hear from others who explain why they think mathematics is important. However, if "[w]e are teaching for a changing world" (1936, 89), how can we know what the opportunities will be available in a "rapidly advancing, technological society" (1997, 1)?

A final assumption appearing throughout the decades is the focus on the individual learner. In the first half of the last century, educational goals focused exclusively on individuals. Consider these statements from the *Programme of Studies for the Elementary School*, written in 1947:

> The ultimate goal of education is the happiness of the **individual**. Accordingly, the teacher's purpose is to assist each child in the class to unfold as fully as possible his unique potentialities. (1947, 10)

The arithmetic "point of view," in 1947, also focuses on individual learners, but I didn't see anything suggesting that the mathematics program was purposefully contributing to the children's happiness. The view that education should foster "the fullest development of each child's potentialities" occurred repeatedly (1963, 7; 1968, 4), particularly in mathematics.

In 1975, the educational goals shift radically to suggest that "education must provide opportunities to meet individual and societal needs" (p 1). However, the mathematics general objectives make little mention of society and continued to read "the aim of Elementary School Mathematics is to foster continuous and maximum development of each child's potentialities" (p 21). In fact, it emphasizes, "the growth of a mature individual who thinks and acts effectively, and who, as a result *may contribute to society*" [italics added] (p 21). The hedge on making a contribution to society seems particularly odd. In 1978, the educational goals also emphasize fulfilling "personal aspirations while making a positive contribution to society" (p 3), but the mathematics goals in that year focus exclusively on individuals and make no mention of society or social relationships.

## Final Thoughts

My quest to locate a convincing rationale for teaching mathematics through almost a century of curriculum documents has been wholly unsuccessful. To my mind, learning mathematics for the purposes of future progress of education, for its utility, for later mathematics learning, for future careers and for individual growth are, at best, inadequate and, at worst, inappropriate. Why do we teach mathematics to children?

The current program of studies says that "Mathematics is one way of trying to understand, interpret and describe our world" (2007, 10). I mentioned previously that this is perhaps one part of a rationale, but it, too, is inadequate. The statement neglects the fact that humans who use mathematics play an essential role in *creating* our world—a mathematical world. Much like the "nature of language" in the English language arts curriculum (2000a), mathematics is also a "primary instrument of thought" and a "defining feature of culture" (p 1). How does mathematics shape our thinking? How has it defined our culture? What has mathematics allowed us to create? How has it constrained or perhaps disallowed possibilities for knowing, seeing, doing and being? Why is mathematics the only "academic" school subject that does not include a critical thinking component or address issues within the discipline? How does our uncritical stance on the value of mathematics prevent us from moving beyond individual development towards cultural implications of a mathematical world? Mathematics is important for children, but there are many more questions that need to be raised and discussed before I'll be comfortable dusting off and stepping on my soapbox.

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