## QUOTATIONS ON MATHEMATICS TEACHING FROM EGERTON RYERSON

Egerton Ryerson (1803-1882) was the first Superintendent of Education in Canada West. He took his job very seriously, and prefaced his tenure with a trip abroad to study education in the United States, Great Britain, France and Germany. His observations and recommendations make up his *Report on a system of public elementary instruction for Upper Canada* published in 1847. This informed the legislation passed by the province that provided for free nondenomination public schools run by boards of trustees and supported by earmarked taxes, a common syllabus and system of textbooks, and a normal school for the training of teachers. His publication is important, both for his articulation of what he wanted public education to achieve, and for his awareness of how children learned or failed to learn a syllabus. It is also representative of opinions expressed in many times and places.

In his mind, the primary goal of education is to support good citizenship. *By education,* he wrote, *I mean not the mere acquisition of certain arts, or of certain branches of knowledge, but that instruction and discipline which qualifies and disposes the subjects of it for their appropriate duties and employments of life, as Christians, as per sons of business, and also members of the civil communities in which they live.*

The system that Ryerson created in the nineteenth century persisted in Ontario schooling until the 1960s. It had the advantage of operating under a pretty strong social consensus as to its purpose – to produce citizens equipped to take advantage of opportunites and discharge their duties responsibly, its pedagogical goals – to provide a solid technical foundation for the three Rs, its social norms – to provide a solid nondenominational Judaeo-Christian foundation for how members of society should relate to each other.

The increasing diversity of the population has led to a modification of its goals, but unfortunately the public commitment to a strong universal education system in the province has also been eroded, partly due to controversies over the syllabus and a loss of faith in the system to deliver. In the process, citizens have lost sight of the vision of Egerton Ryerson.

To provide a little context, we will start with two earlier quotations out of many that could be found that even in earlier times, the importance of understanding and applications were indicated.

Consider, for example, the first arithmetic text in the year 1202, *Liber abbaci*, by Leonardo of Pisa, also known as Fibonacci, to accustom its readers to the then new Indian-Arabic numeration. This is from the preface of a later edition of the text:

**Liber abbaci** (2nd edition: 1228)

by Leonardo of Pisa (Fibonacci) (c1175-c1250)

You, my Master Michael Scott, most great philosopher wrote to my Lord [Emperor Frederick II] about the book on numbers which some time ago I composed [1202] and transcribed to you; whence complying with your criticism, your more subtle examining circumspection, to the honour of you and many others I with advantage corrected this work. In this rectification I added certain necessities, and I deleted certain superfluities. In it I presented a full instruction on numbers close to the method of the Indians, whose outstanding method I chose for this science. And because arithmetic science and geometric science are connected, and support one another, the full knowledge of numbers cannot be presented without encountering some geometry, or without seeing that operating in this way on numbers is close to geometry; the method is full of many proofs and demonstrations which are made with geometric figures. And truly in another book I composed on the practice of geometry [*De Practica Geometriae*, 1220], I explained this and many other things pertinent to geometry, each subject to appropriate proof. To be sure, this book looks more to theory than to practice. Hence, whoever would wish to know well the practice of this science ought eagerly to busy himself with continuous use and enduring exercise in practice, for science by practice turns into habit; memory and even perception correlate with the hands and figures, which as an impulse and breath in one and the same interest, almost the same, go naturally together for all; and thus will be made a student of

habit; following by degrees he will be able easily to attain this to perfection. And to reveal more easily the theory I separated this book into XV chapters [the reader will not appreciate arabic numerals until they get into the book], as whosever will wish to read this book can easily discover. Further, if in this work is found insufficiency or defect, I submit it to your correction.

Move forward 500 years to the *Art of Reckoning*, a practical text written in 1738 by Leonard Euler, a mathematician whose standing was comparable to that of his contemporary Johann Sebastian Bach in music.

**Rechenkunst** (1738)

by Leonard Euler (1707-1783)

Since learning the art of reckoning without some basis in reasoning is neither sufficient for treating all possible cases nor apt to sharpen the mind – as should be our special intent – so have we striven, in the present guide, to expound and explain the reasons for all rules and operations in such a way that even persons who are not yet skilled in thorough discussion can see and understand them; nonetheless, the rules and shortcuts appropriate to calculation were described in detail and extensively clarified by examples.

By this device, we hope that young people, besides acquiring an adequate proficiency in calculation, will always be aware of the true reason behind every operation, and in this way gradually become accustomed to thorough reflection. For, when they thus not only grasp the rules, but clearly see their basis and origin, they will in some measure be enabled to invent new rules of their own, and by means of these, solve problems for which ordinary rules are insufficient.

*Quotations on Mathematics Teaching and Learning*

**Report on a system of public elementary instruction for Upper Canada** (1847)

by Egerton Ryerson (1803-1882)

Nay, it is held to be less difficult for a child to learn to count than to learn to read, while it contributes more than reading to strengthen and discipline the mind. But the manner in which is it too often taught, renders the study of it an insupportable task, and not unfrequently an object of bitter aversion, without imparting any useful knowledge.

There are doubtless many exceptions; but the remarks of the Author of the *District School*, are scarcely less applicable to Canada than to the State of New York: "From this science very little is obtained in our District Common Schools, which is of any *practical use*. There is much compulsive, uncertain, and laborious study of arithmetic; but it is often in vain, from the manner in which it is taught, since the scholar gets very little in return for his labour that is valuable or practical. Those who have received nothing more than a Common School education, obtain their practical knowledge of the science of numbers, not from their instructions or study in the School, but from their own invention and the rewards of experience. There is in the country but a small part of arithmetic *in use* which came from the Schools; necessity has taught the people what they ought to have learned at School when young, and when they were wasting so much time and money to no purpose. The pupil learns nothing thoroughly; what he does not understand he feels little or no interest in; he sits with his slate before him most of the day, groping, guessing, doing nothing. Prehaps scarcely any two pupils are studying the same rule, or using the same book, instead of being formed in as few classes as possible." (page 100)

In teaching arithmetic, nothing must be considered as done, which is not thoroughly comprehended; a *meaning* and *reason* must be attached to every step of the process. Begin, therefore, first of all, by referring the pupil to sensible objects, and teach him to compute what he *can see*, before you perplex him with abstract conceptions. A mere infant may in this way be taught to add, subtract, multiply, and divide, to a considerable extent. Apparatus for this purpose, of various kinds, is already in use; but what need have you

of apparatus? Everything around you may be made subsevient to this end. It will not do, however, to stop here. The mind must before long be accustomed to abstraction, and therefore the sooner you can teach the child to convert this tangible arithmetic into abstraction, the better. (page 101)

Mr. Wood [reporting on the Edinburgh Sessional School] says: "It was in arithmetic we first succeeded in kindling that ardour, which has since diffused itself through every other department of the Institution. Arithmetic, which had hithertoo been one of their dullest occupations, now became to the scholars a source of the highest interest and amusement. They, by degrees, obtained a rapidity movement in this Art, which we should have previously accounted quite incredible, and along with that celerity a proportional accuracy in calculation. But this was not all. They obtained at the same time, what in our opinion, is infinitely more valuable than any arithmetical attainment, — that general energy and activity of mind which we find of so much service in the introduction of all our subsequent improvements, and which we doubt not has in a great measure formed the character of many of them for life." (page 102)

"It struck me that the main differences between their mode of teaching arithmetic and ours, consist in their beginning earlier, continuing the practice in the elements much longer, requiring a more thorough analysis of questions, and in not separating the process or rules so much as we do from each other. The pupils proceed less by rule, more by an understanding of the subject. It often happens in our children, that while engaged in one rule, they forget a preceding. Hence many of our best Teachers have frequent reviews. But there, as I stated above, the youngest classes of children were taught addition, subtraction, multiplication, and division, promiscuously, in the same lessons. And so it was in the later stages. The mind was constantly carried along, and the practice enlarged in more than one direction. It is the difference which results from teaching in the one case from a book, and in the other from the head. In the latter case the Teacher sees which each pupil most needs; and if he finds one halting or failing in a particular class of questions, plies him with questions of that kind until his deficiencies are supplied." (page 104)