



Math Curriculum in Ontario: A Historical Perspective

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Who Am I?

- Over 20 years in the STEM Education field
- PhD in Education (June 2021)
- Masters of Mathematics for Teachers
- Bachelor of Education (I/S Level, Junior ABQ)
- Bachelor of Science (Chemistry and Mathematics)
- Wrote and illustrated a book for youth on math following my dogs (Alpha and Delta)
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Background

- My thesis
 - 483 participants
 - Over 50% couldn't pass basic numeracy test
 - By end 90% could pass, nearly 70% with a score over 75%
- Why I find this interesting and important
- Where this research comes from

Opening Questions

- Is mathematics a science, or does it more closely relate to the arts/humanities?
- Is it a tool for solving problems or is it a way to open our mind to critical thinking and more philosophical pursuits?
- What subjects in mathematics are worthy of attention?
- Who should be responsible for teaching mathematics and what training should they have?
- What pedagogy should we be following and how do we assess that our students understand what they are being taught?

The 17th and 18th Centuries

- *The first fault line is the distinction between 'liberal' and 'practically useful' (or 'mechanical') knowledge [...] The 'liberal arts' in turn were divided into two, forming the second fault line: the Trivium (grammar, logic and rhetoric) and the Quadrivium (arithmetic, astronomy, geometry and music). (Muller, 2009, p. 206)*

1871 – 1950

- European influence
 - Focus was on “Nature Study”
 - *Outdoors education, science education, educational psychology, agriculture, vocational education, and hygiene...introduced science into public schools of North America. (Bing, 2005, p. 7)*
- In early 1900’s a focus more on education aimed at industrialization
 - Lead to the “formation of subject-based streaming” (Bing, 2005, p. 26)
- John Seath, superintendent of education:
 - *“deplored the overemphasis on mathematics, and yet at the same time criticized the neglect of the sciences” (Bing, 2005, p. 29)*

1950 – 1990

- Soviet Union technological superiority (Sputnik) and the Cold War
- Greater emphasis on Math
- Hall-Dennis report (1965), officially titled “Living and Learning: The Report of the Provincial Committee on Aims and Objectives of Education in the Schools of Ontario,” was a *“fresh look at education in Ontario” (vol. 1)*
 - Part of it sought to define purpose of education and math’s place
 - Concepts rather than subjects
 - *“counting rather than mathematics, [...] rain rather than science” (Ontario, 1965, vol. 3)*

Hall-Dennis Report

- curriculum focused more on communication, “man and his environment” and “man’s ideas and values” (Vol. 1)
- *[...] that there are many children who have special gifts in music or art or drama, but who have no particular interest in the sciences or mathematics or other academic disciplines. The curriculum must provide for their progress and for graduation with emphasis in their specialties. These children cannot be branded as failures by the fact that their talents lie in special areas rather than in the traditional disciplines. (Ontario, 1965, vol. 1)*
- Math was seen as a tool rather than a subject

Hall-Dennis Report

- “[t]he major essential for the achievement of virtually any curricular purpose is the acquisition of the skills of communication [...] Together with simple mathematics, they constitute the one skill which must be measured and brought to an acceptable standard in keeping with the pupil's ability.” (Ontario, 1965, vol. 3)
- Research taking place at academic institutions in education needed to be relayed to those who were teaching the students; including those academic studies focusing on mathematics and mathematics education (Ontario, 1965, vol. 5).

Hall-Dennis Report

- *[s]ome lambasted it for being simply unrealistic, philosophically flawed, and dangerous. Others attempted reforms on a trial basis with little success. And few used it to legitimate their own personal initiatives. In the end most experiments were judged impractical, not in the sense of their being unrealistic but more of teachers and students being unprepared. (Memon, 2006, p. 119)*
- Memon claims implementation was handled poorly
 - *“The Minister, instead, served up the study as a coffee table brochure.” (p. 199)*
 - *“One day teachers were told about open classrooms and the next day they walked into schools with no walls. It was too drastic” (p. 120)*

1950's and 60's (New Math)

- *The old math emphasized repetitive calculations. Students were taught first to count, then to add, then to subtract, then to multiply, then to divide, and then more complicated mathematical operations. A **rigid algorithm** was taught for each, and about a quarter of class time was spent doing **repeated examples**. Grading was based entirely on ability to do the calculations exactly as instructed, quickly and accurately. Arithmetic plus some rote geometry and algebra were the only requirements for a secondary (high-school) degree; only advanced students studied other fields, and even basic calculus in most high schools meant signing up for a local college course. [...] The new math made two changes. First, it **replaced the class time spent on rote practice with deeper explanations of what was being done**. ... The second change was to **introduce abstraction** at the very beginning of mathematics instruction. **Modular arithmetic, inequalities, symbolic logic, abstract algebra, and other topics normally considered advanced were taught to the youngest children as arising in natural ways from interesting questions. Students were encouraged to think about things and use logic and abstraction to come up with useful, non-obvious answers.** (Brown, 2015, p. 12)*

1990 – 1995

- *“In May 1993, the Province of Ontario established the Royal Commission on Learning “to ensure that Ontario's youth are well-prepared for the challenges of the twenty-first century.” After exhaustive public consultation, the Commission released its report, entitled For the Love of Learning, in January 1995. The report was to suggest a vision and action plan to guide the reform of elementary and secondary education. This would include values, goals and programs of schools, as well as systems of accountability and educational governance.” (Government of Ontario, 1994)*

For the Love of Learning

- Education should be a collaboration between schools (teaching basic competencies) and business and industry (to teach advanced technologies)
- Focus on meta-cognitive strategies (thinking about thinking)
- Challenging the standardization of the 1960's and 70's; focus on competing globally
 - Pulled from "New Math" concepts
- Math was applied directly to science, technology and business
- De-streaming students

EQAO

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- The purpose of the EQAO was to assess the abilities of students in grades 3, 6 and 9 on their mathematics and literacy skills.
 - The EQAO refers to itself as “... *a world-class large-scale testing organization that provides valuable services to the people of Ontario with a focus on improving student learning.*” (Education Quality and Accountability Office, 2013, p. 3)
 - Accountability, measurable benchmarks, and information
 - MPT test
 - “Weak and not universal” correlations between teacher competency scores and student outcomes and issues with recruitment from minority ethnic groups (EQAO, 2019, p. 4)

Math Institutions and Associations

- Ontario Association of Mathematics Educators (OAME) (1860 as Ontario Teacher's Association)
 - Inclusion of Geometry and adoption of the metric system (1901)
 - 1960 even wrote a text on "New Math"
- Fields Institute
 - 2013 report on elementary teacher candidate math requirements

What's it all for?

- What can we learn from the past?
- Are there things from these reports we can bring into today?
- How has the past year changed our perceptions?
- How do we define math, and do we need to?

Looking to the Future



Bakker et al. (2021)

- Approaches to teaching (teaching strategies, and curriculum)
- Goals of math education (societal and educational)
- Relation of math education to other practices
- Teacher professional development
- Technology
- Equity, diversity and inclusion
- Affect
- Assessment

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