

Learning Mathematics in the 21st Century

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Trends in Math Curriculum

- Reduction in emphasis in manual calculation and memorization
- Reduction in emphasis on standard algorithms
- Removal of formal geometry
- Increased reliance on technology for calculation and algebraic manipulation

Results of Youngstown School Math Program

Grade	% Acceptable		% Excellence	
	Youngstown	Province	Youngstown	Province
3	95	89	17	21
6	100	79	45	12
9	85	68	33	18

Youngstown: Grade 12 Results

Diploma Participation	Youngstown	Province
	77%	37%

% Acceptable		% Excellence	
Youngstown	Province	Youngstown	Province
97%	83%	52%	27%

“There is a cause for every effect!”

- 1997- The Youngstown Model was used to develop the curriculum delivery model for the Cogito Program in Edmonton Public Schools.
- Cogito:
 - Direct instruction model (not a child centered program)
 - Enhanced knowledge base to enhance ability with analysis
 - Today 5000 students in 11 schools.

Cogito Demographics

- 34% English Language Learners
- 40% low SES
- Many children of immigrant families from south and east Asia and Eastern Europe

Cogito Math Results 2000-2014

Grade	% Acceptable		% Excellence	
	Cogito	Province	Cogito	Province
6	93%	73%	56%	18%
9	94%	66%	61%	19%



There is a cause for every effect!

Key elements of effective mathematics instruction

1. Use correct mathematical vocabulary from grade one.

Acceptable math terminology assists instruction, understanding and enables translation of a word problem into a mathematical expression.

2. Develop Number Sense and Automaticity

- Concepts need to be carefully sequenced
 - Proficiency developed through practice and correction.
 - Teach proper algorithms for basic operation including long division.

3. Early proficiency with fractions

- Fractional operations need to be learned before decimals
- Adding, subtracting, multiplications and division of fractions should be learned by the end of grade 4.

<http://Pss.sagepub.com/content/23/7/691>

4. Euclidian Geometry

- Basis of western mathematical thought.
- Formal Geometry removed from Alberta Curriculum
- Fundamental tool for building logic, reason and analysis

5. Minimization of technology

- No quantified, reproducible studies to demonstrate a link between improved student achievement in mathematics and technology.
- In Alberta billions have been spent on technology as measurable results decline.
- Mathematicians are not advocating for more technology in math instruction.

6. Teach students to derive formulae!

- Requires good knowledge of algebraic manipulation and skill in working with fractions.
- Declining stress in this area.


7. Use of Well Designed Text Books

Characteristics of a good text:

- Topics well sequenced
- Good selection of exercises in varying difficulty
- Provides background, rationale and instruction on processes and solution development and rules.

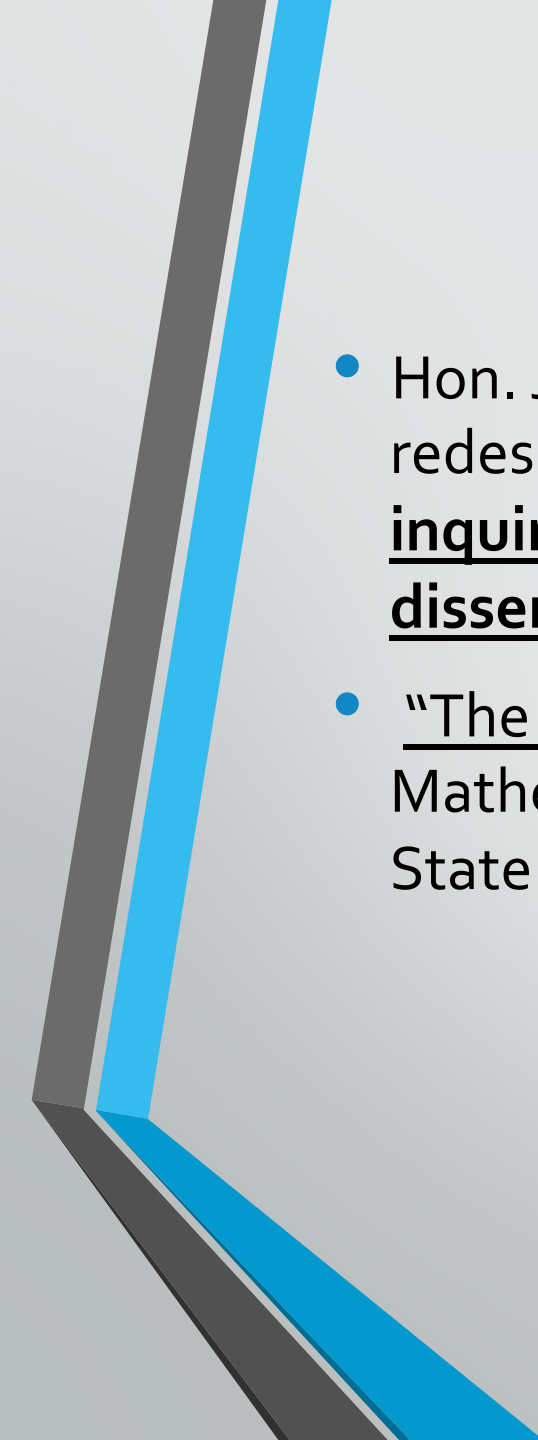
7. Use of Well Designed Text Books

- Benefits of a good text:
 - Supportive to students and parents
 - Helps teachers, who may not be expert, understand rules, vocabulary and processes
 - Enables consistency between classes



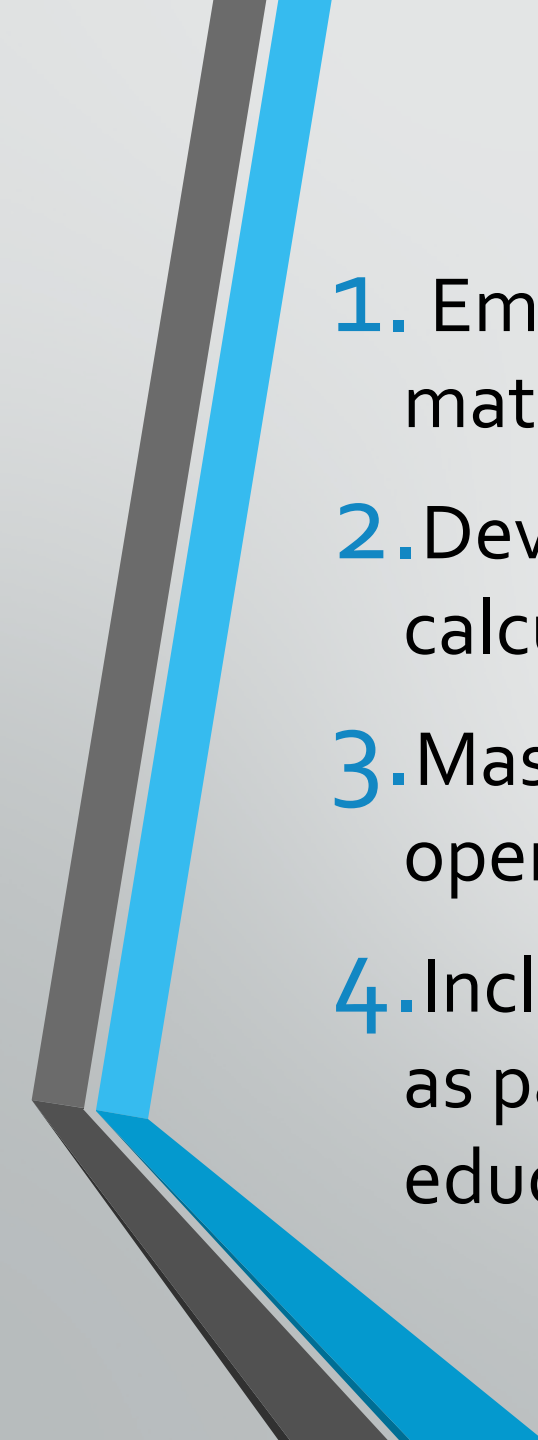
8. Include Direct Instruction as a Teaching Strategy

- Direct instruction is essential to provide the transfer of information, explanation and practice in a reasonable time frame.
- Ministerial order of May 6, 2013 imposes one model of instruction on all. This needs to be rescinded.


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- Hon. Jeffrey Johnson instructed his staff that in the process of curriculum redesign, they were to focus “...on **competency than on content; on inquiry, discovery and the application of knowledge than on dissemination of information...**”.
 - “The Contradictions in the Constructivist Discourse”, Centre for Teaching Mathematics, University of Plymouth: Educational Foundations, Montana State University



Concluding Recommendations

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1. Employ correct mathematical vocabulary.
 2. Develop automaticity in calculations.
 3. Master fractional operations in elementary.
 4. Include formal geometry as part of mathematics education from junior high.

5. Minimize use of technology in mathematics classrooms
6. Train students in formula derivation
7. Employ a good print textbook
8. Employ direct instruction methods to introduce and explain topics



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