

## Spotlight on Mathematics and Education in Ontario

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Cue music: How do you solve a problem like . . . math implementation?

Background:

Ontario has almost 5000 schools with over 115 000 teachers. The Ministry of Education has 10 education officers assigned to curriculum implementation. The Ontario Mathematics Coordinators Association (OMCA), an affiliate of NCSM, yearly has about 100 members from almost all of the 60 English boards of education.

Dilemma:

So, as leaders in the mathematics community, how do we help teachers ‘discover’ the curriculum, understand the curriculum, implement the curriculum and assess the achievement of the curriculum? Standard professional learning methods used to include workshops, either local to a school or board, or provincially to large regions. The use of workshops has been minimized – a lot of the professional learning in Ontario is now being done through Collaborative Inquiry Learning in Math (CIL-M’s). There are also local and provincial conferences, run by the Ontario Association for Mathematics Education (OAME), an affiliate of NCTM, and its chapters. We also use web-based presentations and interactive Adobe Connect sessions.

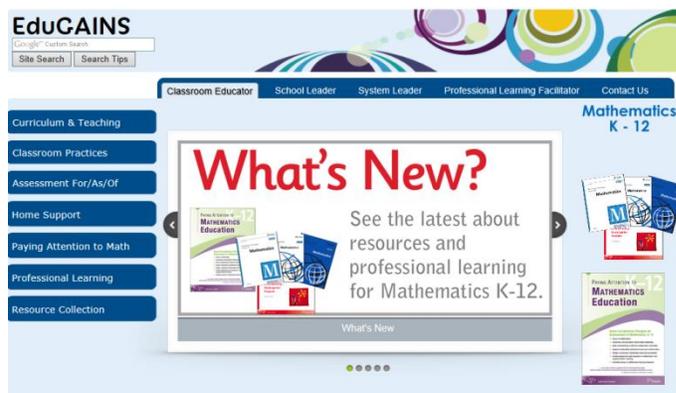
But the challenge still remains of how to reach ALL of our teachers. One way is to put ourselves in the teachers place and consider what we need, how do we want it, and when do we want it. As a result, Ontario teachers now have a multitude of resources, guides, examples, and demonstrations to assist in understanding the intent of the curriculum and collate ideas on delivery – especially on-line.

Resources and Supports:

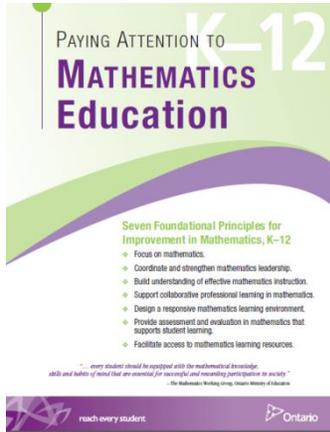
The sources start with the Ministry of Education at their EduGAINS web site

(<http://www.edugains.ca>). The ministry website shares materials resulting from collaboration between several departments in the Ministry including the Literacy and Numeracy Secretariat (LNS) and Curriculum and Assessment Policy Branch (CAPD). In the foundational document, Paying Attention to Mathematics Education,

(<http://www.edugains.ca/newsite/math/payingattentiontomath.html>) the Mathematics Working Group says “...every student should be equipped with the mathematical knowledge, skills and habits of mind that are essential for successful and rewarding participation in society.” ([www.edu.gov.on.ca/eng/teachers/studentsuccess/FoundationPrincipals.pdf](http://www.edu.gov.on.ca/eng/teachers/studentsuccess/FoundationPrincipals.pdf))



The document goes on to describe and explain what Ontario considers The Seven Foundational Principles for Improvement in Mathematics, K–12, namely;



- Focus on mathematics.
- Coordinate and strengthen mathematics leadership.
- Build understanding of effective mathematics instruction.
- Support collaborative professional learning in mathematics.
- Design a responsive mathematics learning environment.
- Provide assessment and evaluation in mathematics that supports student learning.
- Facilitate access to mathematics learning resources.

There are continuing specific support documents to assist in the “Paying Attention to” series including Algebraic Reasoning, Spatial Reasoning, Fractions, and Proportional Reasoning, with more to come.

Then teachers can access the Capacity Building Series, produced by the Literacy and Numeracy Secretariat to support leadership and instructional effectiveness in Ontario schools. The series includes resources directed at supporting numeracy, student inquiry, Bansho (board writing), and asking effective questions in mathematics.

Teachers can also look into ideas for parent engagement, maximizing learning in the early years, listening, communicating, differentiating math instruction, and so on. In each of these on-line documents (<http://www.edugains.ca/newsite/math/monographs.html>), teachers are given practical examples to use, suggestions on preparations, and techniques for follow up.

For example in ‘Effective Questions’ amongst the eight tips we find the suggestion to “pose open questions”. What does this mean?

Well rather than asking “what is  $4 + 6$ ?” we could ask “how can you make 10?” or “what is 10?”.

Students in early grades will suggest  $4 + 6$ ,  $3 + 7$  etc., and then discussions can arise whether  $4 + 6$  is the same as  $6 + 4$ ? How are they the same? How are they different? Is there a pattern which will ensure we don’t miss any combinations?

Usually some students will then ask if  $11 - 1$  is OK? And then what about  $20 \div 2$ ? Or half of 20? Or 50% of 20? This technique does have a long history, going back to the 1980’s when The Standards had teachers grappling with problem solving and discussing the difference between a question and a problem. Now any teacher can access these suggestions on-line in real-time, and see how it might play out in their classroom.

Just think of the richness of the input from students, the opportunities to delve into the connections between operations and the use of descriptive mathematical language. All this from one simple, open question (sorry, problem), along with teacher interventions as appropriate plus encouragement.

The EduGains web site gives educators links to curriculum connections, LNS documents, and a wealth of supports and programs such as gap closing, guides to effective instruction, math posters, and videos of facilitated professional learning sessions. Two very popular links are to CLIPS and TIPS!

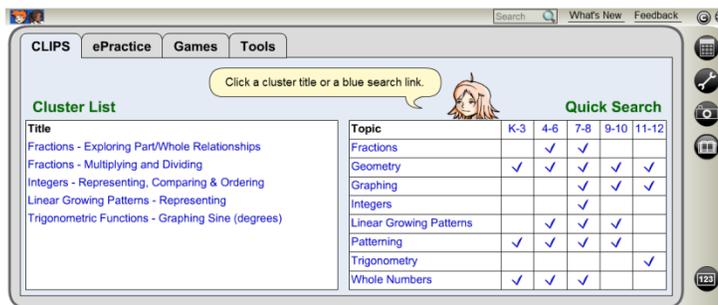
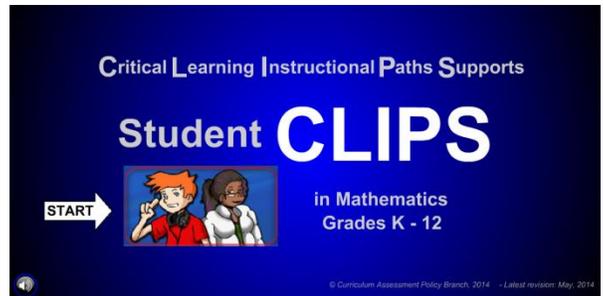
## CLIPS

Critical Learning Paths Supports (CLIPS) are web-based interactive opportunities for instruction, assessment, additional support or enrichment across grade bands. These instructional trajectories focus on key mathematical concepts.

Initially there is an overview with a virtual tour which provides suggestions of how to access and use CLIPS.

There is also a CLIPS Ruler template that includes a ruler with both metric and imperial measure, as well as CLIPS access information. Graphics of selected math tools are included and teachers can print copies of this template for students in their class.

The main focus of CLIPS though is the interactive electronic Tools. These tools are used to discover or reinforce key concepts in mathematics through exploration.



Teachers and students have access many activities for a variety of topics for a range of grades K – 12. Students ‘play games’, review concepts, watch videos, and use different assessment tools. Throughout they have access to any of the CLIPS tools which include a

calculator, an integer comparison line, fraction strips, a graphing calculator, Gizmos and GSP. Why not leave your reading (for a break) and visit <http://www.edugains.ca/newsite/math/clips.html> right now?

## TIPS

Targeted Implementation and Planning Supports (TIPS) had been in development before the Ontario curriculum was revised. Targeted Implementation and Planning Supports For Revised Mathematics (TIPS4RM) continues this resource and offers ways of thinking about mathematics education, resources, and teacher education for those working with students in Grades 7 to 12. [While TIPS4RM is the official acronym, teachers still refer to these resources as TIPS.] TIPS provides numerous 3-part lesson plans (Minds on, Action and Consolidate/debrief) illustrating how teachers can connect program goals, research and effective instruction, and the characteristics of adolescent learners.

It is important for teachers to recognize connections, since a sound understanding of mathematics is one that sees the connections within mathematics and between mathematics and the world rather than isolated or disconnected bits of information.

**Unit 3: Day 1: What's the Story? Grade 7**

**Math Learning Goals**

- Make inferences and arguments based on the analysis of data.
- Distinguish between primary and secondary data.
- Distinguish between a census and a sample.
- Identify bias in data collection methods.

**Minds On...** **Whole Class → Brainstorm**  
Create a mind map with "data management" in the middle, and "sports" and "music" in two corners. Elicit answers that lead to creating some connections among these three ideas, e.g., What data could we collect from the Internet about music? (secondary data) or by surveying our class? (primary data)

**Connecting/Oral Questioning/Observation/Mental Note: Assess students' ability to connect the use of data to situations in their world.**

**Action!** **Groups of 4 → Investigation**  
Students examine and analyse the data and answer the questions (BLM 3.1.1). Ask specific questions from the chart to relate the data to the headings. Groups answer the questions on BLM 3.1.1.  
Note: Use this activity as a beginning for a discussion that graphs, data, and statistics are a math tool for organizing and analysing large amounts of information, i.e., data helps to tell a story.

**Whole Class → Discussion**  
Discuss the discrepancy between the number of men vs. women who lost their lives.  
To demonstrate a census vs. a sample, survey the class, by a show of hands, posing the question: Is the "women and children first" rule fair? Generalize from the data obtained that % of the class thinks it is fair, and then survey the girls only. Introduce the term *bias*: in data collection.

**Consolidate/Debrief** **Whole Class → Discussion**  
Revisit the terms introduced during **Minds On...** and **Action!** Students give evidence of when they were used during the lesson.

**Home Activity or Further Classroom Consolidation**  
Find current statistics in a newspaper, a magazine, on television, or on the Internet to answer the following question about the data: What story might the data tell?

**Assessment Opportunities**

Think Literacy: Mathematics, Grades 7-8, p. 2-4

Point out the difference in the two surveys (one is a census of the class, the other is a survey).

**Words Wall**

- census
- sample
- primary/secondary data
- bias

For a topic (e.g. collect, organize and analyse data) for a given grade (e.g. grade 7) teachers will find in TIPS lesson plans for up to a three-week unit. The unit overview will include reference to the relevant student expectations from the provincial curriculum. Each lesson starts with the main math learning goals and a material list. The 'Minds on' may be a whole class brainstorming idea, with connections notes. The 'Action' section may be groups of 4 tackling an investigation or whole class discussion. The 'consolidate/debrief' is usually a whole class discussion. Also included are ideas for further classroom consolidation or home activity.

Throughout these resources, teachers will find relevant black line masters to provide support and assessment tools. For example, selected passenger data from the Titanic is displayed as a resource for questions addressing analyzing data.

Another TIPS resource leads teachers into the second organizer of the curriculum. The student expectations are organized into strands, which in Ontario have been grouped as:

- Number Sense and Numeration
- Geometry and Spatial Sense
- Measurement
- Data Management and Statistics
- Patterning and Algebra

Interwoven with these are critical processes that are an essential part of the expectations. The strands and processes are like the warp and woof of a finely woven garment.

The TIPS Math Processes Package lets teachers delve into the 7 math processes of the Ontario Curriculum, namely:

- Problem Solving
- Reasoning and Proving
- Reflecting
- Selecting Tools and Computational Strategies
- Connecting
- Representing
- Communicating



For each process there are ideas and suggestions for the role of students, instructional strategies, sample questions and sample feedback.

For example some of the instructional strategies suggested for problem solving include collaboration, scaffolding, asking probing questions, facilitating, discussing, using cross-curricular applications, modelling and using manipulatives.

### Conclusion

So visit [www.edugains.ca](http://www.edugains.ca) and explore, experiment and expect . . . to revisit many times, as Ontario math educators do every day.

Cue music: and these are a few of my favorite . . . Ontario math resources.