Excellence | Equity | New Evangelization

NUMERACY ACTION PLAN

DURHAM CATHOLIC DISTRICT SCHOOL BOARD
Catholic Education: Learning and Living in Faith

Our Mission

We are called to celebrate and nurture the God-given talents of each student as we serve with excellence in the light of Christ.

Introduction

For the past few years, the numeracy goal at the Durham Catholic District School Board has been to improve student engagement and achievement by learning through the Mathematical Processes. In 2014/2015, this was adapted to include the context of Balanced Numeracy.

As educators, we have learned a great deal about our students and how they best learn Mathematics. We have developed diagnostics for Number Sense (Continuum Based Math (CBM)), Scope and Sequence documents to assist educators with their program. We also understand the importance of having a program that balances rich tasks, while promoting conceptual understanding with carefully planned practice opportunities.

We know that a rich task for one student might not be rich for another student in the same class. What makes a task rich is how well students can utilize the Mathematical Processes and Polya's Four-Step Problem Solving Model. We also know how students' Numeracy development can be measured on various continua and, in particular, the Concrete-Diagrammatic-Symbolic continuum (which is used extensively in Singapore). As educators, it's crucial for us to provide students with opportunities to talk through their mathematical ideas with others — by listening carefully to these conversations, we can obtain great insights into what our students do and don't understand.

Above all, we know that all students best learn Math by actually doing Math.

Looking ahead, we will continue to build on our knowledge of Numeracy by offering the following supports:

- Collaborative Inquiry for Learning Mathematics (CILM) in 12 schools
- Job-Embedded Learning sessions
- Math Cafés
- Capacity Building Days
- Student Work Study Teachers (SWST)
- Numeracy Action Teams

Balanced Numeracy

By focusing on Balanced Numeracy, we understand that there is no one perfect instructional approach. A Balanced Numeracy program is not made up entirely of lessons with students copying notes from a blackboard. Nor is it entirely comprised of lessons with students working at Math centres. Instead, a good Math program offers a balance of the following:

- conceptual and procedural understanding;
- investigation;
- problems and practice;
- groupings (whole class, small — homogeneous and heterogeneous and independent);
- instructional approaches;
- assessment strategies (observation, conversation, product); and
- assessment purposes (for/as/of learning).

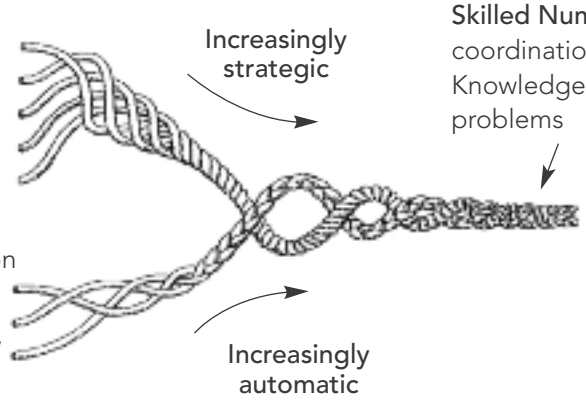
By going deeper with Balanced Numeracy, we will learn more about what Balanced Numeracy is and what it looks like in our classrooms.

Problem Solving Skills:
- Reasoning and Proving
- Reflecting
- Selecting Tools and Strategies
- Connecting
- Representing

Mathematical Knowledge:
Number Bonds (additive facts, multiplication facts, decomposition numbers)

Spacial Bonds (shape recognition, symmetry sense, decomposition)

Communication (use of conventions, symbols, etc.)



Skilled Numeracy – fluent coordination of Mathematical Knowledge to effectively solve problems

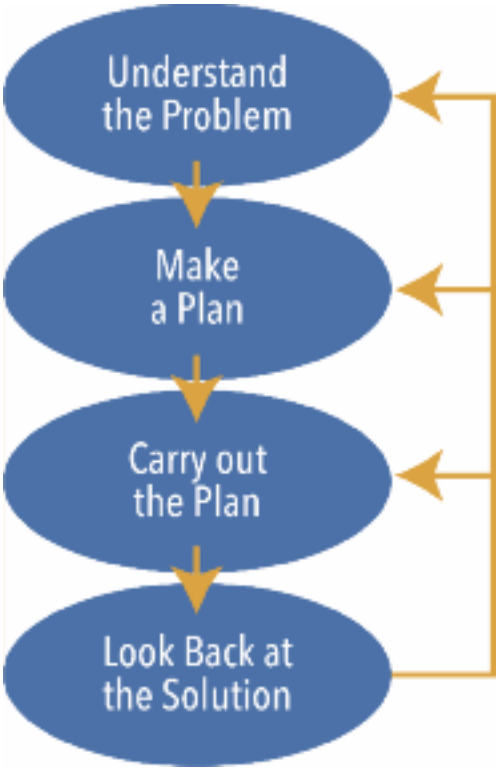
Online Resources for Teachers

- mathematicsmastery.org/mastery-what-it-isand-what-it-isnt
- youcubed.org/fluency-without-fear
- themathguy.blogspot.ca/2015/06/balanced-math-mastery.html

Using Problem Solving Models

Problem solving is at the heart of all Math and actually predates Math concepts and procedures. It is a myth to say that students must learn concepts before they can learn how to use them in problem solving situations. We have seen many examples of great problems that students have solved that have led to new concepts being learned. What is important is that the problems must be relevant to the students. This doesn't mean that the problems must be 'real-world' — sometimes a 'contrived-world' problem is counter-productive.

By going deeper in our learning of problem solving models, we will extend the importance of seeing students use the Mathematical Processes when solving rich tasks and make connections to Polya's Four-Step Problem Solving Model (Understand the Question; Make a Plan; Carry out the Plan; and Look Back at the Solution).



Polya's Four-Step Problem Solving

Online Resources for Teachers

- math.berkeley.edu/~gmelvin/polya.pdf
- youcubed.org/tasks
- themathguy.blogspot.ca/2015/04/have-you-checked-your-work.html

Continua for Learning

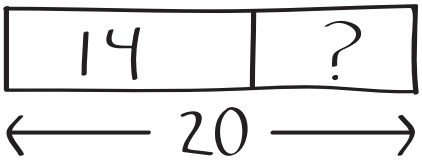
When educators are aware of how Mathematical thinking develops, they are able to make on the spot decisions and provide immediate feedback to the observations and conversations that are occurring in their classroom.

In analyzing the work that is produced, educators can support what learning needs to come next and how to help struggling students. Educators and students are empowered to see learning as a continuation with incremental steps.

As educators, we have learned a lot about continua such as:

- **Concrete-Diagrammatic-Symbolic** (for learning new concepts or for scaffolding problem solving); or
- **Next-Near-Far-Any** (to help students generalize a pattern); or have taken
- **Sandra Herbst's assessment continua** for improving student learning to create a continua for problem solving as seen in the following video: youtube.com/watch?v=aLy634hXqH4.

Concrete



Diagrammatic

$$27 + x = 50$$

Symbolic

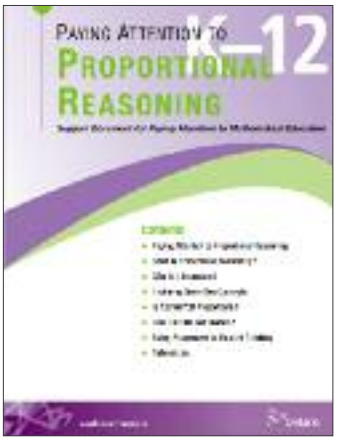
Online Resources for Teachers

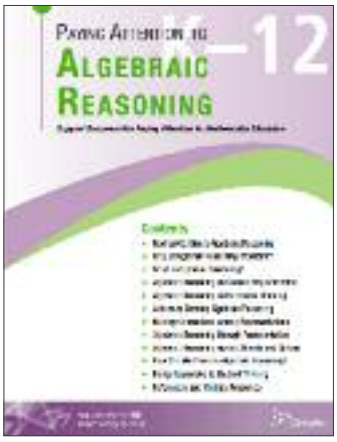
- thedailyriff.com/WordProblems.pdf
- hmhco.com/~/media/sites/home/education/global/pdf/white-papers/mathematics/elementary/math-in-focus/MIF_Model_Drawing_LR.pdf
- themathguy.blogspot.ca/2015/01/bar-models-1.html
- themathguy.blogspot.ca/2015/03/patterns-are-predictable.html
- edugains.ca/newsite/math/continuum_connections.html

Professional Learning Resources

How do you improve Math knowledge and pedagogy at the same time? What if a specific content area is also your area of greatest weakness? An idea is to address numeracy skills throughout the year rather than in separate units — this will allow you as educators to provide balance to your program.

Below are a series of documents that delve deeper into specific content areas, while giving meaningful examples and tasks.





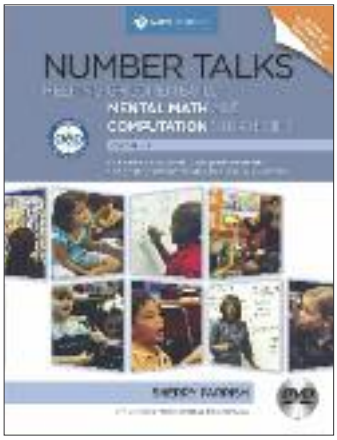
Online Resources for Teachers

- edu.gov.on.ca/eng/teachers/studentsuccess/ProportionReason.pdf
- edu.gov.on.ca/eng/literacynumeracy/PayingAttentiontoAlgebra.pdf
- edu.gov.on.ca/eng/literacynumeracy/LNSPayingAttention.pdf
- edu.gov.on.ca/eng/literacynumeracy/LNSAttentionFractions.pdf

"You're braver than you believe,
and stronger than you seem,
and smarter than you think!"
– Christopher Robin,
Pooh's Grand Adventure (1997)

Conversations in the Classroom

As educators familiarize themselves with Three Part Learning and Balanced Numeracy, a question that often arises is how do I consolidate learning and ensure that the discussion taking place during Math is meaningful? Two books that may assist educators in answering this question are:



Number Talks serve to enhance Math conversations by making sense of problem solving, reasoning, constructing viable arguments for critiquing, modeling Math, use of tools strategically, attending to precision, looking for and using structure, and expressing regularity. Through these conversations, it is the intention to enhance the balanced Math classroom by building conceptual understanding and problem solving skills.

5 Practices help to make consolidation more intentional. Student-centered instruction can be challenging, but manageable by using *5 Practices* that help educators plan, anticipate and improvise a meaningful consolidation. Through the *5 Practices* of anticipating, monitoring, selecting, sequencing and connecting student responses, educators can make better use of their time in consolidation and help engage their students in Math, making it feel relevant.

Online Resources for Teachers

- youcubed.org/from-stanford-onlines-how-to-learn-math-for-teachers-and-parents-number-talks/
- mathsolutions.com/documents/numbertalks_sparrish.pdf
- insidemathematics.org/classroom-videos/number-talks
- mctm.org/mespa/5Practices.pdf

Learning Environment

The learning environment, or ***Third Teacher,*** encompasses the physical space in which we learn as well as the social dynamic that exists between teachers, students and the curriculum. A reflective learning environment is one that supports critical thinking, collaboration and enhances student voice.

Students need a space where they can access manipulatives to solve problems and the ability to record and share their thinking, either through the use of technology or through more traditional methods. Students need space to post co-created reference charts and success criteria as well as a social environment that encourages collaboration, student voice, rich Mathematical dialogue and deep problem solving. When students are active participants in the creation of their learning environment, they have increased feelings of self-efficacy and have increased ownership of their education. The above documents (*The Third Teacher* and *Student Voice Monographs*) will help educators go deeper in their understanding of the learning environment.

Online Resources for Teachers

- edugains.ca/resourcesLNS/Monographs/CapacityBuildingSeries/CBS_ThirdTeacher.pdf
- edugains.ca/resourcesLIT/ProfessionalLearning/CBS/CBS_StudentVoice.pdf

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