



Unpacking Thinking in the Math Classroom

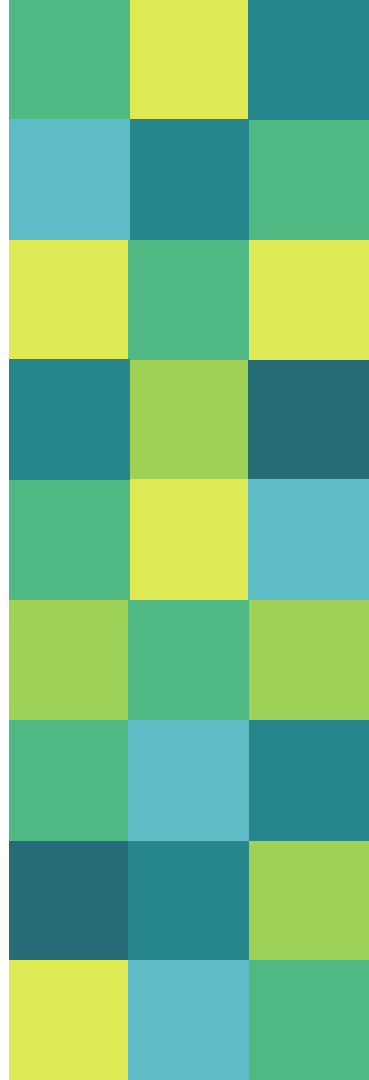
Tracey Brent

Christine Kohse

<http://bit.ly/UnpackingThinking>

Welcome

- On the table, there are math activities.
- Complete a couple of activities with a partner or as a group
- Reflect on your thought process as you are solving the question(s)
- With your group, discuss what you were thinking



Our Journey

- EQAO data - challenges with thinking questions
- Make thinking visible
- Better insights into student thinking
- Alternative way to differentiate instruction
- Improve how we support our ESL / ISSP population
- Increase teacher efficacy



Professional Learning Goals

KNOW

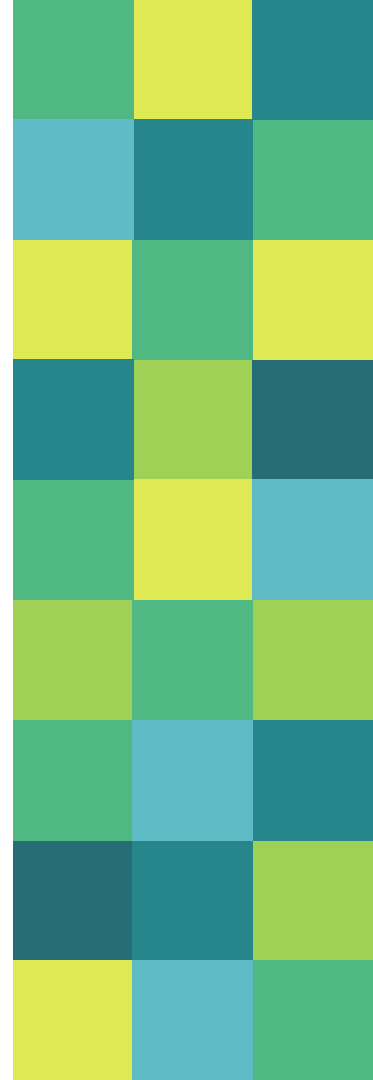
- Develop an understanding of thinking in the Math curriculum
- Explore and name the categories of thinking

DO

- ◀ Make connections between the activities and the categories of thinking

BE

- ◀ Reflective and responsive in planning intentional Math thinking tasks

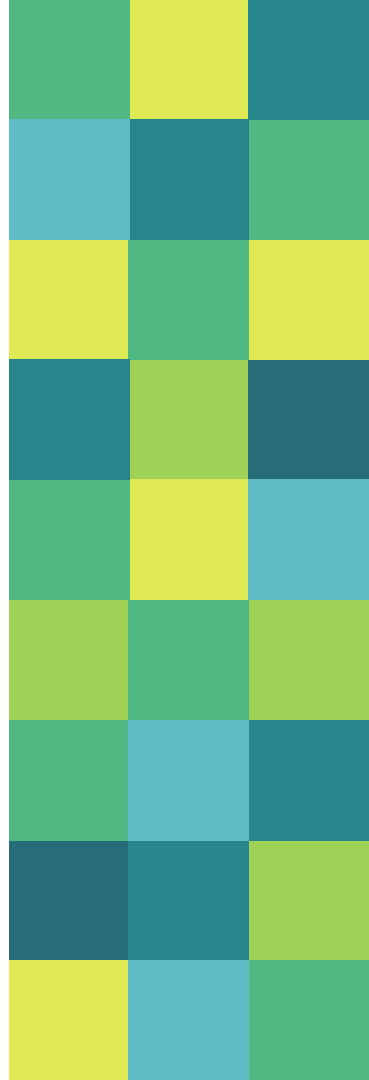


What is MATHEMATICAL THINKING?

Small: “mathematical practice and processes”

Fiore and Lebar: “make sense of mathematics (by reasoning, proving, connecting, reflecting and justifying), use mathematical skills effectively (by using mathematical conventions and vocabulary), thoughtfully communicate mathematically thinking and critically interpret mathematical knowledge and skills (by considering multiple mathematical perspectives).”

Ball: “changing, varying, reversing, altering, generalizing, conjecturing, explaining, justifying, verifying, convincing and refuting”



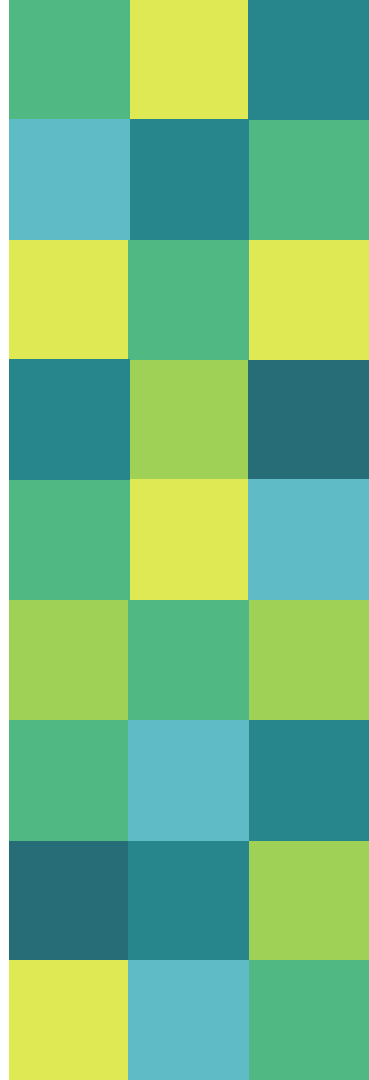
What is MATHEMATICAL THINKING?

Small: “mathematical practice and processes”

Fiore and Lebar: “make sense of mathematics (by reasoning, proving, connecting, reflecting and justifying), use mathematical skills effectively (by using mathematical conventions and vocabulary), thoughtfully communicate mathematical thinking and critically interpret mathematical knowledge and skills (by considering multiple mathematical perspectives).”

Ball: “changing, varying, reversing, altering, generalizing, conjecturing, explaining, justifying, verifying, convincing and refuting”

OUR DEFINITION: “Interacting with numbers”



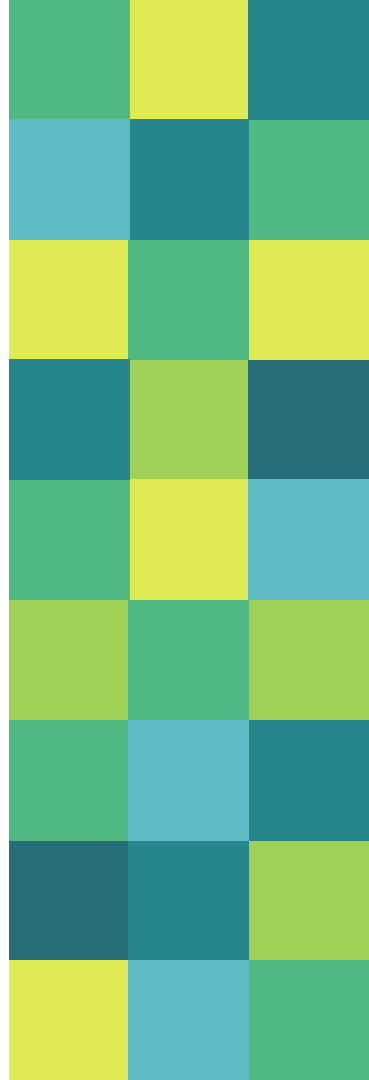
Resources

Mathematics Curriculum

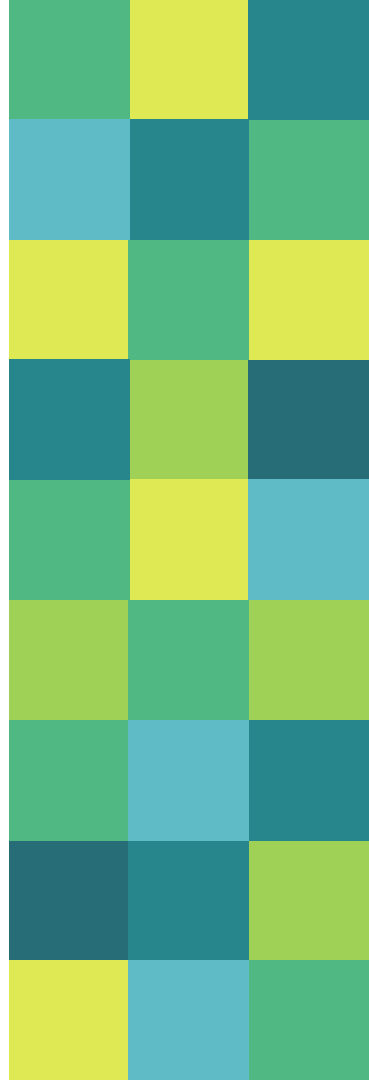
TC2 Thinking Competencies

Teaching Math with Meaning by Cathy
Marks Krpan

Moving Math by Mary Fiore and Maria Luisa
Lebar



Where is thinking
in the
Mathematics
curriculum?



Categories of Thinking

Procedural

Conceptual

Representative

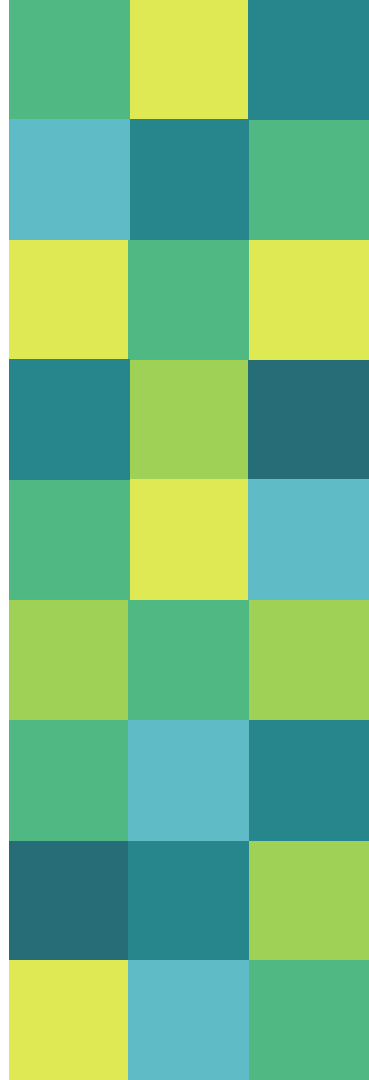
Structural

Communicative

Connective

Constraint

<http://bit.ly/ThinkingCategories>



Naming Thinking

Reflecting on the activity in the beginning, name the thinking based on the categories:

Procedural

Conceptual

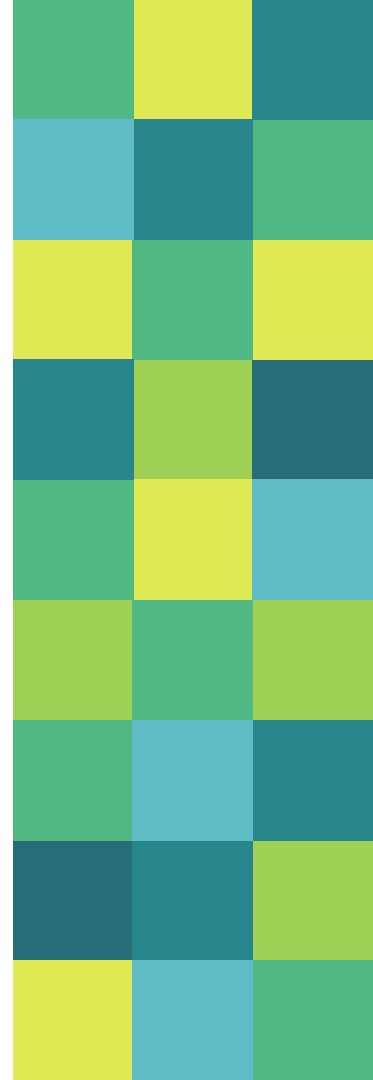
Representative

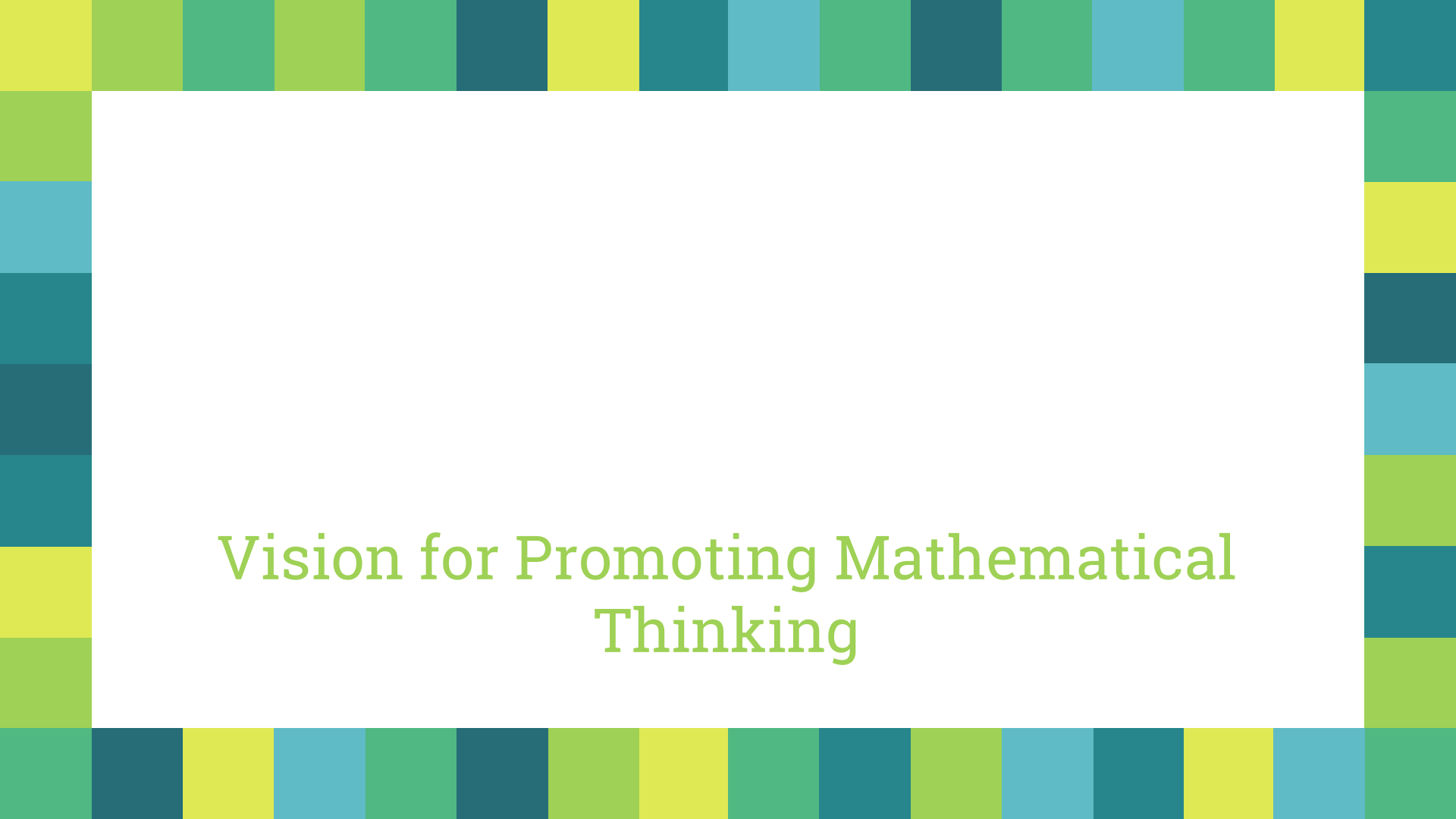
Structural

Communicative

Connective

Constraint





Vision for Promoting Mathematical Thinking

Culture of TALK

**Communicating
Thinking in the
Math Classroom**

**Metacognition -
Self Talk / Reflection**

Vision for Promoting Mathematical Thinking

Culture of TALK

Learning Culture

- Creating a safe space
- Protocols for listening and sharing
- Opportunity to hear others' thinking
- Grouping students

Instructional Strategies

- Paraphrasing / Convincing a friend
- Number / Fraction Talks / WODB
- Turn and Talk
- Talking prompts (What I hear you say is..)
- Wait Time
- Mathematical Think-Alouds
- Mathematical Arguments
- Rich problems that encourage discussion

Communicating Thinking

Culture of TALK

- Oral vs Written Communication
- Teaching and Reinforcing Math Vocabulary
- Instructional Strategies to make thinking visible (math tools)
- Success Criteria for communication
- Forms of Communication (e.g., Math Journals / Personal Writing)
- Effective questions to elicit a type of thinking (e.g., Identify the greatest number between 500 and 1000 that is divisible by 3, 9 and 10 - constraint thinking)
- Writing Prompts (e.g., What do you think ____ means?)
- Symbolic and Graphical Communication (e.g., pictorial representation)

Metacognition - Self-Talk Strategies

Metacognition - Self Talk Strategies

Culture of TALK

Communication of Thinking

- Reflection - What are your look fors?
- Modelling self talk
- Naming and noticing self talk strategies (e.g., think bubbles)
- Using cue words/small phrases to change mindset (e.g., I can't do this YET)
- Opportunity to consolidate learning (e.g., I used to think...Now I think)
- Asking effective questions to promote metacognition (e.g., Do you have a plan?)

Supporting Your Math Thinking Journey

[Thinking and Questions - General](http://bit.ly/ThinkingandQuestions) - <http://bit.ly/ThinkingandQuestions>

[Thinking and Questions Planning - Grade 3](http://bit.ly/ThinkingandQuestionsGr3) -
<http://bit.ly/ThinkingandQuestionsGr3>

[Thinking and Questions Planning - Grade 7](http://bit.ly/ThinkingandQuestionsGr7) -
<http://bit.ly/ThinkingandQuestionsGr7>

[Thinking and Questions Planning Template](http://bit.ly/ThinkingandQuestionsBlank) -
<http://bit.ly/ThinkingandQuestionsBlank>

A decorative border composed of a grid of colored squares in shades of green, teal, yellow, and blue, surrounding a central white area.

Questions