Children's Literature Through the Mathematical Lens

March, 2023

Direction des programmes d'études en formation générale des jeunes (DPEFGJ)
Ministère de l'Éducation du Québec (MEQ)

Québec

Who are we?

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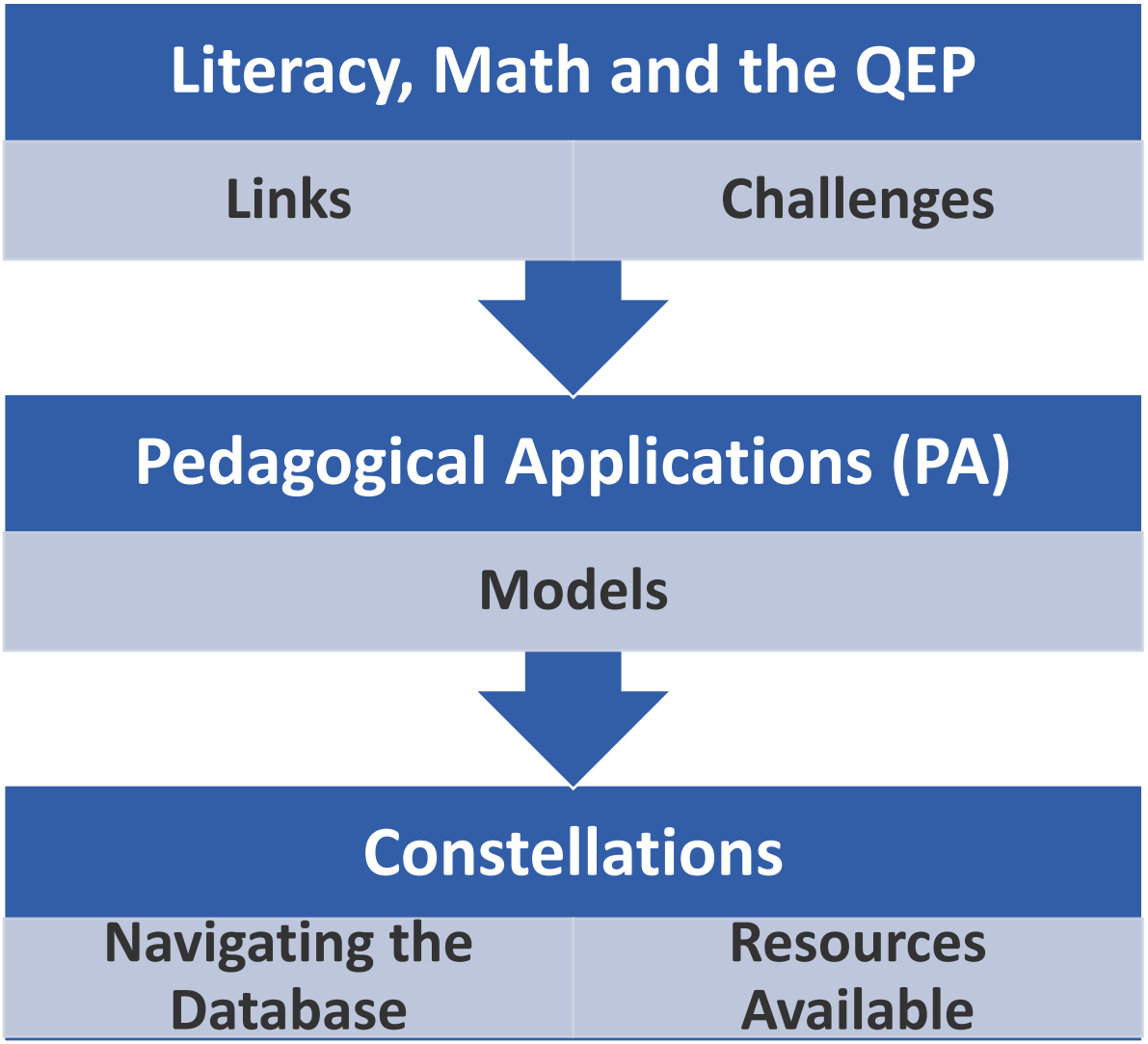
Constellations-English

By the end of this presentation you will be able to . . .

- Use children's literature to integrate mathematics in the elementary classroom
- Use the Constellations resource and navigate its database

Outline


Literacy, Math and the QEP
Links
Challenges
Pedagogical Applications (PA)
Models
Constellations
Navigating the Database
Resources Available

Literacy, Math and the QEP

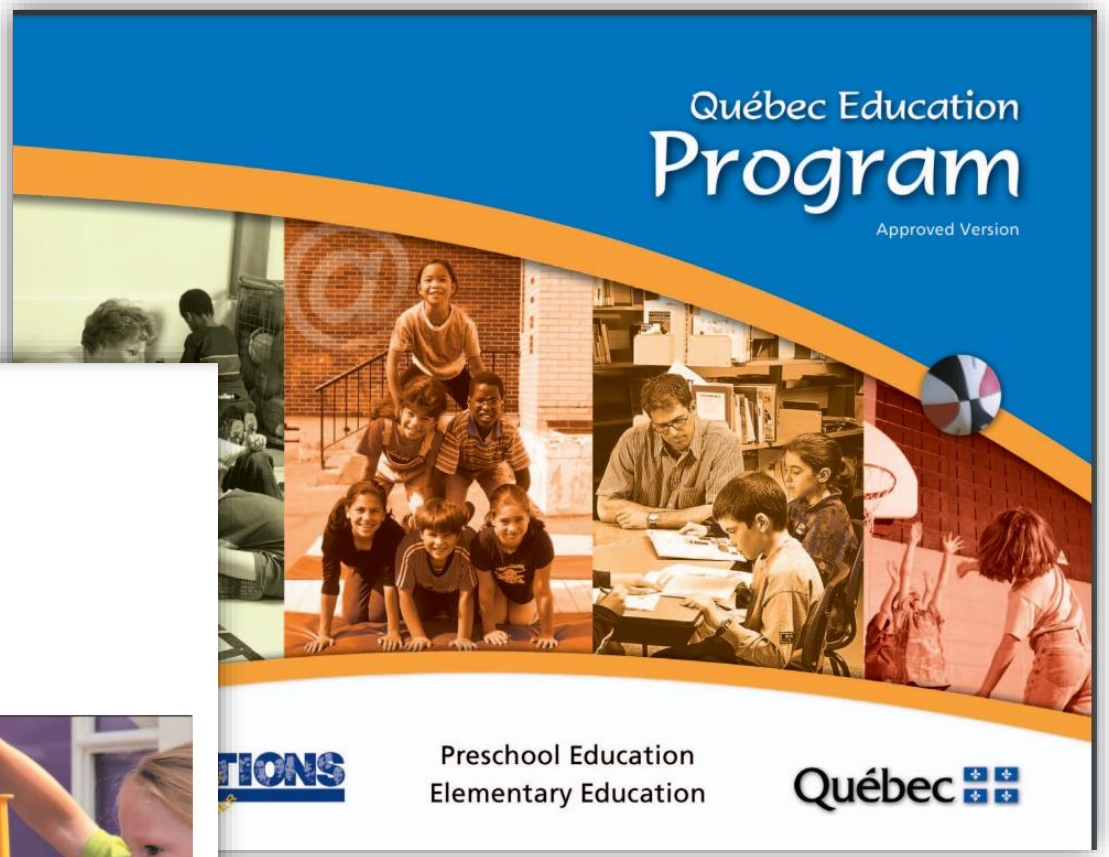
Links

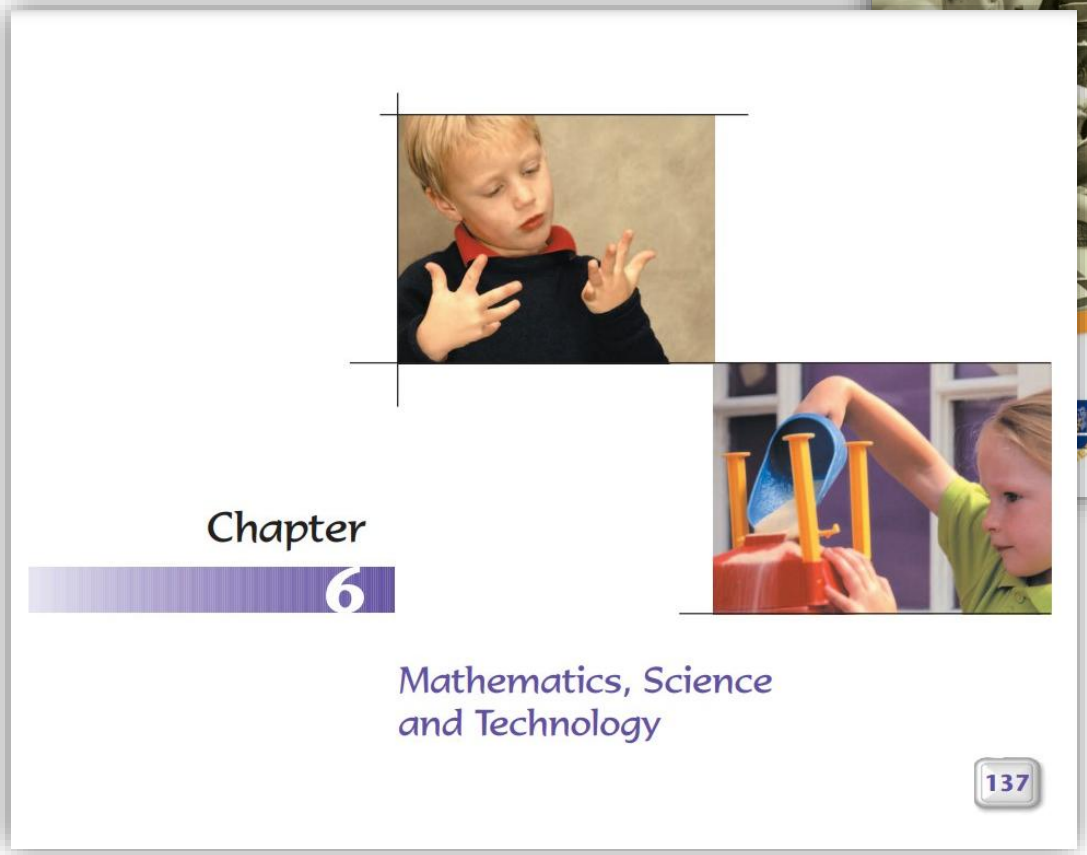
Challenges

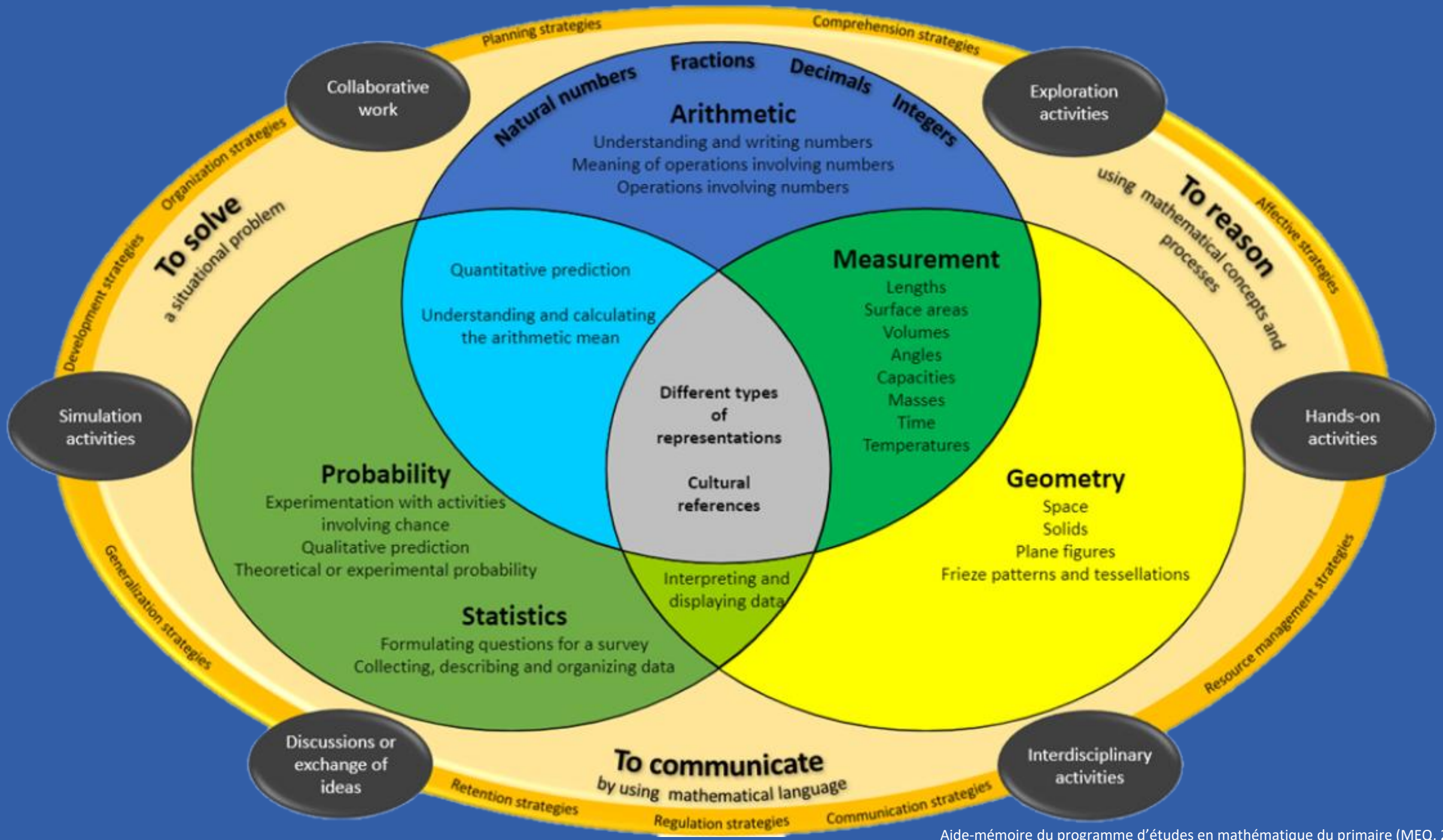
Ice-Breaker

Have you used children's literature to teach a subject other than ELA?

Constellations







Aide-mémoire du programme d'études en mathématique du primaire (MEQ, 2020)

Mathematical Proficiency

Conceptual Understanding: concepts and processes

Procedural Fluency: i.e. fluidity and flexibility

Productive Disposition: cultural references

Adaptive Reasoning

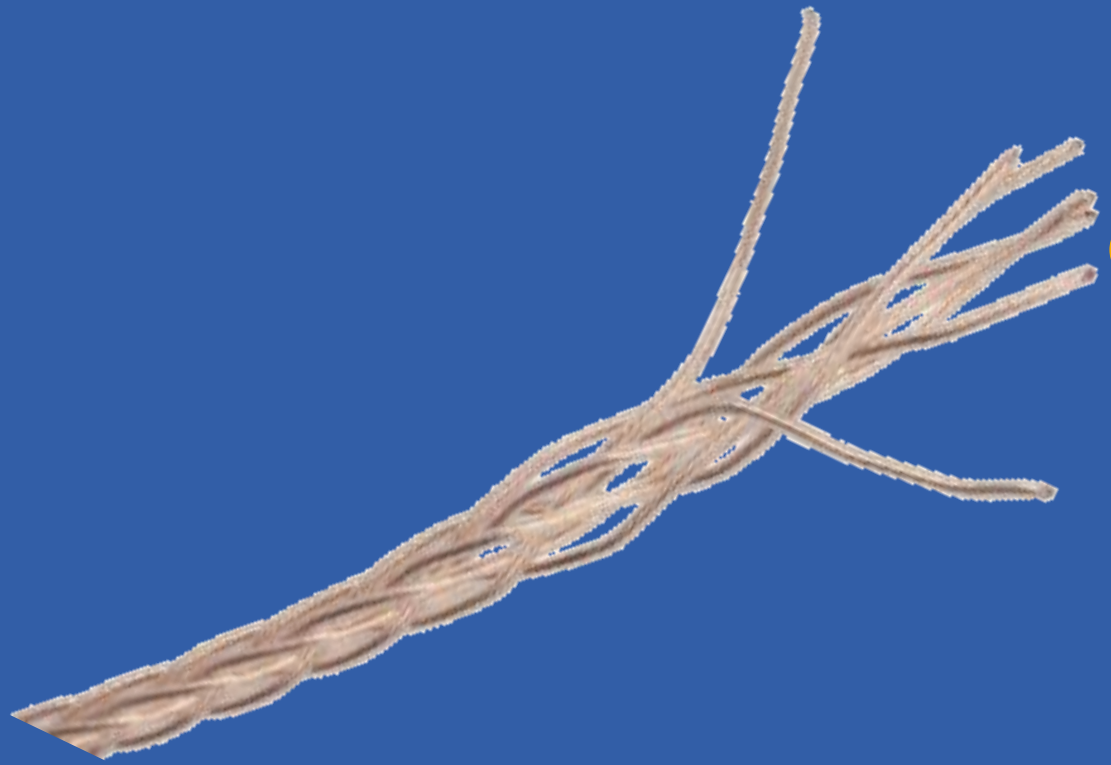
Strategic Competence: cognitive and metacognitive strategies

National Research Council. (2001). Adding it up: Helping children learn mathematics. J. Kilpatrick, J. Swafford, and B. Findell (Eds.). Mathematics Learning Study Committee, Center for Education, Division of Behavioral and Social Sciences and Education. Washington, DC: National Academy Press.

Mathematical Proficiency

Conceptual Understanding

Procedural Fluency



Productive Disposition

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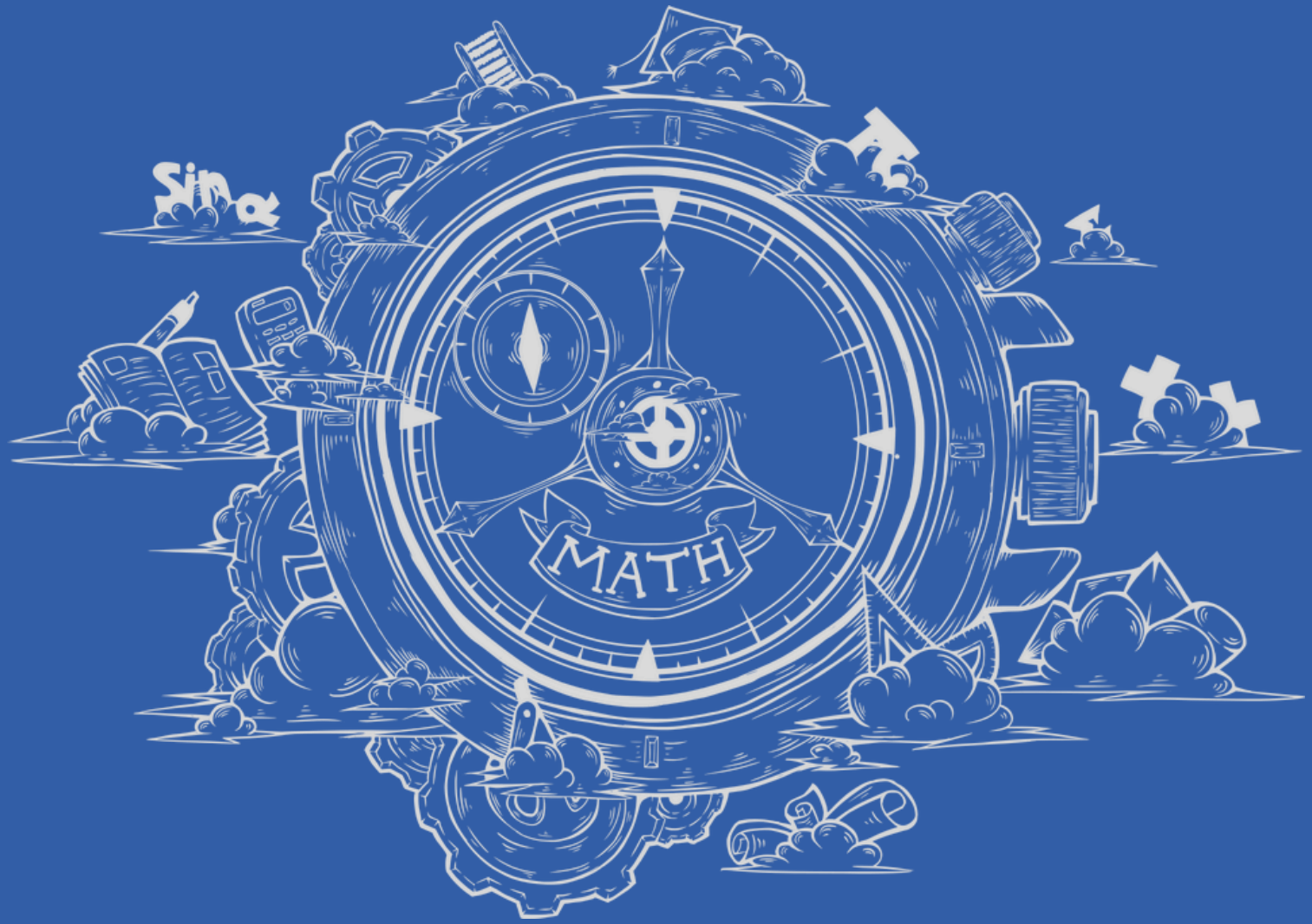
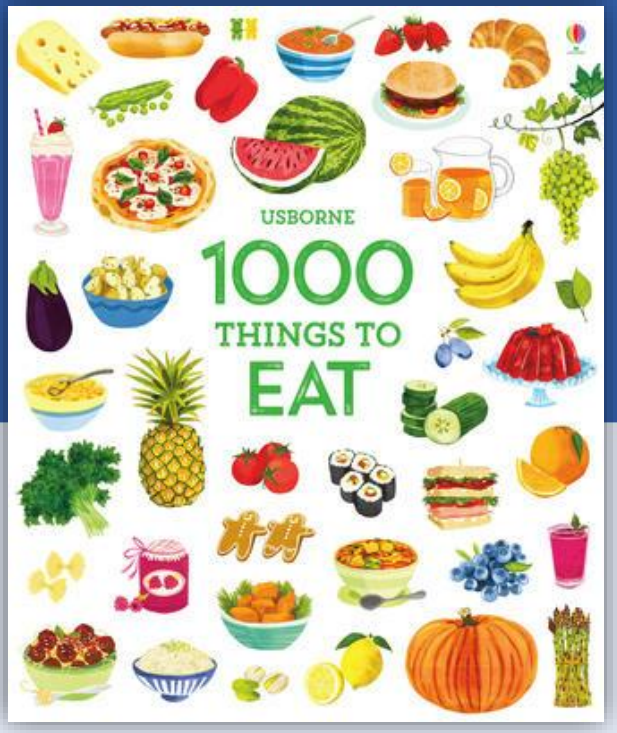
Strategic Competence



Literature serves to anchor mathematics in our daily lives and facilitates its comprehension.

Math in Everyday Life



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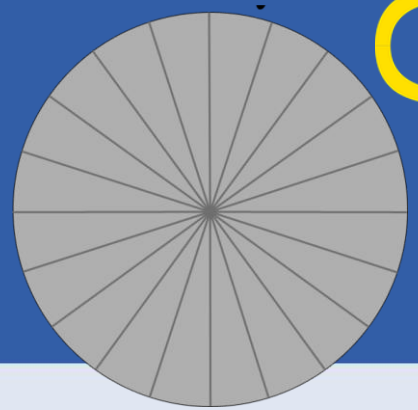


20 minutes

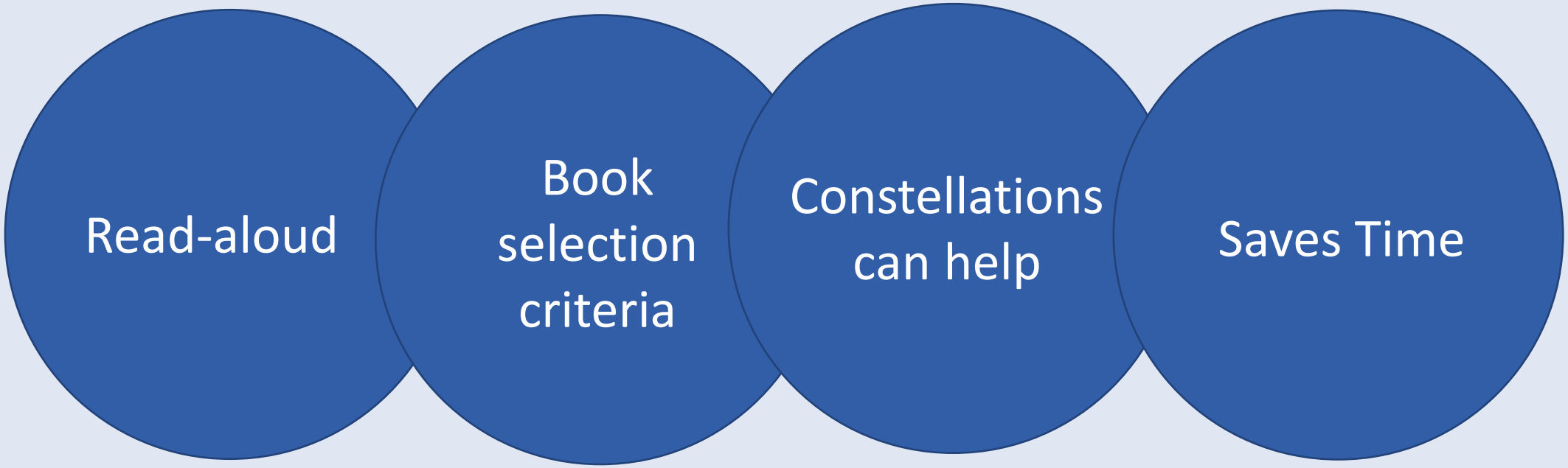
20

Question

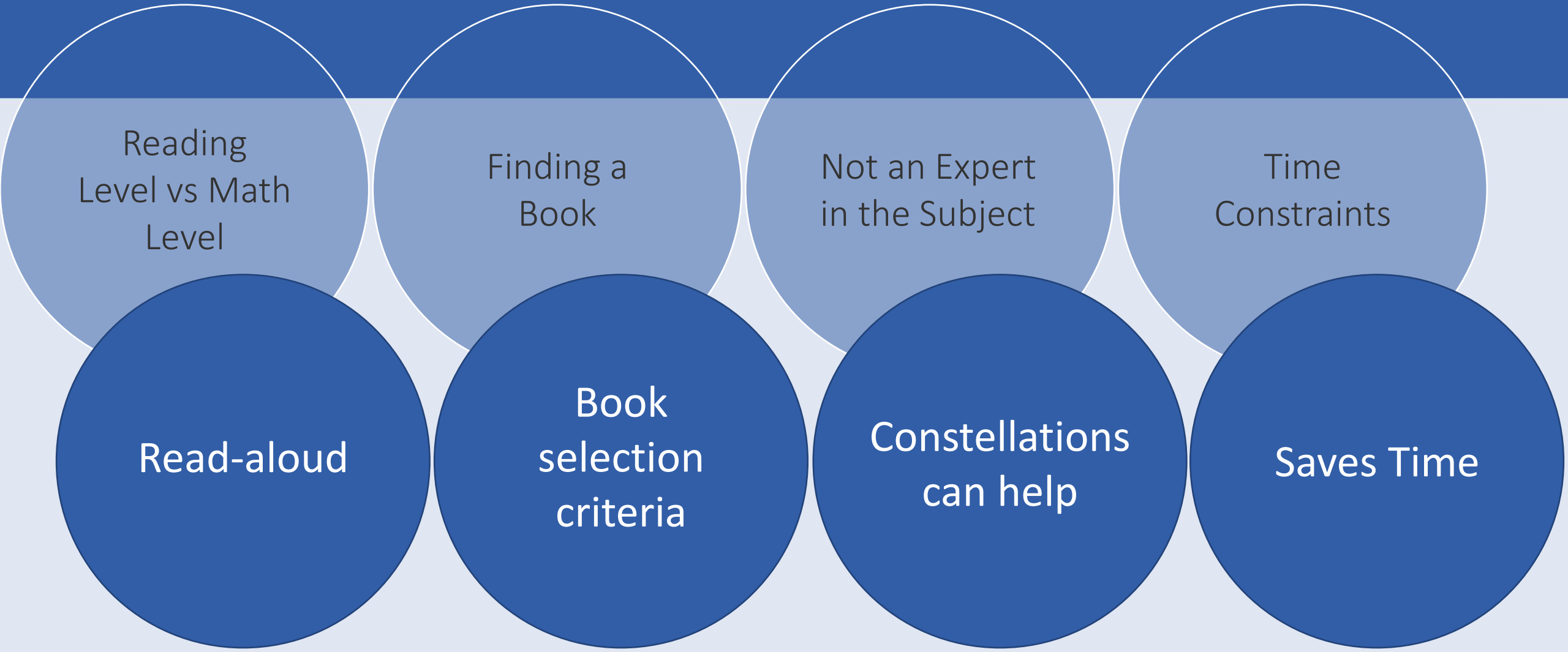
What are some of the challenges of teaching math in elementary school?

abstract, cultural references, mental calculations

Challenges of Teaching Math Through Literature



Challenges of Teaching Math Through Literature



*“Stories can help students understand the meaningful contexts that support **mathematical thinking**. They will see mathematics not [only] as a prescribed set of algorithms to master but as a way of thinking about their world.*

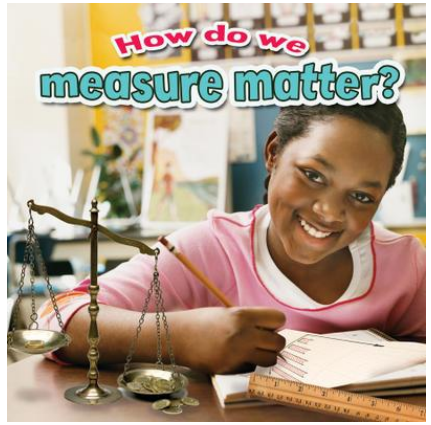
*Children's literature presents a non-threatening avenue to test out current notions about important **mathematical concepts.**”*

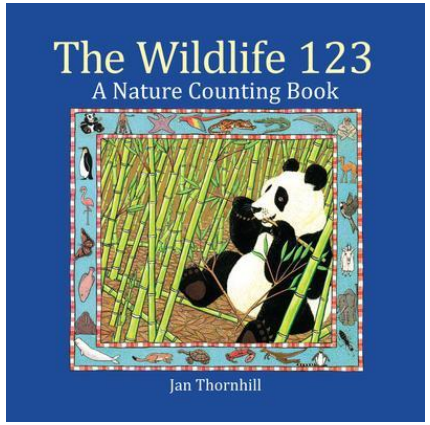
Whitin (2002)

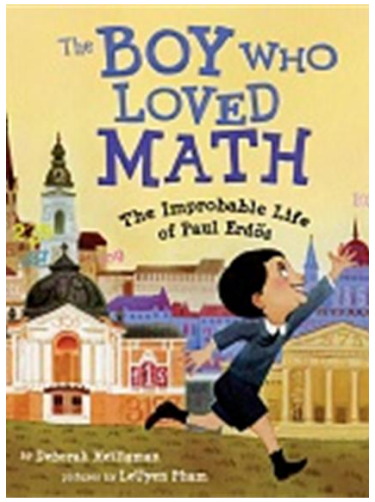
https://www.usherbrooke.ca/litt-et-maths/fondements/pourquoi-lier-litterature-et-mathematiques/

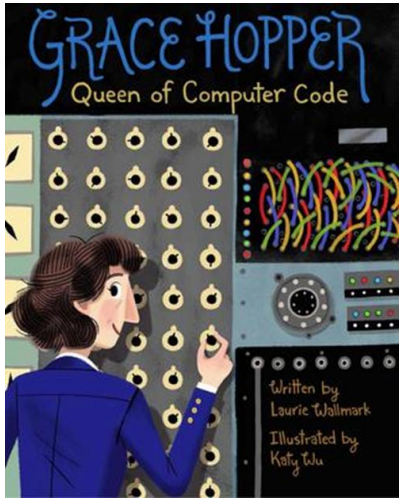
3 Types of Books for Math

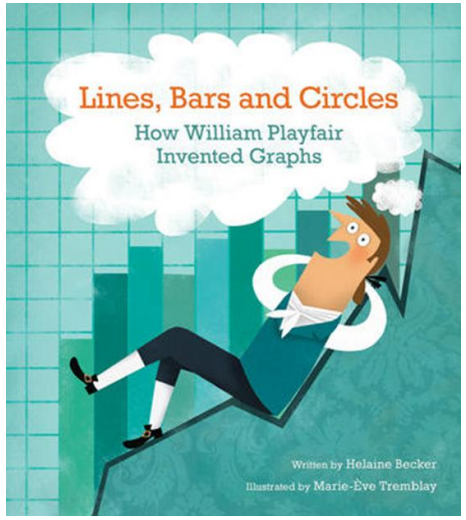
- ✓Math-related books
- ✓Historical narratives about mathematicians or math problems
- ✓Picture books that have math in everyday life

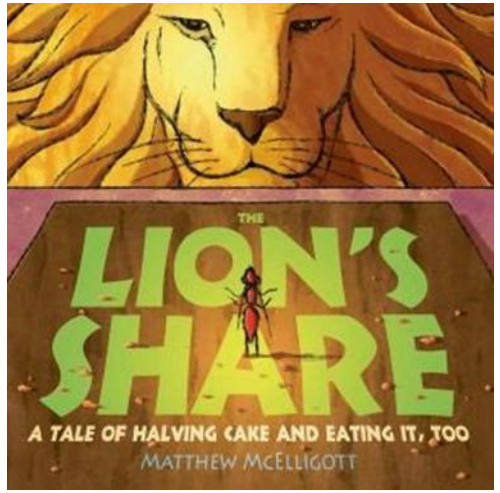


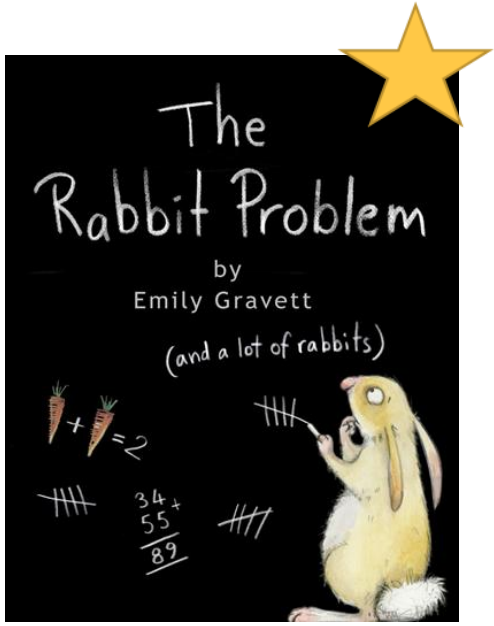




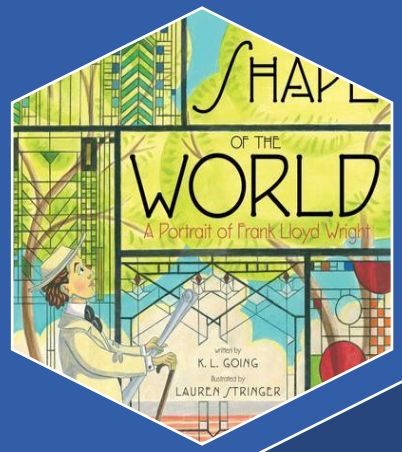






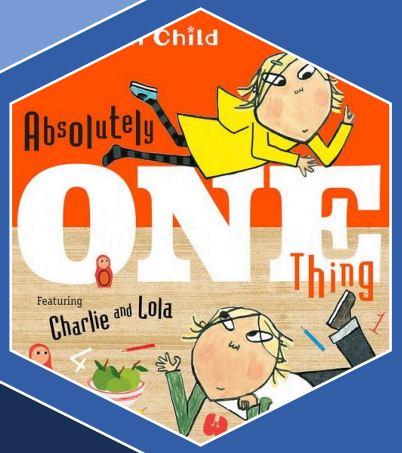


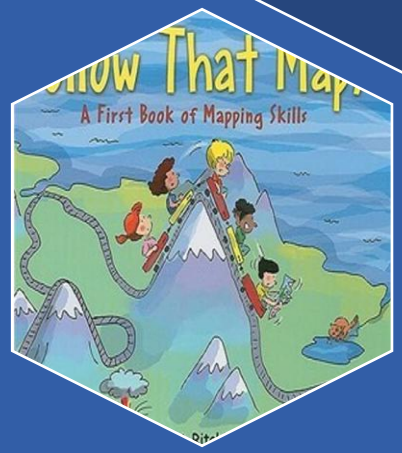
Pedagogical Applications



Historical Narratives

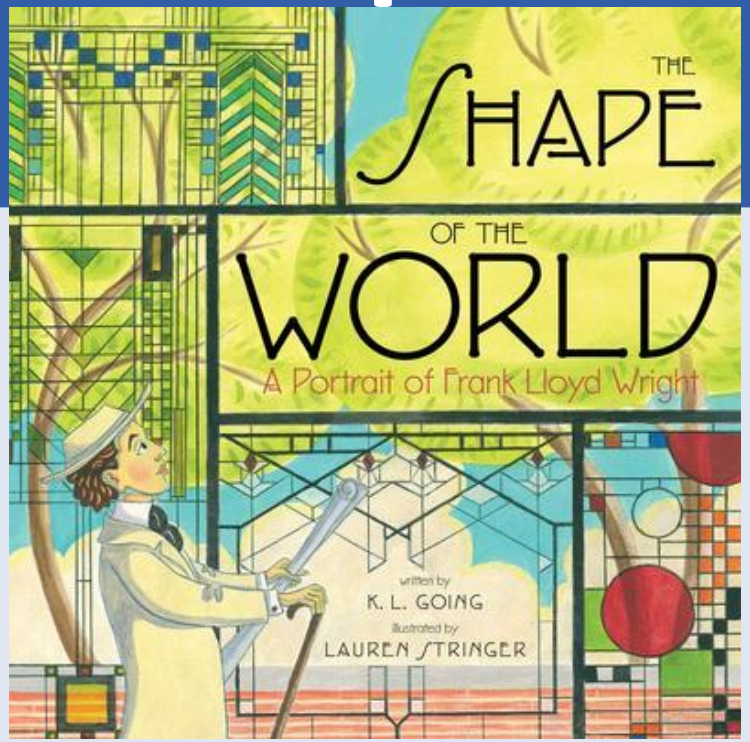
Picture Books





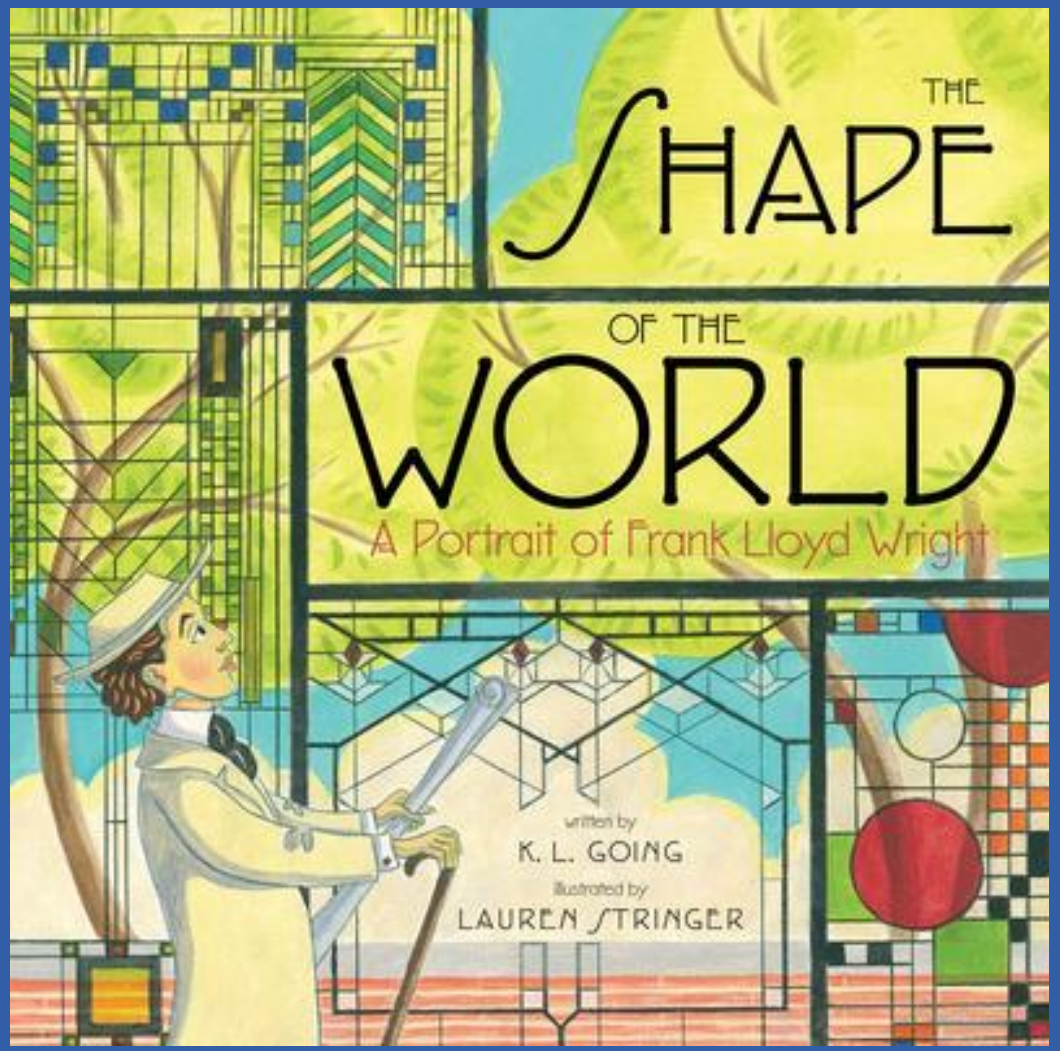
Other

Example - 1

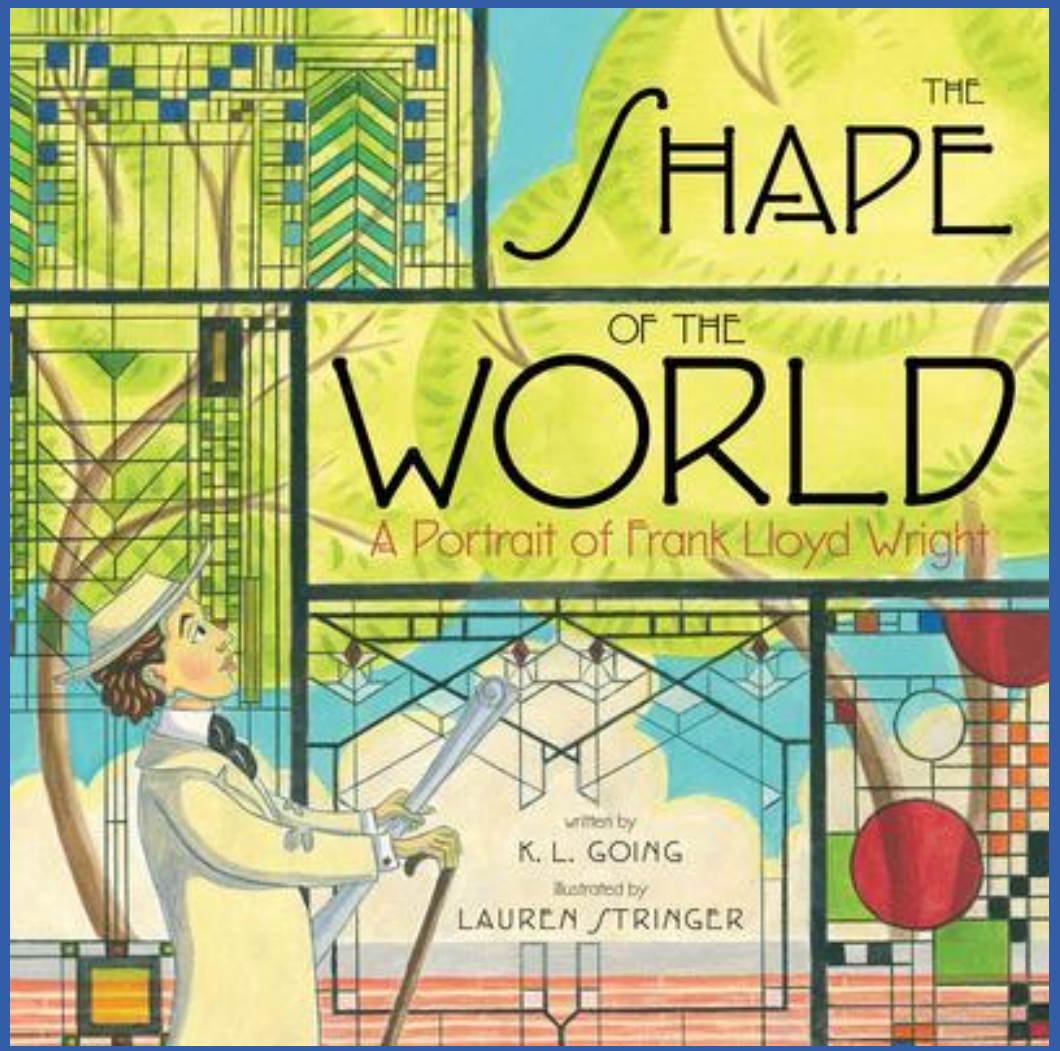


When he was only an infant, Frank Lloyd Wright's mother gave him wooden shapes and told him he would build beautiful things someday. *The Shape of the World* takes us through his transformation into one of the world's most respected architects.

Context (Before Reading)



Procedure (During Reading)



Integration (After Reading)

Extensions

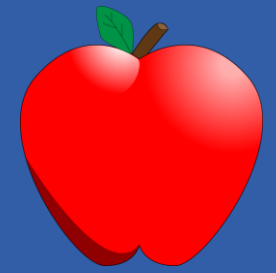
Castle Challenge

Anna and Lucas were playing with their connecting cubes, when Anna decided to challenge her younger brother's construction abilities. She told her brother that she would buy him ice cream if he could build a castle according to the following restrictions.

- The perimeter of the castle must be equal to18 cubes.
- There must be an entrance in the middle of one of the walls.
- The castle must have 3 towers located at 3 of the corners of the castle.
- The tallest tower must be to the right of the entrance.
- The second tower must be 1/2 the height of the tallest tower and located in the corner closest to the tallest tower.
- The third tower must be 1/3 the height of the tallest tower and located diagonally opposite the 2nd tower.
- All the walls must be the same height.
- The castle must be built with exactly 38 cubes.

Your task is to build a model of the castle by following the instructions given above.

Goal of the Pedagogical Application (PA):



PAs are **lesson outlines** focused on the exploration of **authentic texts** containing ideas and strategies to **inspire** teachers and students.

The Text Analysis Tool

Text Analysis Tool

Mathematics – Elementary Cycle 1

Title:

☐Fiction	☐Non-Fiction	☐Creative Non-Fiction

Competencies	Concepts and Processes
To solve a situational problem related to mathematics ☐To decode the elements of the situational problem ☐To model the situational problem ☐To apply different strategies to work out a solution ☐To validate the solution ☐To share information related to the solution	**☐Arithmetic** ☐Understanding and Writing Numbers ☐Natural numbers less than 1000 ☐Fractions ☐Meaning of Operations Involving Numbers ☐ Natural numbers less than 1000 ☐Operations Involving Numbers ☐ Natural numbers less than 100 000 **☐Geometry** ☐Space ☐Plane figures ☐Solids ☐Frieze patterns and tessellations **☐Measurement** ☐Lengths ☐Time ☐Temperatures **☐Statistics** **☐Probability**
To reason using mathematical concepts and processes ☐To define the elements of the mathematical situation ☐To mobilize mathematical concepts and processes appropriate to the given situation ☐To apply mathematical processes appropriate to the given situation ☐To justify actions or statements by referring to mathematical concepts and processes	
To communicate by using mathematical language ☐To become familiar with mathematical vocabulary ☐To make connections between mathematical language and everyday language ☐To interpret or produce mathematical messages	

Mathematics Content – Part 1

Competencies

To solve a situational problem related to mathematics

- To decode the elements of the situational problem
- To model the situational problem
- To apply different strategies to work out a solution
- To validate the solution
- To share information related to the solution

To reason using mathematical concepts and processes

- To define the elements of the mathematical situation
- To mobilize mathematical concepts and processes appropriate to the given situation
- To apply mathematical processes appropriate to the given situation
- To justify actions or statements by referring to mathematical concepts and processes

To communicate by using mathematical language

- To become familiar with mathematical vocabulary
- To make connections between mathematical language and everyday language
- To interpret or produce mathematical messages

Mathematics Content – Part 2

Concepts and Processes

Arithmetic

- Understanding and Writing Numbers
- Natural numbers less than 100 000
- Fractions
- Decimals up to hundredths
- Integers
- Meaning of Operations Involving Numbers
- Natural numbers less than 100 000
- Decimals up to hundredths
- Operations Involving Numbers
- Natural numbers less than 100 000
- Fractions
- Decimals

Geometry

- Space
- Plane figures
- Solids
- Frieze patterns and tessellations

Measurement

- Lengths
- Surface areas
- Volumes
- Angles
- Capacities
- Masses
- Time
- Temperature

Statistics

Probability

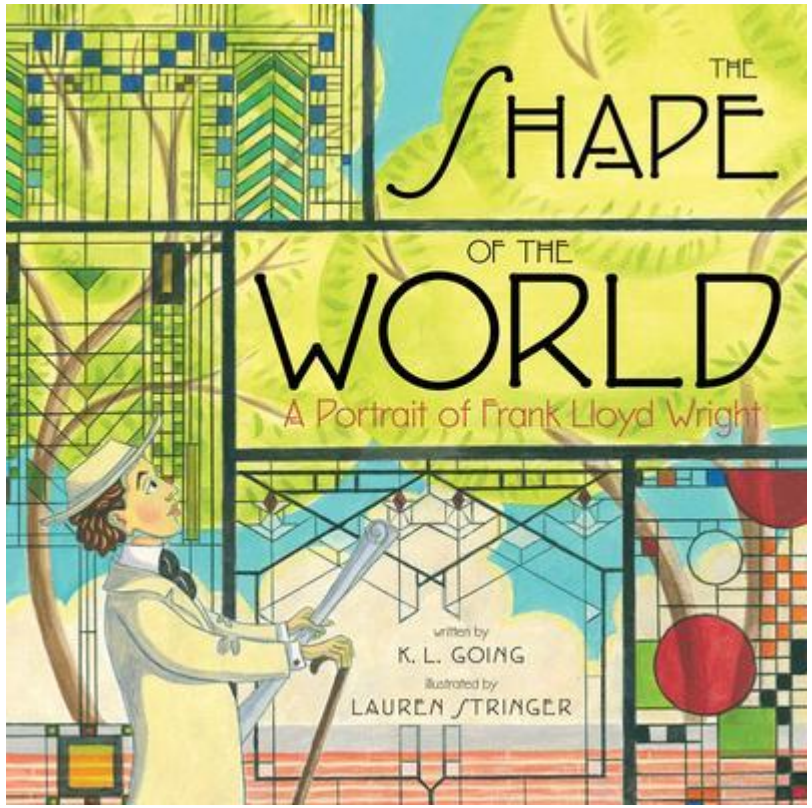
Lesson Planning

Proposed Activities: **Pages:**

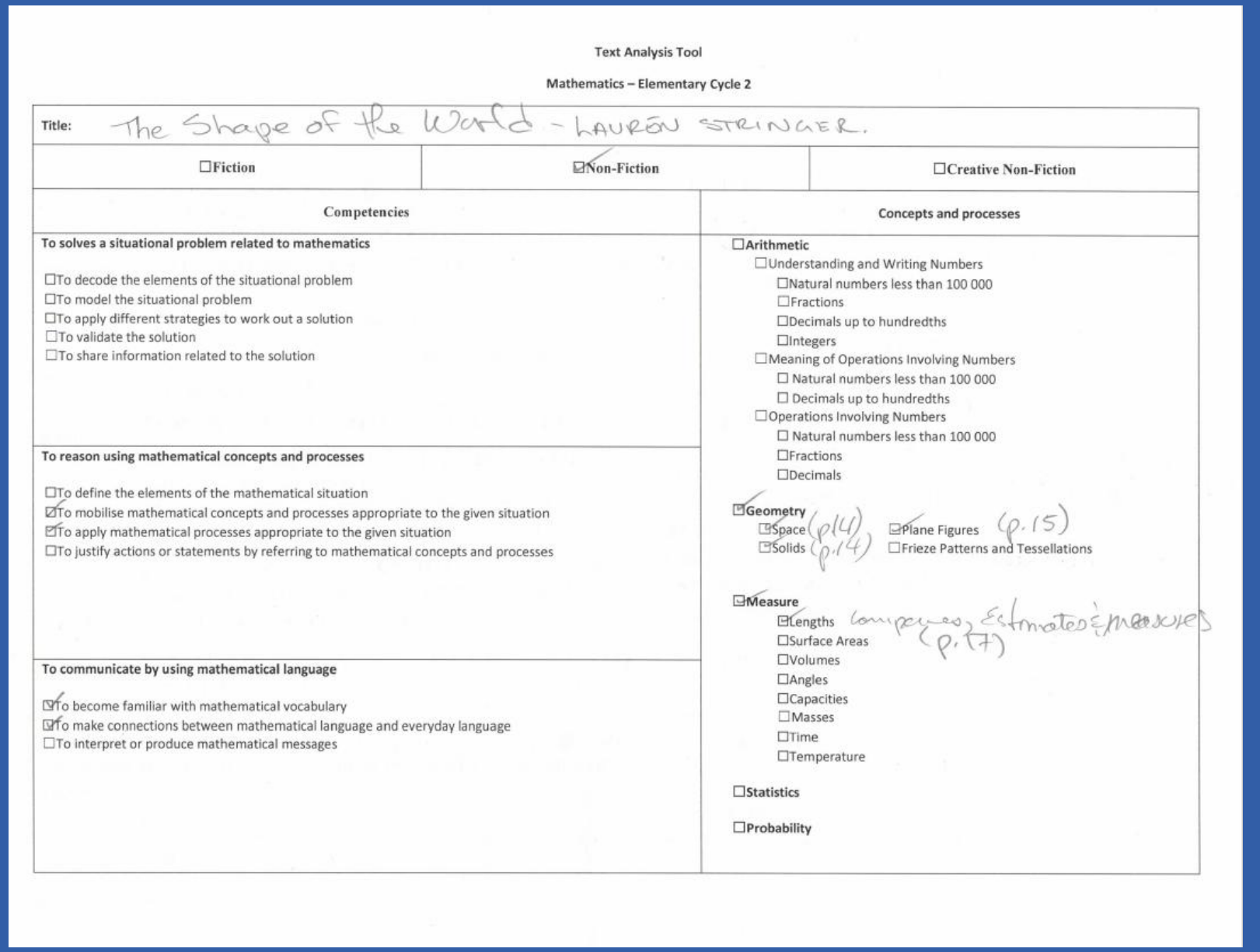
Learning Intention:	
Before: **Required vocabulary to be explored prior to reading the selected text** ☐ Thematic or contextual vocabulary	
During:	
After:	
Extensions:	

Example: PA for *The Shape of the World*

- Before
- During
- After
- Extensions



The Text Analysis Tool in Action



Text Analysis Tool

Mathematics – Elementary Cycle 2

Title: The Shape of the World - LAUREN STRINGER.

☐Fiction | ☑Non-Fiction | ☐Creative Non-Fiction

Competencies

To solves a situational problem related to mathematics

- ☐To decode the elements of the situational problem
- ☐To model the situational problem
- ☐To apply different strategies to work out a solution
- ☐To validate the solution
- ☐To share information related to the solution

To reason using mathematical concepts and processes

- ☐To define the elements of the mathematical situation
- ☑To mobilise mathematical concepts and processes appropriate to the given situation
- ☑To apply mathematical processes appropriate to the given situation
- ☐To justify actions or statements by referring to mathematical concepts and processes

To communicate by using mathematical language

- ☑To become familiar with mathematical vocabulary
- ☑To make connections between mathematical language and everyday language
- ☐To interpret or produce mathematical messages

Concepts and processes

☐**Arithmetic**
- ☐Understanding and Writing Numbers
  - ☐Natural numbers less than 100 000
  - ☐Fractions
  - ☐Decimals up to hundredths
  - ☐Integers
- ☐Meaning of Operations Involving Numbers
  - ☐ Natural numbers less than 100 000
  - ☐ Decimals up to hundredths
- ☐Operations Involving Numbers
  - ☐ Natural numbers less than 100 000
  - ☐Fractions
  - ☐Decimals

☑**Geometry**
- ☑Space (p.14)
- ☑Solids (p.14)
- ☑Plane Figures (p.15)
- ☐Frieze Patterns and Tessellations

☑**Measure**
- ☑Lengths comparing, Estimates & measures (p.17)
- ☐Surface Areas
- ☐Volumes
- ☐Angles
- ☐Capacities
- ☐Masses
- ☐Time
- ☐Temperature

☐**Statistics**

☐**Probability**

The Text Analysis Tool in Action

Proposed Activities: **Pages:**

Learning Intention:
Students will discover the many geometric shapes in the world around them, their names and be able to identify them.

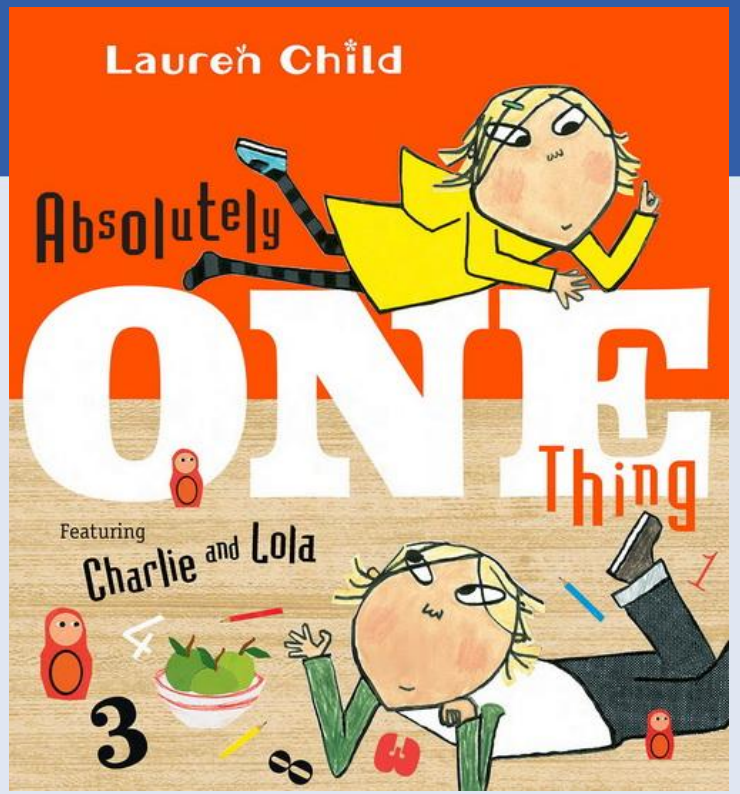
Before:
Vocabulary required to be explored prior to reading the selected text.
☐ Thematic or contextual vocabulary Mathematics, Geometry, Architect.
learning about the world → using ingenuity.
Provide and explore plane figures and solids. Identify in your environment! Learn about buildings.

During:
PROVIDE MANIPULATIVES TO LINK THE PHYSICAL TO THE WRITTEN
WHAT ARE THE SOLIDS CALLED (FEATHER GIVES SOLIDS TO BABY)
RECREATE OBJECTS BUILT WHEN VARIOUS STRUCTURES ARE CREATED.
WHAT DOES "EVERY SHAPE IS MANY SHAPES" MEAN.
DO YOU SEE SHAPES "EVERYWHERE YOU LOOK?" IDENTIFY THEM ON THAT PAGE.
RETRIEVE PICTURES OF THE ACTUAL BUILDINGS ONLINE AND COMPARE THEM TO THE DRAWINGS IN THE BOOK!

After:
EXPLORE YOUR IMMEDIATE SURROUNDINGS → VISIBLE SHAPES?
LOOK OUT THE WINDOW → DO YOU SEE SHAPES YOUR HAD NOT SEEN INSIDE?
GO OUT AND EXPLORE YOUR ENVIRONMENT → ID FIGURES / SOLIDS.
INTRODUCE NETS TO STUDENTS.

Extensions:
SIT PROB - CASTLE ACTIVITY (DOMAINE DE LA MATHEMATIQUE)
CREATE A SIT PROB INCORPORATING SOLIDS & FIGURES.
OR FIND)
FOR CYCLE 2 & 3 - INTRODUCE PERIMETER AND SURFACE AREA.

Example - 2



From Lola's perspective, the world is an exciting place with endless things to count and wonder about. The compelling story makes counting and equations fun and adventurous.

Absolutely One Thing - PA on Constellations

Pistes pédagogiques

Préscolaire: 4ans 5ans | Primaire: 1re 2e 3e 4e 5e 6e | Secondaire: 1re 2e 3e 4e 5e

Learning Intention

Students will explore the different daily applications of the four mathematical operations.

Links to the Program of Study - English as a Second Language - Elementary

Mathematics, Science and Technology overview

- Views this knowledge as a tool that can be used in everyday life (p.138)

Competency 2: To reason using mathematical concepts and processes - Focus of the competency

- … students become familiar with mathematical language, construct the meaning of mathematical concepts and processes, and establish links between them (p. 144)

Competency 3: Key features of the competency

- To make connections between mathematical language and everyday language (p. 149)

Context (Before Reading)

1. Ask students how many times in the past week they have used math, besides during math class, and chart their answers.
2. Ask students for more instances when they think they use math outside of math class. Offer suggestions if they can't think of any, e.g. playing board games, telling time, counting money, baking or cooking, splitting food like pizza or pieces of candy.
3. Explain that we use math every day in most things that we do.
4. Tell students that you are going to read them a book about a brother and sister who use math in several different ways on a trip to the store with their mother.

Procedure (During Reading)

5. Give students sticky notes and tell them to jot down a math concept every time they see one. One concept or operation per sticky note.
6. Read the story aloud.

Integration (After Reading)

7. Have the students get into groups of three, sharing their sticky notes and eliminating duplicates of their answers.
8. Add these concepts to the chart with an example of how it is used by the characters in the book.
9. Have students choose one of their math concepts and write a story and corresponding word problem using that concept to share with the class.
10. Have the groups trade stories, identify the math concept in the story they receive and solve the math problem.
11. Groups will share the story and problem they solved along with the strategies they used.

Extensions

1. Students can answer the questions from the book
   - "How many shoes or socks would fifty or twenty seventeen lady bugs need?"
   - "What is twenty seventeen, if it were a real number?"
   - "How long do Charlie and Lola spend at the store?"
   - "How late are they leaving for the store?"
   - "How far is 156 steps in a standard measurement?"
2. *Visual Arts:* Lauren Child has a unique illustrating technique. Explore how the pictures help to tell the story.

Links, Resources, References

- Copibec: https://www.copibec.ca/en/agreement-elementary-highschool

Pedagogical application created in collaboration with Western Québec School Board

Pistes pédagogiques

Préscolaire | Primaire | Secondaire

4ans | 5ans | 1re | 2e | **3e** | **4e** | 5e | 6e | 1re | 2e | 3e | 4e | 5e

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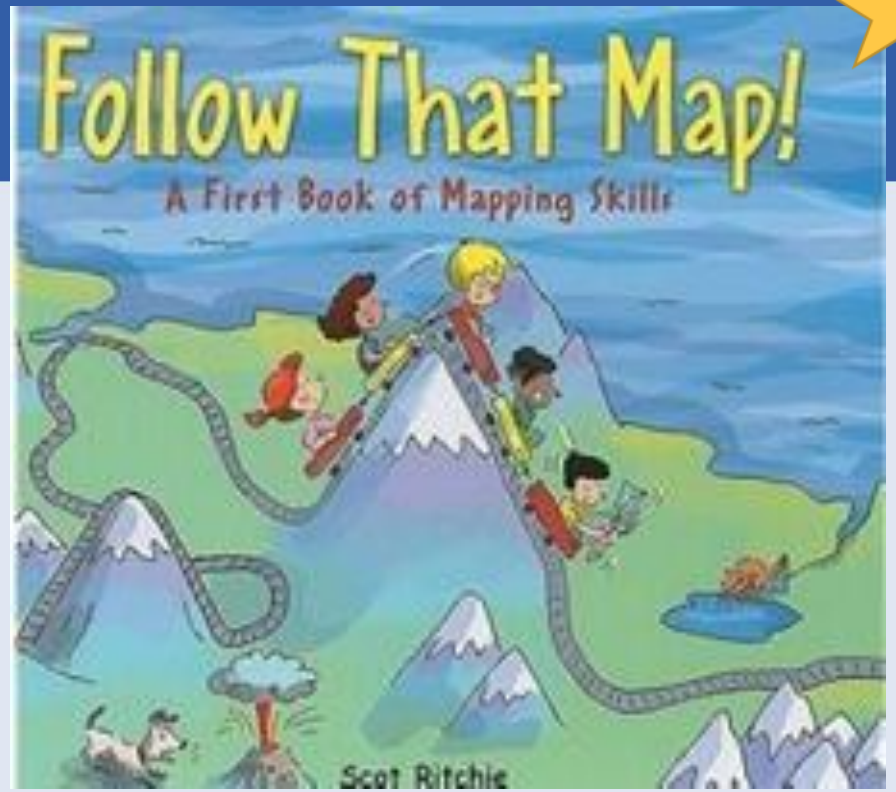
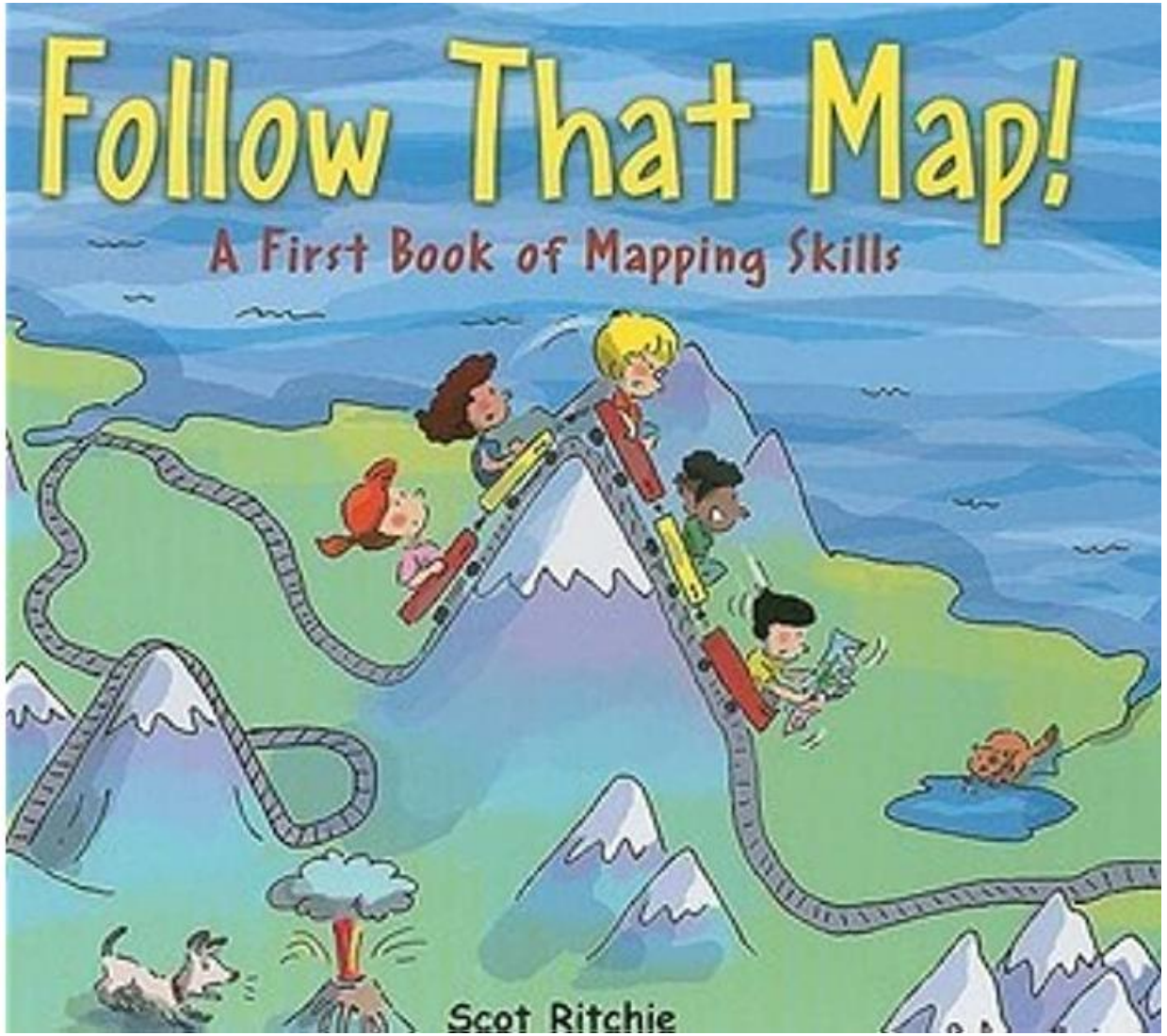
Example - 3

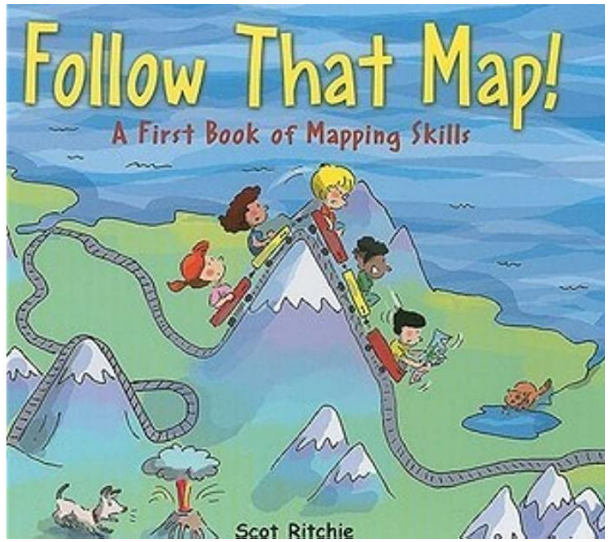


In this picture book of basic mapping skills, engaging language encourages readers to find their way through a series of panoramic illustrations that double as maps—complete with compass points, scales, legends, routes and landmarks.



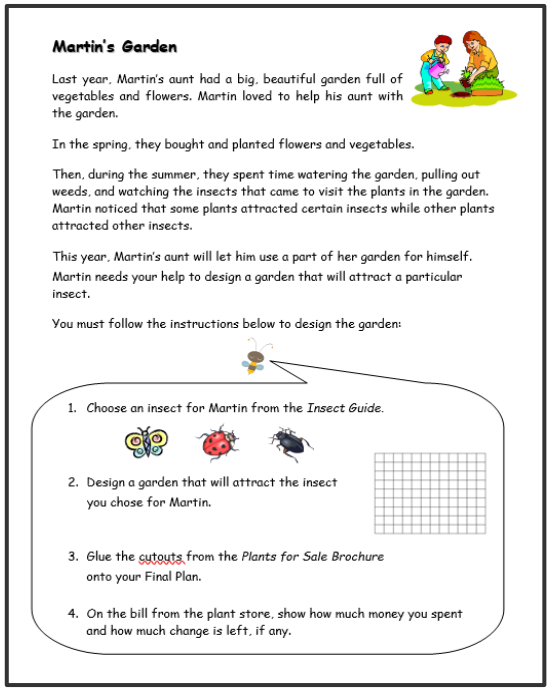
Children's Literature in Support of Situational Problems

Cycle 1	Martin's Garden
Cycle 2	A New Room
Cycle 3	The Treasure Map



Children's Literature in Support of Situational Problems

Cycle 1	Martin's Garden



Martin's Garden

Last year, Martin's aunt had a big, beautiful garden full of vegetables and flowers. Martin loved to help his aunt with the garden.

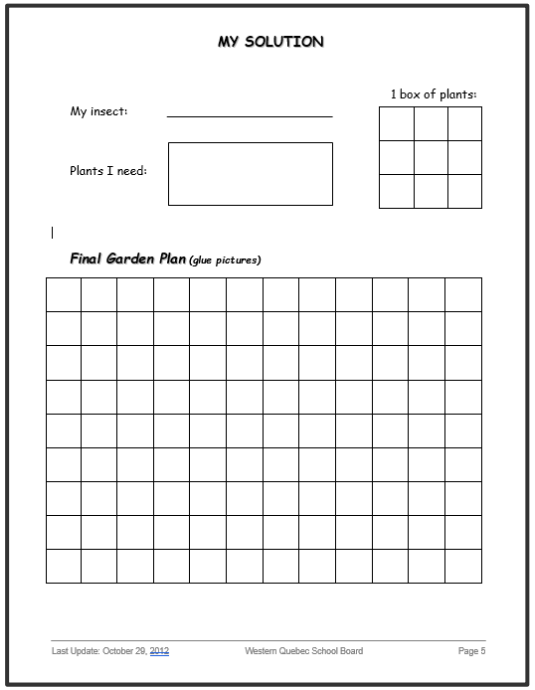
In the spring, they bought and planted flowers and vegetables.

Then, during the summer, they spent time watering the garden, pulling out weeds, and watching the insects that came to visit the plants in the garden. Martin noticed that some plants attracted certain insects while other plants attracted other insects.

This year, Martin's aunt will let him use a part of her garden for himself. Martin needs your help to design a garden that will attract a particular insect.

You must follow the instructions below to design the garden:

1. Choose an insect for Martin from the *Insect Guide*.
2. Design a garden that will attract the insect you chose for Martin.
3. Glue the cutouts from the *Plants for Sale Brochure* onto your Final Plan.
4. On the bill from the plant store, show how much money you spent and how much change is left, if any.



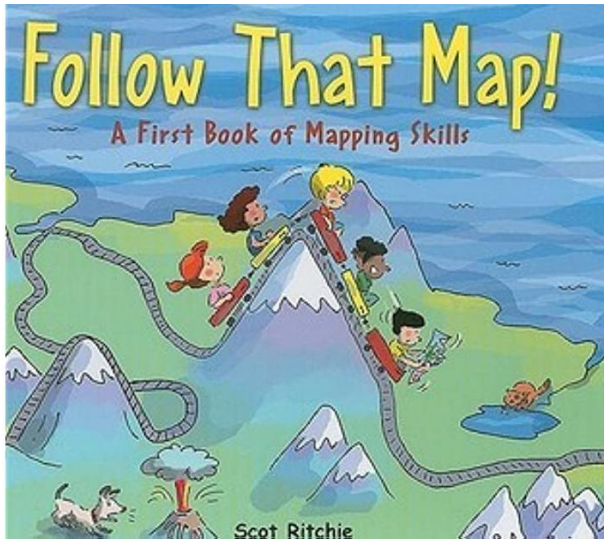
MY SOLUTION

My insect: _____

1 box of plants:

Plants I need:

Final Garden Plan *(glue pictures)*



Children's Literature in Support of Situational Problems

Cycle 2 A New Room

A New Room

Joey's parents have bought a new home.

They have told Joey that he can design the family's recreation room.

His parents have given him $ 900 to spend on the rec room.

You must prepare a floor plan and a budget for Joey's parents.

The rec room floor measures 4 m by 6 m.

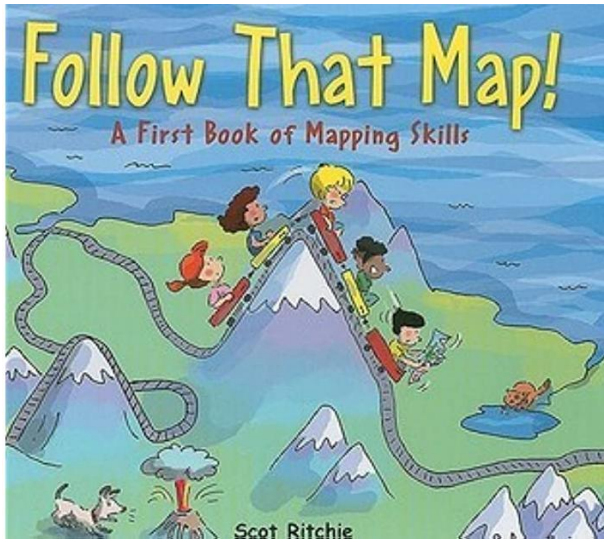
You must have:

- A couch
- A coffee table
- Three other items.

Item	Dimensions	Price
Couch	3 m by 1m	$500
Coffee Table	100 cm by 50 cm	$120
End Table	50 cm by 50 cm	$55
Computer Desk	2 m by 1 m	$128
Bookcase	50 cm by 100 cm	$76
TV Stand	100 cm by 50 cm	$59
Ping Pong Table	4 m by 2 m	$183
Storage Chest	150 cm by 50 cm	$89
Beanbag Chair	1 m by 1 m	$98

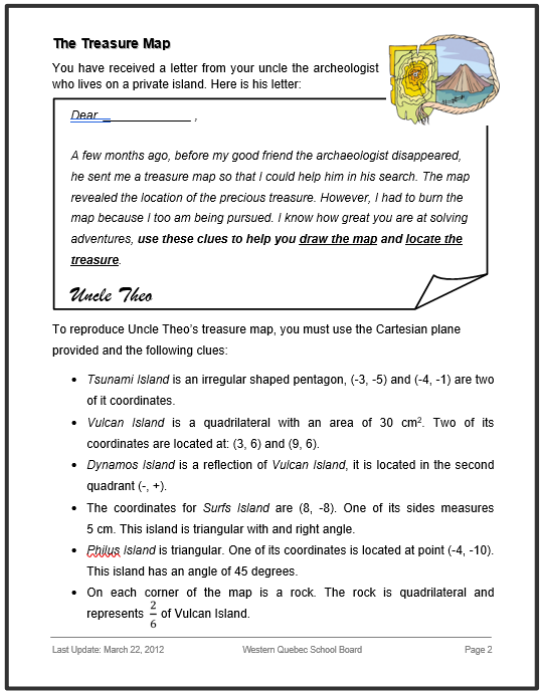
Floor Plan

1 m



Children's Literature in Support of Situational Problems

Cycle 3 The Treasure Map



The Treasure Map

You have received a letter from your uncle the archeologist who lives on a private island. Here is his letter:

Dear _____ ,

A few months ago, before my good friend the archaeologist disappeared, he sent me a treasure map so that I could help him in his search. The map revealed the location of the precious treasure. However, I had to burn the map because I too am being pursued. I know how great you are at solving adventures, ***use these clues to help you draw the map and locate the treasure****.*

Uncle Theo

To reproduce Uncle Theo's treasure map, you must use the Cartesian plane provided and the following clues:

- *Tsunami Island* is an irregular shaped pentagon, (-3, -5) and (-4, -1) are two of it coordinates.
- *Vulcan Island* is a quadrilateral with an area of 30 cm^2. Two of its coordinates are located at: (3, 6) and (9, 6).
- *Dynamos Island* is a reflection of *Vulcan Island*, it is located in the second quadrant (-, +).
- The coordinates for *Surfs Island* are (8, -8). One of its sides measures 5 cm. This island is triangular with and right angle.
- *Philus Island* is triangular. One of its coordinates is located at point (-4, -10). This island has an angle of 45 degrees.
- On each corner of the map is a rock. The rock is quadrilateral and represents $\frac{2}{6}$ of Vulcan Island.

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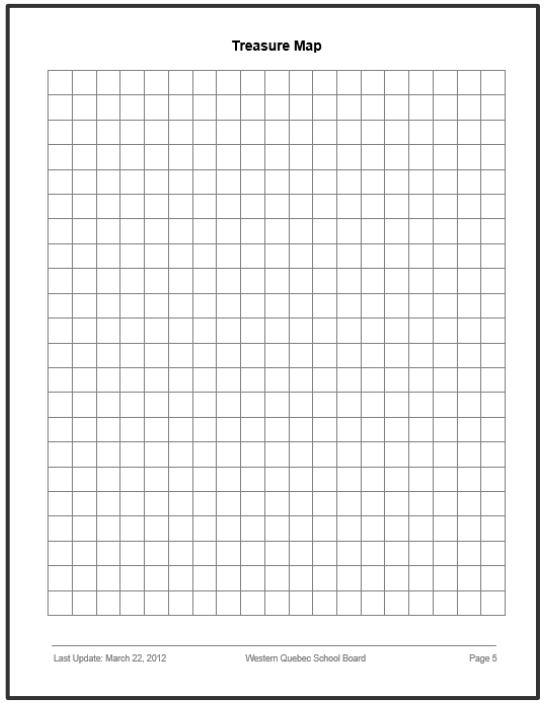

Treasure Map

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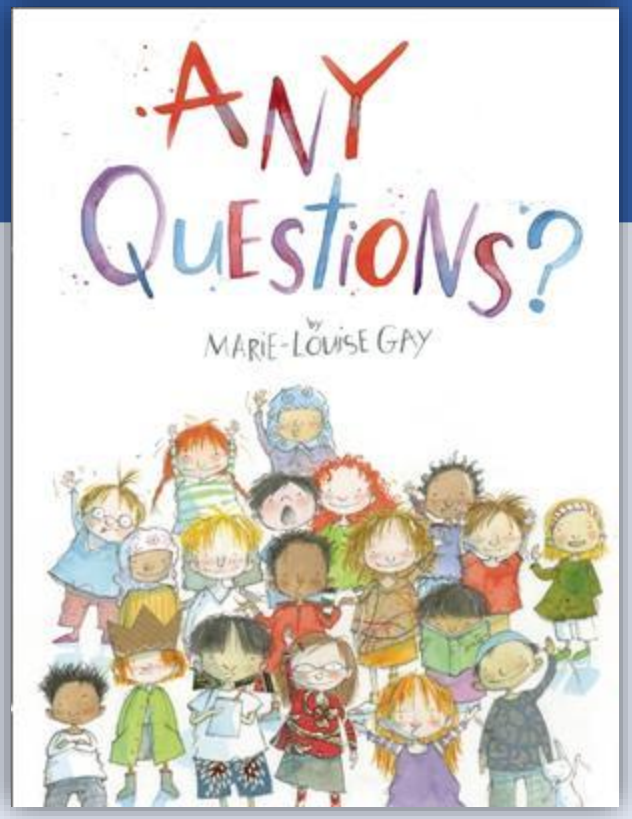
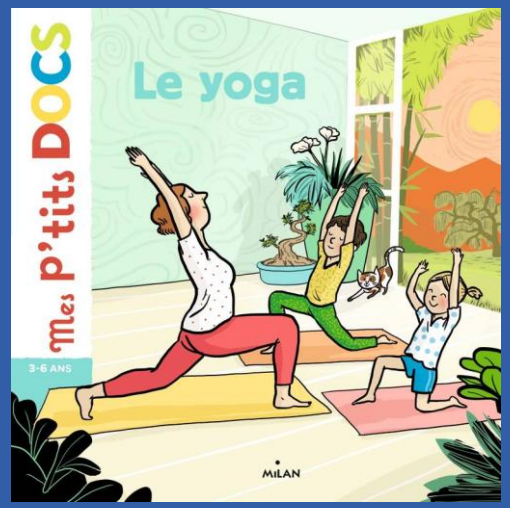
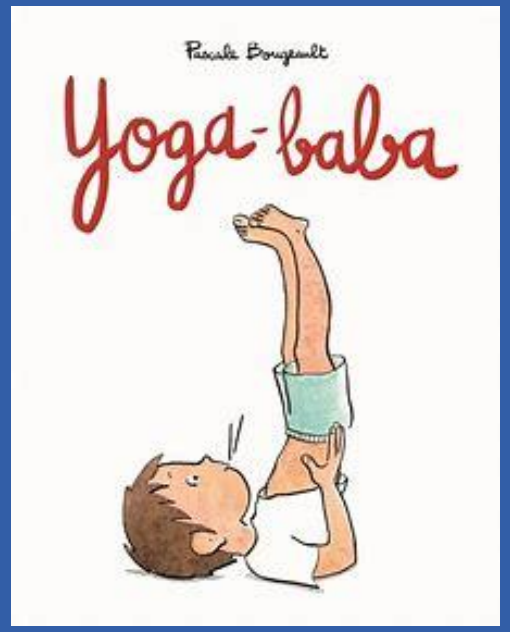
Creating Pedagogical Applications

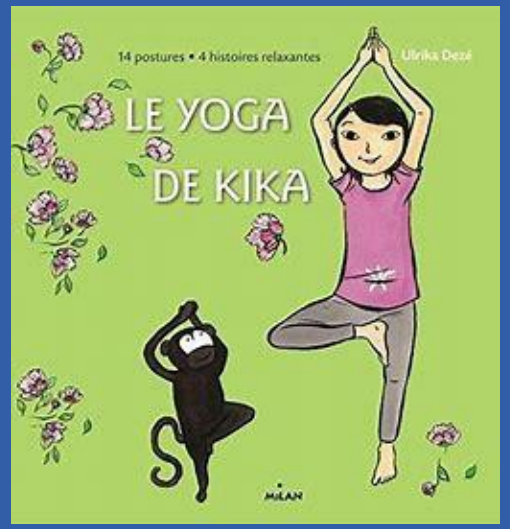
Questions?

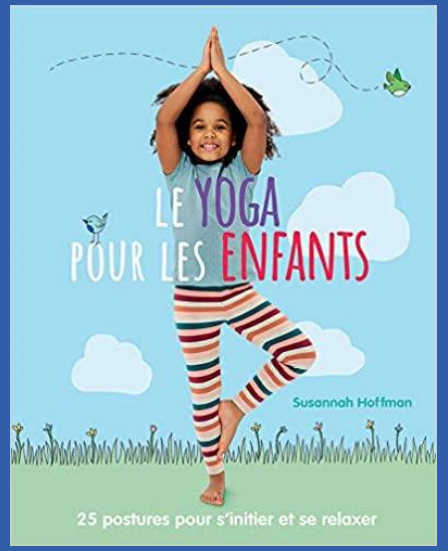


Two-Minute Stretch









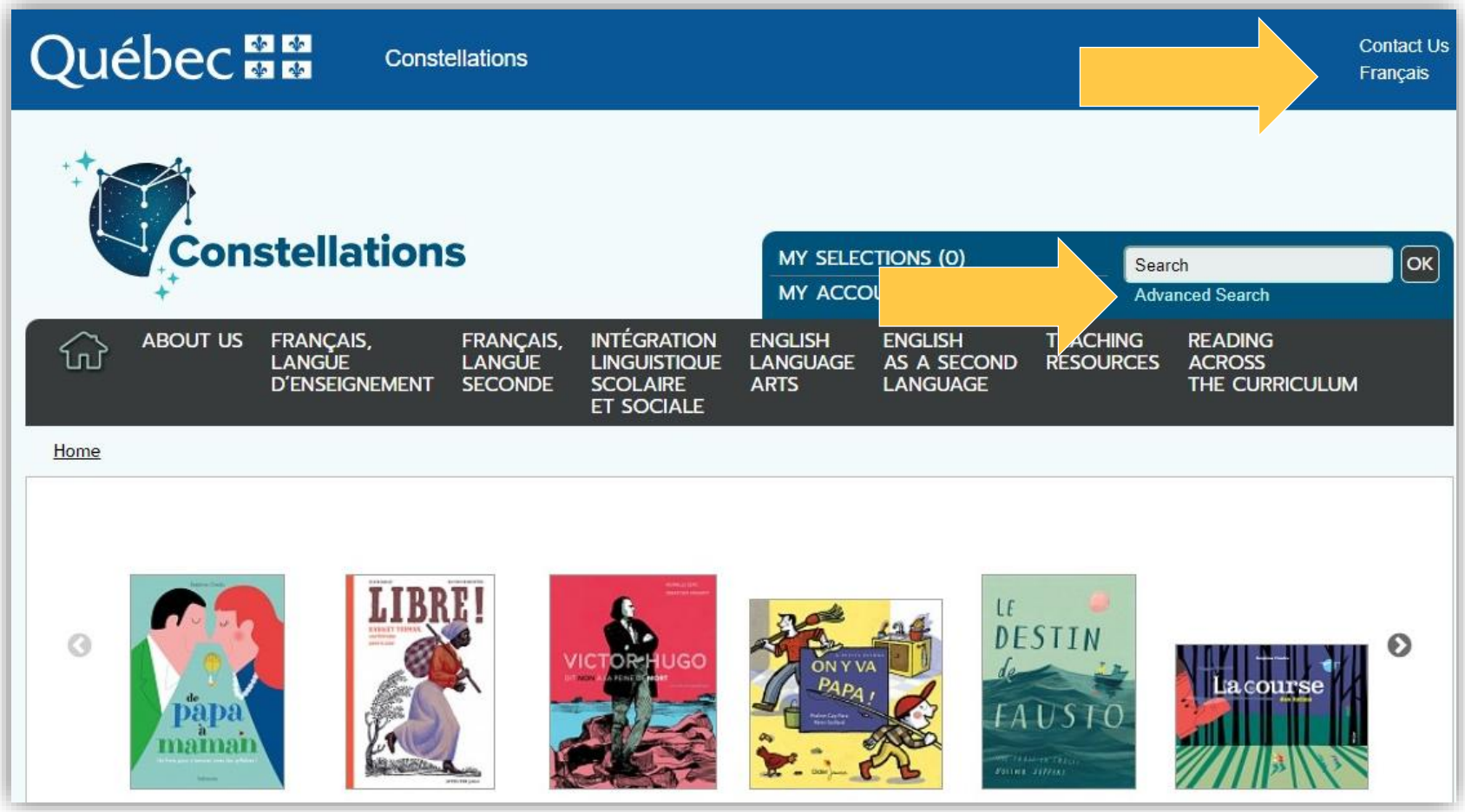
Constellations

Constellations

Navigating the Database

Resources Available

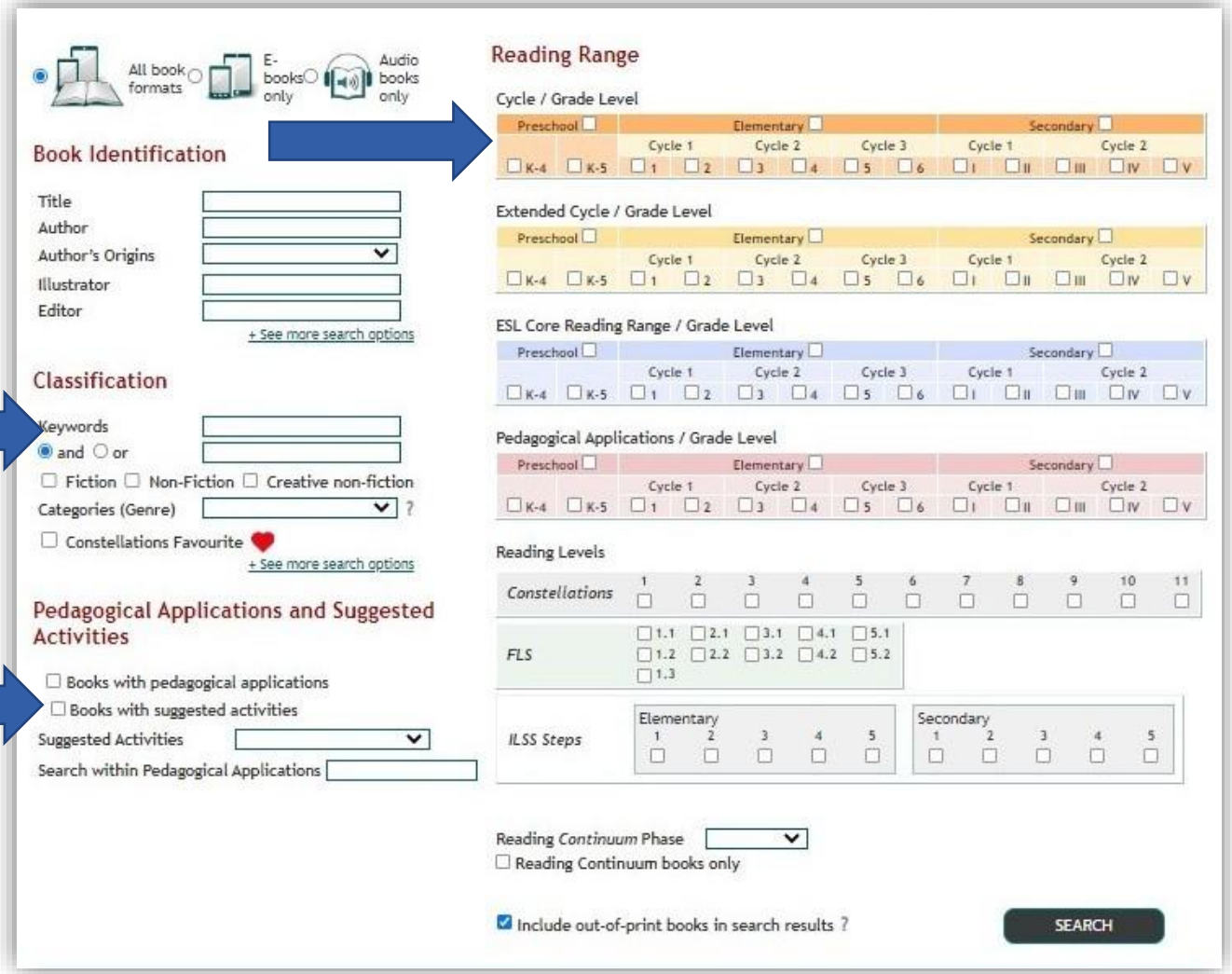
Constellations



https://constellations.education.gouv.qc.ca

Advanced Search

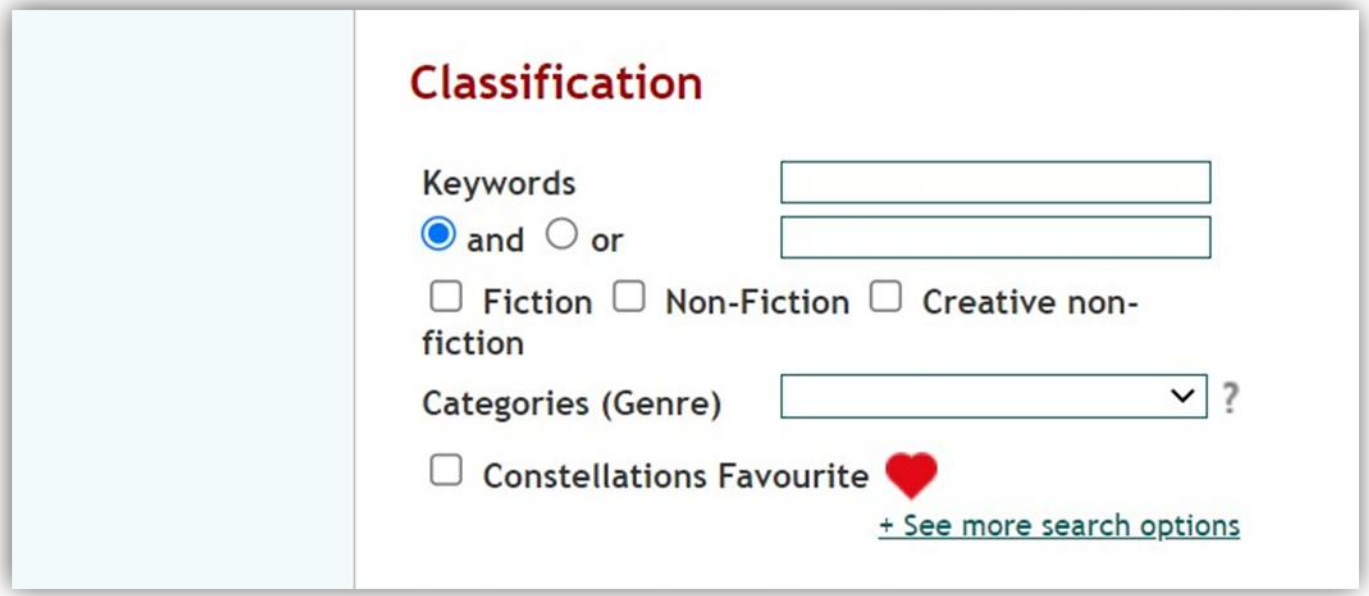
- Cycle/Grade Level
- Keywords
- Search within pedagogical applications



Constellations

Keywords

- Numbers
- Comparison
- Measurements
- Architecture
- Speed
- Statistics
- Size
- Time
- Puzzles



Reading Across the Curriculum

Book Lists by Cycle and Subject Area

This section suggests books to support literacy in subject areas other than English Language Arts or English as a Second Language.

To better understand the process behind the compilation of these book lists, please see *Constellations* and Reading Across the Curriculum.

Elementary

- Cycle One
- Cycle Two
- Cycle Three

Secondary

- Cycle One
- Cycle Two

To explore the book lists, first select an elementary or secondary cycle then click on the desired subject area.

Mathematics, Science and Technology

- Mathematics
- Science and Technology
  - Material World
  - Earth and Space
  - Living Things

Social Sciences

- Social Sciences

Sexuality Education

- Sexuality Education

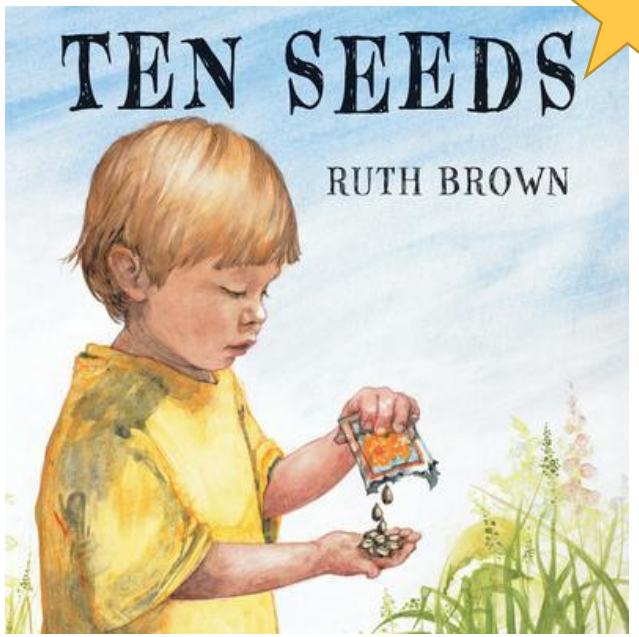
Arts Education

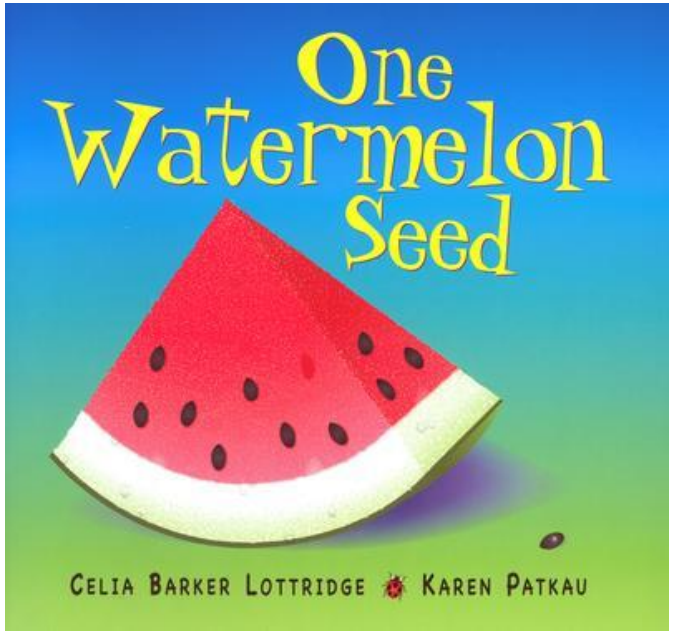
- Drama
- Visual Arts
- Dance
- Music

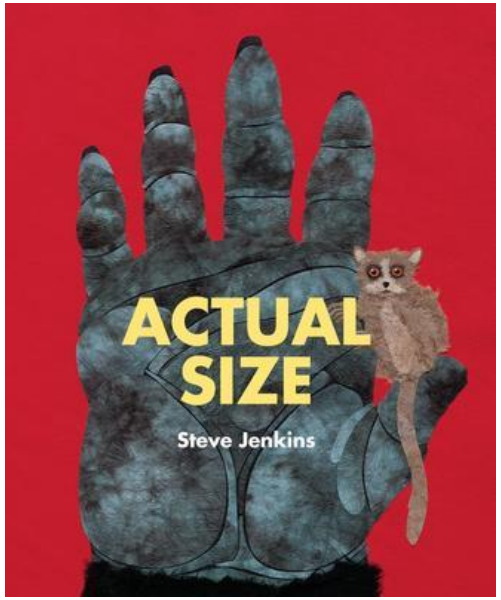
Personal Development

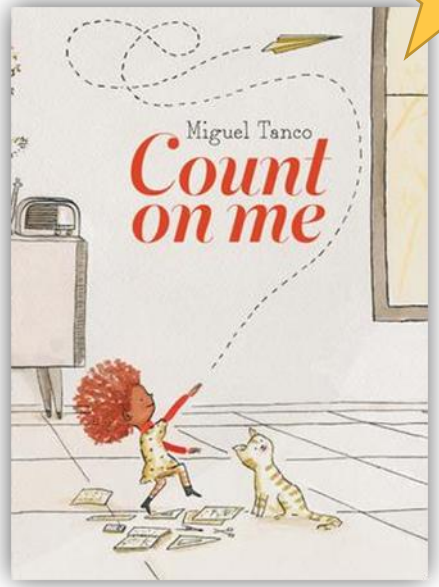
- Physical Education and Health
- Ethics and Religious Culture
  - Ethics
  - Religious Culture

Our Favourite Titles- Cycle One

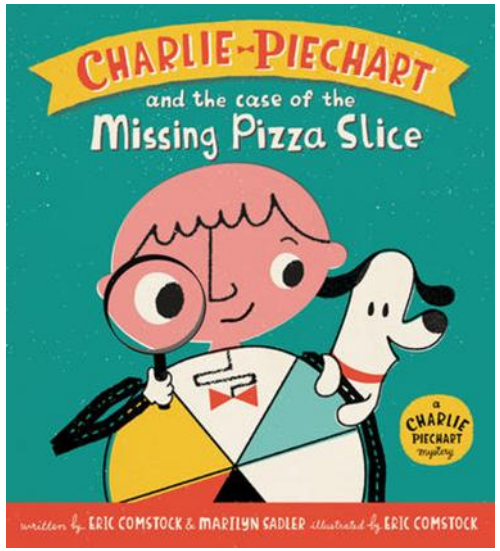


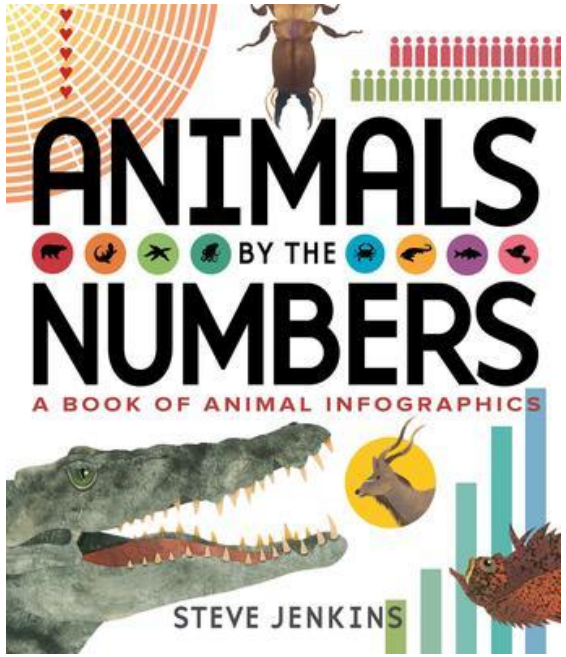


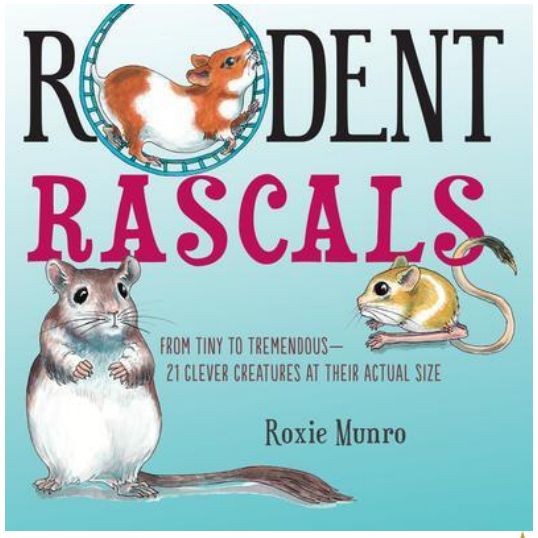


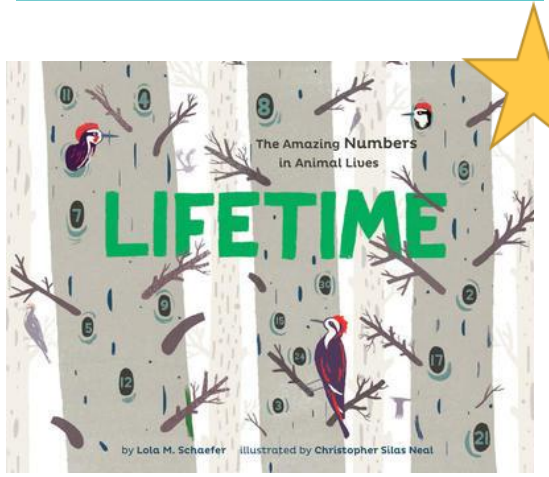


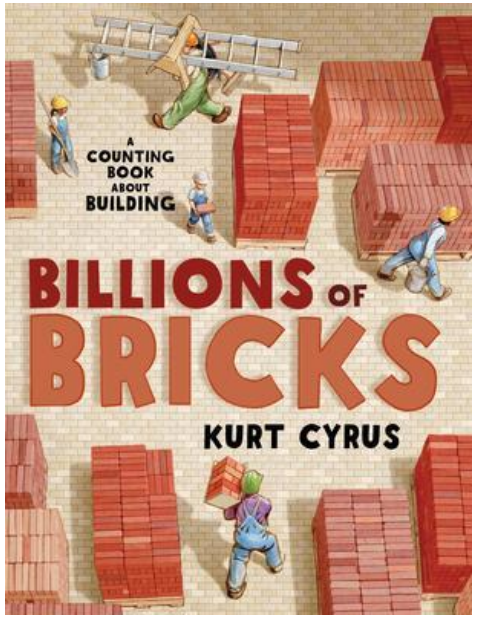
Our Favourite Titles- Cycle Two

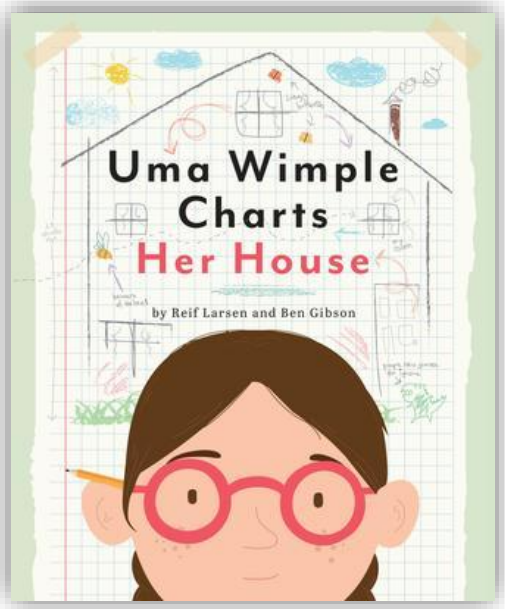




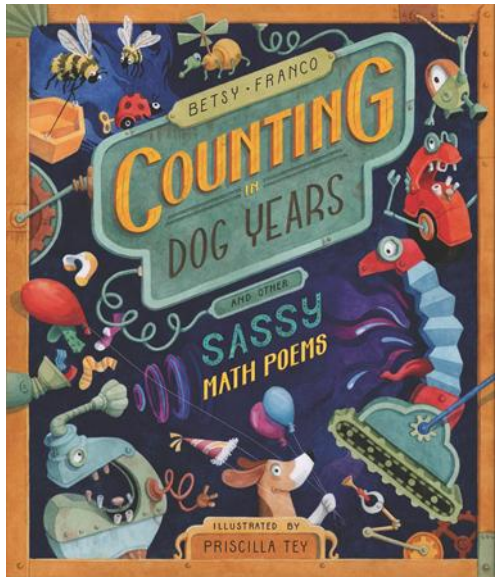


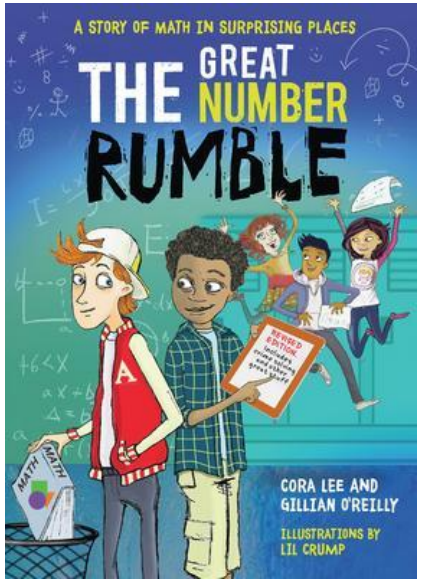


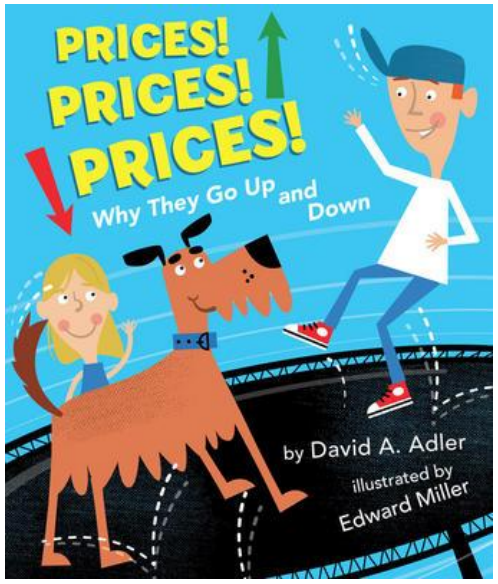


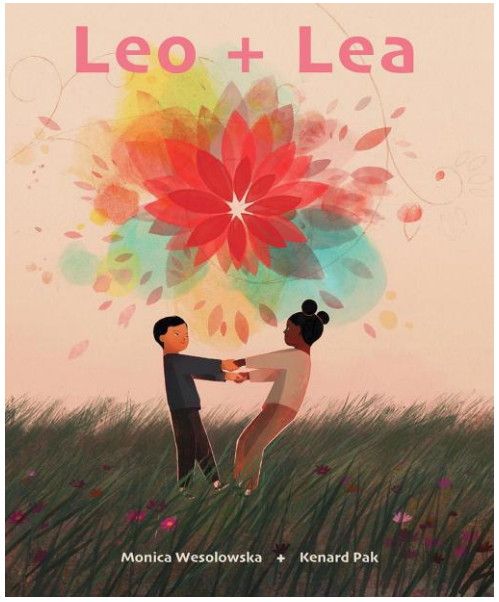


Our Favourite Titles- Cycle Three









Thanks!

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