Story in the Mathematics Classroom

Nóra Nic Con Ultaigh, Lorraine Harbison, Gráinne Higgins

FIGHTING WORDS
The write to right.

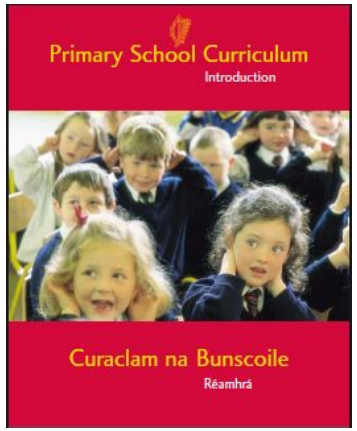
An Chomhairle Mhúinteoireachta
The Teaching Council

CASTeL
Centre for the Advancement of STEM Teaching and Learning

CROÍ
Research at the heart of teaching and learning

St. Philomena's N.S. 1932

Timeline



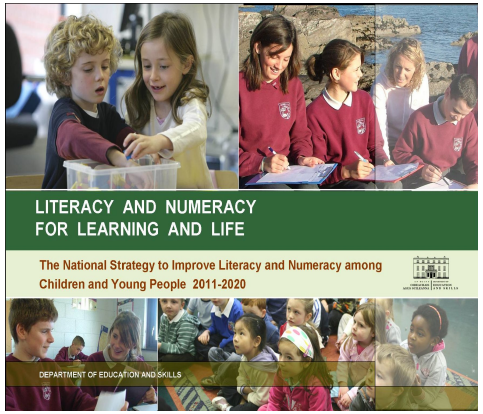
1999

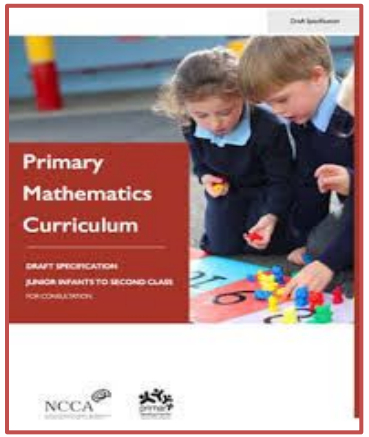
It is important to make connections between learning in different subjects. Integration gives children's learning a broader and richer perspective. Integration emphasises the interconnectedness of knowledge and ideas and reinforces the learning process. (GoI, 1999, p.16)

2011

We need to equip teachers to provide effective teaching and learning experiences

- to be familiar with the various strategies, approaches, methodologies and interventions that can be used to teach literacy and numeracy as discrete areas and across the curriculum (DES, 2011, p.31)





2017

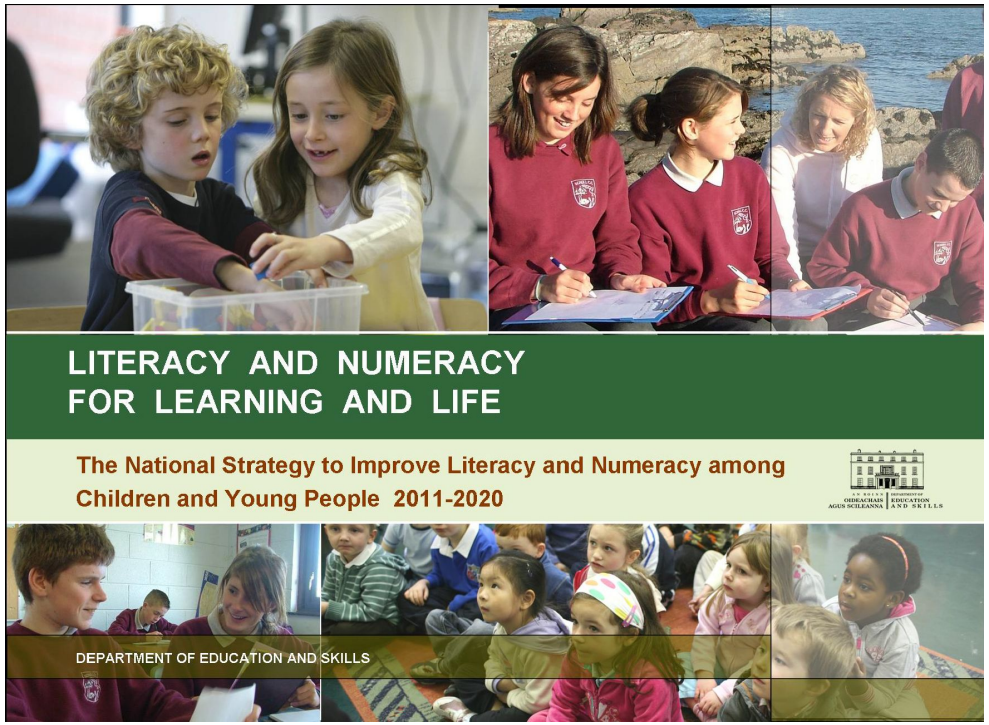
Practices in Integrative Contexts

- Play
- Story/picturebook reading
- Project work
- Learning mathematics through the arts and physical education
- Digital tools (NCCA, 2017, p.77)

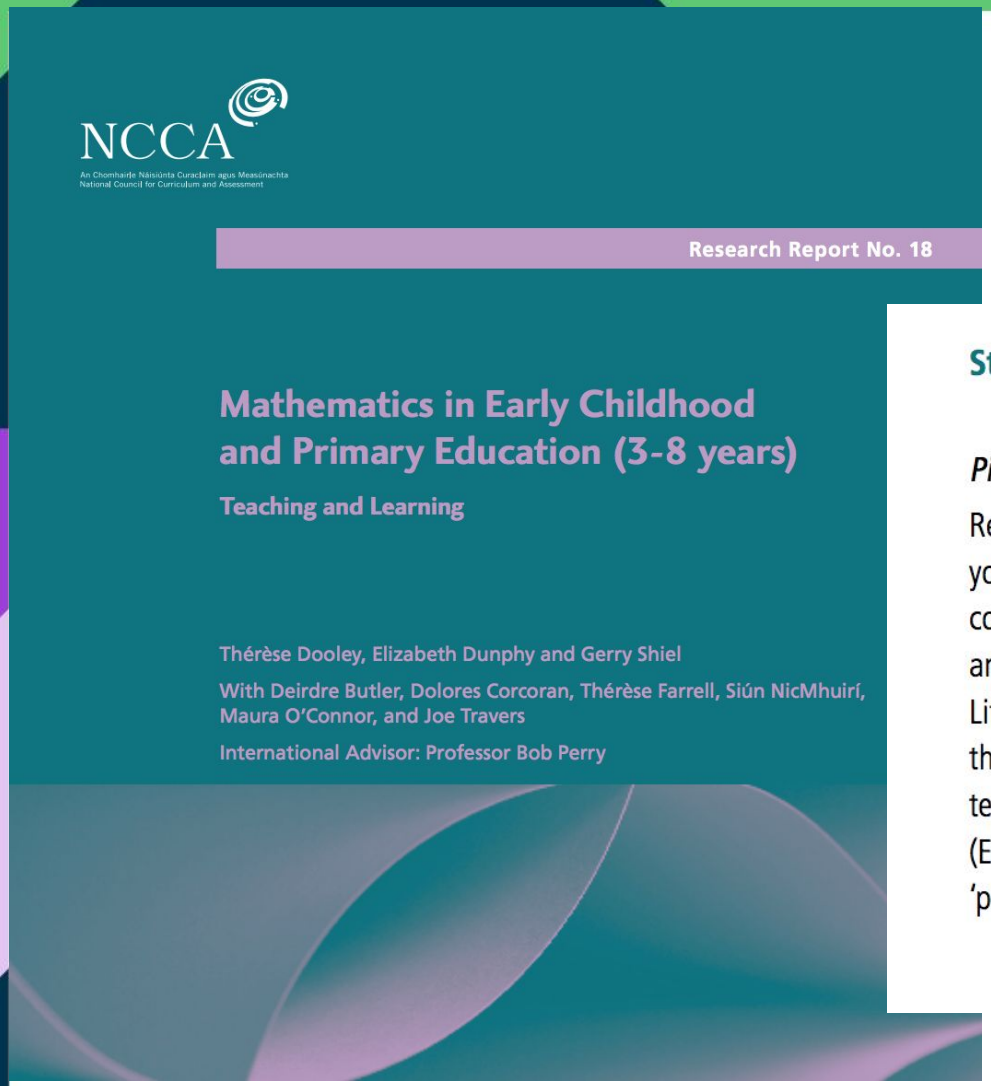
Literacy and Numeracy Strategy

Learning in many curricular areas provides a rich context for the development of literacy and numeracy skills.

Literacy and numeracy activity can become contextualised, meaningful and purposeful to the learner **through many subjects and areas of learning**.



DES, 2011, p. 46



Story/Picture-Book Reading

Picture-Books

Research indicates clearly that children's literature contributes greatly to the process by which young children acquire mathematical thinking. It does so by offering enjoyable and meaningful contexts – paper-based or digital – in which mathematical content and concepts may be explored and developed (Casey, Kersh, & Young, 2004; Hong, 1999; van den Heuvel-Panhuizen, 2012). Literature for young children generally includes pictures since artwork is an important feature in the education of pre-literate children. In most story books the illustrations, as well as the text, play a prominent role in the telling of the narrative and the creation of meaning (Elia, van den Heuvel-Panhuizen, & Georgiou, 2010) so these books are generally referred to as 'picture-books' (van den Heuvel-Panhuizen & Elia, 2012). Picture-books usually show mathematical

Curriculum Framework

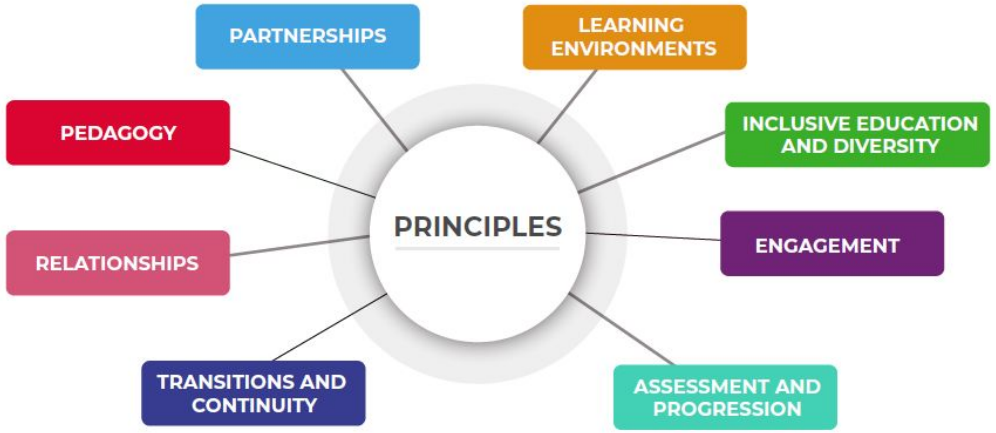
(NCCA, 2018, p.75)

Integrated and thematic curriculum structure benefits planning for teachers.

Pedagogy

Teachers use appropriate and evidence-based pedagogical approaches and strategies to foster engagement, ownership and challenge while connecting with children's life experiences and their interests.

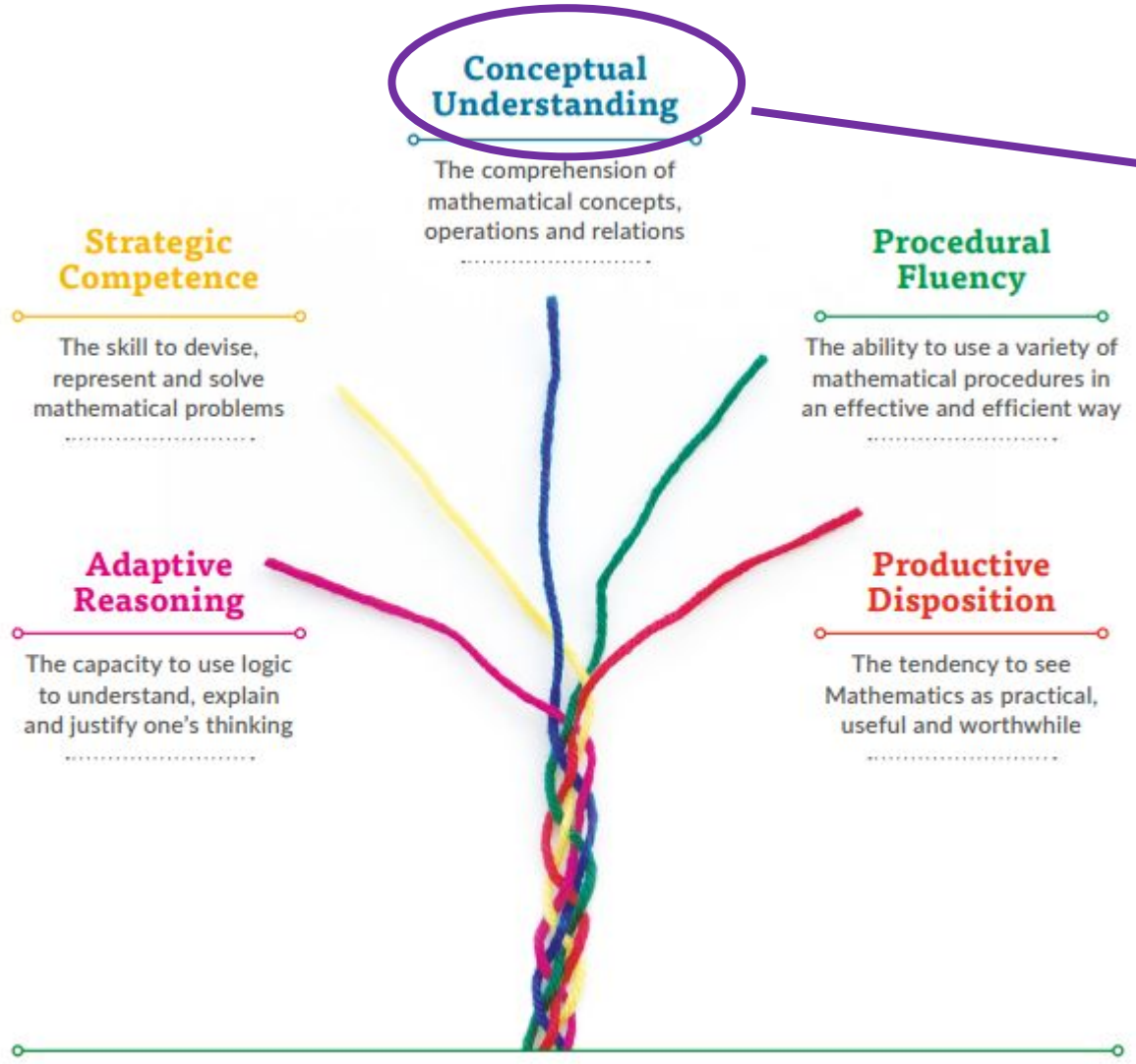
Figure 1: Principles



(NCCA, 2023, p. 6)

Pedagogical Benefits of Using Mathematical Picturebooks

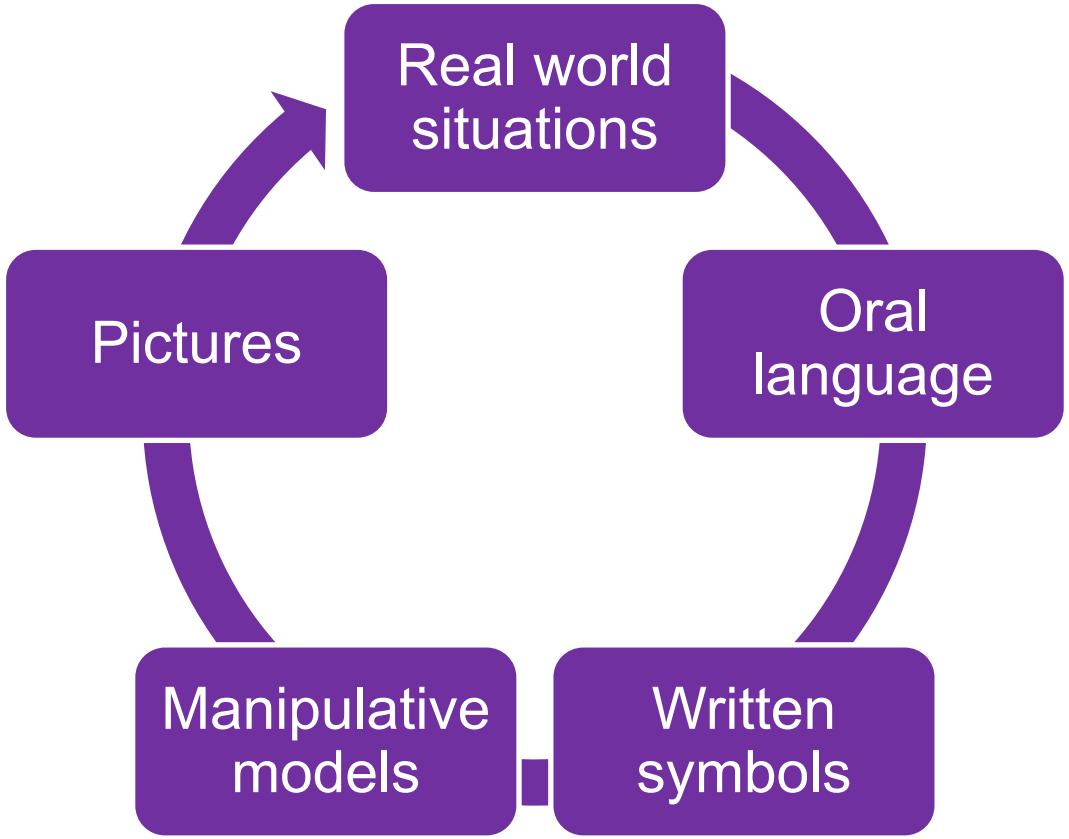
Foster Conceptual Understanding Through Multiple Representations



One's ability to **"represent mathematical situations in different ways"** and the degree of students' conceptual understanding can thus be measured by examining "the richness and extent of the connections [between representations] they have made" (p. 119).

Kilpatrick et al.'s (2001)
Mathematical Proficiency

Connections Model of Mathematical Understanding



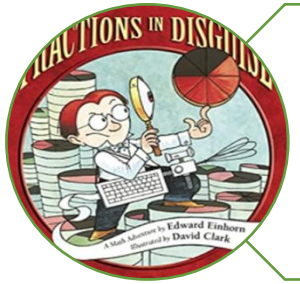
Source: Haylock (2010, p. 26)

“Experiences with mathematically-related stories have the potential to promote aspects of mathematical proficiency, including procedural fluency, adaptive reasoning and a productive disposition” (Dooley et al., 2014, p. 53).

Mathematical Picturebooks Explored

Picturebooks that are explicitly linked to mathematical concept(s), but without any narrative;

If: A Mind-Bending Way of Looking at Big Ideas and Numbers (Smith, 2014).



Picturebooks with a narrative that is explicitly linked to mathematical concept(s);

Fractions in Disguise: A Math Adventure (Einhorn, 2013).

Picturebooks with a narrative that is implicitly linked to mathematical concept(s):

The Very Hungry Caterpillar (Carle, 1969).

Why Picturebooks for Mathematics?

- Emphasis on the **story** element
- **Playful approach** to mathematical learning and development
- **Emotional investment** in seeing what is going to happen next
  - Group of characters
  - Crisis to solve
  - Engagement through narrative
- **Visual representation** of mathematical content
- **Contextualisation** to the forefront
- **Use of mathematical concept** to solve

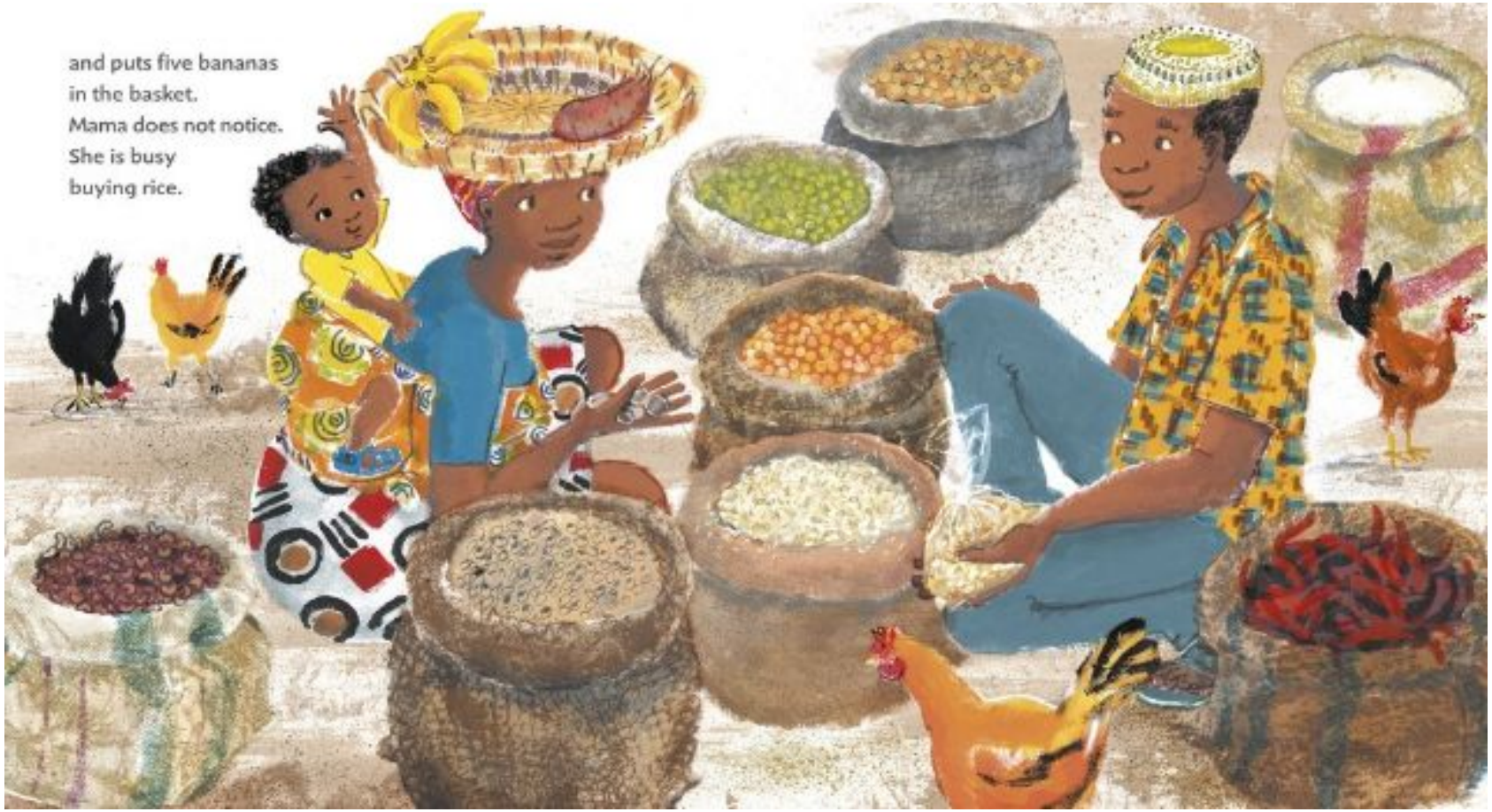
Relationship between Words and Pictures

Rosie's Walk

Rosie the hen went for a walk **across** the yard, **around** the pond, **over** the haystack, **past** the mill, **through** the fence, **under** the beehives, and got back in **time for dinner**.

Relationship Between Text and Picture

Baby Goes to Market



Mirror Clarify Elaborate Emphasise

Handa's Surprise (Browne, 2000)

Numbers 0 – 10

Handa carries seven delicious fruits to her friend Akeyo as a surprise but meets some hungry animals along the way!

The Doorbell Rang (Hutchins, 1986)

Division with remainders

Mother has made 12 cookies to share between her two children. But then the doorbell rings and more and more friends come to share the delicious cookies mother has made.

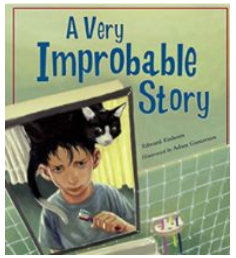
Literature **Mathematical Concept** **Context**

Ways to Integrate Children's Literature in the Mathematics Classroom

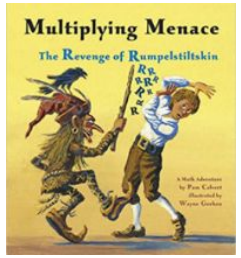
Provide a Context

Introduce Manipulatives

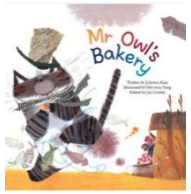
Pose an Interesting Problem



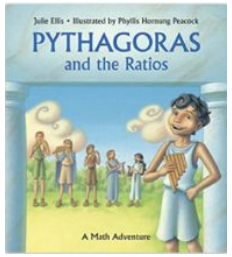
Prepare for a Concept or Skill



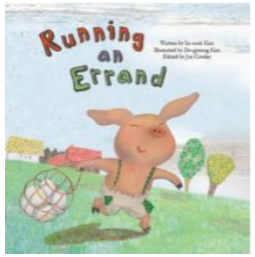
Model a Creative Experience



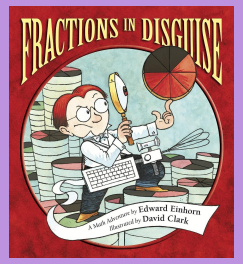
Develop a Concept or Skill



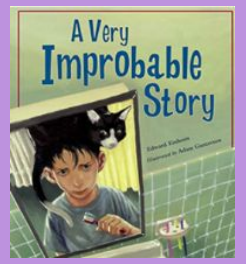
Provide a Context for Review



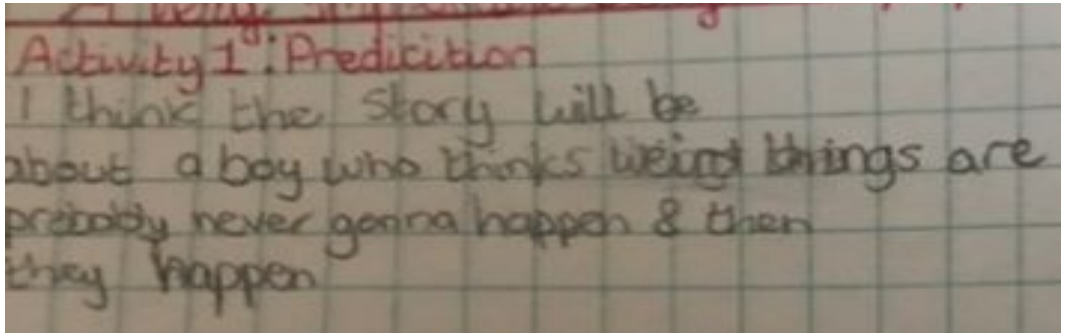
Welchman-Tischler, 1992

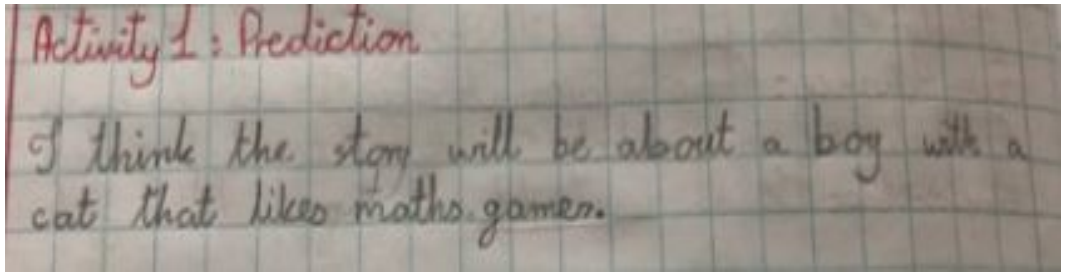
	Literature	Synopsis
Develop a concept or skill	Fractions in Disguise (Einhorn, 2006) 	**Simplifying fractions** Some kids collect baseball cards. Some collect action figures. Me? I collect fractions. Learners explore equivalent fractions with the help of the Reducer Machine invented by George Cornelius Factor.

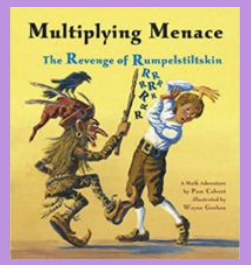
1. *Why do you think GCF thinks that $^{5}/_{9}$ is a thing of beauty?*
2. *Why do you think $^{4}/_{0}$ is an illegal fraction?*
3. *Describe how Dr. Brok was able to 'disguise' fractions?*

	Literature	Synopsis
Pose an interesting problem	A Very Improbable Story (Einhorn, 2008) 	**Probability** What are the odds of waking up with a cat on your head? Learners engage with games of chance and probability as the only way to remove the cat is to win a game.

Examine the front cover of the book. What do you predict this book will be about?



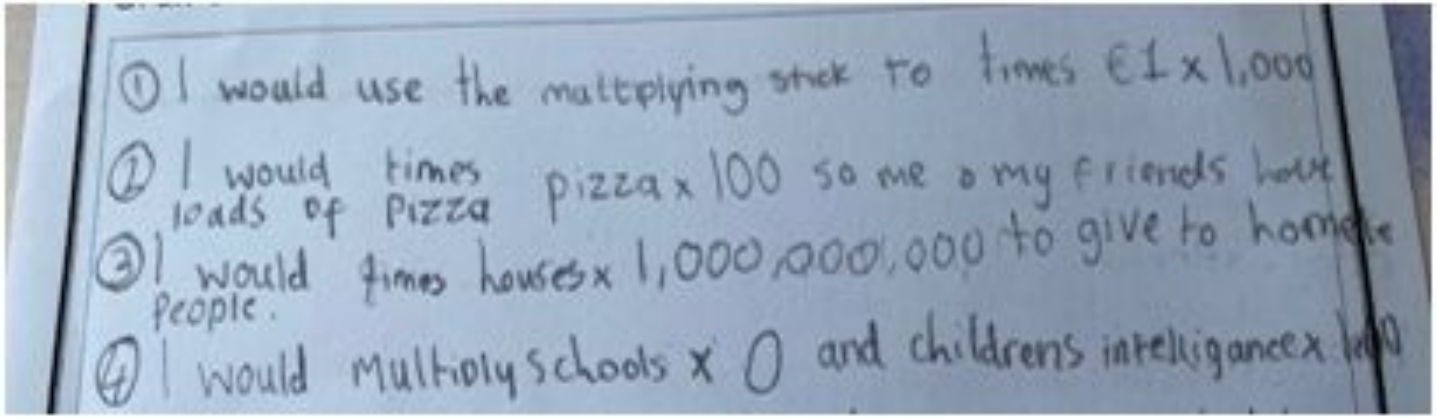


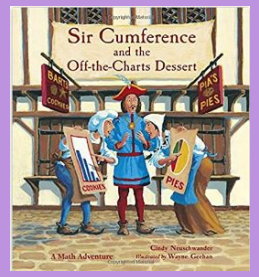
	Literature	Synopsis
Prepare for a concept or skill	Multiplying Menace. The Revenge of Rumpelstiltskin (Calvert, 2006) 	**Multiplication of whole numbers and fractions** It's been 10 years since the queen defeated Rumpelstiltskin and now he's back to collect his payment from years before. Learners consider the use of Rumpelstiltskin's magical multiplying stick to multiply whole numbers and fractions in order to restore peace to the kingdom.

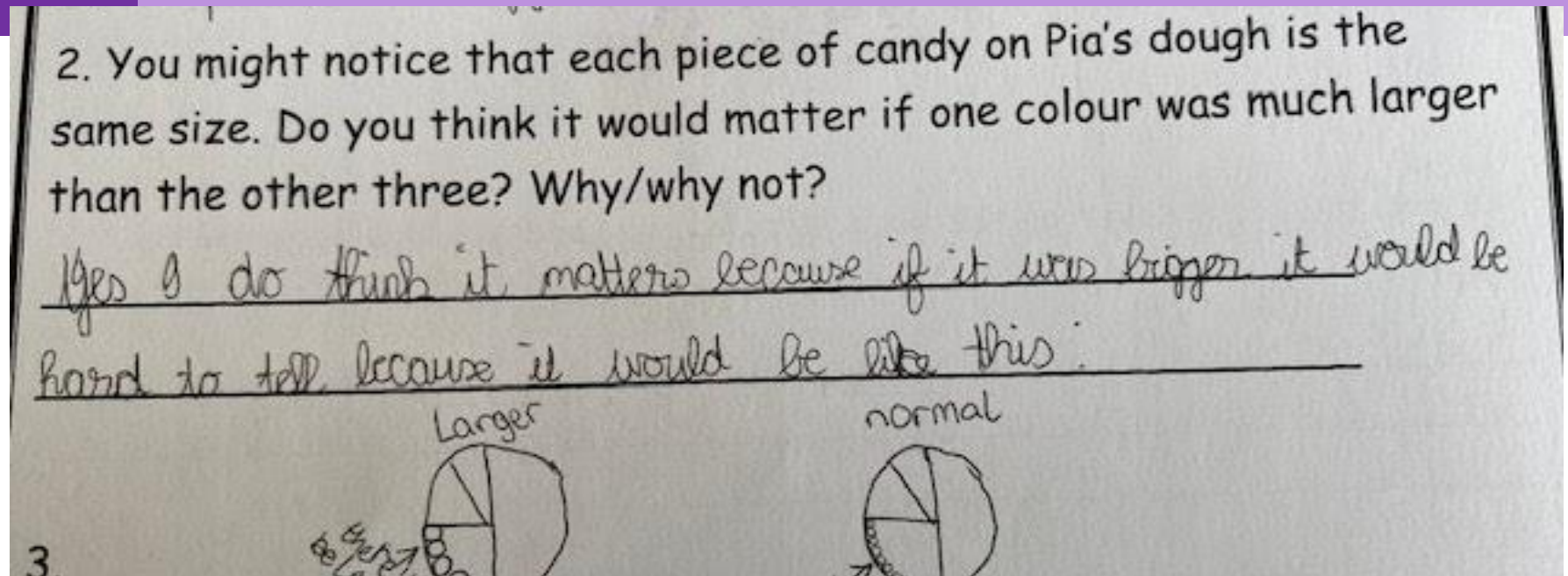
Imagine you have been given 5 chances to use the multiplying stick.

What would you do?

Draw or write about it.



	Literature	Synopsis
Provide a context	Sir Cumference and the Off-the-Charts Desserts (Neuschwander, 2013) 	**Data Handling** Sir Cumference and Lady Di need a baker to prepare a special dessert for the annual Harvest Faire. Two bakers enter a competition to prove who makes the best sweet treat. Both bakers struggle to keep track of the votes their desserts receive. Learners are introduced to charts and graphs.



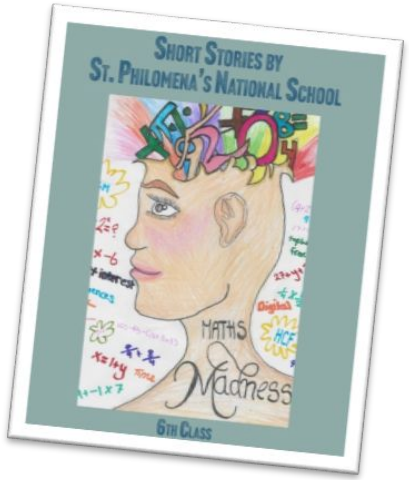
Meet the teachers

https://www.mathsweek.ie/2021/picture-books-in-maths-education/

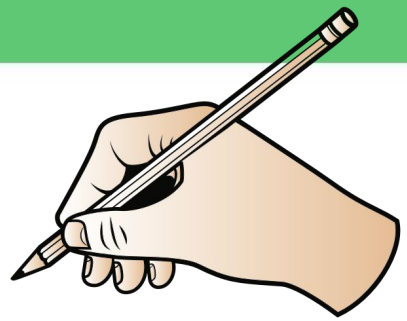
Want to know more?

Harbison, L., Kingston, M., & Miller, S. (2021). Teachers' use of mathematical picturebooks to engage children in the upper primary years in mathematics. In M. Kingston & P. Grimes (eds.), *Proceedings of the Eighth Conference on Research in Mathematics Education in Ireland (MEI 8)*, 188–195. https://doi.org/10.5281/zenodo.5636433

Using Maths Picture Books as a Stimulus for Story Writing: Examples from the Classroom



Write Your Own Maths Story

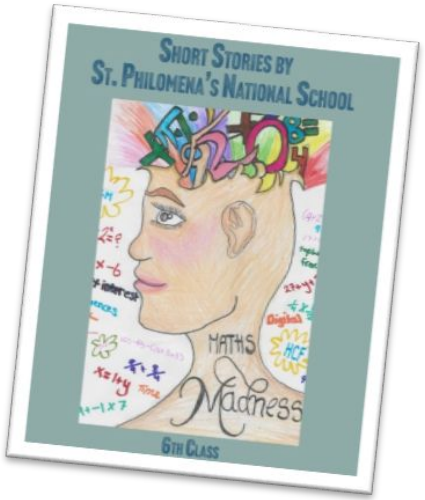


Your story should:

- Be in the form of a cartoon strip
- Be at least six slides long
- Include the multiplier stick
- Include multiplication by a whole number, zero, and a fraction

Maths Madness: Our Fighting Words Project

- Researchers in Residence Scheme
- Maths Week activities
- Fighting Words workshops
- Publishing our stories
- Our Book Launch



FIGHTING WORDS
The write to right.

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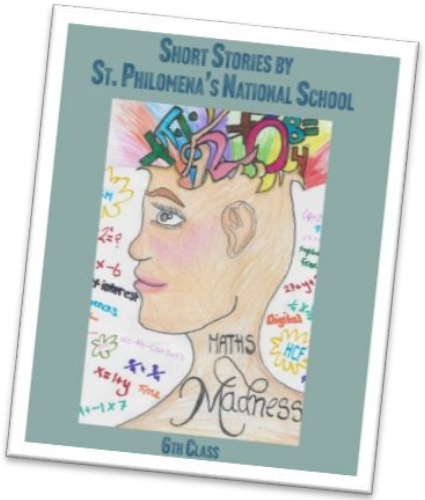

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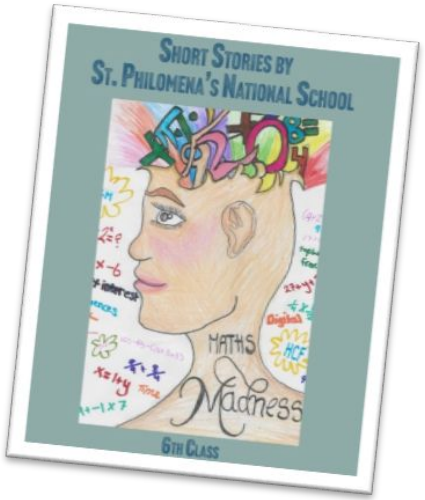
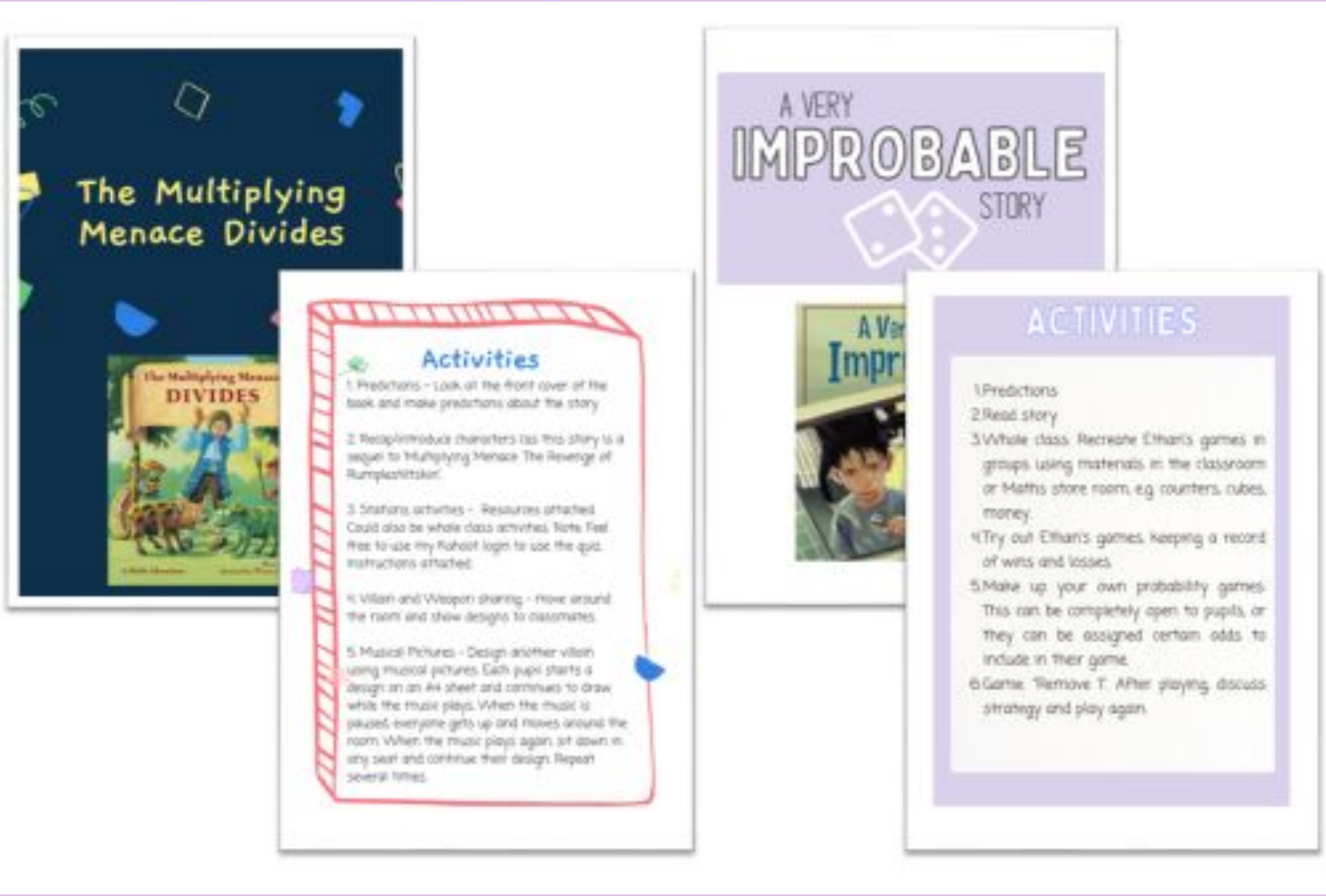


FIGHTING WORDS
The write to right.


FRACTIONS
IN DISGUISE
Activities
1. Predictions - Look at the front cover of the book and make predictions about the story.
2. 'Me in Fractions' activity - Read the quote from the book ('I'm 1/4 genius, 1/4 stubborn, 1/3 determined and 1/6 eccentric'). Ask the pupils to represent themselves in fractions. Template attached.
3. Stations activities - Resources attached. Could also be whole class activities. Note: Feel free to use my Kahoot login to use the quiz. Instructions attached.
4. Fraction Museum hunt - Resources attached. Hang up around school/classroom. Use Padlet or worksheet to record.
Sir Cumference and the Fraction Faire
SIR CUMFERENCE AND THE FRACTION FAIRE
Activities


The Multiplying Menace Divides
DIVIDES
Activities
1. Predictions - Look at the front cover of the book and make predictions about the story.
2. Recap/introduce characters (as this story is a sequel to 'Multiplying Menace The Revenge of Rumplestiltskin'.
3. Stations activities - Resources attached. Could also be whole class activities. Note: Feel free to use my Rahoot login to use the quiz. Instructions attached.
4. Villain and Weapon sharing - move around the room and show designs to classmates.
5. Musical Pictures - Design another villain using musical pictures. Each pupil starts a design on an A4 sheet and continues to draw while the music plays. When the music is paused, everyone gets up and moves around the room. When the music plays again, sit down in any seat and continue their design. Repeat several times.
A VERY
IMPROBABLE
STORY
ACTIVITIES
1.Predictions
2.Read story
3.Whole class. Recreate Ethan's games in groups using materials in the classroom or Maths store room, e.g. counters, cubes, money.
4.Try out Ethan's games, keeping a record of wins and losses.
5.Make up your own probability games. This can be completely open to pupils, or they can be assigned certain odds to include in their game.
6.Game: 'Remove 1'. After playing, discuss strategy and play again.

Maths Madness: Our Fighting Words Project

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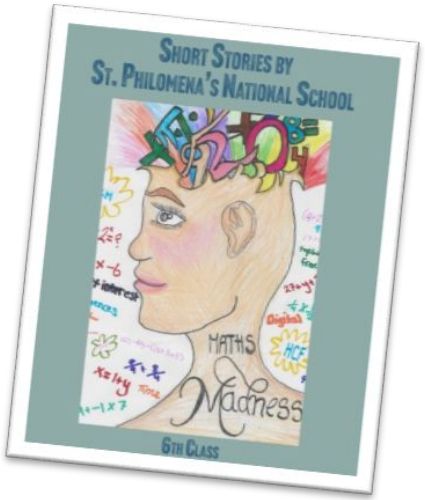

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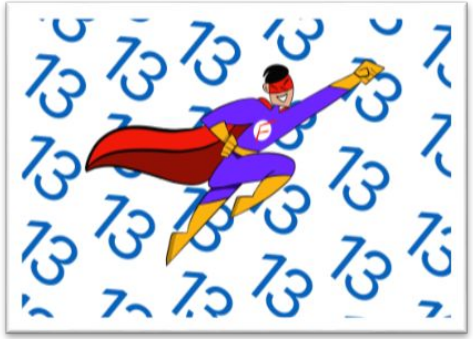
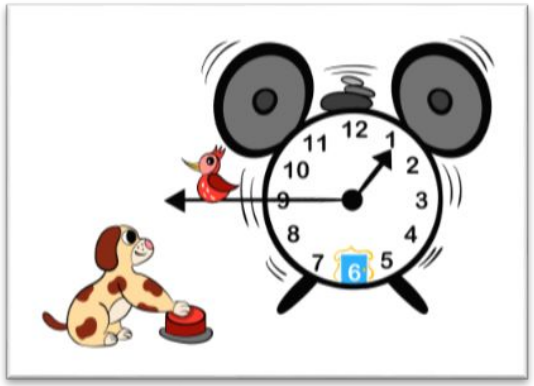
Fighting Words Process

- Characters
- Shared writing
- Independent/ Group work





FIGHTING WORDS
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Maths Madness: Our Fighting Words Project

“On a cold and dusty morning, Mr Minute was in his workshop building an analogue clock. His house was on a big hill. There in the corner were a lot of broken clocks. Mrs Minute walked in with a tray full of cookies in the shape of clocks. He said he didn’t want any so she pulled out a digital clock set at the time of one minute past twelve. Mr Minute the wizard shrieked because he has an immense fear of digital clocks, especially after 12pm. Mr Minute loved school as a child, but hates digital clocks because when he was in school he was walking home, and some older boys threw digital clocks at him…”

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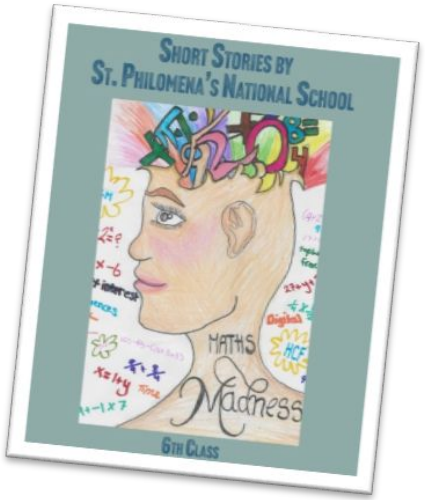

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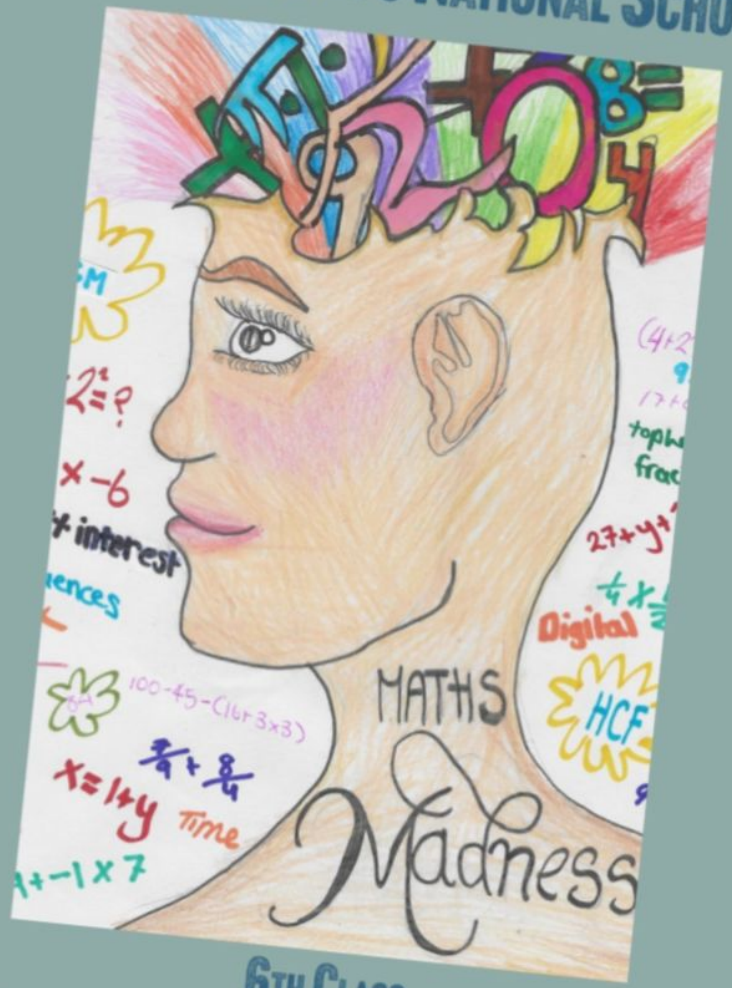
Short Stories by St. Philomena's National School



6th Class

Maths Madness: Our Fighting Words Project

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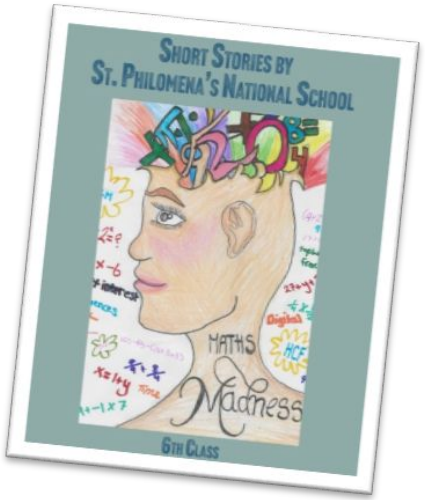

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Thank you.

Contact details:
grainne.higgins@ncca.ie; nora@fightingwords.ie; lorraine.harbison@dcu.ie