

Creating Rich Learning Environments

An effective mathematics rich learning environment is a space where children's mathematical learning and understanding are enhanced by making mathematics visible, by providing the tools to be successful and by creating a culture of Maths Talk, taking risks and learning from mistakes. The environment should support children in developing mathematical thinking and processes as outlined in the four Elements of the Primary Mathematics Curriculum – **Understanding and Connecting; Communicating; Reasoning; Applying and Problem Solving.**

Physical Environment

When considering the physical environment, it is important to consider the school building (indoors and outdoors), the school grounds and the surrounding area. Within the school building, the physical environment includes the hallways, the classroom set up (seating, displays, storage, etc.) and the tools and resources used for mathematics.



Consider:

- What are the opportunities for mathematical engagement in each area of the environment?
- What can be added to the environment to enhance its mathematical potential?
- What can the teacher do to develop mathematics in the environment?

Literacy and numeracy resources – Lots of books and displays are provided which show pictures, numbers and words (some in the home languages of the children for whom neither English nor Irish is a first language). There is a variety of mark-making and writing tools and different types of paper available for children to use. A range of mathematical tools are provided, for example calculators, measuring tapes, rulers, height charts, weighing scales, and phones. (NCCA, 2009: p. 57)

Displays

Displays that are **current** and **relevant** to children's present learning needs and **celebrate their mathematical achievements** are most effective. They should give the message that **mathematics is important in the classroom**. Here are suggestions for effective use of displays:

- Display numerals and mathematical symbols around the room, both printed and handwritten by teachers and children
- Create a mathematics word wall to provide the vocabulary children need for their current mathematical activities
- Display children's work in mathematics to celebrate their learning and encourage productive dispositions to mathematics
- Display posters of a wide range of representations of mathematical concepts, both adult and child-made, to support current strands
- Display a *Problem of the Week*, accessible at different levels, as part of the maths display area. Problems that are meaningful and relevant to the children's everyday lives and developed in collaboration with children are most useful
- Display photos of numerals and mathematics in everyday life (Maths Eyes)
- Use a mathematics investigation table/shelf to encourage children to investigate mathematical concepts through questions and interactive resources
- Display children's books with mathematical concepts on the mathematics investigation table/shelf
- Use and encourage children to use the posters, word wall, number lines, 100 charts, calendars, clocks that are displayed around the room to support learning and remind children of prior learning, and as effective tools for mathematics
- Displays should be updated regularly to support the mathematics curriculum strands

Resources and Storage

A wide range of natural, commercial and everyday mathematics resources are available. The resources are stored, organised and labelled with easy access for children to choose when they need them. Mathematical resources are available throughout the classroom as well as on the maths shelf.

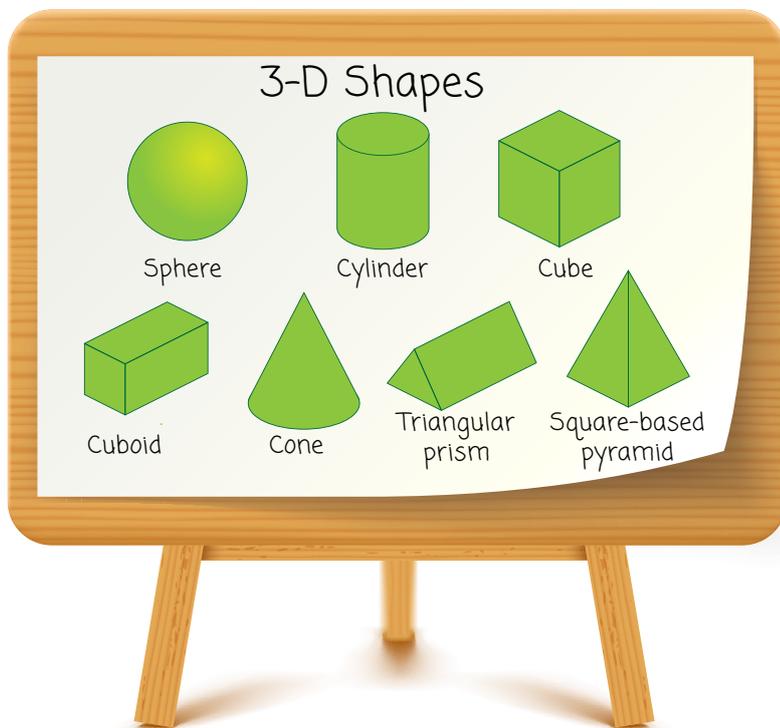
Work Space

It might be useful to introduce flexibility in terms of where children work and how seating is organised.

Children are free to choose where to work. Clipboards are available for working on floor or outdoors. Seating is flexible to allow for group and pair work. Tables are free of clutter to allow for work with materials and recording on whiteboards or paper.

"The learning environment should be flexible in terms of recognising and catering for multiple forms of expression and multiple means of engagement."

(NCCA, 2022)



Mathematical Play

Mathematical play and playful learning should be a feature of all learning environments. Consider the opportunities for children to develop mathematics through play and through games, quizzes and activities with peers. Teachers can create a play environment (indoor and outdoor) rich in mathematical experiences and tools, making sure to display mathematics used in real life situations, e.g. clocks, calendars, charts with recipes, signs with the number of children allowed in an area (decided with children), measuring tapes, calculators, etc.

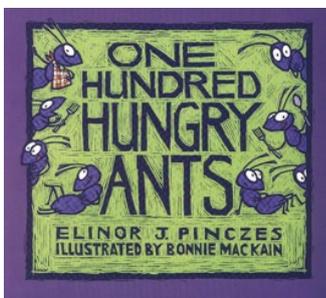
Maths games, both commercial and school made, should be available to play during maths lessons and at lunch times. Children can also be encouraged to develop their own maths games and quizzes. For example, have a group of children create a table quiz for the rest of the class at the end of each strand.

Providing opportunities for children to explore and play with mathematics materials and on-line resources allows them to discover their possibilities, for e.g., pattern blocks, tangrams, 2D shapes, 3D shapes, compass, etc.

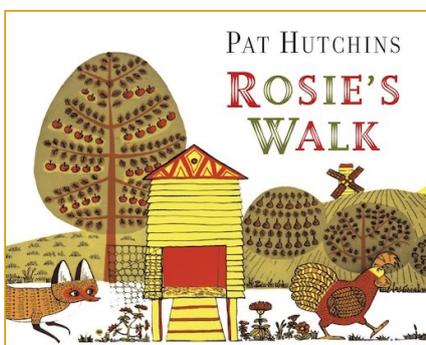
Play is an integrated learning experience that allows children to engage with maths play at the same time as learning about many other things. Providing everyday resources such as weighing scales, etc. for e.g. socio-dramatic play is a way of building opportunities for maths to be incorporated naturally into different types of play. When teachers use these same maths materials for direct teaching, children are more likely to engage with them in later play experiences and this helps link the two contexts for children.

Using children's literature in the maths class

Children's literature, both fact and fiction, are useful to provide a context for mathematical problem solving, to develop mathematical language and as a prompt for mathematical discussion in all classes. While there are many books written to teach mathematical concepts, other books have mathematical ideas embedded in them. Consider what books in your classroom you can use to develop mathematical concepts. It is important that the books also have an interesting story to grasp the children's interest. Using children's books also helps facilitate integrated learning with other curriculum subjects.



100 Hungry Ants by Elinor J. Pinczes is a children's picture book about 100 hungry ants moving towards a picnic to get some food before it is all eaten. Various formations are considered to help get the ants there quicker, dealing with the factors of 100. After reading the first few pages, children could be asked to consider all the possible formations and which one would be the quickest. Children can represent the formations using unifix cubes, counters or by drawing them in their copies. Different quantities of ants could also be considered.



Rosie's Walk by Pat Hutchins is a children's picture book that follows a red hen through a farmyard unaware that she is being followed by a fox. The story uses the language of spatial awareness to describe her journey. Using a map of the farmyard, children can recreate the journey using a toy hen encouraging mathematical language development and sequencing and integrating with mapping in Geography.

Follow the links for more examples of using children's literature in maths class:

<https://marilynburnsmath.com/using-childrens-literature-to-teach-math/>

<https://www.mathsthroughstories.org>

Cultural Environment

The cultural environment is the culture around mathematics and its importance that you promote in your classroom and will include the messages that the school environment provides about Mathematics. The cultural environment should encourage the development of productive dispositions for mathematics by creating a safe environment for children to be agents in their own learning, take risks and learn from mistakes and engage in Maths Talk. Of course, these productive dispositions should be encouraged all day long, in all areas of the curriculum.

An open, respectful and collaborative classroom culture and learning environment are essential to supporting children to think about their own learning and that of others. Children working in pairs or small groups may be necessary to facilitate group reflection and feedback sharing.

(NCCA, 2022)

Encourage children to take risks and learn from mistakes

In order for children to take risks and learn from their mistakes, they need to feel that the classroom is a safe place. To encourage this, teachers could use the following strategies:

- Establish rules with the children about maths discussions, commenting on each other's work and giving feedback.
- Use conferencing, as in writing workshop, to talk to the child about his/her work. Avoid a focus on the answer and instead focus on the procedures used. Provide positive affirmation of the children's efforts and encourage the child to self-assess and self-correct.
- Discourage the use of erasers. Children's mistakes offer a glimpse into their misunderstandings and provide a starting point for discussion with the child thus encouraging children to see mistakes as an opportunity for learning.
- Use Maths Journals for children to reflect on their own or group's learning and to set goals. Develop rubrics with the children so they know what is expected of them. Encourage children to self and peer-assess, but first this needs to be modelled for them.

"Recognising mistakes, self-correcting, checking, and justifying decisions are some of the behaviours that educators can encourage and develop in order to support children towards realising their capabilities in respect of self-monitoring. These behaviours are closely related to the development of adaptive reasoning."

(Dooley et al. 2014: p. 31)

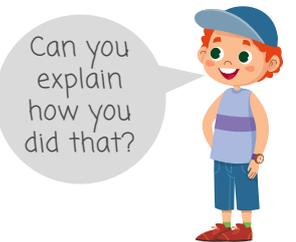
Create a rubric for what good problem solving looks like with children

	1	2	3	4
Understand the problem				
Identify the relevant information				
Identify a strategy to use to solve the problem				
Use a strategy to solve the problem				
Check does the answer make sense				

Mistakes, erroneous solutions and diverse approaches should be expected, welcomed and respected. (NCCA, 2022)

Promotion of Maths Talk

Consider whether your classroom is an effective mathematics rich learning environment that promotes Maths Talk?



Ask yourself the following questions:	Sometimes	Always	Never
Do I have the expectation that children can learn correct mathematical language?			
Do I model correct mathematical language?			
Do I encourage children to use correct mathematical language?			
Do I use questions to prompt rich mathematical discussion?			
Do I think out loud about my mathematical ideas?			
Do I allow time for children to reflect on their learning?			
Do I provide opportunities for children to discuss their thinking and justify their answers?			
Do I encourage large group, small group and pair discussion of mathematical ideas?			
Do I read books with mathematical ideas embedded in the story which provide context for using mathematical language?			
Do I have the expectation that children will listen to each other and try to understand the explanations?			
Do I have a focus on children explaining the strategies used, rather than on the right answer?			
Do I encourage children to say why they agree or disagree with other child's explanation or ask questions to help them understand?			

A culture of Maths Talk and an emphasis on mathematical modeling and productive disposition, lend strongly to positive engagement with cognitively challenging tasks.

(NCCA, 2022)

Maths Talk equips children with tools to make their thinking visible.

(NCCA, 2022)

Resources

For examples of more questions to promote mathematical discussion:

https://education.wm.edu/centers/sli/events/math-day/question-stems_crisher.pdf

See how one teacher promotes discussion about mathematical concepts:

<https://www.teachingchannel.org/video/common-core-teaching-division> (link to video of 4th grade discussion)

10 Big Math Ideas by Marilyn Burns

<https://pdst.ie/sites/default/files/10%20Big%20Maths%20Ideas%20Burns.pdf>

Transforming the Culture of Math: Developing Students as Powerful Mathematical Thinkers

https://www.nctm.org/Publications/TCM-blog/Blog/Transforming-the-Culture-of-Math_-Developing-Students-as-Powerful-Mathematical-Thinkers/

References

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