

Self regulated mathematical learners: counting the steps to school

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Counting the steps

- Introduce executive functioning skills
- Australian Curriculum for Mathematics in the foundation year
- Link executive functioning to the proficiency strands
- Highlight some experiences in ECEC where children draw on Maths and EF
- Make links between the research in executive functioning and mathematical achievement
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Why use an executive functioning lens?

Using the lens of executive functioning allows us

- Notice where children are having challenges
- Use a problem solving approach to find new ways to support these children
- To provide learning experiences that align with children's brain function
- This is evidence informed practice



(Raver & Blair, 2016).



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Elements of executive functioning

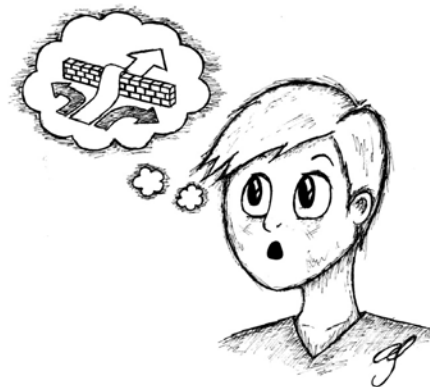
Working
memory



Inhibitory
control



Flexible
thinking



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Number & Place Value



https://www.youtube.com/watch?v=59Ad_jqhD68






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Representing Number

Working memory 	Inhibitory control 	Flexible thinking 
<ul style="list-style-type: none">• Recall numeral• Recall rote sequence• Recall touch counting• Recall process for representing with objects	<ul style="list-style-type: none">• Focus on task• Resist playing with cubes• Wait for their turn	<ul style="list-style-type: none">• Switch between different representations of number



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Australian Curriculum Foundation Year

Content for Foundation - Learning area content descriptions

Mathematics					
Proficiency Strands	Understanding Involves connecting names, numerals and quantities.	Fluency Includes readily counting numbers in sequences, continuing patterns, and comparing the lengths of objects	Problem Solving Includes using materials to model authentic problems, sorting objects, using familiar counting sequences to solve unfamiliar problems, and discussing the reasonableness of the answer	Reasoning Includes explaining comparisons of quantities, creating patterns, and explaining processes for indirect comparison of length.	<i>The proficiency strands describe the actions in which students can engage when learning and using the content. While not all proficiency strands apply to every content description, they indicate the breadth of mathematical actions that teachers can emphasise.</i>
NUMBER AND ALGEBRA	Number and place value Establish understanding of the language and processes of counting by naming numbers in sequences, initially to and from 20, moving from any starting point (ACMNA001) Connect number names, numerals and quantities, including zero, initially up to 10 and then beyond (ACMNA002) Subitise small collections of objects (ACMNA003) Compare, order and make correspondences between collections, initially to 20, and explain reasoning (ACMNA289) Represent practical situations to model addition and sharing (ACMNA004)			Patterns and algebra Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings (ACMNA005)	
	Using units of measurement Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language (ACMMG006) Compare and order duration of events using everyday language of time (ACMMG007) Connect days of the week to familiar events and actions (ACMMG008)		Shape Sort, describe and name familiar two-dimensional shapes and three-dimensional objects in the environment (ACMMG009)		Location and transformation Describe position and movement (ACMMG010)
STATISTICS AND PROBABILITY	Data representation and interpretation Answer yes/no questions to collect information and make simple inferences (ACMSP011)				





Building a foundation for maths

There are many activities in ECEC settings that support the development of mathematical language that builds a foundation for content knowledge in:

- Number & algebra
- Measurement & geometry
- Statistics and probability
- However we are not aiming to 'push down' foundation year content into ECEC
- Our goal is to build children's capacity to engage with the proficiency stands by building executive functioning skills



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Linking proficiency strands and executive functioning skills

		Working memory	Inhibitory control	Flexible thinking
understanding	includes connecting names, numerals and quantities	X	X	X
fluency	counting numbers in sequences, continuing patterns and comparing the lengths of objects	X	X	X
problem-solving	model authentic problems, sorting objects, using familiar counting sequences to solve unfamiliar problems and discussing the reasonableness of the answer	X	X	X
reasoning	explaining comparisons of quantities, creating patterns and explaining processes for indirect comparison of length.	X	X	X



Design



- When children design they create rules for themselves about how they will construct their design
- These rules can often be interpreted from a mathematical perspective:
 - Spatial language & relationships
 - Quantity
 - Mathematical relationships (e.g, patterning, symmetry, 1-1 correspondence)



Design



Owen demonstrates an awareness of these mathematical concepts:

- 1-1 correspondence
- Enclosing space
- Seriating size
- Quantifying



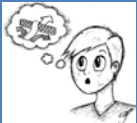


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Design work and executive functioning

Working memory 	Inhibitory control 	Flexible thinking 
<ul style="list-style-type: none">• Recall their own rules• Recall counting process:<ul style="list-style-type: none">• Rote• 1-1 correspondence• Representing quantity with numerals	<ul style="list-style-type: none">• Stay focussed• Apply their own rules• Accomplish their goal	<ul style="list-style-type: none">• Switch between different attributes of the objects e.g. Cylindrical and wooden• Problem solving to follow their own rules e.g. What do they do when they run out of a set that they need?• Experience sets of objects as both design objects and objects to be counted





Outdoors: Loose parts

What mathematical concepts or language could be introduced or discussed with these children?






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Loose parts and executive functioning

Working memory 	Inhibitory control 	Flexible thinking 
<ul style="list-style-type: none">•Recall concept•Recall safety practices	<ul style="list-style-type: none">•Staying focussed•Limiting attributes•Sharing resources/turn taking	<ul style="list-style-type: none">•Problem solving- design•Transferring ideas•Viewing objects in different ways•Representing ideas in a variety of ways





Executive functioning/self regulation linked to school success

- Assessments of executive functioning during preschool years consistently predict academic achievement & social maturity throughout school years
- Children who display age appropriate self regulation skills tend to
 - perform better in school
 - display fewer behavioural problems
 - more socially competent
- Difficulties with self regulation are stable and indicative of future social and academic problems in elementary school and adolescence (Lengua 2003, cited in Winsler, Ducenne & Korry, 2011)



(Berk & Meyers, 2013; Winsler, Ducenne & Korry, 2011).



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***It takes more than counting the steps from ECEC
services to school
to foster self-regulated mathematical learners!***

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