Australian Education Research Organisation

Early numeracy

Promote children's early numeracy skills

Early Years Learning Framework | All outcomes

This guide is one in AERO's Tried and Tested series on evidence-informed teaching practices in early childhood education and care settings that make a difference. Educators and teachers can use these guides to reflect on their practice and inform their planning for future instruction.

For this guide, AERO has synthesised the most rigorous and relevant evidence-based practices from meta-analyses, systematic reviews and literature reviews. AERO has rated these sources of information against its Standards of evidence, focusing on evidence generated in an Australian context where possible.

The Early Years Learning Framework (EYLF) describes **numeracy** as the capacity, confidence and disposition to use mathematics in daily life. Mathematics involves understanding about numbers and quantity, operations, patterns, space, measurement and shapes. Numeracy is the application of these mathematical concepts, with skills developing along trajectories from birth. As children's mathematical capabilities grow, they are increasingly communicated and applied to solve real-world 'problems' and build numeracy skills. In the context of early childhood education and care, these problems may include how many cups we need so that every learner has a cup for their water, who has built the tallest tower, or how to make and extend a pattern made with musical instruments.

The EYLF encourages early childhood educators and teachers to support learners' positive dispositions, knowledge and skills in early numeracy. Learning to apply mathematical ways of thinking helps children to understand, explore and contribute to their world, and become effective communicators and confident and involved learners. As learners build confidence in numeracy, their self-confidence and sense of identity develops, and wellbeing increases.

Evidence-based practices for supporting learners' early numeracy development in early childhood education and care settings are listed below. Some examples offered may not apply in all contexts and/or may be more suitable for particular learners or age groups.

1. **Embed mathematical skills and numeracy across all aspects of your program.** This means making the most of moments throughout the day to support learners' skills and interest in numeracy.
   - Find opportunities to use and reinforce maths vocabulary, including quantitative terms such as 'more than', 'fewer', 'less' and spatial terms such as 'first', 'below', 'higher up'. Stories can provide an opportunity to incorporate maths talk into the day (for example, 'is the rabbit in front of or behind the tree?', 'how many pigs are there?')[1,2].
   - Experiment with opportunities to support learners' numeracy skills during everyday routines[3]. Sorting and counting foods, solving puzzles that involve a sequence of steps, or searching for and creating patterns in nature are all opportunities to lay the foundations for numeracy.
   - Notice learners' use of numeracy in their play and use this as an opportunity to explore and talk to children about maths and extend their learning[4]. For example, if learners are comparing sizes of objects, provide instruments they can use to measure. Joining in learners' imaginative play can be a wonderful opportunity to explore mathematical ideas and practice problem solving, as you pose complex questions to stretch learners' thinking.

- Provide objects and materials that set the stage for numeracy learning, for example blocks, puzzles, mud kitchens and loose parts that can be used for sorting and classifying[5]. Notice when learners play with these materials and use this as an opportunity to extend their learning.

2. **Balance child-initiated activities with teacher-led early numeracy instruction.** Plan play-based activities that allow you to extend on children's learning, either in groups or in individual interactions with children.
   - Plan teacher-led activities where numeracy is the goal and which focus on a specific maths skill or set of related skills (such as, comparing, ordering and estimating)[6]. For example, putting blocks in muffin tins or sharing blocks between dolls helps children to learn skills of matching and comparing. Make activities fun and playful to help develop positive dispositions towards numeracy from a young age.
   - Help to bring maths ideas to life through use of physical play and objects[7]. Create patterns through movements or dance, challenge children to follow simple maps on a treasure hunt or make shapes with blocks[8]. Make the link between the objects or physical activity and the maths idea they are learning.
   - Dedicate time each week for purposeful numeracy experiences[9]. For example, in small groups engage learners in a new numeracy experience lasting 20-30 minutes and repeat it at least twice a week, introducing a new numeracy experience each week. This could include reading books with mathematical concepts, exploring patterning or focussing on shapes in art making.

3. **Be a learner yourself.** Build your understanding of early numeracy development and how to support children's learning.
   - Understand how children develop early maths skills, including the typical developmental trajectories of these skills from infancy through to school (for example, the typical stages in learning to count) to help you scaffold learners' numeracy development effectively[10,11].
   - Know how to assess what learners currently know and what they do not know about a particular maths concept[12]. This can be done through observation and formative assessment, asking learners to explain or posing open-ended questions ('how did you know that?'), and working with learners to problem solve.
   - Learn effective techniques to extend learners' current level of understanding and help them learn the skills and ideas needed to achieve the next level of thinking on a particular maths concept[13]. For example, for learners who can name small sets of objects with ease 'there are three balls!', challenge their mathematical thinking by asking them to give you the right number of balls for each child in the group.
   - Engage in critical reflection with your team on your own knowledge and confidence as numeracy educators[14]. Some early childhood educators and teachers may have limited preparation or confidence in numeracy, so support each other to enjoy exploring numeracy in your day-to-day practice.

Joining in learners' imaginative play can be a wonderful opportunity to explore mathematical ideas and practice problem solving.

To provide feedback on this guide or view further information, including full references and additional resources, visit AERO's website.

1 Purpura et al., 2017.
2 Klibanoff et al., 2006
3 Ginsberg et al., 2008
4 Ginsburg et al., 2008.
5 Ginsburg et al., 2008.
6 Clements and Sarama, 2011.
7 Laski et al., 2015.
8 Clements and Sarama, 2011.
9 Wang et al., 2016.
10 Clements and Sarama, 2011.
11 MacDonald and Murphy, 2019.
12 Doig et al., 2003.
13 Doig et al., 2003.
14 Linder and Simpson, 2018.