Language is the core for the concept of addition

Rosemary Irons

Rosemary is a consultant and curriculum developer for mathematics education specialising in early childhood. She has advised teachers on mathematics curricula in the United States, Singapore and Australia. Rosemary was a Senior Lecturer in Mathematics Education at the Queensland University of Technology for over 35 years and has written a wide range of innovative and practical classroom resources to help young children build their mathematical understanding. Rosemary conducts seminars for teachers and presents at mathematics education conferences around the world.

Young children have many opportunities to explore and investigate in early childhood environments. Children naturally solve problems that occur in their day-to-day lives. For example: moving (rotating) a puzzle piece to fit into position or stabilising a block structure to avoid the tower falling over. Mathematical concepts contribute to children's confidence to try out ideas, take risks and change procedures to solve problems. Every learning experience in mathematics supports each child's reasoning in thought processes. A variety of books, opportunities for play and a range of resources provide a rich mathematical environment.

As children progress to primary school, operating with numbers becomes a strategy for interpreting and solving story problems. When children encounter problems given verbally or with written stories, they must interpret the words. There are never mathematical symbols in the story problems. To be able to interpret a story situation to be solved with addition, children must have a very good understanding of the addition concept by having a picture of the idea in their minds and a knowledge of the words that represent addition in different contexts.

The Early Years Learning Framework (2009) guides educators to interact, support children's interests, plan and motivate for discovering literacy and numeracy. The Australian Curriculum: Mathematics (ACARA, 2010) states that addition and subtraction within the Number and Algebra Strand are concepts to be considered in Foundation and Year One. The ACARA document publicises the curriculum to teach but it does not state how to teach it.

The concept of addition is the first operation concept developed in Prep and Year One. Over years of experience working with young children, some suggestions for developing the concept of addition through a language approach are offered in this article. Conceptual ideas are developed through language to enable children to have a picture of the idea.

Theoretically, Irons and Irons (1989, 2003) have adapted the Payne and Rathmell (1976) teaching model to guide teachers in the development of any mathematical concept through a language approach. (Figure 1)

Language stages described

The language stages help educators with a sequence of activities to establish the idea of addition.

- Child's Language
  The language from the child's real world experiences - including both fiction and non-fiction. Stories, pictures and the children's experiences are the source for this language.

- Materials Language
  The language that comes from using concrete and pictorial materials. Children use new language as they explore the idea with concrete materials. Pictorial materials help expand the idea.
**Mathematical Language**
The specific words from mathematics that relate to the idea being developed. Mathematical words are verbalised and read that relate to the idea. By this stage, some children want to write the words and expressions.

**Symbols**
The mathematical number symbols that represent the idea. At first, these should be used to record the ideas. Later the focus can shift to developing strategies for finding "the answer".

Specific addition concept learning experiences for the whole group of children and small group activities are outlined here.

**Developing the Addition Concept**
The addition concept has two situations:
- Active stories which show the idea of combining then later reversing
- Static stories which show balance to support the part/part/total idea. Both are important for children to experience.

*Child’s Language – Active*
The story *Bears on Buses* presents the active idea of the addition concept. Read the story with your own natural interaction and questioning. Reread the story to stop and count how many bears are on the bus and how many will get on the bus. On another day, reread the story and ask children to determine how many bears are on the bus, how many are getting on the bus and how many altogether or in total.

*Materials Language*
With a small group of children, show each double page spread and have the children match the bear groups.
with the bear counters. Then encourage pushing one group to the other to support the action in the story.

**Mathematical Language**

The words cards **add** and **plus** are introduced. The children can read a number expression and make groups to show the addends and then determine the total.

Use cards as shown in the photos to read the addition language word and make the two groups to match the expression. Using snap-locked bags is another way that the children can work individually to read the addition word and make the groups. They can show their work to a friend before taking the counters out of the bag.

**Symbols**

Introduce the addition symbol + by verbally calling it ‘add’. It is suggested to model the word ‘add’ as it’s the verb for addition. Accept ‘plus’ from the children but modelling ‘add’ supports their reading skill because children like the double ‘d’ and find the word easy to read.

**Child’s Language – Static**

The story *Mice Mice, Everywhere* presents the Static idea of the addition concept. Read the story with your own natural interaction and questioning. Reread the story to stop and count how many mice are in each group according to the rhyme. On another day reread the story and count to determine the total of the mice on each double page spread.

**Materials Language**

With a small group of children, verbally state a number of mice for upstairs and another number for downstairs. Children place a matching number of mice using materials such as counters and then determine the total. Each child can then take turns to say how many mice are upstairs and downstairs so the others can act out the numbers by making the matching groups and then work together to determine the total.
Stories can be acted out with familiar resources. Children use various resources to make two groups and then talk about how many are in each group and how many altogether or in total.

Mathematical Language

Introduce the words ‘part’ ‘part’ ‘total’ verbally, and then word cards as shown in the photo with the gingerbread characters. This encourages seeing the two groups and discussing the total number of gingerbread characters. Felt boards serve as a resource to advance from concrete counters to pictorial work.

Use the word cards with other felt characters to show the two groups. Connect to children’s interests to allow many opportunities to see part/ part/ total with objects and pictures.

Symbols

Use symbol and expressions on pocket cards to reveal the addition symbol as the same for the active stories.

As children become confident and begin number fact activities, pictorial groups and the addition symbol are presented. Dice serve well to support the beginning of using the count on strategy. Practicing the number facts for the strategies of ‘add on 1’ and ‘add on 2’ is appropriate for Prep children to develop confidence with the addition concept.

Making sense

Language helps children make sense when they need to use mathematics. Having a clear picture of the useful mathematics concepts is a key aspect. Throughout the development of mathematical ideas, we must keep the language growing. As the language grows the picture of the idea broadens and the thinking expands. Addition is the first operation concept that children encounter. Using the language stages deepens the understanding of this fundamental mathematics concept. Enjoy using stories and familiar resources to create interesting addition learning experiences in your early childhood environment.

References
