

Connecting non-symbolic to symbolic representations



ECE resources

Connecting symbolic and non-symbolic representations refers to connecting set sizes to their symbolic representations (written numerals or number words). In early childhood, it might involve children in associating number words with the specific sets of visible objects they represent. This requires developing one-to-one correspondence, or the ability to assign individual count words to single objects in a set, as well as identifying the last number in their counting sequence as the set size (the cardinality principle). Children also need to learn to link the numeral symbols directly to their respective quantities. There are different skills involved in connecting non-symbolic to symbolic representations, including object counting, subitising, and numeral knowledge.

Object counting

This skill involves learning to apply particular counting principles to quantify sets of objects. These counting principles include understanding of:

- **One-to-one correspondence:** counting all objects in a set, giving each object one count word only
- **Cardinality:** recognising the last number counted as the set size and associating a number word with the right number of objects
- **Order irrelevance:** understanding that objects can be counted in any order, not just left to right
- **Stable order:** saying numbers in the same order while counting

How to spot this skill being applied in free play

You might hear children:

- Applying count words to groups of objects and emphasising the last word in the sequence (for example, 'I have five blocks, 1, 2, 3, 4, 5'). Sometimes children emphasise the last number when counting and do not understand that this last number said is the number of the set.

You might notice children:

- Distributing objects one by one to a group, setting a table for a tea party with dolls, or lining up objects one by one in a row.
- Pointing to or touching all objects in a set (often but not always while counting out loud).

How to check for understanding

- Give children 15 objects and request various subsets of those objects (for example, ask for 5 of the 15 objects). Do this twice for each quantity.
- Show children groups of objects of different types and ask them to count how many are in each group. Note that if children count without re-emphasising the total set size, ask them to tell you how many are in the set. You might have to cover the objects with a cloth or a piece of paper after the child counts to prevent them from trying to count the objects again.

- Have children watch a puppet count objects in different ways that are correct and conventional, correct but unconventional, as well as incorrect (for example, counting objects right to left, counting objects 1, 2, 4, 5, or skipping some objects when counting). Have them tell you if the puppet made an error and why.

Guided activities to support object counting

- **Snakes and Ladders:** When playing the game, count the number of spaces moved, as well as the number of spaces from the beginning and to the end. Make sure to both label and count the objects, in that order ('you moved 3 spaces, 1, 2, 3').
- **Card and board games:** Count the marks on playing cards and the dots on die.
- **Number storybooks:** pick existing ones or make your own that clearly display numerals 1-10 in order with adjacent easily countable corresponding groups of objects (with minimal or no distracting pictures). Be sure to both label sets of objects in addition to counting them directly afterwards. Research shows that providing this contingent information helps children to connect the number word with its corresponding number of objects (cardinality). In general, research suggests talking to children about numbers in the presence of (and to describe) visible sets of objects helps children learn the concept of cardinality.

Subitising

Subitising is the skill of being able to automatically label the set size of a group of objects without counting, including small numbers and multiples of 5.

How to spot this skill being applied in free play

You might hear children:

- Labelling set sizes of objects without counting ('I have 5 bears').
- You might notice children:
- Giving the number of objects requested by a friend in one motion or grasp, without counting the items one by one.
- Recognising the number on a die by the pattern of dots rather than by counting the dots/

How to check for understanding

Show children different quantities of objects for a few seconds, hide them to prevent them from counting, and ask how many objects you are hiding.

Guided activities to support subitising

- **Playing games with dice:** play games such as [Parcheesi](#), which involve rolling the dice and asking children to quickly label the number of dots on the side facing up. Because the dots on dice are small, counting them is less feasible, but larger dice can be used.

Numeral knowledge

This skill involves associating written numerals with their names and corresponding sets of objects.

How to spot this skill being applied in free play

You might hear children:

- Talking about the numerals they are using in play and applying them to set of objects. For example, the child types the number 5 into the play cash register and then scans 5 pieces of pretend fruit or requests \$5 from a playmate.
- You might notice children:
- Responding to the use of numerals in play, for example, in response to seeing the number 5 on the toy register, the child provides 5 pieces of play money as payment.

Note that children may not necessarily correctly name the numerals or provide the exact number of objects for a given numeral they have seen, but they can still practise the concept of naming numerals and representing them in terms of groups of objects.

How to check for understanding

Create cards with dots and separate cards with printed numerals, then have children name each numeral and match them with the right set of dots. Cards for numerals and sets of dots can be presented for children to match all at once (numeral cards randomly arranged in one row and dot cards randomly arranged in the row below), or presented one numeral/dot set at a time with multiple dot sets/numerals from which to choose (as multiple choice problems). This could also be played as a memory matching game (see below).

Guided activities to support numeral knowledge

- **Board games that use dice, cards or spinners with numerals:** Label the numeral and help children move the correct number of spaces.
- **Concentration/Memory:** create pairs of playing cards, one with the written numerals and one with the corresponding number of dots to play [memory](#). Mix up the cards, arrange them face down in a grid-like pattern, and have children take turns flipping over two cards each turn to match the numerals with their set sizes. First play with the numerals/dots facing up to reduce memory demands.

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