



The Learning Institute

Early years: Building early number sense

Overview

It has long been understood that mathematical skills are important for successful adulthood (Parsons and Bynner, 2007) and research suggests that maths skills may be even more important than literacy skills (Parsons and Bynner, 2005). It has also been identified that the development of mathematical skills begins early in life (Gifford, 2018). Because of this, there is increasing recognition that Early years practitioners need to develop their understanding of how young children develop mathematical skills and how practitioners can support this development (Education Endowment Foundation, 2020).

Number sense is important because it is the foundation of later number skills such as addition and subtraction (Way, 2011). This training aims to increase practitioners understanding of some of the basic principles of how children develop early number sense. It begins to consider how a practitioner may respond to the skills in number that children bring to their activities and provides links to further resources so that practitioners can develop their understanding further.

Target audience

Anyone who works in the EYFS, e.g. Early Years Practitioners, Early Years Managers, Teaching Assistants in Nursery and Reception classes.

Duration

Approximately 1 – 1½ hours

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Introduction

Number sense is broadly recognised as the understanding that we have of numbers and how they relate to each other (Way, 2011). For example, if you were told that one person was given a bunch of 3 yellow roses and another was given a bunch of 12, you would almost certainly have a feel of how much bigger and brighter the second bunch would be. That is because we have number sense that helps us to have a sense of how much bigger 12 is than 3. This helps us to then understand how the change in quantity changes other features of a situation, for example, how much larger, heavier and more colourful the second bunch of roses would be.

Number sense is important because it underlies the way we relate to numbers and calculations throughout our lives. Number sense develops throughout our lives but begins soon after birth (Gifford, 2018). For example, before the age of six months, babies can tell the difference between sets of 1, 2 and 3 objects using a skill called subitising (Pound, 2005, p.7).

This training begins in Task 1 with a closer look at subitising and how it can help young children develop a more sophisticated sense of number. It then goes on to consider how number sense can be developed into successful counting in Task 2 while Task 3 ends with reflection on the learning from this CPD.

Objectives

- To understand the role of subitising in building number sense
- To introduce the five principles that underlie successful counting
- To begin to consider how subitising, counting and number sense can be supported in practice

Resources

Pen and paper for note taking

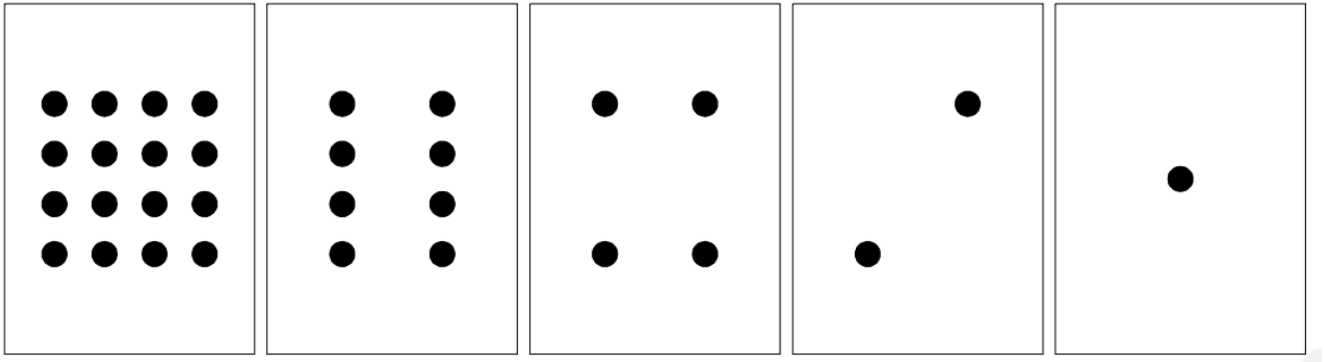
Internet access to following videos, available at:

- <https://www.youtube.com/watch?v=j0ceWNFCuUQ>
- <https://www.youtube.com/watch?v=nLslrNXxZW0>
- <https://www.youtube.com/watch?v=CCkS8atJ9dk>
- <https://www.youtube.com/watch?v=6bqCewhXSGI>
- <https://www.youtube.com/watch?v=USFP6atPi50>

Task 1

In this task we will consider the skill of subitising and how it can be developed to support young children's understanding of numbers.

Look at each of the images below but only for 1-2 seconds each. Without counting, think about the 'sense' of the number of dots that you get for each of the images.



Were there any images where you just 'knew' the number of dots without any need to count? If so, you just subitised!

Gifford (2018) defines subitising as our ability to 'recognise numbers of things without counting' and young babies can subitise up to 3 items before the age of 6 weeks, without being able to count or know a single number (Pound, 2005, p.7).

As an adult, we can often subitise higher than 3, especially if the items make a familiar pattern such as those seen on the faces of dice.

Watch the video (2:06) which explains how subitising is important for building number sense, which is available here: <https://www.youtube.com/watch?v=j0ceWNFCuUQ>

It is important also to remember that once children know the 'number sequence' of counting (see Task 2), there is little point in asking children to count small groups of objects, such as 3. If you repeatedly ask children to count sets of 1, 2 and 3, it may just teach them to distrust their own subitising skills and developing number sense. Instead, simply ask children who can already count if they have any idea of how many there may be of small amounts of objects. For example, if the snack table is set with 4 plates, ask children if they know how many plates there are. Then the child can choose if they need to count or if they can simply subitise. If they choose to subitise, you could occasionally ask them to count to check. If they were right, this will help the child to build confidence in their subitising skills whilst understanding the different purposes of subitising and counting.

Further ideas for developing subitising can be found here:
<https://www.youtube.com/watch?v=nLslrNXxZW0> (Video, 2:07)

Task 2

In this task, we will introduce counting as a means of building number sense. We will also consider the range of skills and understanding that children need in order to count successfully.

Counting is useful because it helps children to work with larger numbers as well as increasing their accuracy of understanding quantities. Both of these help them to develop and refine their number sense further. However, counting is not a single skill and cannot be learned without a lot of practice. You may have realised this by watching children who are learning to count. You may have seen them make a range of mistakes while they are developing all the skills that they need for successful counting. These mistakes can 'tune us in' to the skills that children already have and those that they are still mastering.

Think of all the mistakes that you have seen children make when learning to count and make a list. This video (0:19) may help to remind you of some of the more common mistakes:

<https://www.youtube.com/watch?v=CCkS8atJ9dk>.

Rochel Gelman and Randy Gallistel (1978) analysed the skills needed for counting and identified that 5 principles were needed in order to count successfully. These 5 principles are:

- **Stable order Principle:** The number names are always used to count in a constant order. We never count 7,3,9,8. We always count 1, 2, 3, 4, 5, etc.
- **One-to-one correspondence:** Each item is to be counted only once. For young children, this often means touching, pointing or nodding towards each object, or even moving the objects as they are counted. As we become experienced counters - and as we gain more control over our eye movements - we can begin to count by just looking.
- **Cardinal Principle:** The final number that is said indicates the number of items in the set. Children begin to realise that the answer to 'How many?' is the final number that they have said when counting aloud.
- **Abstraction Principle:** This is the understanding that we can count anything, no matter the differences between them in terms of type, size, position etc. For example, it may feel very different to count tiny seeds than to count blocks of flats, but both can be counted in exactly the same way.
- **Order-irrelevance Principle:** Whenever you count, you can begin with any of the items to be counted. As long as you only count each item once (one-to-one correspondence), you will always reach the same answer.

Consider each of these principles in turn and think about a child counting. What might the counting be like if the child were still trying to master that principle?

Does any of this bring to mind any of the scenarios that you thought about in our previous activity, above? If so, you may now understand what those children still have to learn.

Watch the 'Every Child Counts' video (13:16) for a further explanation of these principles:

<https://www.youtube.com/watch?v=6bqCewhXSGI>.

So how can practitioners support children to develop each of these 5 principles? Providing plenty of purposeful counting opportunities for adults and children to count together is fundamental for developing these skills. By doing this, adults can model using all 5 principles together.

If a child is having trouble in mastering one of the principles, sometimes it can help to explain what you are doing. For example, for a child who is having trouble in mastering the cardinal principle, it can help to count together and explain that the final number tells us the final number of items we have altogether. Emphasising the final number also helps.

You may also want to start collecting activities that emphasise one of these principles over the others. The grid below may help you, but there were also examples in the 'Every Child Counts' video that you may want to add. Once you have begun looking, you may find plenty of activities that help children to develop each of the different principles.

Principle	Explanation	Activity suggestions:
Stable order Principle	The number names are always used to count in a constant order.	Plenty of counting rhymes and songs to help children to learn the counting sequence.
One-to-one correspondence:	Each item is to be counted only once.	Plenty of opportunities for sharing things out 'one for you'. For example, handing out cups at snack time.
Cardinal Principle	The final number that is said indicates the number of items in the set.	Plenty of opportunities to find out 'how many', emphasising the final number when counting.
Abstraction Principle	This is the understanding that we can count anything, no matter the differences between them.	Plenty of opportunities to count different things. Do you always have small items out to count? Then make an outdoor maths corner with large boxes, tyres and planks.
Order-irrelevance Principle	Whenever you count, you can begin with any of the items to be counted.	When counting small groups of children, ask them, 'Where shall we start?' Count the group more than once, starting with a different child each time and reflect on whether we always get the same answer.

Once children are counting objects confidently, this video (2:21) provides ideas as to how you can extend their skills further: <https://www.youtube.com/watch?v=USFP6atPi50>.

Further ideas for mathematical activities can be found on the following websites:

- NRIC - <https://nrich.maths.org/13371>
- Erikson Institute Early Math Collaborative - <https://earlymath.erikson.edu/>

Task 3: Reflection on learning

Note down your responses to the following questions:

- What knowledge did I already have that has been refreshed by this CPD?
- How has this CPD developed my knowledge and understanding?

- How can I apply what I now know to my practice?
- Consider how you can record your goals/targets so that you will make use of them when you are able to return to the classroom.

Sources

Education Endowment Foundation (2020) *Improving Mathematics in the Early Years and Key Stage 1*. Available at: <https://educationendowmentfoundation.org.uk/index.php?/tools/guidance-reports/early-maths> (Accessed: April 2020).

Gelman, R. and Gallistel, C. R. (1978). *The child's understanding of number*. Cambridge, MA: Harvard University Press.

Gifford, S. (2018) *Subitising*. Available at <https://nrich.maths.org/14004> (Accessed: April 2020).

Parsons, S. and Bynner, J. (2005) *Does numeracy matter more?* Available at: https://dera.ioe.ac.uk/22317/1/doc_2979.pdf (Accessed: April 2020).

Parsons, S. and Bynner, J. (2007) *Illuminating disadvantage: Profiling the experiences of adults with Entry level literacy or numeracy over the lifecourse*. Available at: https://dera.ioe.ac.uk/21971/1/doc_3912.pdf (Accessed: April 2020).

Pound, L. (2005) *Supporting mathematical development in the early years*. Maidenhead: Open University Press.

Way, J. (2011) *Number Sense Series: Developing Early Number Sense*. Available at: <https://nrich.maths.org/2477>. (Accessed: April 2020).

Further reading

Gifford, S. (2015) *Early Years Mathematics: How to Create a Nation of Mathematics Lovers?* Available at: <https://nrich.maths.org/11441> (Accessed: April 2020).

Trundle, R. (2015) *The value of two*. Available at: <https://nrich.maths.org/11527> (Accessed: April 2020).

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