Trusting the count is the foundation of all other work with numbers: in particular, it refers to a learner's capacity to access flexible, mental models for the numbers 0–10 (Siemon, Beswick, Brady, Clark, Faragher & Warren, 2015).

Trusting the count

Why is 'trusting the count' an important notion?

Trusting the count is the foundation of all other work with numbers: in particular, it refers to a learner's capacity to access flexible, mental models for the numbers 0–10 (Siemon, Beswick, Brady, Clark, Faragher & Warren, 2015). The term *trusting the count* was originally proposed by Willis (2002) to refer to the fact that learners may not believe that they would arrive at the same amount if they counted the same collection twice. Di Siemon expanded the term to also refer to a learner's capacity to access flexible, mental models for the numbers 0–10 (Siemon et al, 2015). These mental models also help learners understand how numbers are put together and taken apart to support mental computation and problem-solving more generally. This early development of pattern and structure recognition also positively impacts on the development of algebraic thinking (Mulligan, Mitchelmore & Prescott, 2006).

This paper provides guidelines on the development of trusting the count and how leaders can support educators in fostering this capacity, both in themselves and in their learners.

Developing the ability to trust the count

Many learners are able to name numbers in sequence to 20 and beyond. They can usually recognise, read and write number words and numerals to 10. This alone is not evidence of a thorough understanding of number. Educators could check if learners 'guess' when asked 'how many' in a particular collection by probing further and questioning, '*How do you know? What do you see?*'. Learners may also be unable to say which of two single-digit numbers presented (orally or in writing) is the larger/smaller. Many learners may also experience difficulties in counting large collections (40 or more) accurately.

By the end of their first year in school, learners need a deep understanding of the numbers 0–10. This includes both what each number represents and how numbers might be viewed or reconfigured in relation to other numbers. In particular, learners need to have developed flexible mental models for each of the numbers, going beyond the recognition of number names and numerals to include rich part-part-whole knowledge with visual imagery. This supports *trusting the count* in the sense that when learners read, write or hear 'seven' they can imagine what seven objects look like and how 7 relates to other numbers: for example, part-part-whole knowledge for 7 is 1 more than 6; 1 less than 8; it's a 3 and a 4; it's a 5 and a 2; 3 less than 10.

A key indicator of the extent to which learners have developed mental models for the numbers 0–10 is the extent to which learners can instantly recognise collections of these numbers without counting them one by one, that is, they can *subitise*. The immediate intuitive recognition of numbers in small collections to 4 is referred to by Clements (1999) as perceptual *subitising*. With practice this can be built up to include collections of 5. Students ability to subitise to 5 should be established before moving on. The numbers 6–10 as collections can be recognised in terms of their subitised parts (for example, 8 may be seen as 5 and 3 more; double 4; or 2 more than 6). Clements referred to this secondary capacity as '*conceptual subitising*'. Both perceptual and conceptual subitising are fundamental to developing a sense of number and this supports the capacity of working with a composite unit or chunk which is needed for efficent mental strategies and place value. Be aware that older learners may not have developed these flexible mental models for the numbers to 10.

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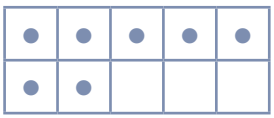
Accessing a mental model for a number usually then renders counting by ones unnecessary for that number (Freudenthal, 1991; Siemon, 2006). For example, a learner trusts the count for 8 when he or she can access knowledge and images of '*eightness*' and does not need to count a collection of 8 in order to determine what 3 more than 8 would be.

How can educators help learners to trust the count?

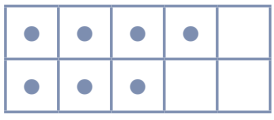
Learners can make sets of number cards for 0–10 to use as flashcards or for memory and matching games as appropriate. They can also use bead strings to talk about the numbers in terms of their component parts (part-part-whole knowledge).

***Five frames* and *ten frames* can be used to make different representations or as flashcards for the purposes of subitising. Educators start with numbers 1–5 and then introduce 0 as a number in its own right. The numbers 6–10 can be modelled by counting on from 5 (eg 6 is 1 more than 5) and by recognising 6 in terms of its subitisable parts (as 3 and 3; or 4 and 2 more). Show cards to students, relatively quickly, and ask, '*What do you see?*' and '*How do you know?*' Students need multiple experiences over a considerable period of time using a range of materials.**

Five frame



Ten frame (build on 5)



Ten frame (doubles)

In addition to the suggestion above, explicitly develop *comparative language related to quantities and collections* through structured, purposeful play using physical materials, pictures, books and the children themselves. Initially, this could include:

- *bigger than/smaller than/the same size as*: explore by comparing items in a collection of toys
- *more/less/same*: explore by comparing different size collections of counters or blocks
- *before/after*: explore ordinal relationships by placing toys and play equipment in a row and discussing which toy is 'before the ball' or 'after the truck' etc. This can lead to a discussion of which number comes before four and which number comes after seven.
- *nursery rhymes, number poems and counting books*: use with hands-on exploratory activities to alert children to numbers and how they are used.

How can leaders support their staff?

To promote the development of *trusting the count*, two approaches to teaching are needed. Firstly, educators need to help students *develop mental models* for each of the numbers to 10 and beyond (numeration). Secondly, students need to *participate in a range of social practices* that use and apply these numbers in a variety of contexts. Leaders can help educators build their pedagogical content knowledge around trusting the count by creating collaborative opportunities to explore and develop multiple representations for numbers 0–10 and beyond and also develop a wide range of learning contexts for their students. This pedagogical content knowledge is essential, as it enables educators to recognise and address learner difficulties with number and ensures that learners have the opportunity to develop a deep sense of number.

When observing lessons, look for learners who:

- can represent the numbers 0–10 and beyond in multiple ways and in a range of contexts
- can recognise collections of numbers without counting one by one
- use comparative language related to collections and quantities.

Leaders should consider how they work with their staff to incorporate the big ideas in number into common agreements around planning, teaching and assessment at their site.

Reflective questions for leaders to ask their teachers

When looking at and discussing the numeracy and mathematics program, you could, for example, ask the teacher:

- How many students in your classroom are able to trust the count? How do you know? How are you extending them?
- Have you used the trusting the count common misunderstanding tools (Siemon, 2009) or the intervention kit for assessment in number (DECS, 2008)?
- For those who seem to be struggling to trust the count, what steps are you taking to strengthen their learning?

- How are the learners in your classroom supported to connect mathematics learning to their lives? In particular:
  - When representing numbers, what connections are students able to make to their experiences beyond the classroom?
  - When interacting in a small group situation, are your students able to demonstrate they trust the count and confidently use comparative language?

Further resources

The big ideas in number are discussed in further detail in the following mathematics papers:

- 3.0 Conceptual understanding: Number and algebra
- 3.2 Place value
- 3.3 Multiplicative thinking
- 3.4 Partitioning
- 3.5 Proportional reasoning
- 3.6 Generalising.

All papers in this series are based on the work of Dianne Siemon, Professor of Mathematics Education at RMIT and a key text (Siemon et al, 2015).

http://bit.ly/BestAdviceSeries

Further reading

ACER PAT Teaching Resources Centre houses relevant concept builders, for example:

- addition of two small collections
- addition strategies
- comparing and ordering one-digit whole numbers.

Victorian Department of Education and Training, Mathematics Developmental Continuum F–10 This resource provides evidence-based indicators of progress, linked to powerful teaching strategies.

Victorian Department of Education and Training, Assessment for Common Misunderstandings These tools draw on highly focussed, research-based Probe Tasks and the Probe Task Manual (RMIT), as well as a number of additional tasks and resources which have been organised to address 'common misunderstandings'

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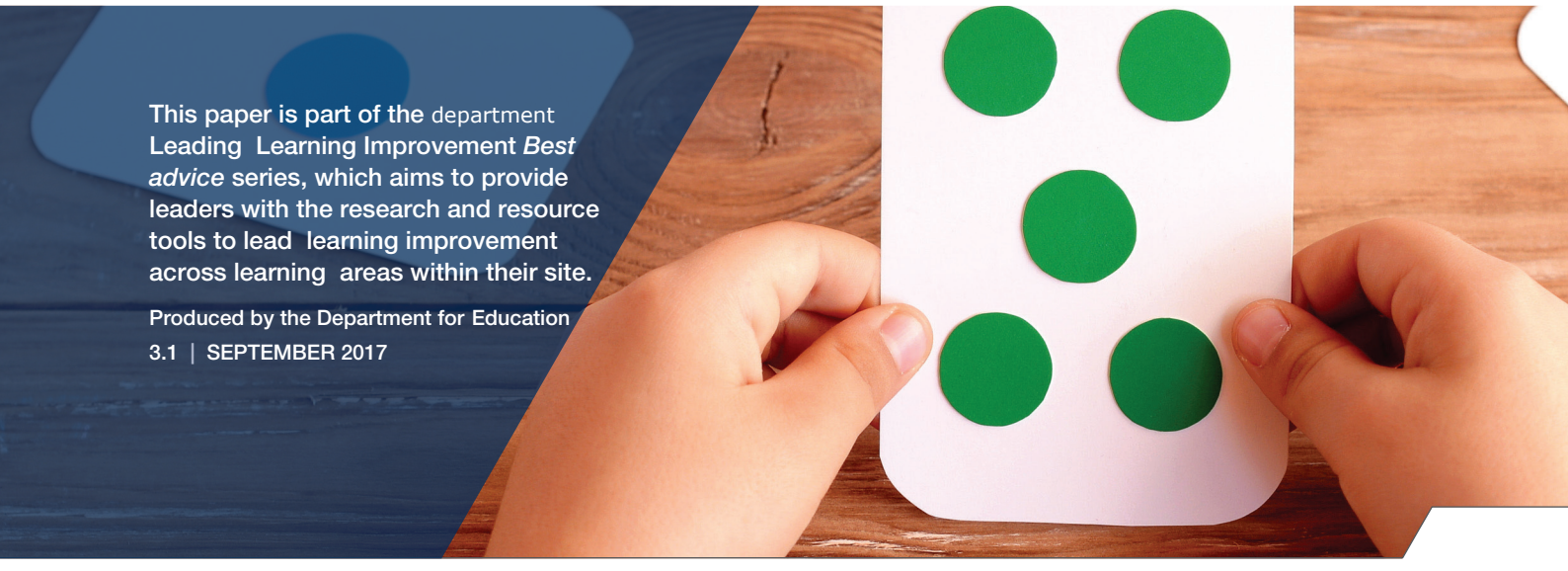

This paper is part of the department **Leading Learning Improvement *Best advice* series, which aims to provide leaders with the research and resource tools to lead learning improvement across learning areas within their site.**

Produced by the Department for Education
3.1 | SEPTEMBER 2017