

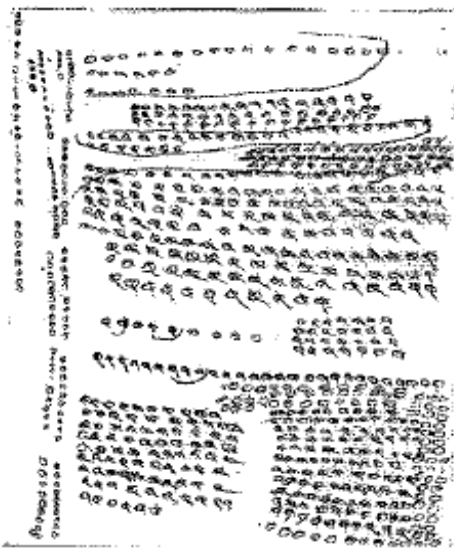
# TURNING THE CORNER ON COUNTING IN FOUNDATION PHASE NUMERACY

STELLENBOSCH UNIVERSITY, 13 JULY 2019

# Widespread evidence of counting-based approaches

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## Learning



Schollar, 2008



G3

214 + 12  
Hoadley, 2007

Ngwala karabo ye e nepagetšego ka lepokisaneng.

7.1  $10 + 10 + 10 =$  30 ✓

7.2  $10 - 2 - 2 =$  6 ✓

G2, Weitz & Venkat,  
2013

Need to transcend unit counting-based approaches

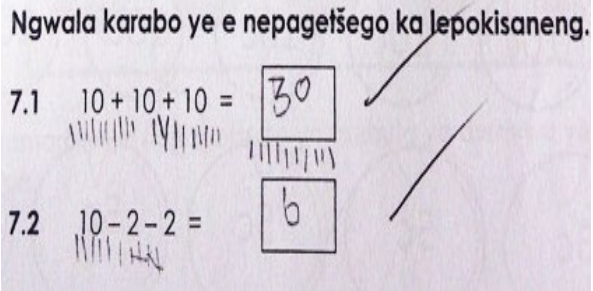
# Progression

## Calculation by counting

Ngwala karabo ye e nepagetšego ka lepokisaneng.

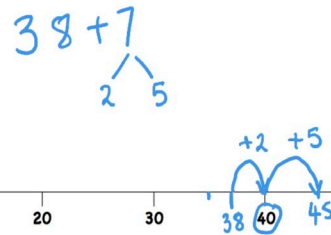
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7.2  $10 - 2 - 2 =$  6



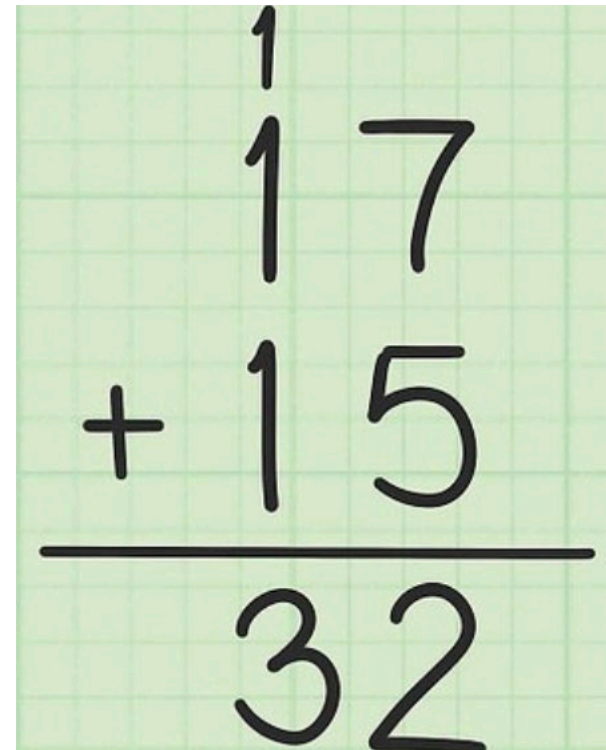
## Calculation by structuring

Adding by bridging through 10



$$99 + 99 = 100 - 2$$

## Formal calculating



A formal vertical addition on a green grid background. The numbers 117 and 15 are aligned to the right. A horizontal line is drawn below the 15. The result 32 is written below the line. A carry of 1 is written above the 117.

$$\begin{array}{r} 1 \\ 117 \\ + 15 \\ \hline 32 \end{array}$$

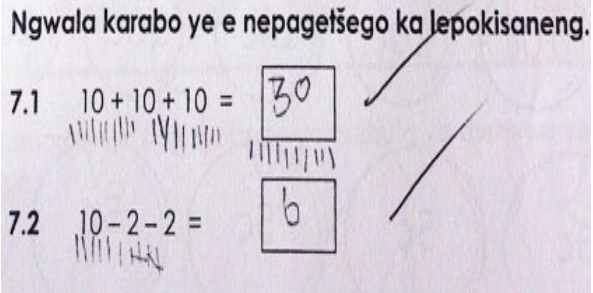
# Progression

## Calculation by counting

Ngwala karabo ye e nepagetšego ka lepokisaneng.

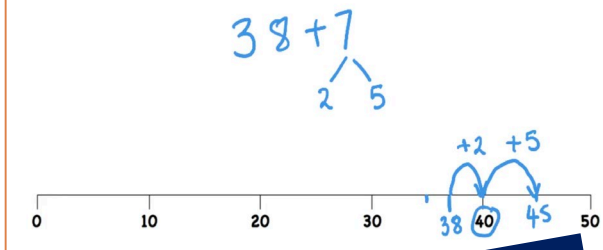
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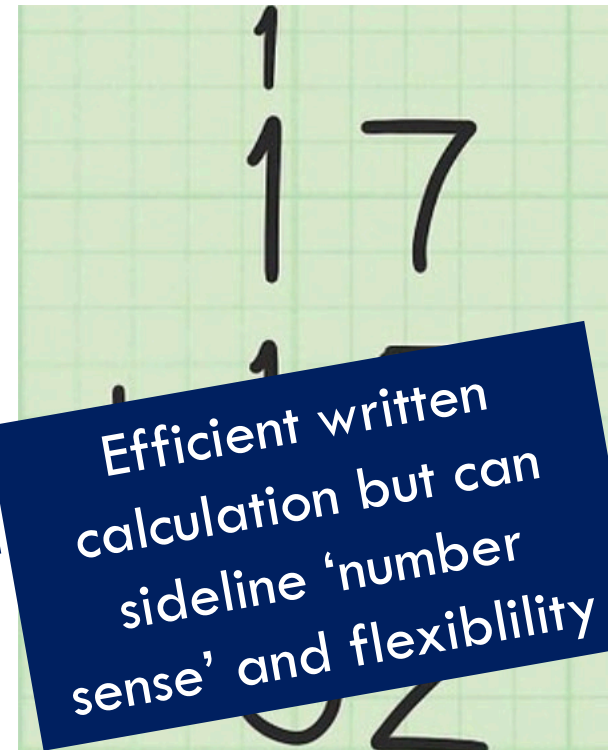
## Calculation by structuring

Adding by bridging through 10



Efficient mental calculation based on 'number sense'

## Formal calculating



The image shows a handwritten formal calculation on a grid background. The numbers 117 and 17 are written vertically, with the 17 shifted to the right. The result 134 is partially visible at the bottom.

Efficient written calculation but can sideline 'number sense' and flexibility

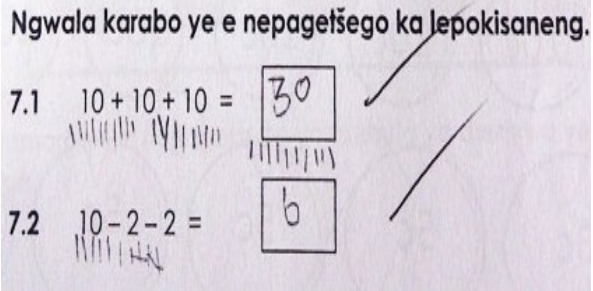
# Progression

Calculation by counting

Ngwala karabo ye e nepagetšego ka lepokisaneng.

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Calculation by structuring

Adding by bridging through 10

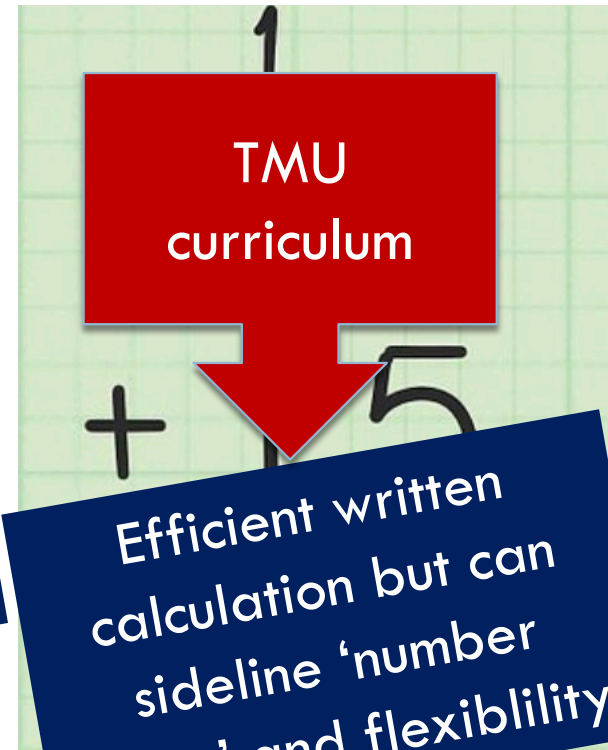


**CAPS,  
SNS project**

$99 + 99 = 198$

Efficient mental calculation based on 'number sense'

Formal calculating



**TMU  
curriculum**

Efficient written calculation but can sideline 'number sense' and flexibility

# Wits Maths Connect-Primary SNS project

- Design, implement, study pragmatic interventions for improving primary mathematics teaching and learning across 10 partner primary schools
- Phase 1 (2011-2015): ten primary schools: 5 no-fee 'township' schools, Home Languages used as medium of instruction in GR-3; 5 suburban schools, English medium of instruction from start.
- Phase 2 (2016-2020): 3 clusters
- 6 schools ongoing into second phase
- SNS Project: Attention to calculating by structuring in G R-3: Tasks, key representations, teacher support package

# SNS Materials: Focus on 'base ten structure': tasks, teacher notes

B. Write down the missing numbers A to G in this 100 square without counting all the squares.

					A				
				15					
				B					
C									
51					D				
	F								E
			G						100

A \_\_\_\_\_  
 B \_\_\_\_\_  
 C \_\_\_\_\_  
 D \_\_\_\_\_  
 E \_\_\_\_\_  
 F \_\_\_\_\_  
 G \_\_\_\_\_

## Task 4

Pg. 4

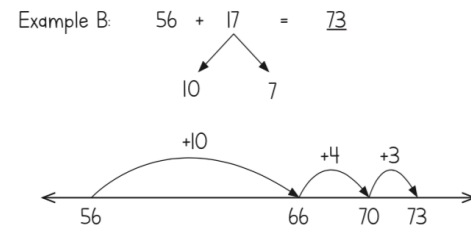
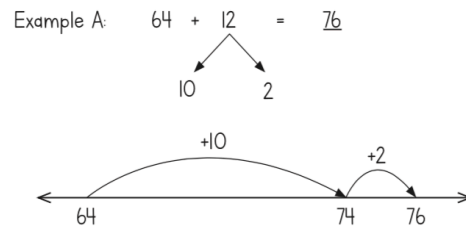
### Know 10 more/less and 1 more/less

- Count f/wd and b/wd on the 100 chart
  - Discuss how to count forward and backward in ones on 100 chart, e.g. Find 36 and count 2 more; find 88 and count 3 more; find 59 and count 2 less; find 72 and count 4 less.
  - Discuss how to count forward and backward in tens on the 100 chart, e.g. Find 65, add 10; 34 add 10, add another 10; 52 add 20; 152 add 20. Find 87, minus 10; 59 minus 10, minus another 10; 93 minus 20; 76 minus 30; 176 minus 30.
  - Close a few numbers on class 100 chart, learners identify screened numbers and say how they know, e.g. 'That is 35 because it is below/10 more than 25'.
- Give learners about 10min to complete Tasks A and B.

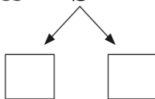
# Calculating using base ten structure & representations

## Task 32

Addition

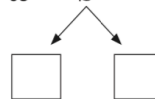


1)  $55 + 13 = \text{---}$



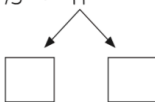
A tree diagram shows 13 splitting into two boxes.

6)  $68 + 15 = \text{---}$



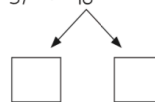
A tree diagram shows 15 splitting into two boxes.

2)  $73 + 14 = \text{---}$



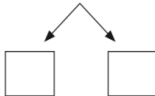
A tree diagram shows 14 splitting into two boxes.

7)  $57 + 18 = \text{---}$



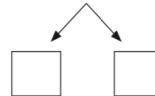
A tree diagram shows 18 splitting into two boxes.

3)  $46 + 13 = \text{---}$



A tree diagram shows 13 splitting into two boxes.

8)  $75 + 16 = \text{---}$



A tree diagram shows 16 splitting into two boxes.



# Grading the progression from counting to structuring

9

## Stages of early arithmetical learning

0 (Emergent count)

1 (Perceptual count)

2 (Figurative count)

3 (Initial number seq)

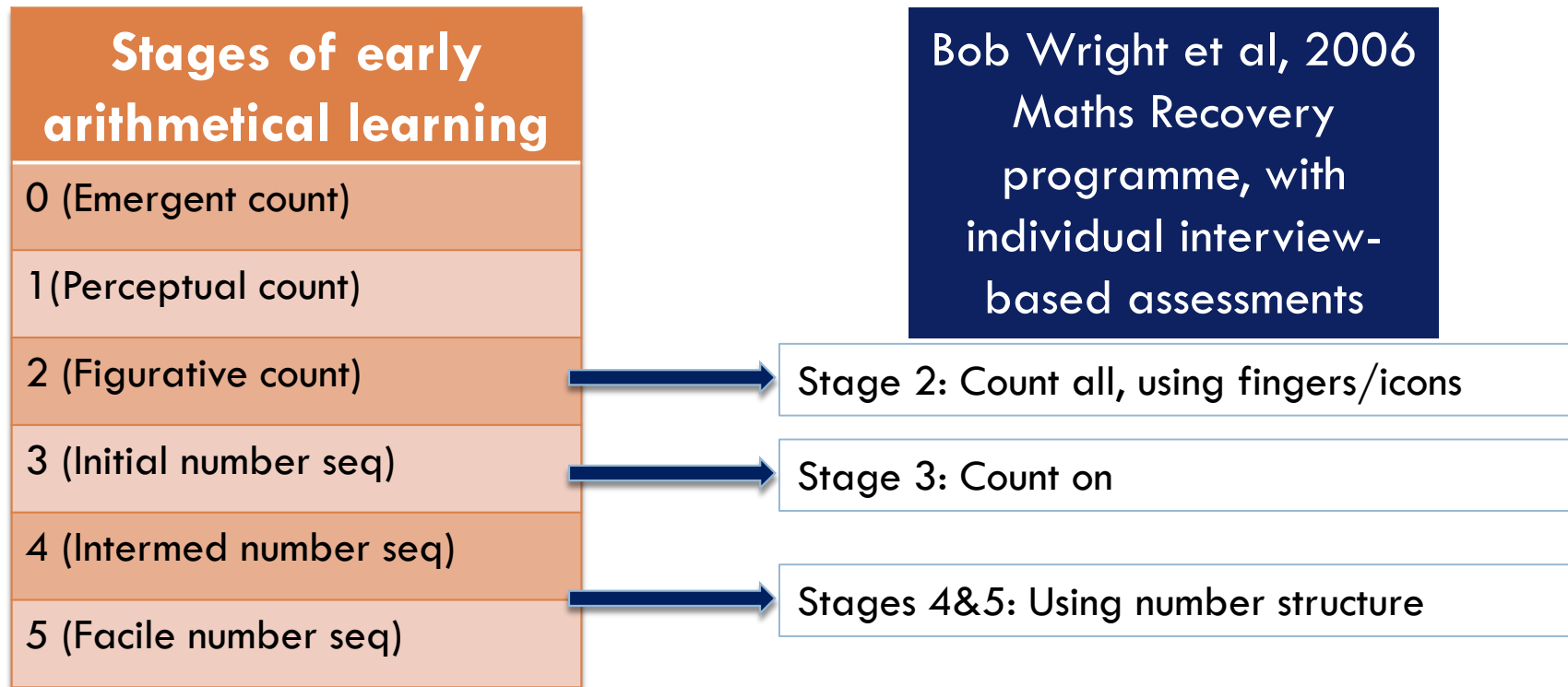
4 (Intermed number seq)

5 (Facile number seq)

Bob Wright et al, 2006  
Maths Recovery  
programme, with  
individual interview-  
based assessments

# Grading the progression from counting to structuring

10



# Development project methodology/ research project data sources

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Year and grade cohort worked with during intervention								
Phase 1 (2011-15)					Phase 2 (2016-date)			
2011	2012	2013	2014	2015	2016	2017	2018	
G2	G3	G1	G2	G3	No data collected	GR&1	G2	

6 learners/school, 2 low, 2 mid, 2 high-attaining across six schools

Early Grade 2: Two of Wright et al's assessments administered in individual interview

# Learning evidence, 2011

12

SEAL Stage	2011
0	4 (11.1%)
1	8 (22.2%)
2	15 (41.7%)
3	8 (22.2%)
4	1 (2.8%)
	0 (0%)

Count on or more sophisticated methods: 2011

**25%**

52%

methods: 2011  
sophisticated

Three quarters of early G2 learners at 'count-all' stage at best in early additive contexts

# Analysis of gains in 6 partner schools (2011-2018)

13

SEAL Stage	2011	2014	2018
0	4 (11.1%)	1 (2.8%)	1 (2.8%)
1	8 (22.2%)	4 (11.1%)	1 (2.8%)
2	15 (41.7%)	9 (25%)	10 (27.8%)
3	8 (22.2%)	20 (55.6%)	15 (41.7%)
4	1 (2.8%)	2 (5.6%)	7 (19.4%)
Count on or more sophisticated methods:	0 (0%)	0 (0%)	2 (5.6%)

Count on or more sophisticated methods: 2011

**25%**

52.0%

methods: 2011  
sophisticated

Count on or more sophisticated methods: 2014

**61.2%**

91.5%

methods: 2014  
sophisticated

Count on or more

Count on or more sophisticated methods: 2018

**66.7%**

99.1%

methods: 2018  
sophisticated

# Analysis of gains in 6 partner schools (2011-2018)

14

SEAL Stage	2011	2014	2018
0	4 (11.1%)	1 (2.8%)	1 (2.8%)
1	8 (22.2%)	4 (11.1%)	1 (2.8%)
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3	8 (22.2%)	20 (55.6%)	15 (41.7%)
4	1 (2.8%)	2 (5.6%)	7 (19.4%)
5	0 (0%)	0 (0%)	2 (5.6%)

Using number structure 2011  
**2.8%**

Using number structure 2014  
**5.6%**

Using number structure 2018  
**25%**

2.8%  
2011  
structure  
number

5.6%  
2014  
structure  
number

25%  
2018  
structure  
number

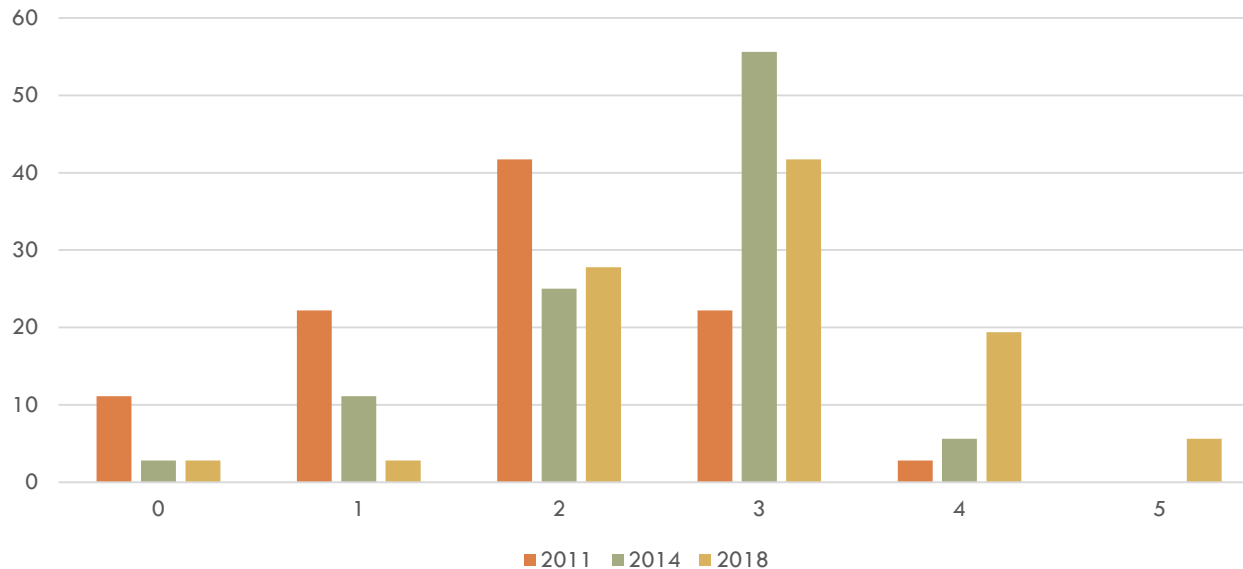
# Commentary

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Null hypothesis: The distribution of students across the counting vs reifying/structuring combined levels was independent of the year of assessment.

$\chi^2 (2, N = 108) = 14.75, p < .001$

SEAL Stages Profile across 2011, 2014 and 2018  
% of learners (n=36 in each year)



SNS project:  
supporting pedagogic  
attention to efficient  
working based in  
number structure

# Broader considerations

- Assessments available for studying impact on early number learning of other FP Maths interventions
- Understanding of different mathematical emphases in different interventions in addition to differences in intervention models

