African Population and
Health Research Center

Assessing learning

How can classroom-based teachers assess students' competencies in numeracy?

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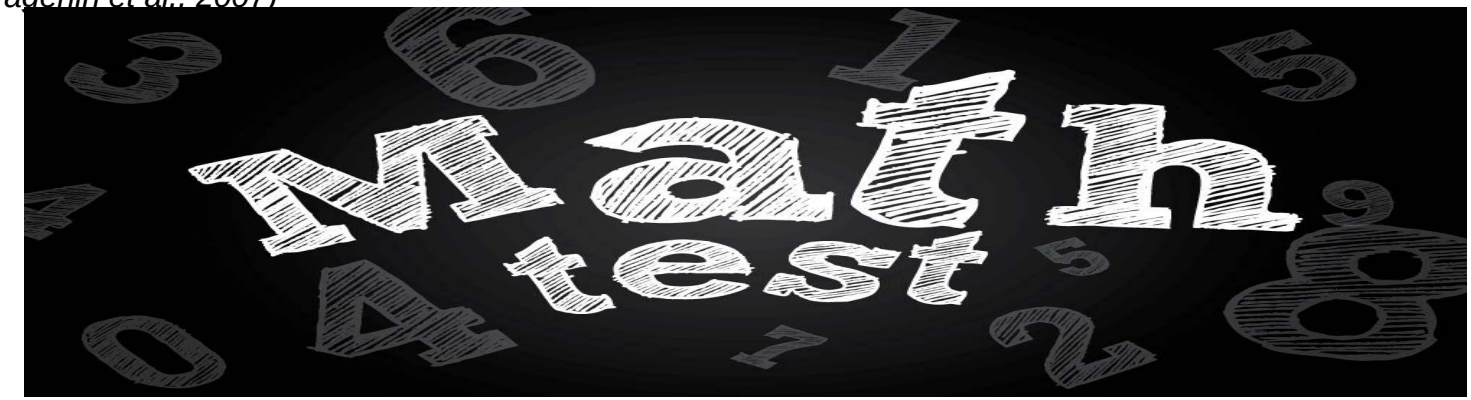
Presentation

- Why assess?
- The approach
- Results
- Conclusion and implications

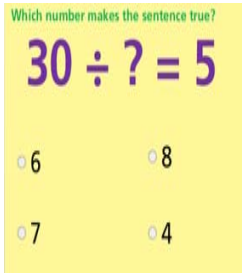
Why Assess?

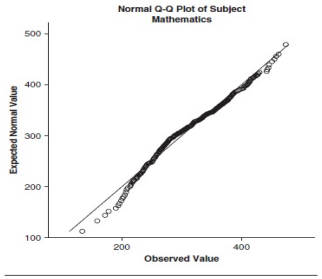
- Numeracy assessment research shows various ways to measure numeracy *(Reyna et al., 2009).*
  - Eg. some assessment tools use personal perceptions of a person's numerical abilities *(Fagerlin et al., 2007)*

- **But why assess**? Teachers assess their students with a view to track:
  - progress,
  - provide feedback,
  - assess student competency levels, and
  - evaluate the achievement of curriculum.



How do you fulfill the purposes of assessment





(1) A numeracy tool should reflect the math curriculum outcome areas

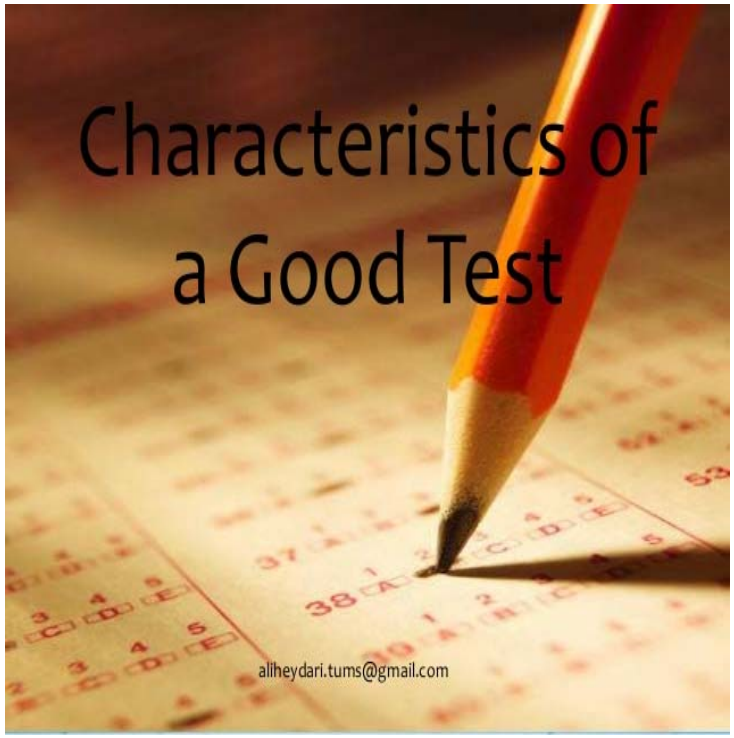
(2) Assess the range of student numeracy abilities

(3) However, the quality of a test is determined by it's psychometric properties, and not what the test items look like

The Approach ….. (1)

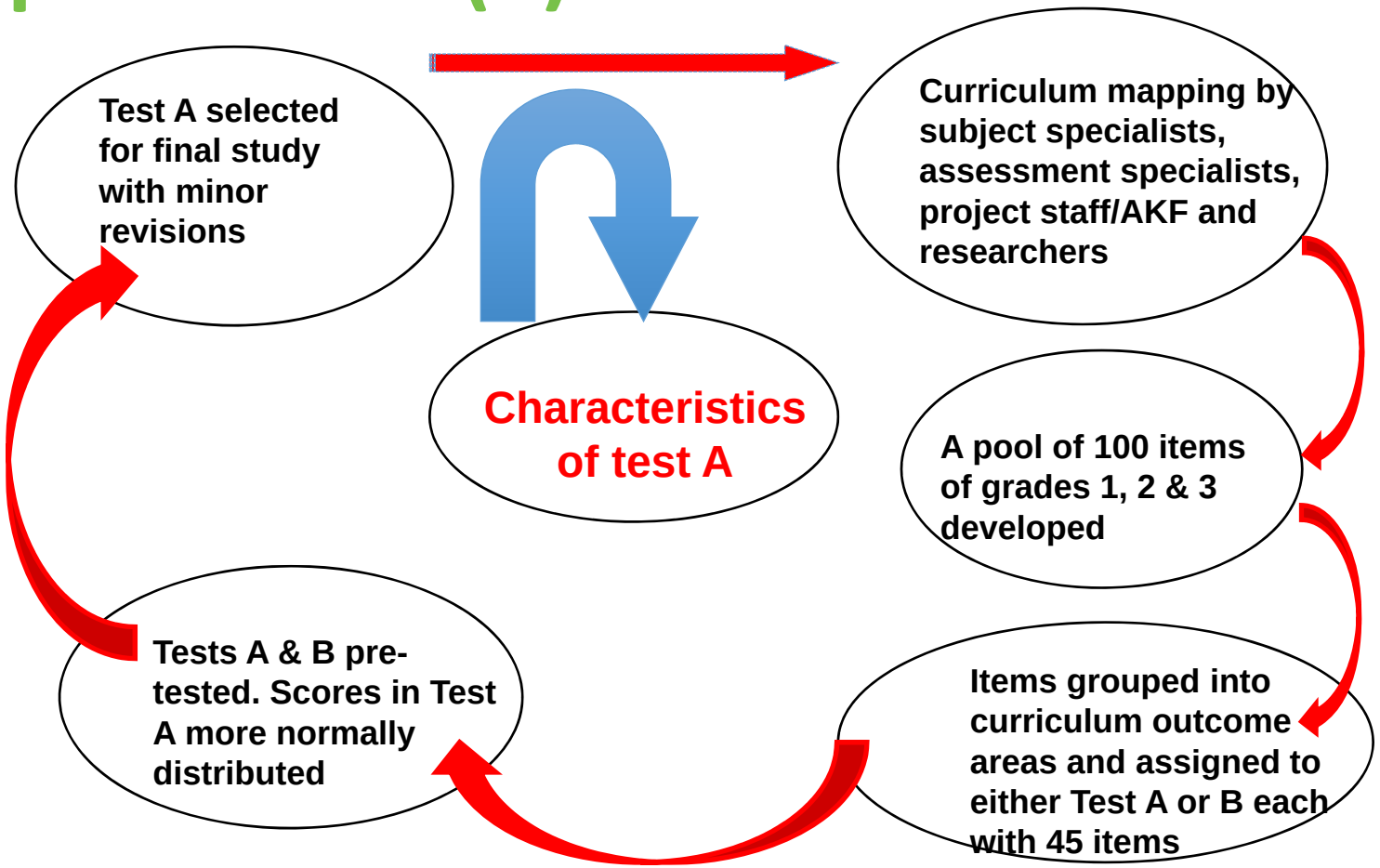
(1) Assessment characteristics

- Addresses key learning areas
- degree of difficulty (simple) – item location
- Item fit (in theory, items should fit the TCC/ICC curve)
- fairness and discrimination in test use (DIF)
- Competence levels/benchmark against which to interpret test scores.



The Approach ….. (2)

(2)Assessment development process

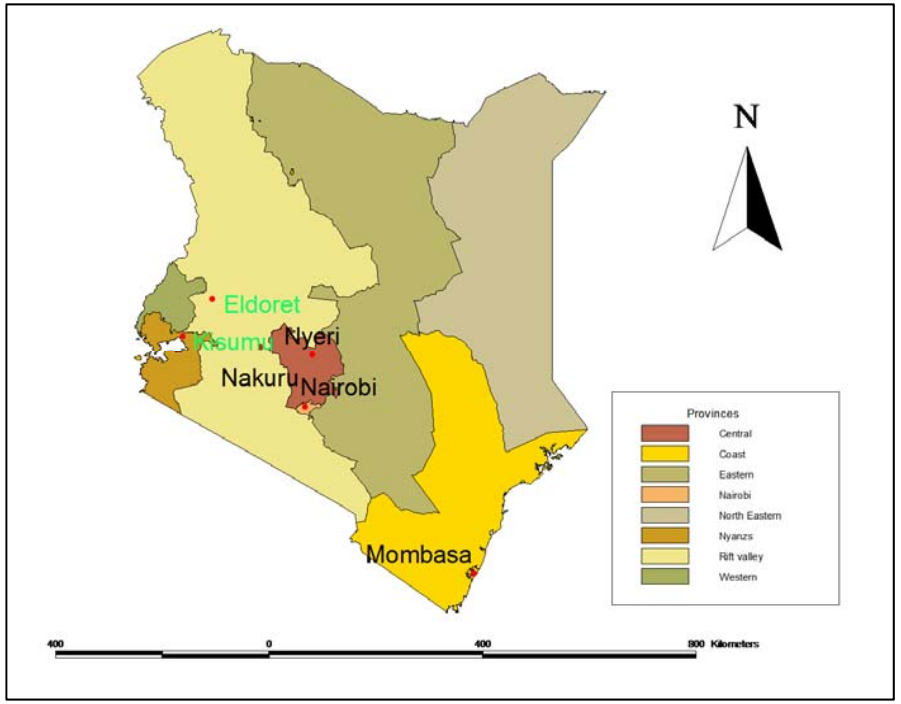


The Approach ..... (3)

Contents	Knowledge	Comprehension	Application	Total Items
Pre-number activities (9%)	2	2	0	4
Whole Numbers (18%)	1	5	2	8
Fractions (4%)	1	1	0	2
Addition (13%)	3	2	1	6
Subtraction (11%)	2	3	0	5
Multiplication (4%)	0	2	0	2
Division (4%)	0	0	2	2
Measurement (Length, Mass, Capacity, Money, Time) (24%)	4	3	4	11
Geometry (11%)	3	1	1	5
Total Items	16	19	10	45

The Approach ….. (4)

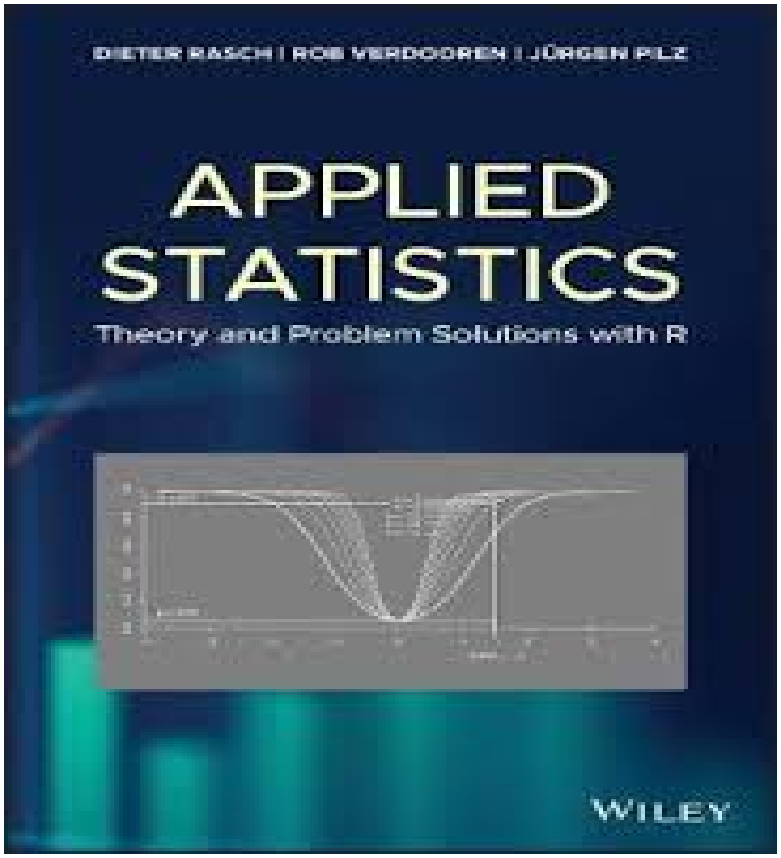
– 7 informal settlements (slums) from 6 major towns in Kenya
– Low cost, formal private and government primary schools within slums and within a radius of 1km from slum
– 1 stream of G3 randomly selected
– 7,648 standard 3 pupils (48% girls)



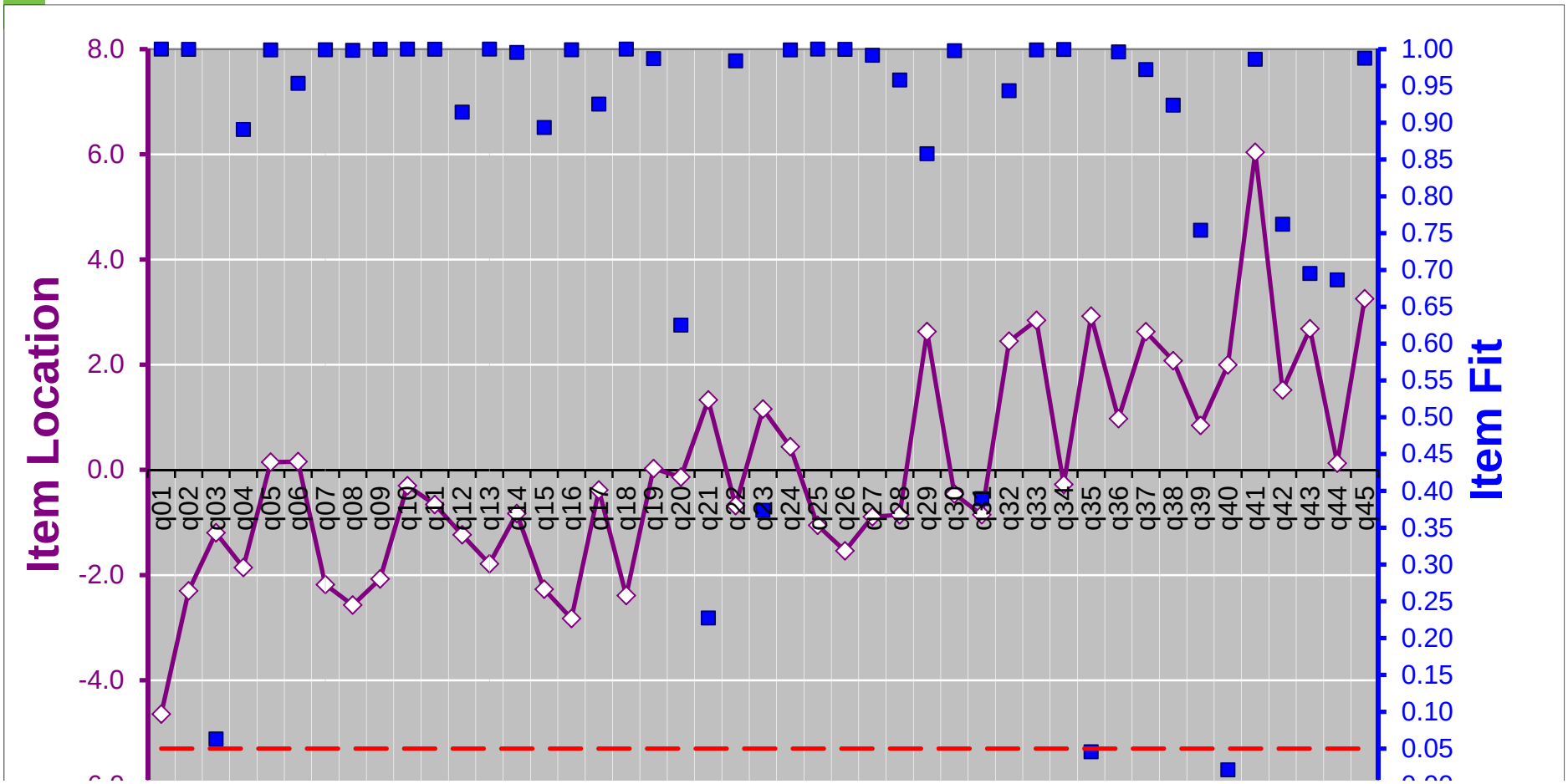
The Approach ….. (5)

- We use Rasch procedures to show:
  - degree of difficulty (simple)
  - Item fit and person location
  - fairness and discrimination in test use

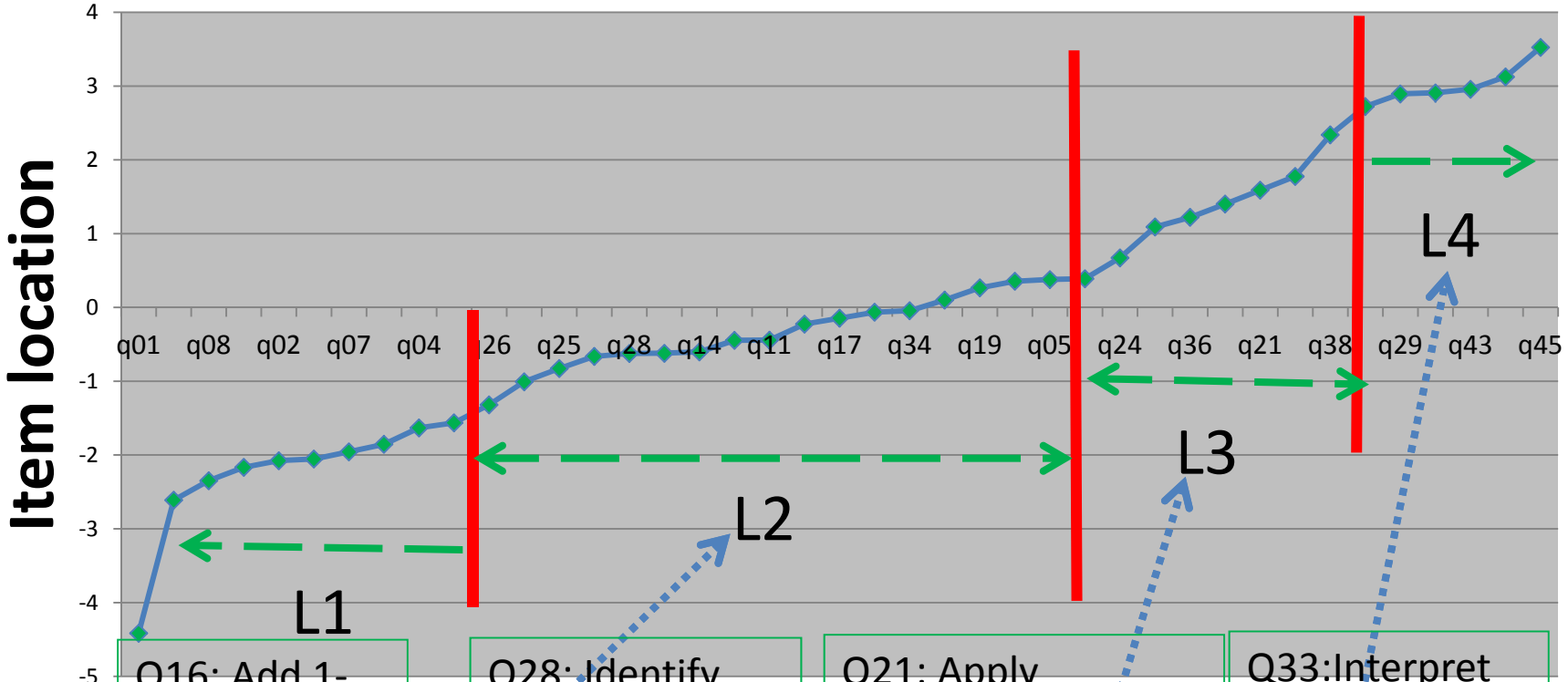
- Some Rasch requirements:
  - Items have equal discriminating power
  - Minimal guessing
  - NB: Rasch model provides diagnostic information on how well items measure what they are supposed to measure
- Competence levels/benchmark against which to interpret test scores



Fit and location of numeracy Items



Grouping the numeracy items



Q16: Add 1-digit numbers with total not exceeding 20

Q28: Identify the days of the week in correct order

Q21: Apply subtraction of 3-digit numbers without borrowing

Q33:Interpret data presented in a simple table

Mapping numeracy items

Level 4

- **Recognize** geometrical shapes within larger shapes
- **Interprete** data presented in a simple table
- **Subtract** 4-digit numbers with borrowing • **Convert** days to weeks
- **Place** the value of a digit on a 4-digit whole number

Level 3

- **Summarize** multiple addition of same number by multiplication
  that is, N + N + N = N × 3
- **Apply division** of 2-digit numbers with 1-digit number (involving multiples of 9)
- **Multiply** single digit numbers • **Subtract** 3-digit numbers without borrowing
- **Apply addition** with carrying over (up to 2-digit numbers)
- **Divide** 2-digit numbers with 1-digit number (involving multiples of 6)
- **Divide** 1-digit numbers with 1-digit number (involving multiples of 3)

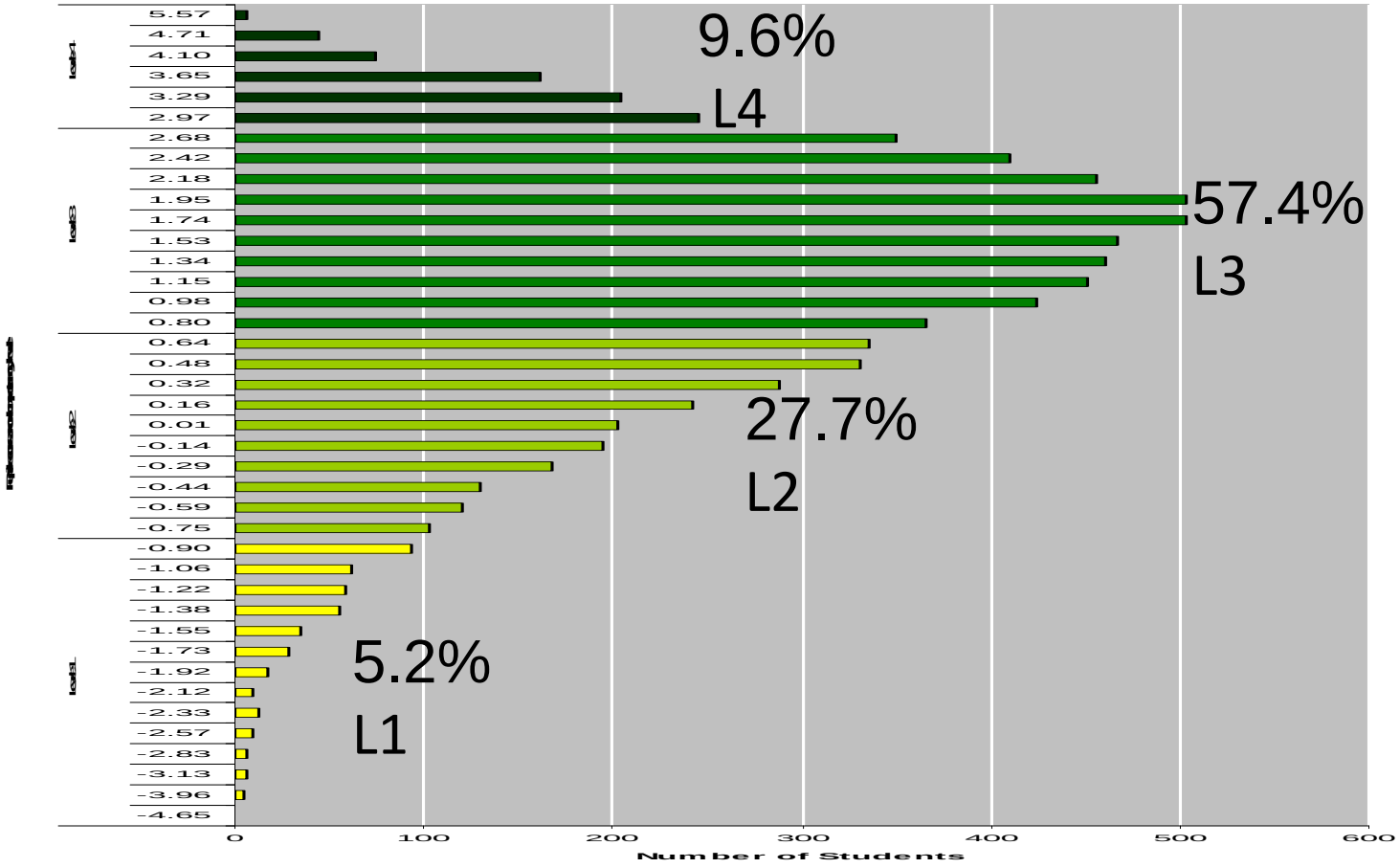
Level 2

- **Rank quatities or sizes** in increasing or decreasing order
- **Add** numbers without carrying over
- **Subtract** numbers without borrowing (up to 2-digit numbers)
- **Recognize** common shapes (oval)
- **Work out** missing numbers in a series involving multiples of 10
- **Associate** units contained with the capacity of a container
- **Associate** metre rule with measurement of length

Level 1

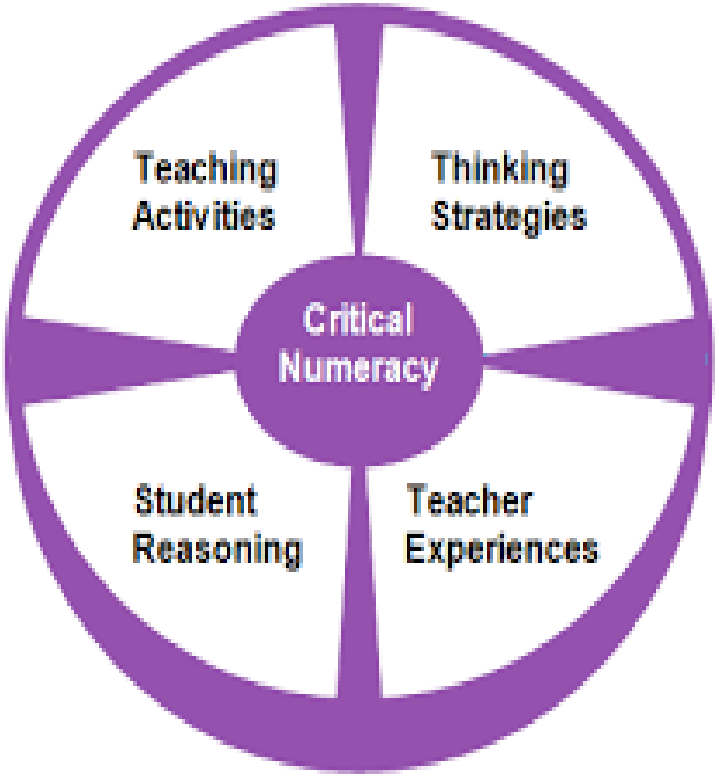
- **Identify** values of coins
- **Identify** what side of a scale balance has more weight
- **Recognize** container with larger capacity
- **Identify** numbers of 100s, 10s and 1s in a 3-digit number
- **Add** 1-digit numbers
- **Match** numbers to objects (<10)
- **Count** objects less than 10

Distribution of numeracy scores



Conclusions and implications

- Only 3 items did not fit and will be dropped – good fit and item difficult
- Item and person parameters (level of difficult and attainment levels of pupils) had a good fit
- The tool did not discriminate by gender
- Competence levels – about three-quarters of pupils in competency levels 3 & 4. Does this match the NAC competency levels?



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THANK YOU

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