How have students' understandings of mathematics changed over time?

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The "standards" debate

- "School leaving exam" (GCE/GCSE) A*-C:
  23% (early 1980s) → 58% (2012)
  BUT considerable slippage in standards
  (Coe, 2008)
- TIMSS: Significant increase since 1995
  484 → 541 (Grade 4)
  498 → 513 (Grade 8)
  BUT fall in PISA (since 2003)

Sample (Y9)

	Algebra	Number	Ratio
1976/7	1647	1661	1595
2008/9	961	247	767

Methods

CSMS (1970s)

- Items: Diagnostic interviews / theory
- Levels 0 → 4:
  - Empirically derived (Rasch-like process)
  - Based on "best-performing" items

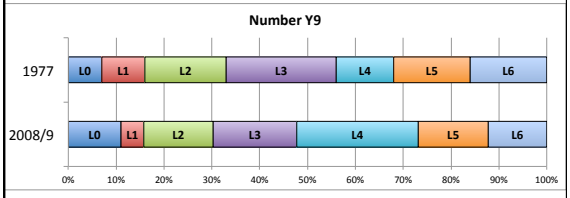
ICCAMS

- Levels & items: Reality check / Rasch
- Differences: Bootstrap & Simulation

Are the samples comparable?

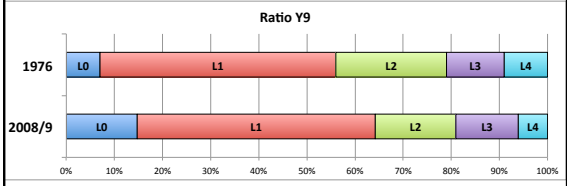
- Sampling *per se* does not guarantee this
  - Non-response / opportunity sampling
  - Small number of schools
- Representativeness claims rest on matched ability scores on a nationally normed test
- Issues:
  - How good are the norms (at both times)?
  - Is the relationship between ability scores and ICCAMS scores strong enough to 'anchor' the sample (at both pupil- and school-level)?
- Bootstrapping provides an estimate of precision

Number (Year 9)



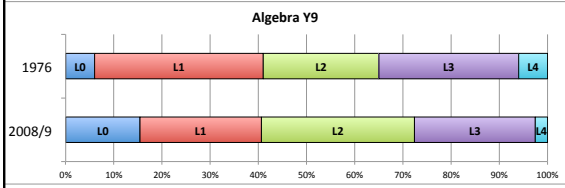
	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
1977	7%	9%	17%	23%	12%	16%	16%
2008/9	11%	5%	15%	17%	25%	15%	12%

Ratio (Year 9)



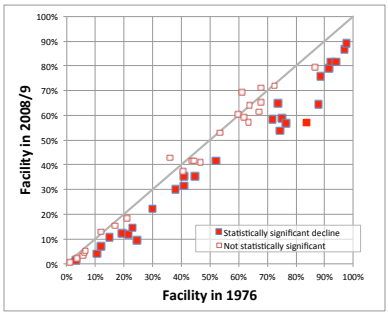
	Level 0	Level 1	Level 2	Level 3	Level 4
1976	7%	49%	23%	12%	9%
2008/9	15%	49%	17%	13%	6%

Algebra (Year 9)



	Level 0	Level 1	Level 2	Level 3	Level 4
1976	6%	35%	24%	29%	6%
2008/9	15%	25%	32%	25%	3%

Algebra (Year 9)



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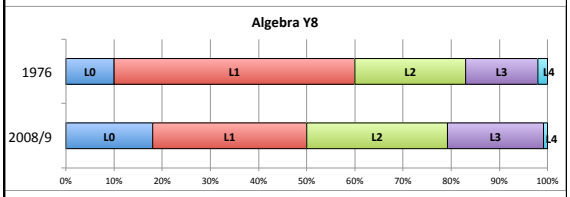
Algebra (Year 8)



	L0	L1	L2	L3	L4
1976	10%	50%	23%	15%	2%
2008/9	18%	32%	29%	20%	1%

Change in attainment since 1970s

- Algebra, ratio & fractions
  - No improvement
- Number
  - Slight improvement a middle of attainment range
- All
  - Decrease in proportion of highest attainers
  - Increase in proportion of lowest attainers
- Similar picture at Year 8