





**An overview of current students' understandings and attitudes**

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**How fast do students learn?**

Number

|        | Mean | % of Total<br>(73) | Std. Dev. |
|--------|------|--------------------|-----------|
| Year 7 | 36.3 | 50%                | 16.8      |
| Year 8 | 39.0 | 53%                | 17.3      |
| Year 9 | 41.1 | 56%                | 17.7      |

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**How fast do students learn?**

Number

|           | Score Gain | % Gain | Effect size | Attainment<br>gap: 5th -<br>95th %ile |
|-----------|------------|--------|-------------|---------------------------------------|
| Y7 --> Y8 | 2.6        | 3.6%   | 0.15        | 53/55                                 |
| Y8 --> Y9 | 2.1        | 2.9%   | 0.12        | 55/56                                 |

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### How fast do students learn?

| Algebra |      |                    |           |
|---------|------|--------------------|-----------|
|         | Mean | % of Total<br>(59) | Std. Dev. |
| Year 7  | 18.2 | 31%                | 10.9      |
| Year 8  | 22.2 | 38%                | 11.7      |
| Year 9  | 24.6 | 42%                | 12.5      |

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### How fast do students learn?

| Algebra   |            |        |             |                                       |
|-----------|------------|--------|-------------|---------------------------------------|
|           | Score Gain | % Gain | Effect size | Attainment<br>gap: 5th -<br>95th %ile |
| Y7 --> Y8 | 4.0        | 7%     | 0.35        | 35/38                                 |
| Y8 --> Y9 | 2.4        | 4%     | 0.20        | 38/41                                 |

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### A widening gap in attainment?

| Algebra   |             |      |      |      |      |      |      |
|-----------|-------------|------|------|------|------|------|------|
|           | Percentiles |      |      |      |      |      |      |
|           | 5th         | 10th | 25th | 50th | 75th | 90th | 95th |
| Y7 --> Y8 | 0.09        | 0.18 | 0.35 | 0.44 | 0.35 | 0.53 | 0.35 |
| Y8 --> Y9 | 0.00        | 0.08 | 0.17 | 0.25 | 0.25 | 0.25 | 0.25 |

Effect sizes estimates (Cohen's *d*) of annual growth in learning in algebra across the attainment range

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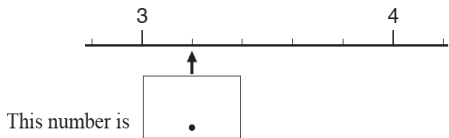
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Strengths: some aspects of number



Y9: 50% → 75%

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Weakness: multiplication

Ring the (calculation) you would need to do to find the answer:



My car can go 41.8 miles on each gallon of petrol on a motorway. How many miles can I expect to travel on 8.37 gallons?

- $41.8 + 8.37$        $8.37 \div 41.8$
- $41.8 \div 8.37$        $8.37 - 41.8$
- $41.8 - 8.37$        $8.37 \times 41.8$       Y9: 54% → 33%

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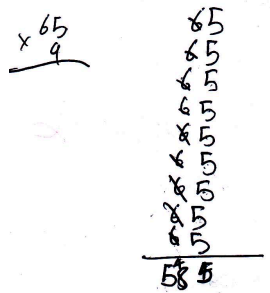
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Weakness: repeated addition

65 x 9




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**Weakness: non-routine problems**

**Six tenths** as a decimal is **0.6**

How would you write as decimals:

eleven tenths . . . . .

Y9: 36% → 16%

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**Weakness: algebra**

If  $e + f = 8$

$e + f + g = \dots$

| Response | Percentage |
|----------|------------|
| $8+g$    | 37%        |
| 12       | 18%        |
| 9        | 7%         |
| $8g$     | 6%         |

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**Self-concept: Do you think you are good at maths?**

|       | Year 7 | Year 8 | Year 9 |
|-------|--------|--------|--------|
| Boys  | 80%    | 79%    | 78%    |
| Girls | 66%    | 63%    | 59%    |

% of all students responding positively to "Do you think you are good at maths?"

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**Self-concept amongst highest attainers**

|       | Year 7 | Year 8 | Year 9 |
|-------|--------|--------|--------|
| Boys  | 98%    | 96%    | 93%    |
| Girls | 89%    | 84%    | 75%    |

% of highest attaining quintile (Ratio) students responding positively to "Do you think you are good at maths?"

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**Intentions to study maths post-16**

|            | Boys   |        | Girls  |        |
|------------|--------|--------|--------|--------|
|            | Year 7 | Year 9 | Year 7 | Year 9 |
| Yes        | 39%    | 34%    | 29%    | 25%    |
| No         | 15%    | 24%    | 17%    | 29%    |
| Don't know | 46%    | 42%    | 53%    | 46%    |

All students' responses to "Do you think you will continue to study maths after GCSE?"

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**Intentions to study maths amongst the highest attaining group**

|            | Year 9 |       |
|------------|--------|-------|
|            | Boys   | Girls |
| Yes        | 44%    | 34%   |
| No         | 17%    | 26%   |
| Don't know | 39%    | 47%   |

% of highest attaining quintile (Ratio) students' responses to "Do you think you will continue to study maths after GCSE?"

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### Implications

- Mathematics attainment is a serious problem
  - More serious than “standards” over time
  - **ALL** need multiplicative reasoning
  - Algebra needed for progression into STEM
- Slow rate of growth in understanding
  - Learning mathematics takes time
  - Tackling the attainment gap is a very significant challenge

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### Improving attainment

- Assessment matters
  - Most teachers ‘surprised’ by students’ errors & by the consistency of errors
- Support and guidance to teachers matters
  - Current textbooks are worse than the textbooks of 1970s (and internationally)
- Ban early entry to GCSE
  - Most students have not attained ‘mastery’

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### Improving participation

- Improving self-concept seems unlikely to increase participation significantly
  - *“I’m good at maths – it is maths that is not good”*
  - But a problem around girls’ self concept
- Address participation directly
  - Increase attainment
  - Information about extrinsic benefits
  - Require it
  - Make school mathematics more meaningful (not more formal)
- Increase post-16 options

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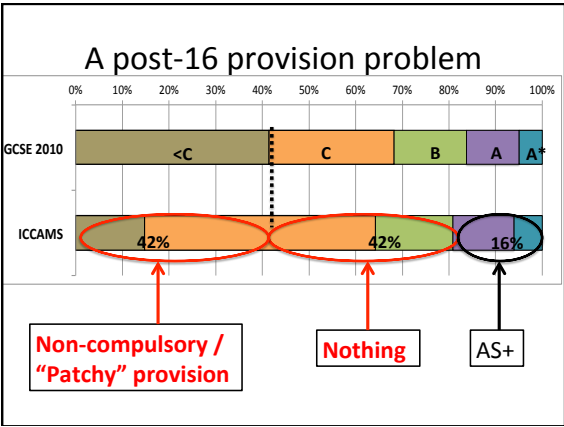
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