

Children's reasoning and mathematical achievement

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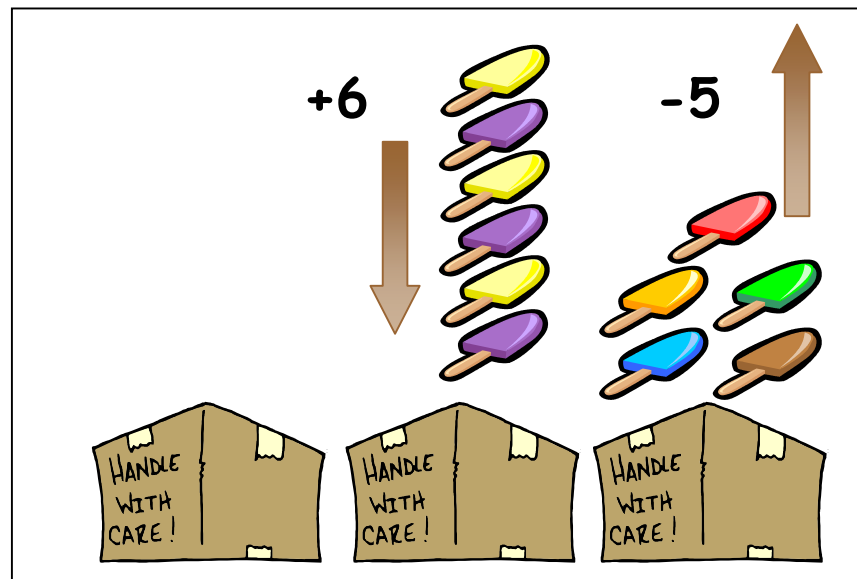
Peter Bryant

Jane Hurry

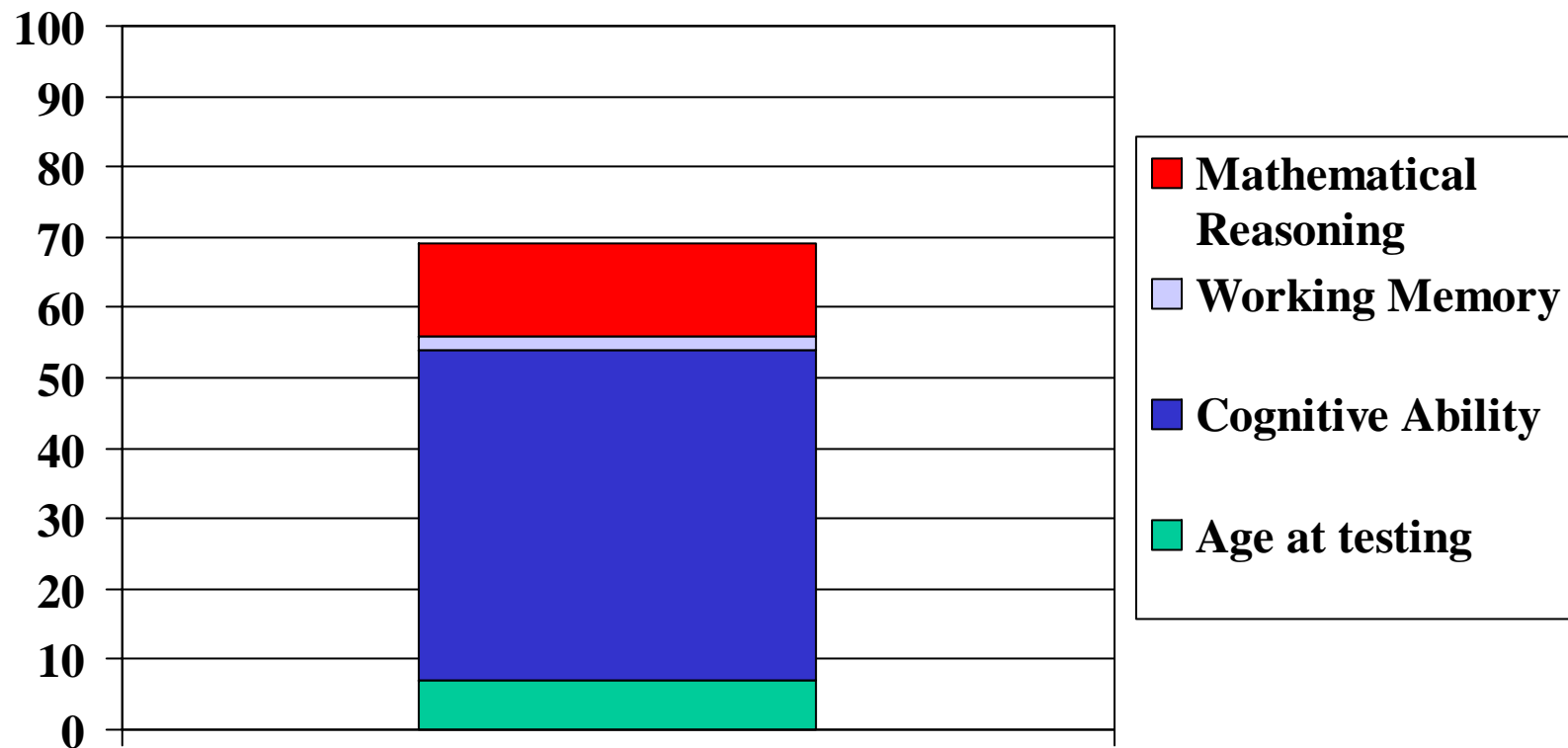


Children's reasoning and mathematics achievement

- Measures of children's reasoning with small numbers at the start of primary school predict their mathematics achievement one year later after controlling for age and a measure of intelligence



Percent variance explained when predicting mathematics achievement



- Children develop much of their understanding of these logical relations informally but it is necessary to extend children's reasoning through school instruction.

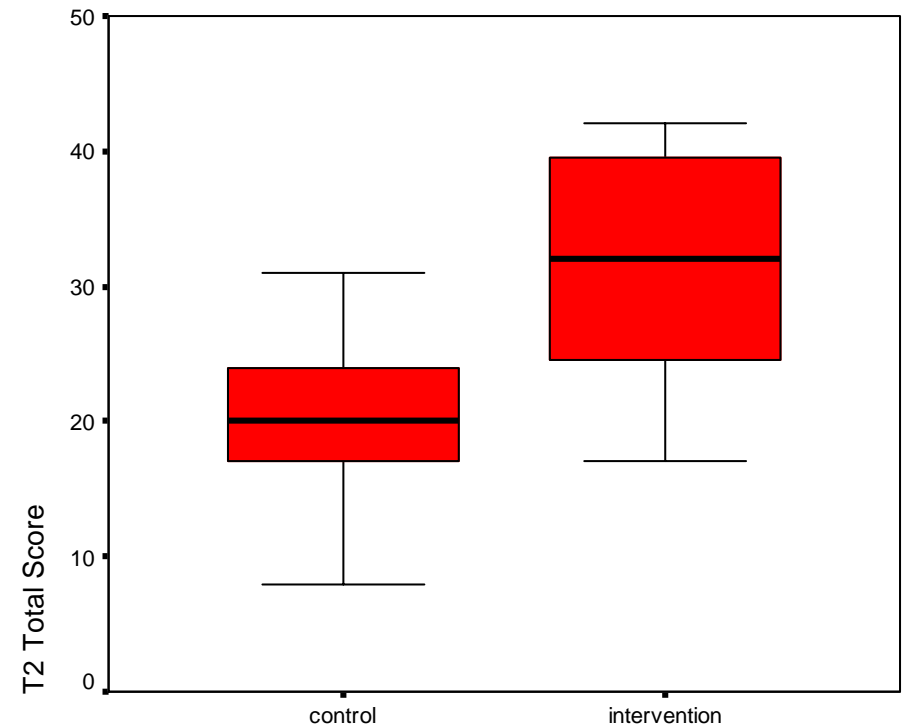
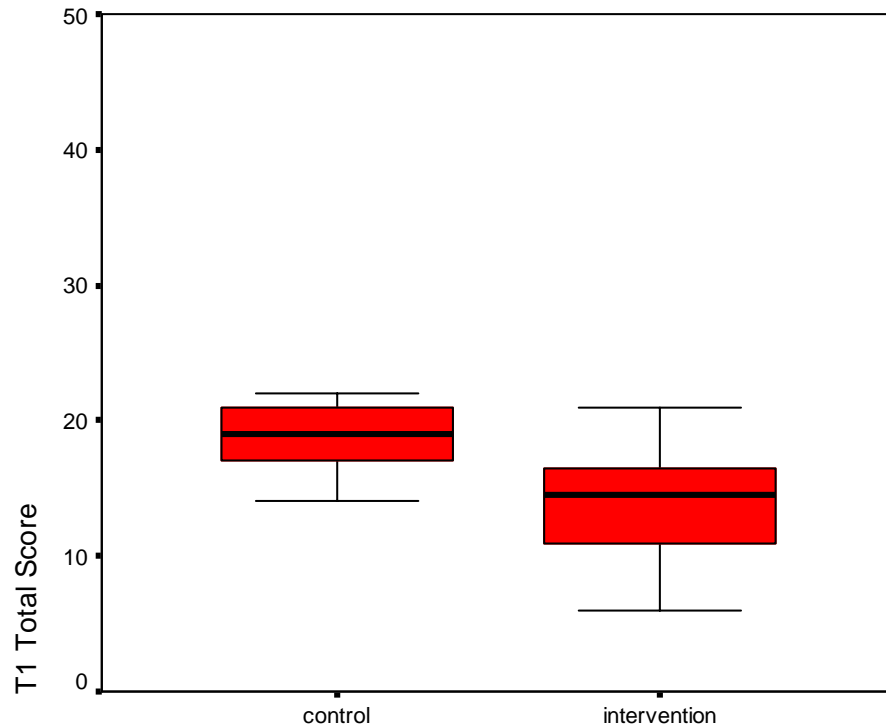
Understanding one-to-many correspondence and solving multiplication problems before school



What if the children need help to develop their logical reasoning?

- A small scale study assessed how effective interventions can be
- Children from the same schools in Year 1: Cohort 1 forms the control group and Cohort 2 (sampled in the following year) the intervention group
- Children were selected because they were underperforming within their age group
- Intervention: 12 small group sessions (3 to 5 children) with a researcher during the Numeracy Hour (over 6 weeks)

Results



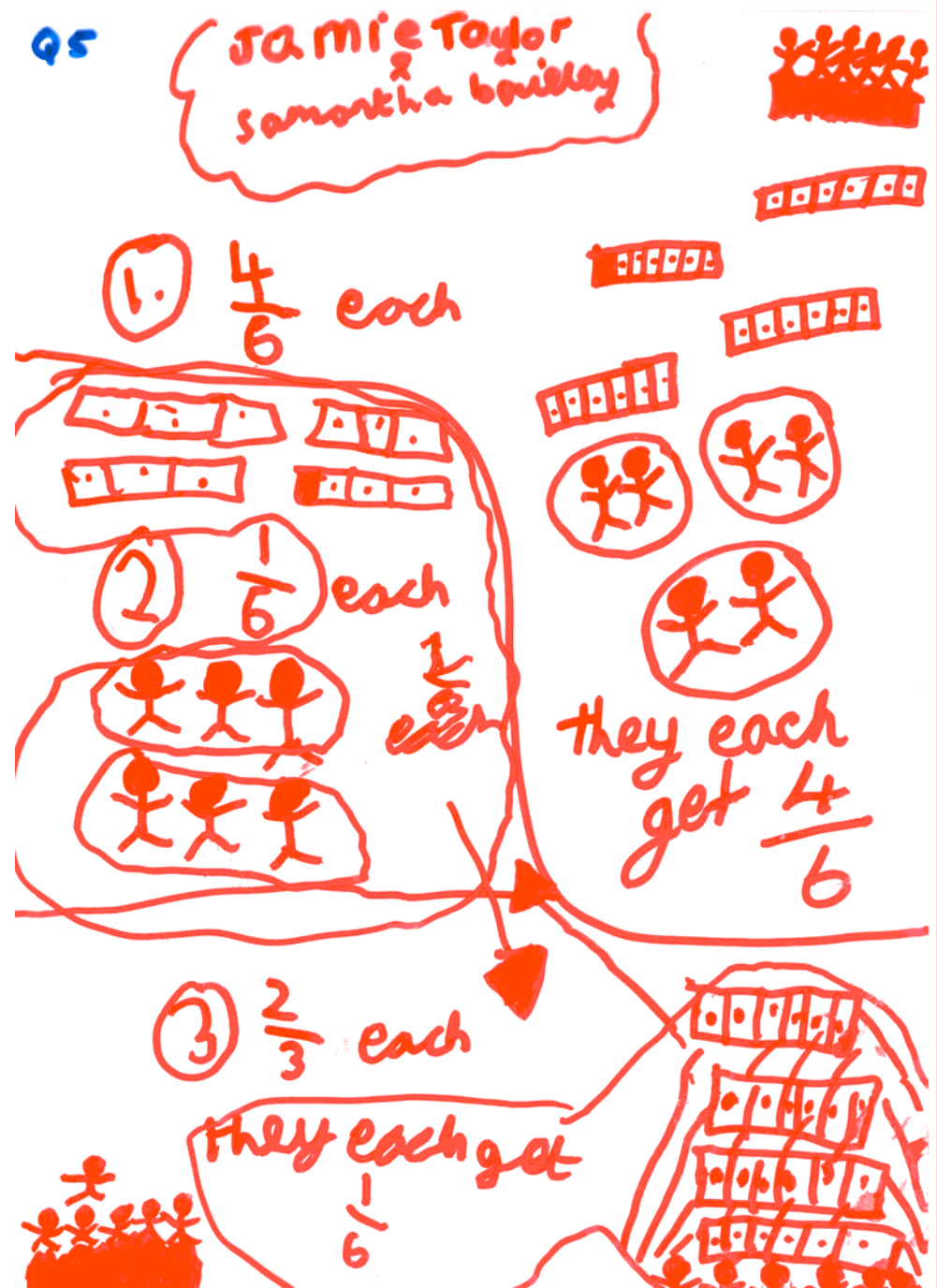
Results are very encouraging but large scale replication and long term follow-up are needed

Fractions pose a new set of difficulties

- Fractions, like natural numbers, involve the idea of equivalence ($1/2 = 2/4 = 3/6$ etc) but number labels don't help
- They also involve the idea of order ($1/2 > 1/3 > 1/4$ etc.) but the larger the denominator, the smaller the quantity
- Recent research has identified situations that children encounter outside school that help them understand fractions

Finding equivalent fractions: if you have 4 chocolates to share among 6 children, are there two different fractions to show how much each one gets?

Using one-to-many correspondence, children who have not yet been taught these fractions can come to understand the idea of equivalent fractions



In conclusion

- Research on children's reasoning has led to the identification of the logical-mathematical principles that form the basis for children's mathematics learning
- It is possible to promote their understanding of these principles through instruction
- It is necessary to extend them through instruction in order for them to master mathematical concepts