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The development and importance of proficiency in basic calculation

This research explores the development of basic calculation fluency in young children and the relationship between basic calculation proficiency and mathematics attainment.

Key words: primary mathematics; relation between fluency and understanding; dyscalculia

Key findings

- Basic calculation fluency (accurate and rapid solution of single digit addition problems and complementary subtractions) is the strongest correlate of success in mathematics in primary school and the most frequent symptom of difficulties in mathematics.
- It develops in conjunction with understanding of the number system and number principles.
- In a sample of schools judged average to outstanding by Ofsted inspectors and with above average performance in Key Stage 2 tests, teachers agreed that developing basic calculation proficiency was important.
- Nevertheless, the current English National Curriculum goal for knowledge of addition and subtraction facts was achieved by none of the 259 children in the study when they were assessed either in Year 3 or Year 4.
- Despite ignorance of many facts, their mathematical achievement was slightly above average.
- Incomplete knowledge of number facts is not the barrier to success in mathematics some believe it to be.
- Children identified with dyscalculia did not just have poor number skills.

What we did

The project was funded by the Economic and Social Research Council (ESRC) (2007-2010). Many studies find relations between basic calculation fluency and mathematics attainment in primary school and there are several explanations:

- success in mathematics depends on basic calculation fluency;
- both fluency and progression in mathematics depend on knowing number patterns and principles; and
- general cognitive skills and socio-emotional functioning affect both fluency and mathematics attainment.

The aims of this project were to examine the development of basic calculation fluency and knowledge of patterns and principles, and to assess the explanations of the relation between basic calculation proficiency and mathematics attainment.

How we did it

Seven schools in the Royal Borough of Windsor and Maidenhead agreed to take part. All Year 3 children with parental consent (269 in total) were assessed individually on number and standardised cognitive tasks, and their teachers provided information on each child's socio-emotional functioning and National Curriculum levels for Mathematics and English. A year later 259 children were re-assessed on the number tasks and their teachers provided information on their current National Curriculum levels and socio-emotional functioning. Teachers were also interviewed on their beliefs about mathematics learning and the causes of differences between children. Standardised reading and mathematics tests were individually administered and these showed strong relations with teachers' assessments. In the statistical analyses adjustments were made for chronological age and time of school year when assessed.

Further information

Cowan, R. (2011). The development and importance of proficiency in basic calculation. London: Institute of Education University of London.

Cowan, R., Donlan, C., Shepherd, D.-L., Cole-Fletcher, R., Saxton, M. and Hurry, J. (2011). Basic calculation proficiency and mathematics achievement in elementary school children. *Journal of Educational Psychology, 103*, 786-803.

See article on BBC News: "Sums tables 'not needed for maths success'"
See IOE press release: 'Primary school children succeed at maths without knowing their tables'

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