Early mathematics achievement in the context of the National Numeracy Strategy

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Introduction

We report here on a cohort of English pupils who have been tracked through primary school during the first five years of the new National Numeracy Strategy (NNS) (DfEE 1999). A limited longitudinal study of young children's early mathematical development took place, initially within three testing cycles: at the mid-point and towards the end of their reception year (at age five-years) and again at the mid-point of Year 1 (at age six-years). These cycles were located within the broader context of progress through to the end of Key Stage 1 (at seven-years) and Key Stage 2 (at 11-years) on the basis of national standardised assessment tests (SATs). The results for the first stage of the study have been reported in the *British Educational Research Journal* (Aubrey and Godfrey 2003) and the results for second stage are in submission (Aubrey, Godfrey and Dahl 2005).

Context

Prior to the introduction of the National Numeracy Strategy, the English National Curriculum for mathematics placed more emphasis on mathematical applications and written calculations. It is not easy to draw conclusions about the impact on pupil learning of the daily three-part mathematics lesson, with its oral-mental starter, development phase and plenary. Much of the increase in Key Stage 2 SAT results occurred prior to the introduction of the NNS in 1999 and evidence for deep changes in teaching is mixed (Earl *et al.* 2003). The opportunity our own data provided for interrogating the performance of younger children in the context of the NNS was a stimulus to this stage of our study.

Methodology

The aims were thus to:

- track our own cohort of pupils from their KS1 SAT results in 2000 to their KS2 SAT results in the Summer term, 2004;
- consider these results in the light of our earlier findings;
- judge the findings in the light of the NNS teaching that pupils had received.

More than 300 children took part, from 21 schools, large and small, including urban and rural areas, with high and low concentrations of free school meals and special educational needs and a variety of attainment levels based on SAT results.

Three forms of the Utrecht Early Mathematics Test (Van Luit *et al.* 1994) were used. Each form comprised eight sub-tests: four sub-tests assessing understanding of relations in space, size, quantity and order; and four requiring counting, ordering numbers and simple problem solving, with forty items in total.

Approximately 100 children took each form of the test on each testing occasion. Tests were administered individually with children responding orally to pictorial material or counting and manipulating Unifix blocks.

A limited longitudinal design was used within three testing cycles, at the mid-point and towards the end of children's reception year (at five years) and again at the mid-point of Year 1 (at six years). SAT results at seven- and 11-years were also included in the multilevel analysis that provided an extension of multiple regression to incorporate the hierarchical nature of the data with groups of ten pupils (five boys and five girls) nested within classes, within schools, within different areas of the south-east of England. Preliminary analysis showed no significant variation between areas and classes and no significant difference between mean scores of boys and girls.

Findings

In summary, the results for the second phase of primary schooling (at the end of KS2) confirmed and reinforced our earlier results for the first phase of schooling (at the end of KS1). Children who bring into their reception year numerical and mathematical knowledge do appear to be advantaged in terms of their mathematical progress through primary school. Numerical attainment increases in importance across the primary years. Given that this cohort of pupils received the new NNS from Year 1 (at six-years) till Year 6 (at 11-years) it is interesting to note that General Number Knowledge, involving practical problem solving, remained important across primary schooling. Indeed, the finding is of particular interest in the context of the suggestion from Brown *et al*. (2003) that English children's scores for word problem solving may have declined with the introduction of the NNS and its emphasis on numerical calculation.

Discussion

A range of studies (for instance, Hardman *et al.* 2003; and Moyles *et al.* 2003) have found that whilst teaching methods and classroom organisation have changed with the introduction of the NNS, at the deeper level of classroom discourse, pupil-teacher interaction is still dominated by closed questions, emphasising recall rather than reasoning and problem solving, with short answers for which teachers do not provide diagnostic feedback. The pace of lessons has been perceived as leaving little time for consolidation and too little time for formative assessment.

Indirectly, these findings may argue for the importance of pre-school education between three- and five-years. Reception class teachers (for five-year-olds) who systematically monitor their pupils from the beginning of the year, identify and coach those *without* these mathematical skills may well help to reduce inequality. Without active intervention, it seems likely that children with little mathematical knowledge at the beginning of formal schooling will remain low achievers throughout their primary years and probably beyond.

What is most striking is the extent to which these findings are compatible with the King's College Nuffield project findings for Year 4 pupils: standards are declining for low-attainers. What our study clearly demonstrates is that the decline starts early on with low attainers slipping further behind. The reported gender differences from the King's College project, with boys being more favoured than girls, was not upheld.

Conclusions

It seems reasonable to suppose that children's attainment has been influenced by the changes to the English curriculum brought in by the NNS. Furthermore, it would appear that the NNS advantages some pupils more than others, with low attainers being least advantaged. This may well be related to the fast pace of classroom teaching and learning and a curriculum that leaves too little time for consolidation and too little opportunity for formative assessment that leads to adaptation to the individual needs of learners (Askew and Brown 2004).

Interestingly, whilst the new Primary Strategy (DfES 2003) is still set upon producing a common approach to teaching and learning approaches promoted by the Strategies and still driven by testing, targets and performance tables, there *is* talk of increasing autonomy of teachers and schools as well as insistence on individualisation. But if teaching and learning must be focused on individual pupil needs and abilities, then this must include the needs of children from special needs and ethnic minority backgrounds, as well as the gifted and talented. The deep irony here, as noted by Alexander (2004), is that whole-class interactive teaching of the Strategies is intended to exploit commonalities of the group, in order to benefit the individuals.

What do you think …?

1. **Does your experiences indicate any similarities with Carol Aubrey's findings?**
2. **Have the Strategies improved children's mathematical learning?**
3. **How do you support young children with their early mathematical learning?**
4. **How do you resolve the individual/collective aspects of teaching?**

Why not share your views with others through the 'Reflecting on Early Years Issues' website?

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