

Changes in Children's Cognitive Development at the Start of School in England 2000-2006

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Abstract

England has seen massive changes in the Early Years over the last few years. There is now an official early childhood curriculum, free nursery education for three-year-olds, the Sure Start programme has started, the Neighbourhood Nurseries programme has been introduced for the most deprived communities and a national network of children's centres was launched in 2003. There have also been important demographic changes. During this period, the CEM Centre at Durham University has been collecting consistent data from many thousands of children when they start school at the age of four on a range of variables that have been chosen because they are good predictors of later success. These include vocabulary, concepts about print, letter and word identification, phonological awareness, ideas about maths, digit identification and simple arithmetic (without any formal notation). The extent to which thousands of children's scores on these measures have changed from 2001 to 2006 inclusively are examined and the link between the major initiatives and the findings are discussed.

Introduction

Since 1997, the English government has introduced several national and local initiatives intended to enhance the lives of children in England and to reduce the impact of poverty and social deprivation. Good quality childcare and education in the early years have been a high national priority and education in the early years was one of the main provisions of the 2002 Education Act. The Act introduced the Foundation Stage of the National Curriculum for children from aged 3 years to the end of the first year at school (the Reception year). The Foundation Stage has specific curriculum guidance across six areas of learning and a statutory assessment, the Foundation Stage Profile, which uses practitioners' observations to monitor each child's progress. Although many children will attend a pre-school setting and the full Reception year, they are not legally required to start attending school until the start of the term after their fifth birthday, unless they are home educated, so, potentially, some children will experience the full Foundation Stage and others will miss much of it. In practice almost all children now start school at the age of 4 and very high proportion have been to nursery before that.

Further initiatives cover a wider age-range than the Foundation Stage. 'Sure Start' is an ongoing, widely implemented initiative supported by the Government that aims to achieve better outcomes for children, parents and communities (Sure Start 2007). Socio-economic status is related to academic achievement (Bordieu and Passeron, 1977) and so Sure Start is predominantly aimed at deprived neighbourhoods. The Sure Start Local Programmes (SSLPs), which were set up to improve the well-being, attainments and life chances of all children aged 0 - 4 years old in each area and to support their families, include a wide variety of local programmes. By 2004, there were 524 SSLPs established aimed at helping almost half a million children living in disadvantaged areas. Evidence that these initiatives have been successful is limited since many of the programmes are still fairly new, however some evaluations have been completed (see for example Brooks *et al.* 2003) and the National Evaluation of Sure Start (2007) is ongoing. The National Evaluation has evaluated SSLPs in terms of their implementation and their effectiveness, and has found variation between schemes (Anning *et al.*, 2007, National Evaluation of Sure Start, 2005).

Another large scale UK Government initiative within the last 10 years has been the establishment of 'Education Action Zones' (EAZs) aimed at raising educational standards in disadvantaged urban and rural areas. EAZs usually run for three years with the possibility of extended funding for a further two years. The first round of EAZs were set up in 1998, with a second round introduced in 1999. Some of the EAZ programmes included interventions for pre-school and school children. An evaluation of the second round of EAZs by OFSTED (2003) reported variable findings. Amongst the conclusions, it reported that "Although some success was evident, overall, the headway made by zones, and the schools in them, was too variable. In the majority of zones there was not enough deliberate and sustained attention to tackling difficult common issues".

More recently in 2003, the Government published a green paper called Every Child Matters, which prompted a debate about services for children, young people and families. Following the consultation, the Government published Every Child Matters: the Next Steps, and passed the Children Act 2004, providing legislation to support the

development of integrated services to meet the needs of children from birth to age 19 years.

Another development in 2003 was the Government's rebranding of Early Excellence Centres, Sure Start projects that offer childcare and Neighbourhood Nurseries, as Children's Centres which aim to integrate daily care, education, family support and health services. Other initiatives are too numerous to mention.

If these recent programmes have enhanced the cognitive development of young children, there should be evidence of a reduction in the previously documented gap between children from affluent and deprived neighbourhoods. There may also be a general improvement in the cognitive developmental levels of young children.

Monitoring improvements over time requires reliable assessment data, whose content remains unchanged, collected on a wide scale over an extended period. Although the intention of the statutory Foundation Stage Profile is to monitor children's progress, in practise it cannot be used for this purpose because it does not discriminate amongst the above average children, it is dependent on judgements which may change over time, it has only partially investigated psychometric properties and it was not introduced until 2003. By contrast, the Performance Indicators in Primary Schools (PIPS) On-entry Baseline Assessment collects very reliable objective data which has well-established predictive validity and has remained unchanged for several years (see for example CEM Centre 1999, Tymms *et al.* 2000).

Measures and Sample

The Performance Indicators in Primary Schools (PIPS) project is one of several projects run from the Curriculum, Evaluation and Management (CEM) Centre at Durham University (CEM Centre, 2007), which aim to provide schools with data on the attainment, progress and attitudes of their pupils. The CEM Centre provides assessments and monitoring systems for children aged 3 – 18 years. Schools (and sometimes whole education authorities) subscribe to the projects and CEM analyses data from more than one million children each year. The CEM Centre provides the necessary assessments and then marks and analyses the data for schools, and provides them with standardised feedback on the attainment, attitudes and progress of their pupils. As a result of these services, the CEM Centre holds large longitudinal datasets that can be further analysed for research purposes such as this paper.

The PIPS On-entry Baseline Assessment (PIPS BLA) was developed by the CEM Centre and is administered within the first six weeks of a child starting compulsory education on an individual basis, taking approximately 20 minutes per child. Its content is based on areas of children's development which have been shown to be the best predictors of later success or difficulty at school (Tymms and Middleton, 1995 and Tymms 1999). The assessment is available in two versions; a text version, where the administrator works through a book with the child, or a computer-delivered version. This paper analysed data from children who were assessed with the computer-delivered version. The assessment includes measures of vocabulary, early reading, mathematics and phonological awareness sections, specifically:

- Writing – the child is asked to write his/her own name and the quality of

writing is scored against examples.

- Vocabulary – the child is asked to identify objects embedded within a picture.
- Ideas about reading – assesses concepts about print.
- Repeating Words – the child hears a word and is asked to repeat it in this assessment of phonological awareness.
- Rhyme Detection – the child selects a word to rhyme with a target word from a choice of three options in this assessment of phonological awareness.
- Letter identification – a fixed order of mixed upper and lower case letters.
- Word recognition and reading. This starts with word recognition and moves on to simple sentences that the child is asked to read aloud. The words within these sentences are high frequency and common to most reading schemes. This is followed by a more difficult comprehension exercises which require the child to read a passage and at certain points select one word from a choice of three that best fits that position in the sentence.
- Ideas about mathematics – assessment of understanding of the vocabulary associated with mathematical concepts.
- Counting and Numerosity – the child is asked to count four objects. These disappear from the screen and then the child is asked how many objects they saw. This is repeated with seven objects.
- Sums – addition and subtraction problems presented without symbols.
- Shape identification.
- Digit identification – single, two-digits and three-digits.
- Maths problems – including sums with symbols.

The sample consisted of 124 primary schools in England that carried out the PIPS BLA with all of their children entering the Reception class in September every year from 2001 to 2006 inclusively. The number of pupils assessed each year is shown in Table 1.

Table 1 Number of Pupils Assessed

Academic Year	Number of Pupils
2001	5992
2002	5963
2003	6013
2004	5929
2005	5902
2006	5167

Additional information on the pupils' date of birth, sex, special needs, first language, entitlement to free school meals and the number of terms in pre-school was also recorded.

Results

Changes in Background Variables

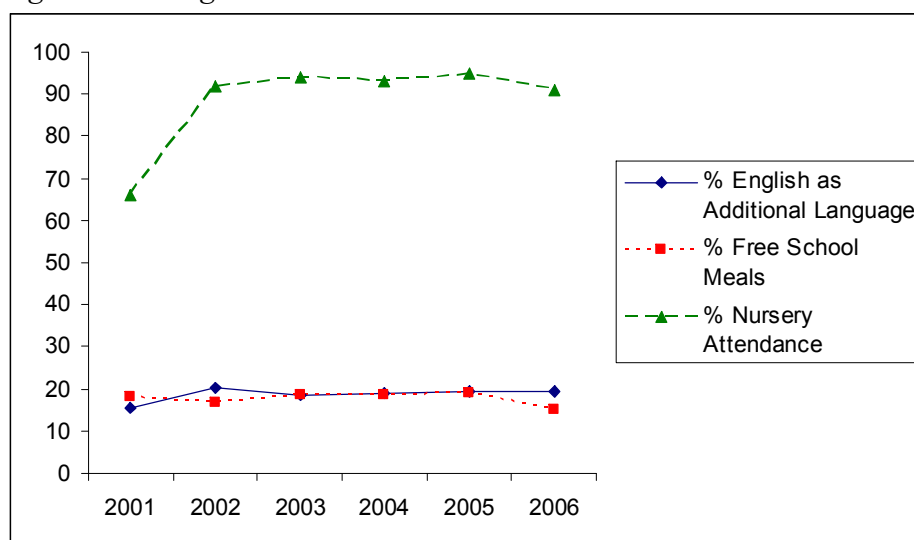
Firstly, the stability of the number of pupils with English as an Additional Language (EAL), the number of pupils entitled to Free School Meals (FSM), the average number of terms of attendance at nursery and sex of the children was investigated. If the income of a family is below a certain threshold, the children in that family are entitled to free school meals, therefore FSM is an indicator of deprivation level. If these sample characteristics changed significantly over the period of investigation, they should be considered when interpreting the trends found in the PIPS BLA scores over time. Table 2 shows the total number of pupils for whom background data were available each year and the percentage of EAL, FSM, the average number of terms spent in nursery and the percentages of boys and girls.

Table 2 Information about Background Variables

Academic Year	EAL		FSM		Nursery		Sex	
	No. of pupils	% EAL	No. of pupils	% FSM	No. of pupils	Mean no. of terms	% Boys	% Girls
2001	5484	15.4	3431	18.1	5988	2.21	51.7	48.3
2002	5347	20.3	3338	16.9	4313	3.10	50.3	49.7
2003	5361	18.5	3073	18.7	4090	3.19	51.8	48.2
2004	5254	18.8	2985	18.4	4003	3.11	50.1	49.9
2005	4722	19.4	2096	18.8	3267	3.30	50.7	49.3
2006	4352	19.6	1963	15.3	3372	3.21	51.6	48.4

There was no significant difference between the number males and females each year or over time. These figures for FSM, EAL and nursery attendance are illustrated in Figure 1 below. Attendance at nursery is expressed as the percentage of children attending rather than the mean length of time.

Figure 1 Background Variables



Although graphically, the differences in EAL and FSM over time look small, all three variables did change significantly ($p < .05$) over the period of time of interest.

Nationally, the percentage of children entitled to free school meals in English nursery and primary schools was estimated to be 16.9% in 2005 and 16% in 2006 (DfES, 2006). The percentage of pupils with English as an Additional Language in English primary schools was 11.5% in 2005 and 12.5% in 2006 (DfES, 2006). The percentage free school meal entitlement of the samples analysed in this paper was a little higher than the national average in 2005 but slightly lower in 2006. The percentage of pupils for whom English was an additional language was noticeably higher in the samples analysed in this paper than the national figure in 2005 and 2006 perhaps because it deals with young children rather than the full primary age range.

Attainment on entry to school was compared to the national average. To do this, the mean standardised total PIPS BLA score and standard deviation for the schools included in the analysis for this paper were compared to the national sample. These are expressed as T scores with a mean of 50 and standard deviation of 10. The sample only differed significantly from the national average in 2003 (sample mean = 49.73) and 2006 (sample mean = 49.68). Although statistically lower than the national average, less than 0.05 of a standard deviation is very small in educational terms.

Changes in PIPS BLA Scores Over Time

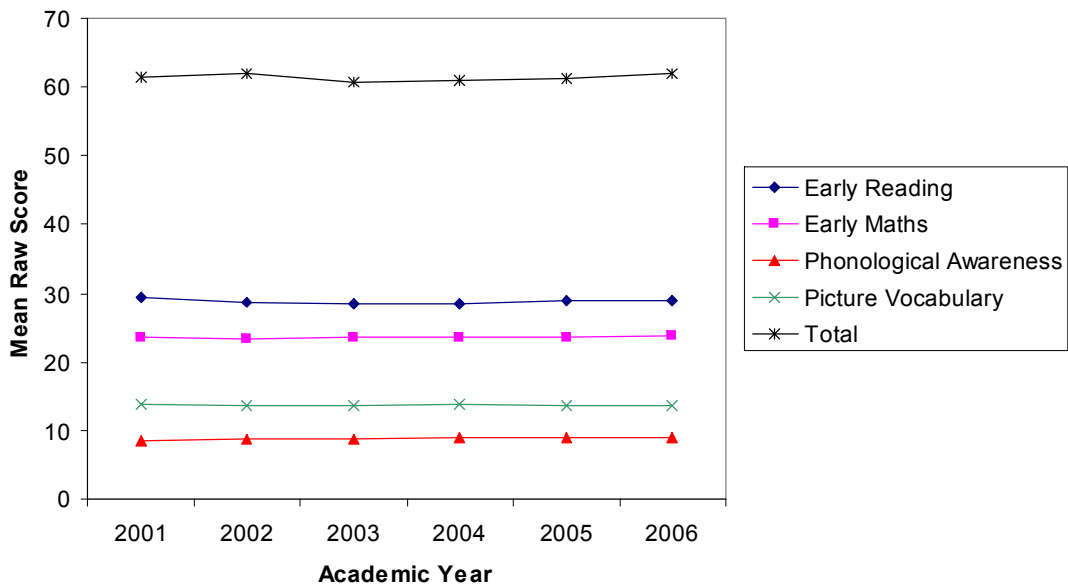
Table 3 shows the mean raw scores and standard deviations from the PIPS BLA for early reading, phonological awareness, vocabulary, mathematics and the total score each year between 2001 and 2006 inclusive. The Early Reading scale was made up of Writing, Ideas about Reading, Letter Identification, Word Recognition and Reading. The Phonological Awareness scale was made up of Repeating Words and Rhyme Detection. The Early Mathematics scale was made up of Ideas about Maths, Counting and Numerosity, Sums, Digit Identification, Shape Identification and Number Problems. The Total raw score, which is the total of the Early Reading, Early Maths, Phonological Awareness and Picture Vocabulary scores.

Table 3 Raw Scores from PIPS BLA

Academic Year	Early Reading		Early Maths		Phonological Awareness		Picture Vocabulary		Total	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2001	29.34	17.03	23.54	9.25	8.53	4.58	13.88	4.55	61.40	27.33
2002	28.80	17.09	23.40	9.25	8.76	4.65	13.69	4.64	60.96	27.54
2003	28.42	17.44	23.66	9.20	8.72	4.58	13.62	5.12	60.80	27.65
2004	28.44	17.44	23.69	9.29	8.90	4.65	13.78	5.13	61.04	27.86
2005	28.85	17.57	23.48	8.80	8.93	4.63	13.63	5.13	61.26	27.57
2006	28.98	18.38	23.92	9.27	9.02	4.64	13.71	5.22	61.92	28.78

The mean scores are illustrated in Figure 2.

Figure 2 Raw Scores from PIPS BLA



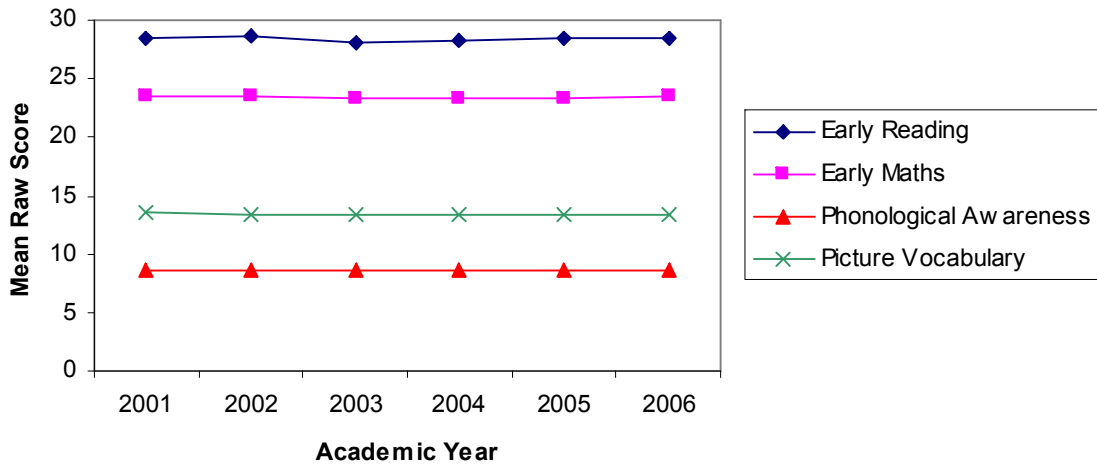
Looking at Figure 2, it is difficult to discern any changes over time. The total score did not change significantly over time however a one way analysis of variance did indicate statistically significant differences over time for the four separate areas. Although significant, these differences were very small, for example comparing the mean scores from 2001 with those of 2006, the Effect Sizes were -0.02 for early reading, 0.11 for phonological awareness, 0.04 for mathematics and -0.03 for vocabulary.

The analysis of the background variables of FSM, EAL and nursery attendance over time indicated that these changed significantly and therefore might have an impact on the BLA scores. Age at time of assessment was stable over the years and the children in the sample started school in the autumn term. Table 4 and Figure 3 show the predicted mean scores for early reading, phonological awareness, mathematics and vocabulary after controlling for FSM, EAL, age at time of assessment and sex, but not for number of terms in nursery. Table 4 also shows the standard deviations.

Table 4 Predicted Raw Scores from PIPS BLA after controlling for FSM, EAL, age and sex

Academic Year	Early Reading		Early Maths		Phonological Awareness		Picture Vocabulary	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
2001	28.51	5.99	23.42	3.44	8.64	1.43	13.53	2.43
2002	28.57	6.04	23.46	3.47	8.64	1.44	13.40	2.57
2003	28.17	6.20	23.24	3.56	8.55	1.48	13.30	2.63
2004	28.32	6.23	23.33	3.57	8.59	1.48	13.31	2.64
2005	28.39	6.21	23.37	3.56	8.60	1.49	13.31	2.64
2006	28.54	5.80	23.46	3.33	8.64	1.39	13.39	2.47

Figure 3 Raw Scores from PIPS BLA after controlling for FSM, EAL, age and sex



After controlling for these variables, Figure 3 essentially shows flat lines. The only significant change over time was for picture vocabulary but this was a very slight decline, as shown in Table 4.

As seen earlier in Table 2 and Figure 1, the percentage of children attending nursery increased over time, particularly between 2001 and 2002, and the mean number of terms also increased. It might have been expected that this increase in nursery attendance would be reflected in the BLA scores but, as shown in Figures 2 and 3, that trend was not found.

Trends for Children Entitled to Free School Meals

The main aim of many of the Government's initiatives in the last 10 years has been to enhance the lives of children from deprived backgrounds. Figures 5 to 11 compare the mean baseline scores of children entitled to FSM with those who were not. The error bars represent the 95% confidence intervals. These plots were restricted to children with English as their first language.

Figure 5 *Early Reading and FSM*

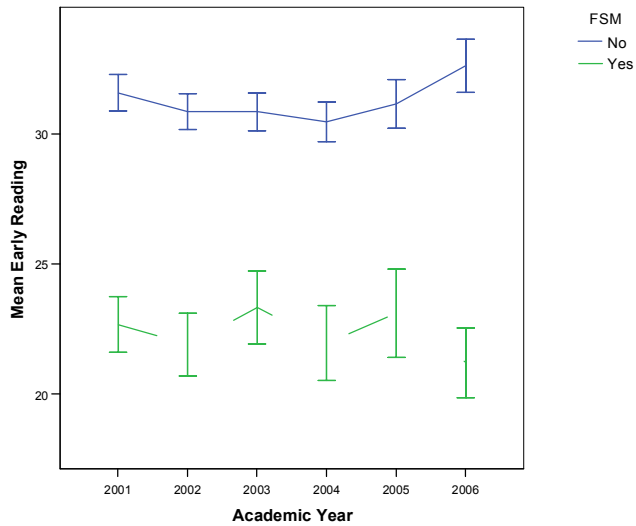


Figure 6 *Early Mathematics and FSM*

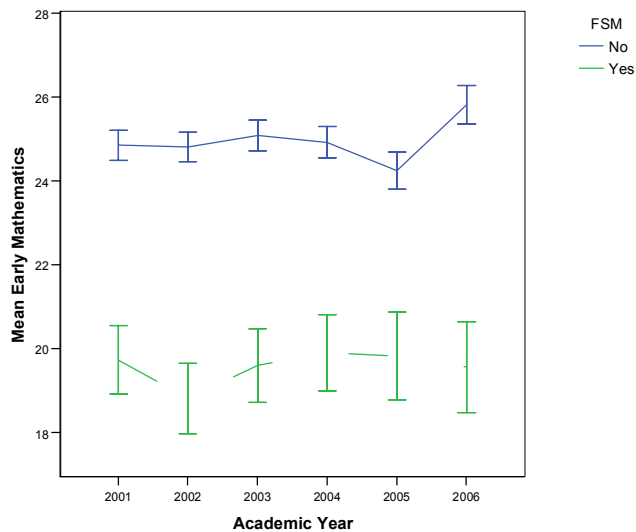


Figure 7 Phonological Awareness and FSM

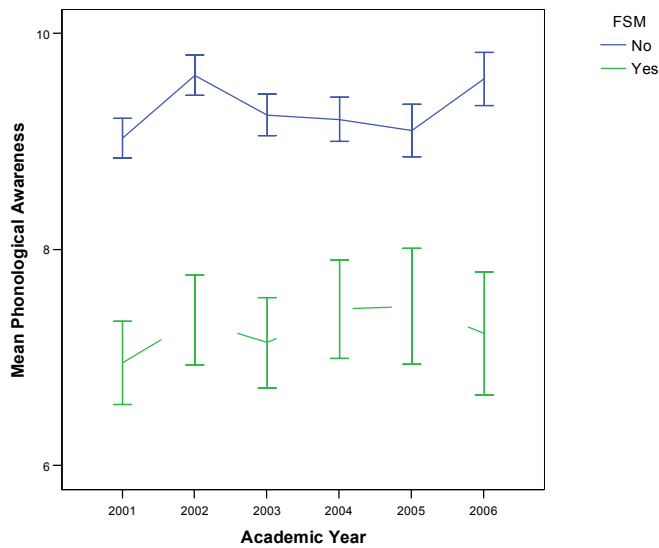
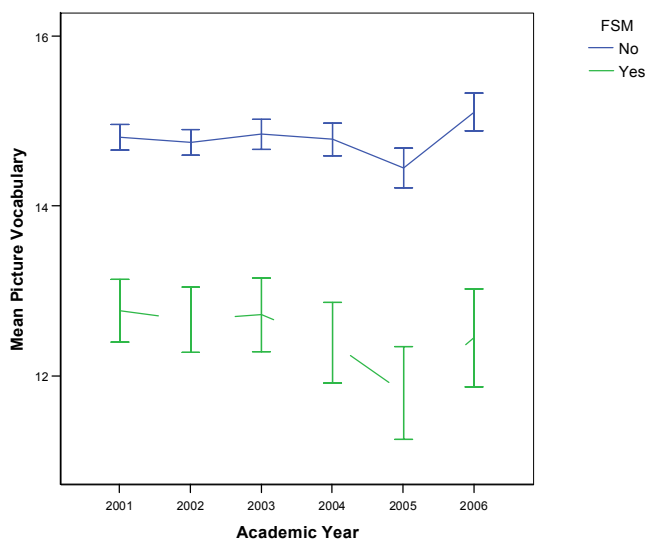


Figure 8 Vocabulary and FSM

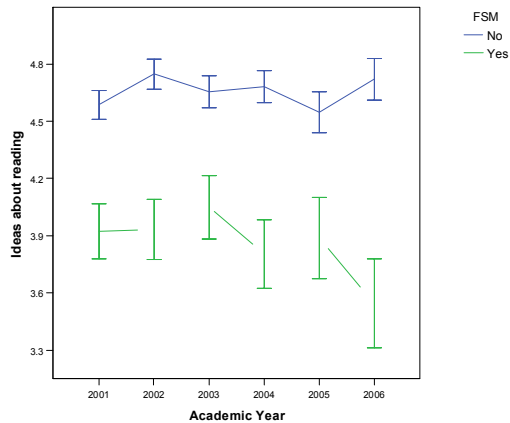


As expected the mean BLA scores of the group of children entitled to FSM were significantly lower than the group from more affluent backgrounds for each of the four areas of development. The trends seen in all four figures indicate that the gap between children from deprived backgrounds and children from more affluent backgrounds neither decreased nor increased statistically over time.

Investigating the sub-sections of the areas in more detail, there were some interesting differences between children entitled to FSM and children who were not.

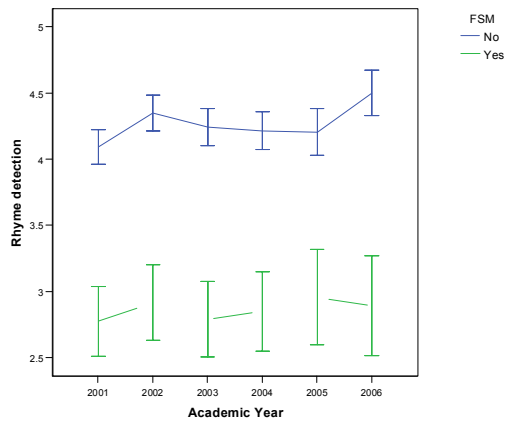
Figure 9 shows Ideas about reading, which assesses concepts about print including an appreciation of the difference between a writer and a reader, the difference between a picture and print, knowledge of where to begin reading a passage and being able to identify where a sentence begins and ends. The difference between those children entitled to FSM and those who were not increased significantly ($p=0.009$) over time although this was only because of large difference in the 2006 cohort and perhaps the following year this difference would have decreased again.

Figure 9 Ideas about Reading and FSM



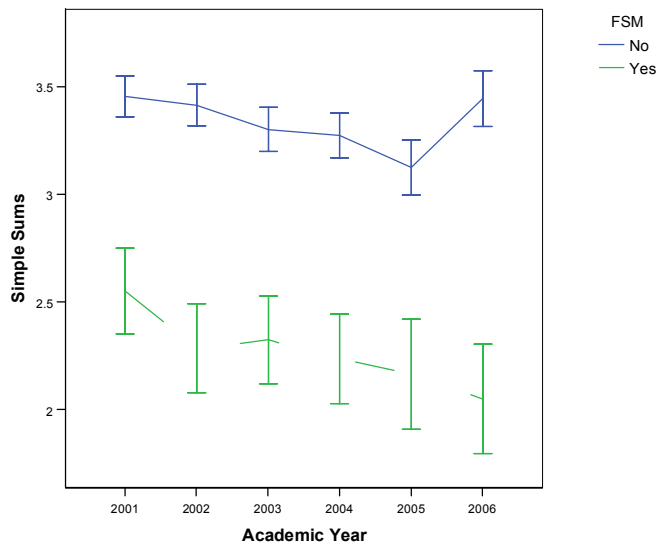
The difference between mean scores for Repeating Words of the two groups was very small each year and not significantly different in 2005. For this part of the assessment, children listened to a list of words of increasing complexity of which most were either unfamiliar or nonsense. They were asked to repeat each word immediately after hearing it. By contrast, Figure 10 shows a significant difference in Rhyme Detection each year between the two groups however the difference between the groups did not increase or decrease significantly over time. This part of the assessment also assessed phonological awareness. Children were presented with an item (for example 'hat') and asked to select an item from a choice of three which rhymed (for example 'cat', 'head', 'ring'). This skill requires a higher level of understanding of language and sounds than simply repeating words.

Figure 10 Rhyme Detection and FSM



In the Early Mathematics scale, the ability to do simple sums, presented to the children without formal notation, showed a decline over time, with the exception of 2006 for the group of children not entitled to FSM. This is illustrated in Figure 11 where a steady decline in the ability of children who are entitled to FSM to do simple sums is apparent and statistically significant.

Figure 11 Sums and FSM



Summary and Conclusion

This paper analysed the development and skills of children starting compulsory education in England between the years of 2001 and 2006 inclusive. The sample comprised a group of 124 primary schools that had carried out the same baseline assessment over the period in question. Nearly 35,000 children were assessed. The sample was generally nationally representative with very slightly lower means in the 2003 and 2006 intakes. An analysis of background variables suggested that the characteristics of the sample were fairly stable over the years with the exception of attendance at nursery, which increased dramatically in 2002 but remained reasonably constant thereafter.

Analysis of the data suggested that:

- The overall development and skills of children in the sample of schools analysed (i.e. the total score on the PIPS BLA) remained stable between 2001 and 2006 inclusive.
- There was some change in the separate areas of early reading, phonological awareness, early reading and picture vocabulary but although statistically significant, educationally these changes were very small.
- After controlling for deprivation, language, age and sex, the only significant change over time was a very slight decline in picture vocabulary.
- There was no indication that the gap between those entitled and not entitled to free school meals was decreasing. In one area of development (Ideas about Reading) it was increasing significantly, however this was a consequence of the data from the 2006 cohort only.

Why should the scores on the BLA have been so stable? On the one hand one might expect that the major initiatives would have resulted in measurable changes. On the other hand it is important not to jump too rapidly to evaluative conclusions. The study had no measures of the involvement of the children in any of the national initiatives. Further, we do not have data on the interactions within families and how that had changed during the period in question. But it is well known that attempts to influence the development of young children through early intervention are not easy. Whilst there are many positive examples of successful interventions there are also many examples of less successful initiatives (see for example Ramey and Ramey, 1998).

Our aim is to provide a single perspective on the changing profiles of children starting school in England during a time of rapid change. As further evidence builds from other studies a clear picture should start to emerge which will either confirm the picture of stability found in the paper or challenge it with better information.

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