

Effective Pre-school and Primary Education 3-11 Project (EPPE 3-11)

Summary Report Influences on Children's Attainment and Progress in Key Stage 2: Cognitive Outcomes in Year 5

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Executive Summary

This report presents the results of analyses related to the Key Stage 2 phase of a major longitudinal study investigating the influence of pre-school and primary school on children's cognitive and social/behavioural development (EPPE 3-11) in England. The study is funded by the Department for Education and Skills. The focus of this report is on children's cognitive attainments at the end of Year 5. A report on children's social/behavioural development at this age will be published separately (Effective Pre-school and Primary Education 3-11 [EPPE 3-11] Team, 2007). The original EPPE pre-school sample was recruited to the study at age 3 years plus and followed to the end of Key Stage 1 (Year 2) in primary school. An additional 'home' sample of children (who had not attended pre-school) was recruited at the start of primary school. The EPPE 3-11 project is following up the sample to the end of primary schooling (age 11 years plus). The research has adopted an educational effectiveness design and mixed methods approach (Sammons et al., 2005; Siraj-Blatchford et al., 2006) in order to investigate child, family and home influences on developmental outcomes so that the relative importance of these influences can be studied in relation to the strength of pre-school and primary school factors.

EPPE 3-11 has a wide range of data on children's development, child, family and home learning environment (HLE) and pre-school characteristics. Additional value added measures of primary schools, derived from multilevel statistical analyses of national data sets conducted for all primary schools in England (Melhuish et al., 2006), are also used in analyses to provide independent indicators of the academic effectiveness of primary schools attended by children in the EPPE 3-11 sample to complement the measures of quality and effectiveness of pre-school settings. It is therefore possible to explore both pre-school and primary school influences on children's outcomes in Year 5.

Standardised tests of Reading and Mathematics have been used to provide measures of children's educational outcomes in Year 1 and again in Year 5. The sample included over 2550 children for whom Reading and Mathematics data were available at these two time points drawn from over 950 primary schools. Measures of the quality of the 141 pre-school centres originally attended by children in the pre-school sample were based on trained researchers' observations in each centre, using environment and care-giver interaction rating scales. Measures of the effectiveness of individual pre-school centres were derived from value added models of the EPPE children's progress against expectations in each centre, controlling for prior attainment and background characteristics.

The aims of the analyses were:

- To explore the how child, parent and home characteristics are related to children's attainment at the end of Year 5.
- To compare the influence of child, parent and home characteristics on children's attainments in Year 5 to the influence at Year 1.
- To model children's cognitive attainment and progress over Key Stage 1 and 2.
- To investigate any continuing impact of pre-school, including variation in children's outcomes related to different types of pre-school, and for those with no pre-school provision (i.e. the 'home' sample).
- To explore the impact of measures of pre-school quality and effectiveness on later child outcomes.

- To investigate the combined impact of home learning and pre-school characteristics.
- To investigate the net influence of primary school academic effectiveness on cognitive attainment and progress.
- To investigate the combined effect of pre-school experience and primary school experience on cognitive attainments.
- To explore whether the impact of pre-school and primary school differs for more and less disadvantaged children.

The impact of child, family and early years home learning environment (HLE) characteristics

Significant variations in average attainment scores were identified for different sub-groups of pupils in Year 5 (e.g. by gender, ethnic group, family socio-economic status [SES] etc.). By studying the way that different groups of children's development varies between the end of Year 1 and the end of Year 5 it was possible to identify the groups of children for whom the attainment gap in Reading and Mathematics has widened or reduced during Key Stage 2 and highlight the factors most strongly associated with better or poorer progress.

Statistical analyses investigated the influence of different child, family and early years HLE background factors on children's attainments at the end of Year 5. These contextualised analyses identify the unique (net) contribution of specific factors to variation in children's outcomes, while other background influences are controlled. For example, the relationship between attainment and family SES is established while taking into account the influence of mother's qualification levels, low income, ethnic group, birth weight, HLE etc. This is important, because much of the apparent difference in attainment associated with certain characteristics, for example, ethnic group membership, is attributable to other socio-economic and demographic factors (e.g. birth weight, income, language, family SES, parents' qualification levels and HLE). Key findings are reported later in this Summary.

Similar analyses have been undertaken on cognitive outcomes at the end of Year 1 in primary school. The net effects of different child, family and HLE characteristics on the same standardised attainment measures in Year 1 were compared to their net effects on attainment at the end of Year 5. These analyses sought to establish the changing influence of individual background factors while young children move through primary school (see Section 2).

The findings draw particular attention to the importance of the quality of the early years HLE on children's longer term educational outcomes. A more detailed exploration of the influence of the HLE investigates interactions between early years HLE and pre-school effects.

The results identify the size and nature of the equity gap in achievement and how it changes at different points in children's pre-school and school careers. This has informed the Government's Equalities Review (Effective Pre-school and Primary Education 3-11 [EPPE 3-11] Team, 2007), a broad ranging enquiry into the nature and influences that shape social inequality in Britain, that highlights the importance of children's educational and early years experiences.

Educational Influences

In addition to investigating child, family and HLE background influences, EPPE 3-11 explored the combined net effects of pre-school experience and the academic effectiveness of the primary school (measured using value added analyses of national datasets). These analyses investigated whether children who did not go to pre-school or who attended a less effective pre-school benefited more if they went on to attend a more academically effective primary school. Another hypothesis tested was that high quality or high effective pre-school experience would have a protective effect on children's later educational outcomes if they went on to less effective primary schools (see Section 3).

Additional value added analyses investigated pupils' academic progress from the end of Year 1 to the end of Year 5 of primary school. The assessments at the end of Year 1 provided the baseline measures for exploring relative gains in Reading and Mathematics over time. In addition to the simple value added model that controls only for prior attainments, contextualised models were developed to investigate which child, family and HLE background factors and which pre- and primary school characteristics predict progress in Reading and Mathematics (see Section 4).

The importance of educational experiences in shaping outcomes at age 10 years has been highlighted by the Year 5 analyses (Sections 3 and 4). Pre-school influences remain evident even after five years full time in primary school. However, attending any pre-school is not sufficient to ensure better outcomes in the longer term. Both the quality and the effectiveness of the pre-school setting predict cognitive outcomes. Poor quality pre-school by itself does not improve later attainment outcomes at the end of Year 5 in primary school, whereas medium and especially high quality pre-school experience is associated with longer term benefits for the development of academic skills in Reading and Mathematics. The results indicate that pre-school influences are somewhat stronger for Mathematics than for Reading.

EPPE 3-11 is the first large scale longitudinal study to investigate both pre-school and primary school influences on the same children's attainment and progress. Results demonstrate that the academic effectiveness (value added) of the primary school attended has an additional positive influence on children's attainment at the end of Year 5. It should be noted that the academic effectiveness measures were independently derived from National assessment data and based on previous cohorts of children in the schools. Thus, they provide robust measures of the academic quality of the primary schools attended by EPPE 3-11 children.

In addition, the research is unique in having investigated for the first time the *combined* influence of pre-school and primary school effects. For 'home' children in particular, the effectiveness of the primary school attended helps to close the attainment gap (for those who attend a high effective primary school there is a particular boost to Mathematics outcomes in comparison with those who attended a low effectiveness primary school). By contrast, attending a high quality or more effective pre-school seems to act as an important protective factor for children who went on to attend a less effective primary school.

Key findings

The key findings are reported in terms of the three main sets of influences studied: child/family; evidence of continuing pre-school influence; and the contribution of the primary school attended.

Child, Family and HLE effects

- The quality of the early years home learning environment (HLE) and parents' (especially mothers') qualification levels are the most important background factors relating to a child's attainment in Reading and Mathematics at Year 5, followed by low birth weight, need for support with English as an additional language (EAL), early health or developmental problems and socio-economic status (SES).
- Taken together, child, family and HLE influences on children's attainment in Reading and Mathematics, in Year 5, are weaker predictors than they were in Year 1. This is likely to indicate the increased primary school and peer group influence.

Pre-school effects

- There is evidence of a continuing positive effect of attending higher quality or more effective pre-school settings on children's subsequent outcomes in Mathematics and Reading at the end of Year 5, once the influence of background factors has been taken into account.
- Those children who attended low quality pre-school no longer show cognitive benefits by Year 5; their results are not significantly different from the children who did not attend pre-school. This is a change in comparison to earlier findings at age 5 (the start of primary school) when all pre-school experience was found to be beneficial.

Primary school effects

- The academic effectiveness of the primary school a child attends (as measured by independently conducted value added analyses of National assessment results for 2002-2004) was found to be a significant factor in accounting for variation in EPPE 3-11 children's Reading and Mathematics attainment in Year 5. Children who had attended a primary school identified as academically more effective had better outcomes at age 10 than children who attended a less effective primary school, after allowing for the influence of child, home and pre-school factors.
- Attending a more academically effective primary school was a more important factor for the later attainment of children who had not attended pre-school or who had attended a low quality pre-school, than to those children who had attended a more effective or higher quality pre-school.
- Equally, early experience of attending a better quality or more effective pre-school appeared to act as a protective factor against the limitations of later moving to a

less academically effective primary school; in terms of fostering better Reading and Mathematics outcomes in Year 5.

- Overall the results indicate that the combined influence of attending a better pre-school and a more academically effective primary school can give a significant boost to children's later cognitive outcomes at age 10, especially for Mathematics. This effect is similar in size to the impact of having a high rather than a low Home Learning Environment or a mother with the highest level of educational qualifications (a degree or above) rather than none.

Implications

The new evidence on the size and significance of the extent to which individual child, family and HLE background factors are predictors of differences in children's academic attainment and progress and the way such influences change over time is relevant to the monitoring of equity in education.

The study of the net influence of particular factors indicates that much of the apparent difference in attainment associated with certain characteristics, for example, ethnic group membership, is attributable to the impact of other socio-economic and demographic factors (e.g. birth weight, income, language, family SES, parents' qualification levels and HLE). Such findings are important to inform thinking on appropriate policy and practical strategies to reduce the achievement gap and enhance outcomes for vulnerable groups and the results have contributed to the evidence base for the Government's Equalities Review (<http://www.theequalitiesreview.org.uk/>).

The research also provides new evidence concerning the *combined* effects of pre-school and primary school in shaping children's educational outcomes. The results demonstrate that it is important to raise the quality and effectiveness of both pre-schools and primary schools in order to raise attainment standards in basic skills, especially for disadvantaged groups of pupils who are at risk of under achievement.

The results show that for more disadvantaged children high quality and high effectiveness of the pre-school seems to be necessary to obtain long-lasting benefits in terms of improved Reading and Mathematics outcomes. For less disadvantaged groups pre-school generally shows a more positive effect, irrespective of quality. The research also reveals the strength of the influence of early years HLE, which is found to be the strongest predictor of higher attainment especially in Reading in Year 5. It also highlights interesting interactions between the quality of the pre-school and early years HLE indicating that the HLE is likely to moderate the influence of pre-school. Again this points to the important role of parents and other carers in providing rich home learning experiences during the sensitive pre-school period of young children's development.

We can conclude that no one factor is the key to raising achievement – it is the *combination* of experiences over time that matters. The child who has a better HLE, goes to a high quality, more effective pre-school setting and who then goes on to attend a more academically effective primary school has a combination of ‘protective’ experiences that benefit current and future educational attainment. In a later report similar analyses will be used to investigate impacts on social/behavioural development for the same pupil sample in Year 5.

The implication of these findings is that policy development should seek to promote strategies to support improvements in early years HLE especially for vulnerable groups and also work to continue to improve the quality and effectiveness of pre-school provision. Pre-schools are well placed to identify children who may need extra support and could be guided to work with parents to improve the HLE. The improvement of provision in poorer quality pre-schools also needs to be given a high priority, since poor quality provision does not appear to offer long term benefits in terms of better child attainments at the end of Year 5, even though any pre-school experience was found to benefit children in a wide range of skills and social behaviours at younger ages when they started primary school, and in their first year of primary school (see Sammons et al., 2002; 2003; 2004a; 2004b for equivalent results at age 5, 6 and 7 years).

In addition, the research indicates that the primary school attended also plays an important role. Improving the academic effectiveness of primary schools is particularly important for disadvantaged groups of pupils, since we find that attending a more academically effective primary school is more critical for this group (further analyses of the equity implications of the findings have contributed to the Cabinet Office Equalities Review, EPPE et al., 2007 in press). The finding that primary school academic effectiveness is a more significant influence for disadvantaged pupils (especially those who did not go to pre-school) is of particular importance to the achievement of the social inclusion as well as the raising standards agendas.

In order to help reduce the achievement gap for multiply disadvantaged groups, concerted and complementary actions to strengthen the early HLE, and ensure good quality pre-school and primary school experiences will be needed, since improvements to any one in isolation would be insufficient to boost outcomes. In addition, targeted interventions for children who are well behind their peers in cognitive or social/behavioural development at the start of primary school are likely to be needed to help prevent a widening of the attainment gap during Key Stage 1 and 2.

Introduction

EPPE 3-11 is a large-scale longitudinal study funded by the Department for Education and Skills (DfES) with the aim of investigating what kinds of early childhood provision are most 'effective' in promoting young children's progress and development during their time at pre-school, and to explore whether any pre-school effects continue to influence children after they start primary school. The first phase of the research followed children to the end of Key Stage 1 (KS1) of primary school (age 7 plus years). Measures of the quality of pre-school settings (pre-school centres) were collected from observations by trained researchers using the Early Childhood Rating Scale (ECERS) and Caregiver Interaction Scale (CIS) instrument (see Sylva et al., 1999a; 1999b; 2003). In total, 141 pre-school centres drawn from five regions across England formed the focus of the EPPE pre-school research. Centres were drawn from six types of provision; nursery classes, playgroups, local authority day nurseries, private day nurseries, nursery schools and integrated centres (i.e. combined centres that integrate education and care). For details of the study of pre-school influences see Sammons et al., (2002; 2003; 2004b). Results of analyses of children's outcomes in Key Stage 1 are reported by Sammons et al., (2004 a & b).¹

The second phase of the study is following children's development to the end of Key Stage 2 (age 11 plus years). This extension to the original research is designed to explore continuing pre-school influences as well as to investigate the effects of primary school attended. EPPE was the first study of pre-schools in Europe to adopt an educational effectiveness design based on sampling children in a range of different pre-school settings (centres) and uses statistical approaches (multilevel modelling) that enable the identification of individual pre-school centre and school effects.

Beginning around the age of 3 years (at entry to a target pre-school in the centre sample or at their third birthday for children who had already entered provision at a younger age), children were assessed and then followed up at entry to primary school. In this way it has been possible to explore variations between individual pre-schools in their value added contribution to children's cognitive progress and social/behavioural development. The first phase of the research explored whether different types of pre-schools differed in their impacts and effectiveness. It also identified variations between different pre-school centres in children's cognitive progress and social/behavioural development.

The overall EPPE 3-11 study uses a mixed methods approach (combining qualitative and quantitative methods) and an educational effectiveness design, including detailed statistical analyses of effectiveness and in-depth case studies of individual pre-school centres (Sammons et al., 2005; Siraj-Blatchford et al., 2006). This report is based on statistical analyses for a sample of 2,556 children for whom cognitive data on Reading or Mathematics attainments was collected at the end of Year 5, between 2003 and 2006 (as the EPPE sample were drawn from four age cohorts reflecting their recruitment to the original pre-school phase of the research). This represents eight-seven per cent of the children in the EPPE 3-11 sample for whom valid baseline data had been collected on cognitive attainment at entry to primary school.

Data on cognitive attainment was collected at different time points: the start of primary school, at the end of Year 1, Year 2 and Year 5. Additionally a wide range of further information has been drawn on, including information about child, family and HLE characteristics collected from parental interviews (in pre-school) and questionnaires (in KS1).

This report focuses on children's attainment at the end of Year 5 and progress from the end of Year 1 to the end of Year 5 in primary school. It explores the influential strength of a wide variety of child, parent and family factors as predictors of attainment, including aspects of the early years HLE provided by parents during the years of pre-school and aspects of the later HLE during Key Stage 1 of primary school. It also investigates pre-school and primary school influences.

¹ Full details of the original EPPE study are provided in a series of 12 Technical Papers (see Appendix 1).

Further analyses of children's social/behavioural development and attitudes to school in Year 5 will be reported in subsequent Research Reports.

Aims

The aims of the multilevel analyses were:

- To model young children's cognitive attainment and progress over Key Stage 1 and 2.
- To explore the influence of child, parent and HLE characteristics on children's attainment at the end of Year 5.
- To compare the influence of child, parent and HLE characteristics on children's attainments in Year 5 to the influence at an earlier age (end of Year 1).
- To investigate any continuing impact of pre-school, including any variations in children's outcomes for those who attended different types of pre-school, and those who received no pre-school provision (the 'home' sample).
- To explore the net impact of measures of pre-school process, particularly measures of quality and effectiveness on later child outcomes.
- To look at the combined impact of 'good' home learning characteristics and attending 'good' pre-school.
- To investigate the net influence of primary school effectiveness on cognitive attainment and progress (controlling for child, family and HLE characteristics).
- To investigate the interactive effect of pre-school experience and primary school experience on cognitive attainments.
- To explore whether the impact of pre-school and primary school differs for disadvantaged children compared with other less disadvantaged children in the sample.

Methods

The analyses employ a range of statistical techniques from descriptive and correlation analysis to multilevel (hierarchical) regression methods to examine the influences on children's cognitive attainment and progress. The paper focuses on two measures of Year 5 attainment assessed with standardised assessments (NFER-Nelson Primary Reading Level 2 and Mathematics 10) in Reading and Mathematics. At the end of Year 1 tests of the same type were administered, so comparable measures of prior cognitive attainments are available.

Multilevel models provide more accurate assessments of the predictive power of different child, pre-school and primary school characteristics. Earlier analyses enabled the calculation of value added estimates (residuals) of individual pre-school effects (see Sammons et al., 2002 for details). These value added measures of pre-school effectiveness have been included in subsequent analyses of children's educational outcomes, at the end of Year 5 in primary school, to establish whether the effectiveness of the pre-school attended continues to show an impact on later cognitive attainment.

To examine the impact of primary school, measures of primary school academic effectiveness in English and Mathematics have been derived from independent value added analyses of pupil progress for three successive full cohorts (2002-2004) using National assessment data sets matched between Key Stage 1 and 2 over three years (see Melhuish et al., 2006).

Background information about child, parent and family characteristics, was obtained initially through parent interviews conducted soon after children were recruited to the study. The parent interviews were designed to obtain information about a child's health and care history, details of family structure and parents' own educational and occupational backgrounds as well as some indications of parent-child activities and routines. Parents were asked to give some further information about child, parent and family characteristics when the children were in Key Stage 1 (aged approximately 6 years) via a parent questionnaire which covered changes in background information (in employment, income, family structure, number of siblings etc) as well as

information on aspects of the HLE in Key Stage 1. The corrected response rate obtained was eighty-one per cent.²

Structure of Report and Analyses

This report is divided into four sections.

The first section investigates to what extent different child, family and HLE characteristics account for variation in children's Reading and Mathematics attainments in Year 5 of primary school education. The net influence of different background factors on children's attainments is explored using statistical techniques. Further analyses are used to identify the unique (net) contribution of particular characteristics to variation in children's cognitive outcomes, while other influences are controlled.

The second section describes the extent of change in the impact of different background factors while young children move through primary school. Contextualised multilevel models were used to estimate the net impact of different background factors on cognitive attainments in both Year 1 and Year 5. Effect sizes (ES) for the different factors were calculated and a comparison between the two years was made in terms of the relative strength of influence measured by changes in the ES over the four years. This section therefore answers the question of whether the cognitive attainment gaps found for different groups of children have remained the same between Year 1 and Year 5 or whether the gaps between certain groups have closed or increased.

In the third section the effects of pre-school and primary school experience on cognitive outcomes at the end of Year 5 are investigated. The first phase of the EPPE 3-11 research had shown that pre-school experience gave children a better start to school, in terms of higher cognitive attainments and improved social/behavioural outcomes. In these analyses measures of pre-school centre influence including the observed quality of pre-school provision (measured by the ECERS-E scale, see Sylva et al., 2003) and centre effectiveness (measured by value added residual estimates based on cognitive progress during the pre-school period) are tested to explore any continuing effect of pre-school at the end of Year 5. This section also addresses the question of whether pre-school effects vary for different groups of children.

Further analyses sought to establish the impact of primary school academic effectiveness (measured by value added) on cognitive outcomes in Year 5. In addition, analyses explored whether certain groups of children benefit more from the academic effectiveness of the primary school attended than other children. Analyses also explore the combined influence of different characteristics of pre-school experience (quality and effectiveness) and primary school academic effectiveness.

Section 4 presents results of analyses that were conducted to explore children's academic progress from the end of Year 1 at primary school to the end of Year 5. Value added analyses of children's cognitive progress across Key Stage 1 and Key Stage 2 have been conducted; these analyses control for prior attainment (Year 1) in analysing progress over time.

The final section summarises the results drawing together the main findings and conclusions.

An appendix is provided reporting some further background information concerning the characteristics of the EPPE 3-11 sample and investigates whether particular groups of pupils show differences in their cognitive attainments at the end of Year 5 of primary school education.

² Between the initial assessment at entry to pre-school and the Reception assessment 139 children dropped out of the study. The response rate is based on the corrected sample of 3032 children.

Section 1: The Impact of different Child, Family and Early Years Home Learning Environment (HLE) Characteristics on Reading and Mathematics Attainment in Year 5

This section presents the results of analyses of the relationships between various child, family and early years HLE characteristics and children's cognitive attainments at the end of Year 5. All the results presented in this section are net results, controlling for any other influences. As in all social and educational research it is very difficult to draw firm conclusions about causal connections. In this report we explore patterns of association and identify the predictive influence of different measures in accounting for variations between pupils in their attainments in Reading and Mathematics in Year 5.

The following measures have been used in the analyses:

- Child factors (i.e. gender, birth weight, number of siblings, early developmental problems, early behavioural problems, mother tongue, ethnicity),
- Family factors (i.e. socio-economic status [SES], parent's highest qualification, family income),
- HLE in the early years (how often parents read to the child, teach the child the alphabet, play with letters & numbers, teach songs & nursery rhymes, paint & draw etc.) before starting primary school,
- Parental activities towards the end of Key Stage 1 (age 6) such as the frequency of reading to the child, taking the child out on educational visits, computing activities, play, etc. (see Appendix 4 for details of these measures).

Figure 1.1: Strategy of statistical analysis of background influences

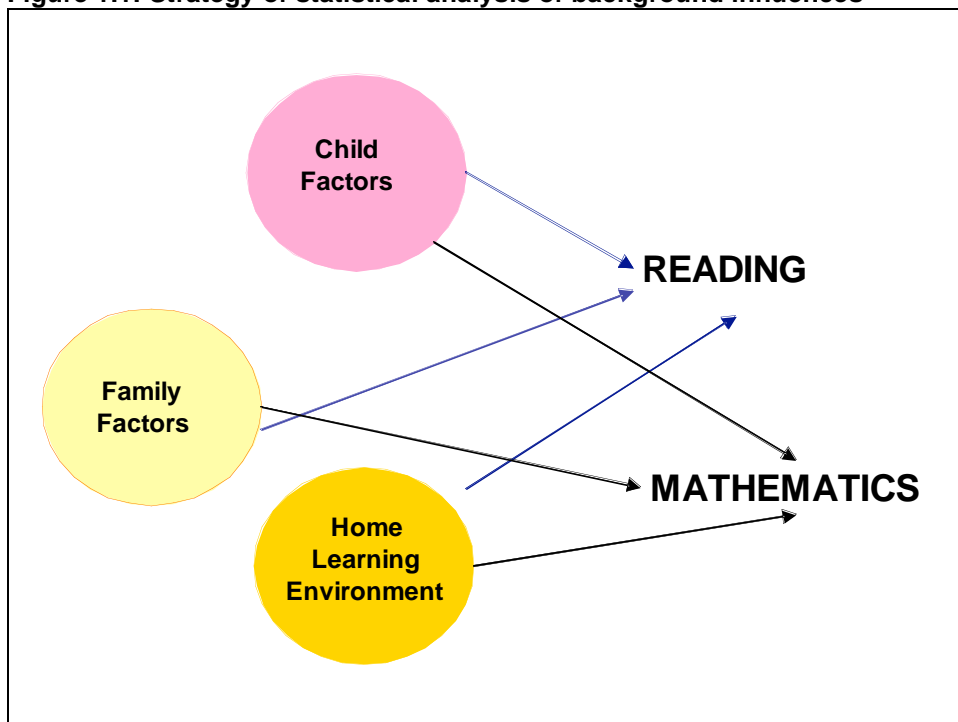


Figure 1.1 illustrates the strategy of statistical analysis³. We investigated whether the associations between cognitive attainments and these child, family and HLE factors remain statistically significant when children reach the end of Year 5 of primary school education. The analysis of the influence of child, family and HLE characteristics on cognitive outcome is an important step as only on this basis is it possible to separately identify and quantify the net

³ Please note that all the analyses also accounted for associations between the predictors which could have been illustrated by additional arrows. For simplicity these arrows are not shown in Figure 1.1.

influence of pre-school and primary school education (explored in Section 3). The extent of differences in standardised assessment results attributable to a child's background is also of considerable policy interest, given the equity implications for later progress at school. The net influence of different child, family and HLE characteristics is illustrated in Figures 1.2 and 1.3. The description given alongside each factor listed in these Figures indicates the strength of influence in terms of the effect sizes (ES) for different pupil group in comparison (e.g. boys compared with girls) for each factor tested⁴. An effect size is a statistical measure representing the strength of the single effect. An ES of 0.2 can be seen as representing a moderate influence while a relatively strong influence would be an ES of 0.5+.

Figure 1.2: Factors with significant 'net' effect on attainment in Reading at the end of Year 5

Reading: Factors with significant 'net' effect at the end of Year 5		
Factor	Effect Size	Description
Gender	0.10	Girls higher attainment than boys
Birth weight	0.40	Normal birth weight higher than very low birthweight
Ethnic groups	0.35	White UK heritage higher than some minority groups
Number of siblings	0.21	3+ siblings lower than singleton
Need of EAL support	0.37	Need of EAL support = predictor for low attainment
Developmental problems	0.17	Early developmental problems = predictor for low attainment
Parents qualification	0.64	Higher qualified parents = higher attainment
SES	0.36	High SES = higher attainment
FSM	0.27	Eligible for FSM = negative predictor
Salary	0.27	Salary > 67.500 £ / Year = higher attainment
(Early years) HLE	0.61	The higher the HLE -Index the higher the attainment.

⁴ For factors where more than one category showed a significant effect (e.g. mother's qualification or early years HLE) the effect size of the most representative category is shown in Figures 1.2 and 1.3. Details on effect sizes for other categories can be found in Figures later in the report.

Figure 1.3: Factors with significant ‘net’ effect on attainment in Mathematics at the end of Year 5

Mathematics: Factors with significant ‘net’ effect at the end of Year 5		
Factor	Effect Size	Description
Birth weight	0.42	Normal birth weight higher attainment than very low birth weight
Ethnic groups	0.39	Indian higher than White UK heritage
Need of EAL support	0.51	Need of EAL support = negative predictor
Health problems	0.45	Early health problems = negative predictor
Parents qualification	0.54	Higher qualified parents = higher attainment
SES	0.27	High SES = higher attainment
FSM	0.22	Eligible for FSM = negative predictor
Salary	0.30	Salary > 17.500 £ / Year = higher attainment than no salary
(Early years) HLE	0.57	The higher the HLE -Index the higher the attainment.

Child Measures

Examining the net impact of child factors on attainment in Reading in Year 5, we find that gender, birth weight, ethnicity, number of siblings, the need of EAL support and early developmental problems are found to have a statistically significant net effect. For Mathematics in Year 5 the following child characteristics are found to have significant net effect: birth weight, early health problems, ethnicity and number of siblings.

Differences related to gender were found in favour of girls for Reading (reported as effect sizes ES = 0.10). This difference, though significant was relatively small in size (for details on the calculation and interpretation of effect sizes see the Glossary). The result is in line with findings at earlier time points. Boys show significantly higher attainment than girls in Mathematics now, though this effect is no longer statistically significant when account is taken of differences in some aspects of KS1 home learning activity (parents reported boys made much greater use of computers at home than girls and this was associated with better attainment in Mathematics). At earlier time points in Key Stage 1, girls showed higher attainment in Mathematics than boys.

Children with very low birth weight had significantly lower attainment in Reading (ES = 0.40) and Mathematics (ES = 0.42) in Year 5 than children with normal birth weight⁵. This is in line with findings at earlier time points, although interestingly for younger ages the effect was stronger for Mathematics than for Reading.

As a group, children from larger families (with 3 or more siblings) showed significantly lower attainment in Reading (ES = 0.21) but not in Mathematics. This may reflect reduced opportunities for parental time to read with a child in larger families during the early years.

Also, children whose parents reported early developmental problems at the beginning of the study showed lower attainment in Reading than children for whom no early developmental problems were reported (one developmental problem: ES = 0.17, more than one developmental problems: ES = 0.42). However, early developmental problems did not have any significant

⁵ Babies born weighing 2500 grams or less are defined as below normal birth weight: foetal infant classification is below 1000 grams, very low birth weight is classified as 1001-1500 grams and low birth weight is classified as 1501-2500 grams (Scott & Carran, 1989).

influence on attainments in Mathematics in Year 5. But for Mathematics children who had 3 or more early health problems showed lower attainment at the end of Year 5 than those children who had none (ES = 0.45).

Children who still needed support because of having English as an additional language showed lower average attainment in Reading (ES = 0.37) and Mathematics (ES = 0.51) than those who did not need such support. It is particularly interesting that the net effect of EAL support is stronger for outcomes in Mathematics than in Reading. This may be because EAL support is more often targeted at Reading but not at Mathematics in primary schools as identified from the earlier study of information on special educational needs (see Taggart et al., 2004). For ethnic groups, the relationships (in comparison with the White UK group) indicated that Reading attainment for two groups; Bangladeshi and White European were significantly lower (ES = 0.35). This is in line with earlier findings. In Mathematics, Indian children showed particularly high attainment compared to White UK children (ES = 0.39).

It should be stressed that these differences relating to ethnic groups and EAL are net of the influences of all other factors in the model, including SES and mother's qualification level in which there are also significant differences between ethnic groups which account for much of the raw differences in average attainment levels identified between different ethnic groups.

Family Measures

A number of family factors were found to have a significant net effect on attainments in Reading and Mathematics, parents' qualifications, family SES, eligibility for free school meals (FSM) and family's salary.

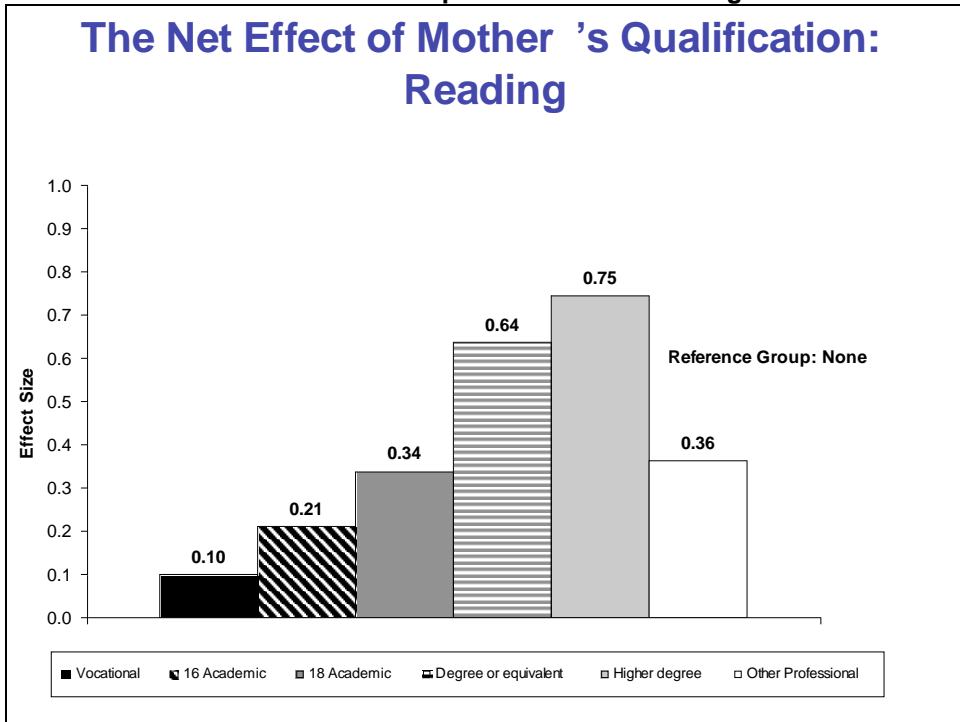
The free school meals (FSM) proxy measure of low income showed a negative relationship with attainment in Year 5. The differences were of moderate size (ES = 0.27 for Reading, ES = 0.22 for Mathematics).

In terms of the salary reported by the parents when their children were in Key Stage 1 the results indicate that children whose parents are on high joint earned incomes (more than £67,000 per annum) have better scores in Reading than children whose parents have no salary (ES = 0.27). For Mathematics net effect sizes in the range of 0.20 to 0.30 are found for different salary groups between £17,500 per annum and more than £67,000 per annum. These effects are broadly in line with previous reported effects of the employment status of the father.

Mother's education as measured by highest level of qualification continued to show a consistent pattern of strong and positive effects. The categories degree and higher degree showed the strongest positive influence (compared with the group that had no qualifications). In terms of effect sizes the association was even stronger than reported at earlier time points especially for Reading in Year 5 (for Reading, ES = 0.64 for mother having a degree versus no qualification, ES = 0.54 for Mathematics). Figure 1.4 illustrates details on effect sizes for other qualification levels compared to no qualification for Reading.

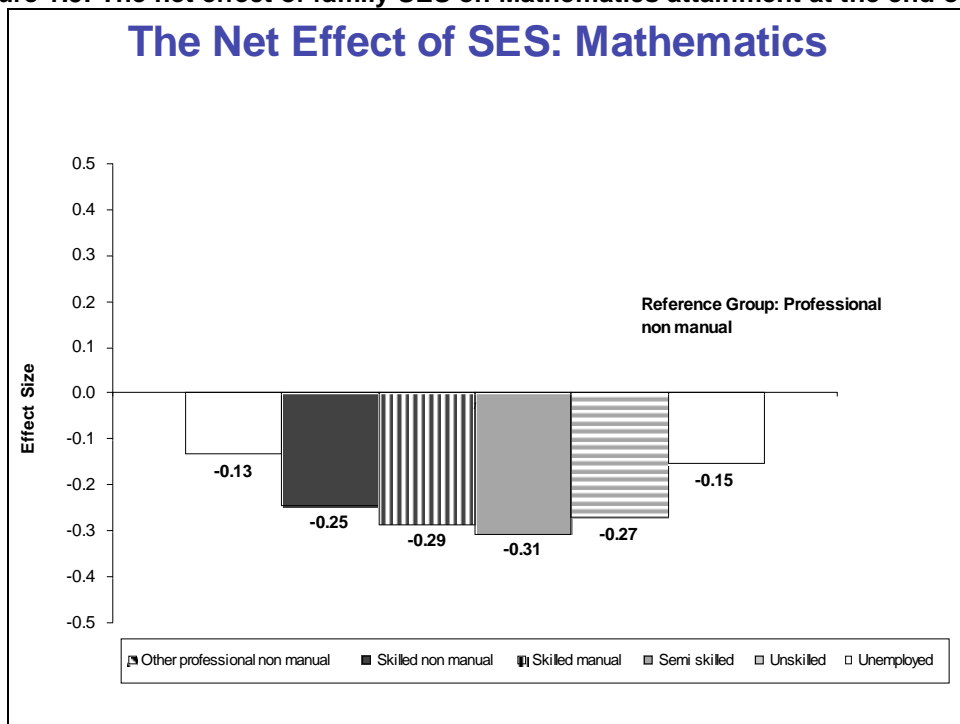
Father's qualification also has a statistically significant effect on children's attainments, but mother's qualification showed a stronger link.

Figure 1.4: The net effect of mother's qualification on Reading attainment at the end of Year 5



In terms of parents' highest social class of occupation (family SES), compared with 'professional non-manual', all other categories were associated with lower attainment levels for both Reading and Mathematics. Statistically significant lower attainment was found for children whose parents belong to the groups 'skilled non-manual', 'skilled manual' and 'semi-skilled' in Mathematics. In Reading the category 'unskilled' was associated with significant lower attainment in addition to the categories reported for Mathematics. Results in terms of effect sizes are illustrated in Figure 1.5 for Mathematics. Effect sizes can be quantified as small to moderate in the range between 0.11 and 0.36 for Reading outcomes and between 0.16 and 0.31 for attainment in Mathematics.

Figure 1.5: The net effect of family SES on Mathematics attainment at the end of Year 5



Results suggest that children, whose parents' highest SES is professional non-manual, continue to have significantly higher attainment levels, net of the influence of income and qualifications, though overall it is clear that mothers' qualification level is relatively more important than either income or SES in terms of predicting differences in children's cognitive outcomes in Year 5.

Early Years Home Learning Environment (HLE) Measures

A number of measures provide an indication of aspects of HLE in the early years. These are based on the frequency of specific activities involving the child, as reported by parents when children were recruited to the study during the pre-school period (i.e. teaching the child the alphabet, playing with letters and numbers, library visits, reading to the child, teaching the child songs or nursery rhymes). These measures were combined to create an overall early years HLE index with scores between 0 (very low HLE) to 45 (very high HLE).

When the overall HLE index was tested, it was found that the overall quality of the early years HLE remains a powerful predictor of better cognitive attainment at Year 5. The effect size (ES) for Mathematics between the highest and the lowest scoring groups on the early years HLE index was 0.57 net of other child and family factors, while for Reading the ES was 0.61 (see Figures 1.6 and 1.7). A high HLE rather than a low one has a similar positive effect on outcomes at Year 5 as having a mother with a degree versus no qualification. It should be noted that there are only modest correlations ($r=0.32$) between HLE and parents' highest qualification levels. This means that although there is a tendency for better qualified parents to provide a better HLE, the link is relatively modest and some poorly qualified parents give a very good HLE while other better qualified parents do not. In terms of the statistical model the early years HLE and parents' qualification level work as two independent predictors indicating that some parents can provide high quality HLE irrespective of their own qualification levels and support the cognitive development of their children in this way.

Figure 1.6: The net effect of early years HLE on Reading attainment at the end of Year 5

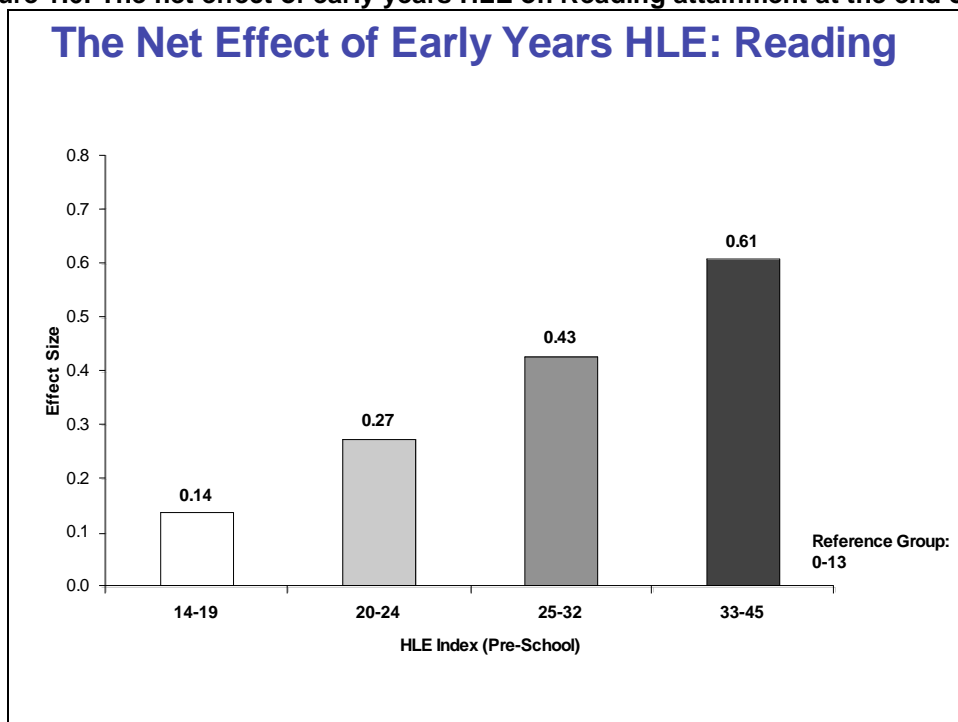
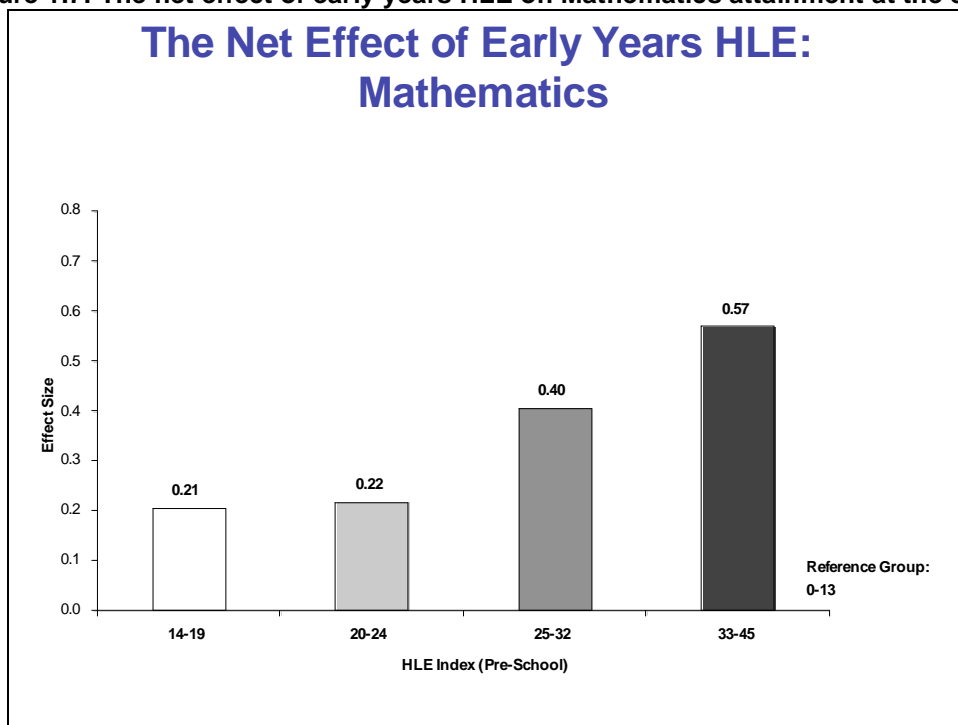


Figure 1.7: The net effect of early years HLE on Mathematics attainment at the end of Year 5



Summary of Background Influences

We tested the net influence of different child, parent and early years HLE measures on Mathematics and Reading outcomes in Year 5, while controlling for all other measures simultaneously and thus the results provide well controlled and robust estimates of statistical significance for specific background characteristics. It does not imply that measures are not of educational or policy importance if they are not statistical predictors after control for other, related measures. For example, SES is itself related to mother's educational qualification level and income and to other aspects such as birth weight. Likewise, measures of the HLE are inter-related and associated with other measures such as the gender of the child. The contextualised model shows which set of measures, taken together, provides the best set of predictors of children's attainment and which measures show a specific impact over and above other influences, helping to tease out the strongest predictors. This is important in identifying the nature of the equity gap in achievement for different pupil groups and can help to inform policy makers of the relative importance of different sources of influence.

The contextualised analyses show the strength of background influences on young children's cognitive attainments at the end of Year 5 of primary school education. Nonetheless, the models reveal that, taken together, background characteristics are less strongly associated with individual variation in Reading and Mathematics attainment in Year 5 (in terms of percentage of variance accounted for) than they were with similar cognitive outcome measures at the end of Year 1. This does not imply that certain individual background factors might have less influence than they used to have. The general pattern is likely to reflect the importance of other influences such as attending primary school for a significant proportion of time, as well as variations between individual schools in their academic effectiveness, and also the growing influence of the peer group.

Section 2: Changes in the Impact of Background Factors on Children's Cognitive Attainments in Year 5 Compared to Year 1

In this section we compare the net impact of child, family factors and early years HLE on cognitive outcomes at Year 1 with findings of their impact at Year 5. The change of net impact of different influencing factors (measured by effect sizes) reveals whether certain groups of children that showed lower attainment in Year 1 have fallen further behind or begun to catch up by the end of Year 5 (controlling for any other influences). It also explores the question of whether certain groups of children have further improved compared to the level of improvement made by other groups on average⁶ in terms of their cognitive attainments during Key Stage 2.

Child Measures

Girls show higher attainment in Reading than boys in both Year 1 and 5. For Mathematics the effect has reversed between Year 1 and Year 5; where girls showed slightly higher attainment than boys at Year 1, at Year 5 boys have not only caught up but have overtaken the girls.

In both years children with very low birth weight showed lower cognitive outcomes than children who had normal birth weight, but the effect has decreased for both Reading and Mathematics by Year 5.

The family size has also lost some of its impact on attainment in Reading. For children who experienced early developmental problems, this factor has increased in its impact on attainment in Reading but slightly decreased in its impact on attainment in Mathematics.

By the end of Year 5 the effect of 'needing EAL support' has decreased for Reading. Children who need EAL support are still showing significantly lower attainment in Reading but the gap compared to those children who do not need EAL support has become smaller.

For ethnic groups we found that Black African children had slightly higher attainment in Reading than White UK children at the end of Year 1. However, by the end of Year 5, they have fallen behind. The same is found for children who are categorised as 'any Other ethnic minority'. Other ethnic groups have, compared to White UK children, stayed at the same level in Reading. For Mathematics a marked change in level of attainment is found for Indian children. In Year 1 they had relatively lower scores than White UK children; at Year 5 they had significantly higher scores. Black African children have fallen further behind in Mathematics, whereas Pakistani and Bangladeshi children have improved their attainment relative to White UK children during KS2. However, given the relatively small sizes of some ethnic groups in the sample these results should be interpreted with caution. Nonetheless they suggest that changes in the relative strength of differences between pupil sub-groups are worth further exploration. It is also important that the potentially confounding influence of demographic factors is recognised in interpreting any 'raw' differences in average attainment levels (hence net effect sizes - as used here - are preferable for this reason).

Family Measures

The highest qualification level of the mother was a strong predictor of children's cognitive outcomes at Year 5 and at earlier time points. The change of impact between Year 1 and Year 5, illustrates that the influence of mother's qualification has become even stronger especially for Reading. For both years the comparison group was 'mothers with no qualification'. Interestingly, although relatively less important than mother's qualification level, the influence of the highest qualification level of the father has become stronger for outcomes in Mathematics.

⁶ Note that attainment was measured by test scores which were age-standardised and normalised within the sample. Therefore the score of an individual child always represents his or her attainment relative to the sample.

Children whose family was categorised as belonging to the highest SES group (professional non manual), had a lead over children of lower SES families in cognitive outcomes at earlier time points. For attainment in Reading, the gap between Year 1 and Year 5 of primary school education has become slightly wider at Year 5 for the majority of the other SES groups. For Mathematics the picture is not as consistent. Attainment for the group of children whose parents were unemployed or not working has fallen, but for other groups the attainment gap has become smaller and for the group of children whose parents were unskilled their relative attainment position has improved. Taken together we can conclude that the impact of parents' SES on attainment in Mathematics has slightly decreased. In terms of eligibility for free school meals (FSM), the impact has become slightly stronger for attainment in Reading but is little changed for attainment in Mathematics.

Early Years Home Learning Environment (HLE) Measures

The quality of the early years HLE was found to be a very important factor for academic outcomes at Year 5, controlling for all the other background variables. For attainment in Reading in Year 5, the influence seems to be of the same strength, showing very little change compared to Year 1. Looking at attainment in Mathematics, it appears that the strength of influence has slightly decreased. Nonetheless, it still is a strong predictor of Mathematics attainment in Year 5.

The boxes in Figures 2.1 and 2.2 summarize the extent of any change in effects. Taken together it appears that, for Reading more than Mathematics, the relative attainment gap related to some of the key background measures has increased. However, the overall impact of background factors on outcomes in Reading and Mathematics taken together appears to be reducing over time.

Figure 2.1: The impact of child, family and HLE characteristics on Reading attainment at Year 5 compared to Year 1

Reading: Effect Sizes – Year 5 compared to Year 1		
	Effect is now ...	Description
Gender	same	Girls show higher attainment in both years.
Birth weight	weaker	Effect of birth weight has decreased.
Ethnic groups	stronger	Some minority groups have fallen further behind.
Number of siblings	slightly weaker	Effect of number of siblings has slightly decreased.
Need of EAL support	weaker	Effect of need of EAL support has decreased.
Developmental problems	stronger	Effect of early developmental problems has increased.
Parents qualification	stronger	Children of less well educated parents have fallen further behind.
SES	slightly stronger	Gap between children of families with different SES has slightly further increased.
FSM	stronger	Gap between children eligible for FSM and not eligible for FSM has increased.
Early years HLE	same	The Early Years HLE shows a continuing strong positive effect on attainment.

Figure 2.2: The impact of child, family and HLE characteristics on Mathematics attainment at Year 5 compared to Year 1

Mathematics: Effect Sizes – Year 5 compared to Year 1		
	Effect is now ...	Description
Gender	reversed	Boys show higher attainment than girls now.
Birth weight	weaker	Effect of birth weight has decreased.
Ethnic groups	pattern changed	Some minority groups have fallen further behind, Indians have strongly increased.
Early health problems	slightly weaker	Effect of early health problems has slightly decreased.
Need of EAL support	same	Children who don't need EAL support have still higher scores than those with need.
Developmental problems	slightly weaker	Effect of early developmental problems has slightly decreased.
Parents qualification	stronger	Children of less well educated parents have fallen further behind.
SES	slightly weaker	Gap between children of families with different SES has slightly decreased.
FSM	slightly stronger	Gap between children eligible for FSM and not eligible for FSM has slightly increased.
Early years HLE	slightly weaker	The Early Years HLE still shows a strong positive effect on attainment, but slightly weaker than at Year 1.

Section 3: The Impact of Pre-school and Primary School on Children’s Reading and Mathematics Attainment in Year 5

The results described in the previous section provide important evidence concerning the strength of background influences on young children’s cognitive attainment at the end of Year 5. These findings show that the overall impact of background factors on outcomes in Reading and Mathematics appears to be reducing while children move through primary school in terms of the percentage of total variance in children’s attainments accounted for. These findings are in line with the results of other studies which have tracked children over their time in primary school and found reduced variation accounted for by background variables the older the children get (i.e. Mortimore et al., 1998; Sammons, 1993). It is necessary to take account of such background influences before attempting to identify the impact of other factors such as any continuing effects of pre-school attendance or the academic effectiveness of the primary school attended.

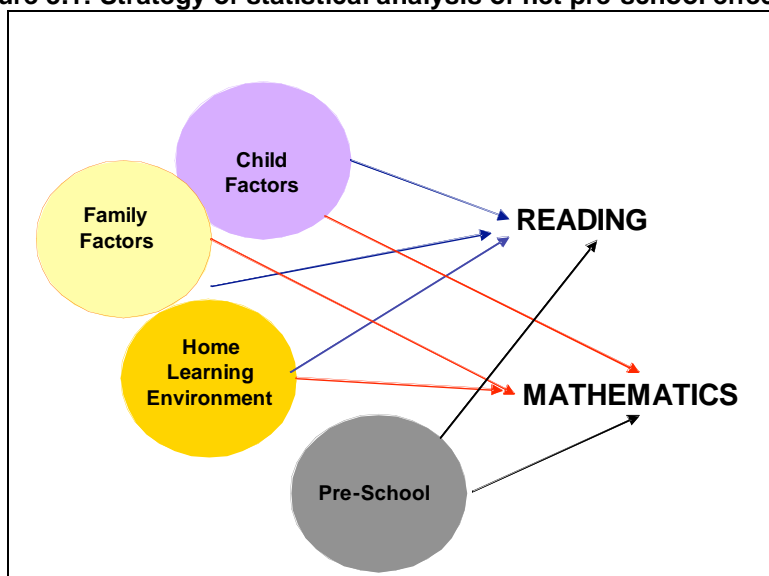
Given the earlier findings, that pre-school experience gave children a better start to school (see Sammons et al., 2002; 2003), an important aim of the Year 5 analyses is to establish whether there is evidence of any continuing pre-school influence at the age of 10 years. By age 10 the children have already spent 5 years in primary school; the study investigated the influence of primary school academic effectiveness, as well as the combined influence of pre- and primary school on young children’s cognitive attainments at the end of Year 5. A further major interest was to explore whether pre-school experience and primary school effectiveness has different influences on different groups of children such as disadvantaged children or children of less qualified parents. Again, effects of pre-school and primary school were investigated net of the effects of any background, child or home variables.

The results of the analyses of pre-school influence are considered in terms of a number of different indicators:

- Whether or not a child attended any pre-school setting
- Duration (in months) of attending a pre-school setting
- Measures of the quality (from observations by researchers) of the pre-school setting attended
- Measures of the effectiveness (in promoting children’s progress from age 3 to 5 years) of the pre-school setting attended.

Figure 3.1 illustrates the analysis strategy.

Figure 3.1: Strategy of statistical analysis of net pre-school effects



The Continuing Impact of Pre-School

1. Pre-School Attendance and Duration of Pre-School Experience

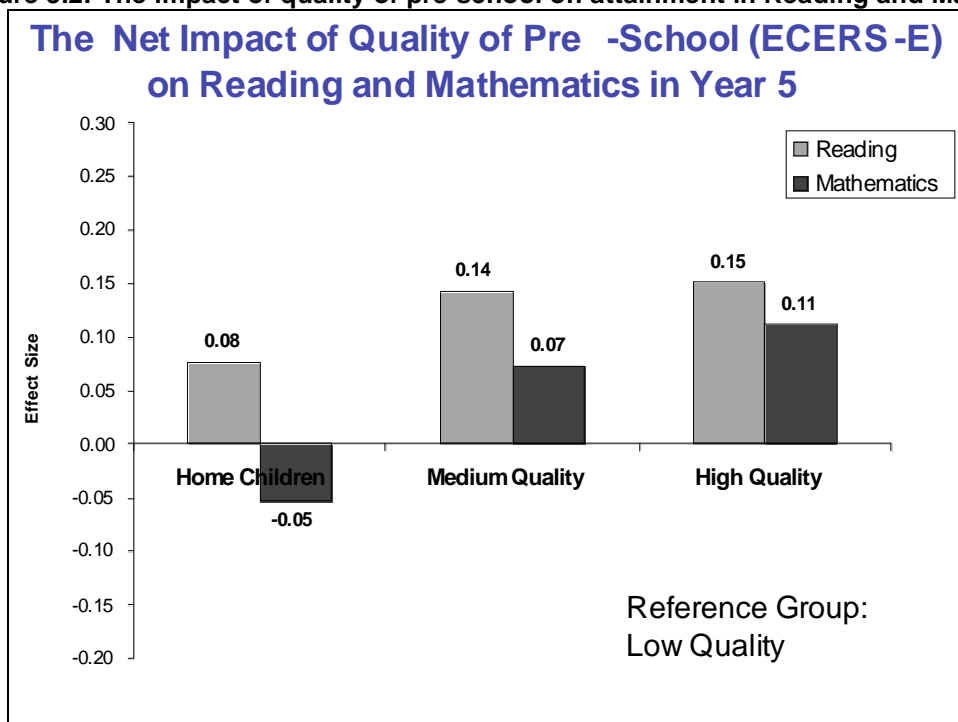
At the end of Year 5 there are no longer statistically significant net effects on attainment in Mathematics and Reading for the most basic indicator: attendance at a pre-school centre compared to no pre-school. In addition, no significant differences were found in relation to type of pre-school attended or duration (in months of attendance) of pre-school. This is in contrast to moderate to strong effects at entry to primary school (age 5) and in Year 1 when duration in months in particular was still significant.

2. Pre-school Centre Quality

Quality of pre-school was based on researcher observations in each centre, using environment and care-giver interaction ratings. Results at earlier time points pointed to the positive influence of higher quality pre-school provision. We divided the sample into groups of children whose pre-school experience could be classified as ranging from no quality (i.e. the 'home' group, approx 9 % of the sample) through low (14%), medium (54%) and high quality (22%), based on individual pre-school centres' ECERS-E scores (see Sylva et al., 2006). The results in Year 5 indicate that there are statistically significant differences in attainment in Reading between the low quality group and the medium and high quality groups. The experience of a high (ES = 0.16) or medium (ES = 0.14) quality pre-school provision shows a relatively better but fairly small continuing positive influence on Reading attainment at the end of Year 5 compared to the experience of a low quality pre-school centre (see Figure 3.2). Also children who stayed at home show similar outcomes in Reading (no statistically significant differences) to those children who went to a low quality pre-school. For Mathematics we found a somewhat different pattern. As Figure 3.2 shows, effects for medium and high quality provision compared to low quality are not quite as strong as for Reading. Again children who stayed at home show no statistically significant differences compared to the low quality pre-school group.

It appears that the quality of pre-school has a somewhat greater impact on longer term Reading attainments that last until the end of Year 5 than on equivalent Mathematics outcomes. However, for Mathematics attending a medium or high quality pre-school centre still also provides a small boost.

Figure 3.2: The impact of quality of pre-school on attainment in Reading and Mathematics in Year 5

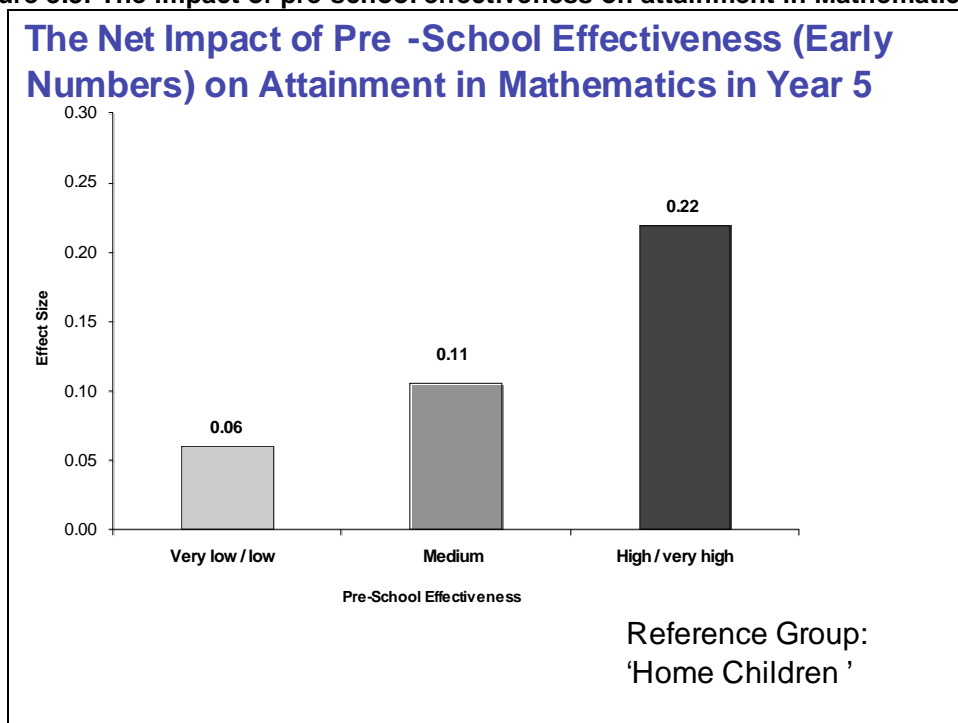


3. Pre-school Centre Effectiveness

During the pre-school phase of the research we analysed children's cognitive progress from age 3 to rising 5 years (till the start of primary school). These analyses provided measures of centre effectiveness (see Sammons et al., 2002). We analysed these measures of centre effectiveness in the same way as those for quality. In these analyses pre-school centre effectiveness, in terms of promoting progress in Pre-reading, was tested as a potential predictor for later Reading attainment in Year 5 of primary school education, and pre-school effectiveness, in terms of promoting progress in Early number concepts, was tested as predictor for later Mathematics skills.

Controlling for child, family and HLE influences, we find that measures of pre-school centre effectiveness still show a positive net impact on children's subsequent attainment in both Reading and Mathematics in Year 5 (see Figure 3.3 for the impact of pre-school effectiveness on attainment in Mathematics). Children who had attended a more effective pre-school setting also show significantly better attainment than children who had attended none or only a low effective pre-school setting.

Figure 3.3: The impact of pre-school effectiveness on attainment in Mathematics at Year 5



Net effects are notably stronger for Mathematics: Compared to the 'home' group, children who went to high or very highly effective pre-schools have significantly higher attainment at the end of Year 5. Thus, the effectiveness of the pre-school setting appears to be relatively more important for this cognitive outcome than for Reading in Year 5.

4. The Combined Impact of Early Years Home Learning Environment (HLE) and Pre-School Experience

We have already demonstrated modest continuing effects for the quality and effectiveness of pre-school experience and strong effects for the early years HLE in Key Stage 1 (see EPPE Sammons et al., 2004a; 2004b) and now in Year 5. Further analyses were used to investigate their joint effects. For this analysis the HLE index was regrouped into three categories representing low, medium and high HLE.

Early Years HLE and the Quality of the Pre-school

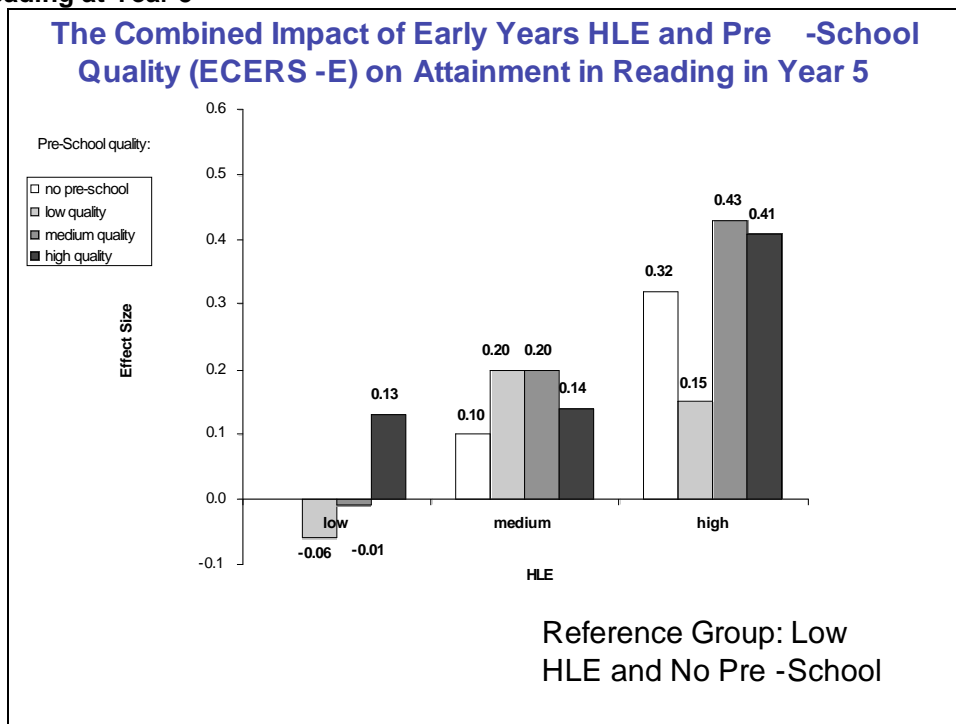
We investigated the relationship between early years HLE and quality of the pre-school centre attended (measured by researcher’s observations in the pre-school centres). This gives further insight into the way HLE and pre-school interact in influencing children’s cognitive attainments in the longer term (see Figure 3.4). The reference group in these analyses is the ‘no pre-school and low HLE’ group.

Figure 3.4 shows the chart for Reading and illustrates that children with low HLE gain a certain small advantage out of a high quality pre-school (ES = 0.13), but not out of low and medium quality pre-schools. Children with medium HLE tend to have an additional benefit of attending pre-school, though the effect for the ‘high quality’ group is smaller than for the low and medium quality (this might be a statistical anomaly due to the small sample size in this group).

Children who had high early years HLE and went to a medium or high quality pre-school show the strongest positive long term benefit in Reading at the end of Year 5.

‘Home’ children (who had no pre-school experience) also benefit particularly from high early years HLE and interestingly, they show higher Reading achievement than high HLE children who went to a low quality pre-school. These findings underline again the importance of the quality of the pre-school centre and also the importance of early years HLE in shaping future Reading attainment.

Figure 3.4: The combined impact of early years HLE and quality of pre-school on attainment in Reading at Year 5



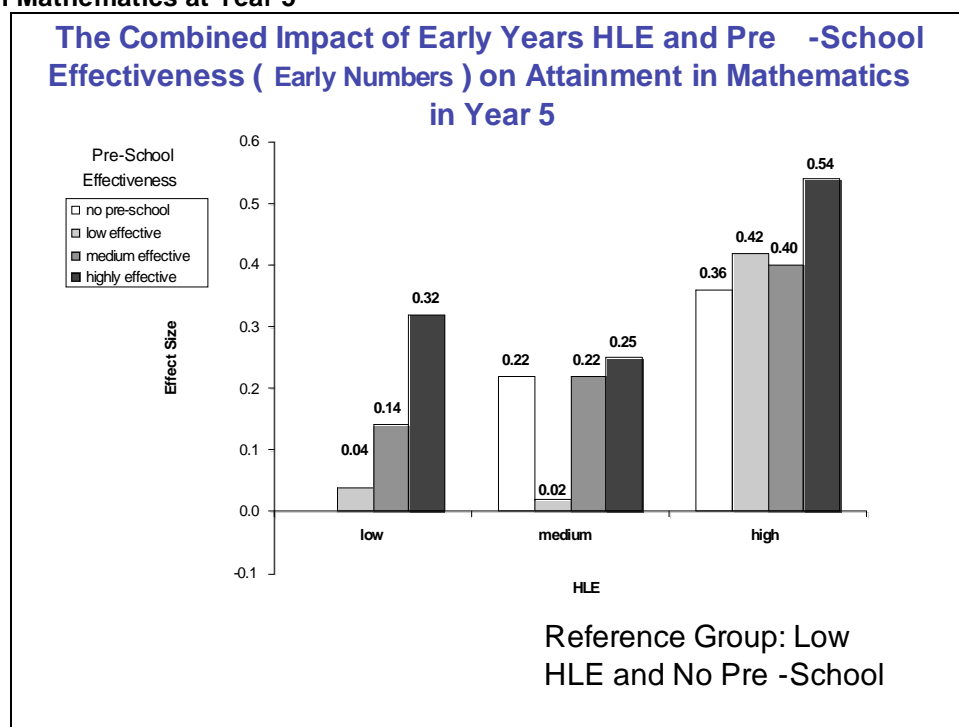
For Mathematics the pattern of results is not as consistent but still indicates positive effects. We find that children with low early years HLE are doing best at the end of Year 5 if they had attended a high quality pre-school and the ES is larger than for Reading (ES = 0.28 compared to ‘no pre-school and low HLE’). Children with medium early years HLE show only a small long-term effect of pre-school irrespective of the quality, but children with medium early years HLE who did not go to pre-school also tend to show better results than children who stayed at home and had a low HLE (ES = 0.21). In contrast, high early years HLE children show greater benefit from medium and high quality pre-school.

These results support the view that for longer term benefit only medium and high quality pre-school centres show higher sustained benefits on attainment at Year 5, but also indicate that the benefits of the pre-school experience appear to be moderated by the quality of early years HLE experienced by children.

Early Years HLE and Pre-school Effectiveness

We also investigated the joint effects of early years HLE and pre-school centre effectiveness (derived from earlier value added analyses on the progress the EPPE sample children made in the individual pre-school centres). The results show the strongest and most consistent pattern for Mathematics and are illustrated in Figure 3.5. Children who had a low early years HLE obtain most advantage out of attending pre-schools that were highly effective in promoting Early number concepts (ES = 0.32 for highly effective pre-schools). For the group of children with medium early years HLE it seems that a moderate or high effective pre-school does not make much difference compared with staying at home, but children who went to a low quality pre-school have similar attainments as children who did not go to pre-school and had low HLE. The children who show the best effects on later attainment are those children who have high early years HLE and go to highly effective pre-schools and this benefit is large. These children not only gain a lot from the high quality of their early years HLE, but also get an additional boost from attending a more effective pre-school. These findings are in broad accord with those on quality reported earlier in this section.

Figure 3.5: The combined impact of early years HLE and effectiveness of pre-school on attainment in Mathematics at Year 5



Results for Reading are not as clear but still a fascinating joint effect was found: children with low early years HLE do not show a substantial long-term benefit from just attending any pre-school rather than staying at home. However, although children with low early years HLE do not show a substantial long term benefit from attending a low or medium effective pre-school, they do get a fairly strong positive effect from attending a highly effective pre-school. In addition, children with medium early years HLE show a long lasting modest effect from attending a medium or highly effective pre-school. As might be expected, high HLE children showed a fairly strong positive effect whether or not they attended a pre-school (ES 0.36), but those who went to highly effective pre-school show the most positive longer term effect on Reading attainment in Year 5 (ES 0.54).

5. Different Pre-school effects for Different Groups of Children

Additional analyses were conducted to explore the question of whether attending a pre-school centre and the quality characteristics of the pre-school centre have different effects for different groups of children. The results are presented below and explore the differential impact of pre-school experience by multiple disadvantage and the qualification level of the parents.

Multiple Disadvantage and the impact of pre-school experience

These results provide some support for the view that higher quality and more effective pre-schools can provide a long term attainment boost for more disadvantaged groups of children as well as for less disadvantaged children. The pattern and strength of benefit for less disadvantaged children is more apparent in this group. This may be due to the larger numbers in the analysis but may also indicate that more advantaged groups can gain greater advantages from educational provision at different ages. For them, pre-school generally gives a long term boost especially higher quality and more effective pre-school. For the more disadvantaged children high quality or high effectiveness of the pre-school centre is absolutely essential to offer long term benefit to cognitive outcomes. Importantly, low quality pre-school appears to offer disadvantaged children no long term benefit on attainment in Year 5 when taking account of the influence of other predictors. This is in contrast with earlier findings, at entry to primary school, where all pre-school provision, even low quality provision, was associated with better outcomes. This indicates that for lasting benefits higher quality experience is needed.

Parents' qualification level and the impact of pre-school experience

For these additional analyses the sample was divided into two groups by the highest qualification level of the parents. Low qualified parents in these analyses are defined as parents who have no qualifications or whose highest qualification level is vocational at age 16 (25% of the sample). In the other group at least one parent had at least one academic qualification at age 16 or above. This group forms the majority of the sample (73%).

With regard to the effect of pre-school attendance, it appears that attending a pre-school makes a certain difference for the attainment in Reading at the end of Year 5 for children of parents with at least one academic qualification but not much difference for children of low qualified parents. For Mathematics similar results are found though effect sizes are generally larger. Children of parents with at least one academic qualification seem to gain more advantage from attending any pre-school than children of low qualified parents.

But again, for children of low qualified parents, the quality of the pre-school is associated with the long term effect for Mathematics attainment; compared to children who had low quality pre-school experience, children of low qualified parents who went to medium quality pre-school are doing slightly better (ES = 0.12), while the impact for children who went to high quality pre-school is stronger (ES = 0.24). Children of parents with at least one academic qualification who stayed at home are doing significantly worse in Mathematics than those who went to pre-school even after 5 years of primary education.

The effectiveness of the pre-school also seems to have some influence on Reading outcomes for children of low qualified parents. Compared to staying at home, these children tend to show lower attainments in Reading if they went to a low effective pre-school centre, but they tend to do better if they went to a medium effective or highly effective pre-school (the difference in ES between those who went to a low rather than a medium effective pre-school is 0.24). Children of parents with at least one academic qualification, had somewhat better Reading attainment at the end of Year 5 if they went to highly effective pre-schools and slightly better attainment in Reading if they attended a medium effective pre-school centre, compared to those children with similar qualified parents who did not go to pre-school.

The findings for Mathematics are somewhat stronger and in line with the other findings. They indicate that children of lower qualified parents benefit especially from attending highly effective pre-school (ES = 0.29), but not particularly from medium and not at all from low effective pre-

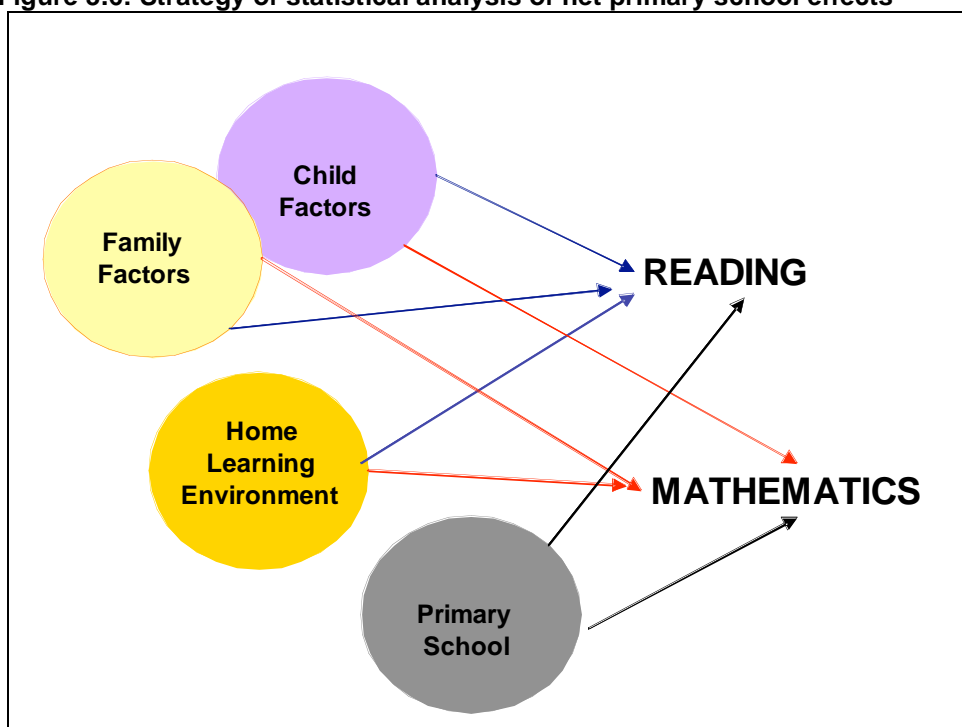
schools (ES = -0.14). Children of parents with at least one academic qualification have better attainment in Mathematics in Year 5 if they had any pre-school experience irrespective of the effectiveness of the pre-school.

The findings in this section indicate that attending any pre-school provision seems to benefit the majority of children who are classified as relatively less disadvantaged (because at least one of their parents has some academic qualification). However, for more disadvantaged children the quality and effectiveness of pre-school attended appears to be particularly important. Even so only weak to modest benefits on later attainment at Year 5 remain evident for both groups. Overall the impacts for both groups seem to be stronger for Mathematics than for Reading.

The Impact of Primary School Effectiveness

We conducted additional analyses to establish the net influence of primary school academic effectiveness on attainment at Year 5 without taking into account any characteristics of pre-school experience in the first instance (but with all the other relevant background, HLE and child characteristics considered, see Figure 3.6 for an illustration of the strategy of statistical analyses).

Figure 3.6: Strategy of statistical analysis of net primary school effects



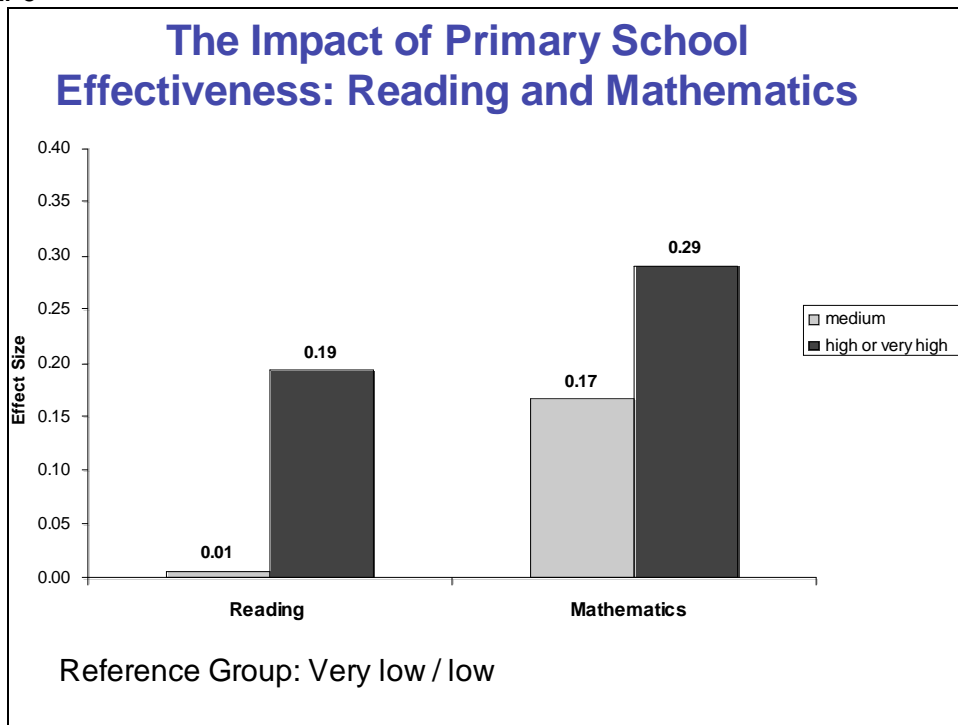
Value added effectiveness measures for primary schools were calculated, using National assessment data, for successive pupil cohorts (2002-2004) for all primary schools in England linking KS1 and KS2 results, and separate indicators were calculated for the different core curriculum subjects English, Mathematics and Science (Melhuish et al., 2006). Each primary school's value added effectiveness in English was modelled as a potential predictor for EPPE 3-11 children's Reading outcomes, in Year 5, and the school's value added effectiveness in Mathematics as a potential predictor for our child sample's outcomes in Mathematics.

We found that the academic effectiveness of the primary school attended matters for longer term cognitive development (see Figure 3.7). It makes an identifiable and separate contribution to children's later attainment at Year 5, after controlling for child, family and HLE influences.

Children who had attended a very highly, highly or medium effective primary school in Mathematics have significantly better attainment in our independent standardised tests of Mathematics in Year 5 than children who had attended a low effective primary school. Children

who had gone on to attend a high or very highly effective primary school in promoting English also have better Reading attainment at the end of Year 5 than children who had attended a low effective primary school.⁷

Figure 3.7: The net impact of primary school effectiveness on cognitive outcomes at Year 5



Different influences of primary school effectiveness for different groups of children

We explored any differential influences of primary school academic effectiveness on children’s cognitive attainments at Year 5. Two measures of disadvantage were examined: 1) the multiple disadvantage index and; 2) the highest qualification level of the parents. These analyses were based on the reported models and control for all other background factors found to have a significant impact on attainment. The multiple disadvantage index is a summary measure based on various child, family and HLE predictors that are associated with an increased risk of low attainment in pre-school and Key Stage 1 (see Glossary for details).

1. Multiple disadvantage and the impact of primary school effectiveness

The sample was divided into two groups, representing less and more disadvantaged children.

For attainment in Reading the academic effectiveness of the primary school (measured independently by value-added analyses) in English is relatively more important for the disadvantaged than for the less disadvantaged children. Compared to a low effective primary school, disadvantaged children show higher attainment when they go to a highly effective primary school (ES = 0.25) but not if they attend a medium effective school (ES = -0.05). By contrast, for less disadvantaged children there seems to be no difference whether they go to a medium effective (ES = -0.03) or to a high effective (ES = -0.03) school compared to a low effective one.

⁷ It is important to note that attainment in Reading and Mathematics was measured independently for the EPPE 3-11 sample by independent NFER-Nelson assessments, while the academic effectiveness measures were based on National assessment data for full pupil cohorts.

The effectiveness of the primary school also shows differential effects on attainment in Mathematics in relation to how disadvantaged children are in terms of the multiple disadvantage index. Children with no or just one disadvantage tend to benefit slightly from highly effective primary schools (ES = 0.14) but not that much from medium effective schools (ES = 0.06) compared with low effective primary schools. By contrast, more disadvantaged children showed substantially higher attainment when they attend a highly effective (ES = 0.43) or medium effective (ES = 0.24) primary school compared to a low effective one.

This is an important finding in relation to reducing the equity gap in achievement because it demonstrates that primary school academic effectiveness (measured independently by value-added analyses) is relatively more important as an influence on pupils' Reading and Mathematics attainments in Year 5 for children who are more disadvantaged.

2. Parents' Qualifications and the impact of primary school effectiveness

For these analyses, again, the sample has been divided into two groups according to the highest qualification level of the parents.

Investigating the differential impact of primary school effectiveness (measured by value added), it is seen for Reading that children of low qualified parents (no qualification or vocational) do not seem to benefit substantially from medium or high academic effective primary schools compared to low effective ones (ES for medium effective = -0.07, ES for highly effective = 0.06). But children whose parents have at least one academic qualification at age 16 or above have higher attainment scores when they attend a highly effective primary school (ES = 0.27). Medium effectiveness only shows a small effect compared to low effectiveness (ES = 0.06).

Results for attainment in Mathematics in Year 5 lead to different interpretations. In Mathematics, primary school effectiveness is found to be especially important for those whose parents have low qualification levels. Compared to those who attend low effective primary schools, children of low qualified parents who go to high (ES = 0.44) or medium academically effective (ES = 0.35) primary schools have significantly higher average Mathematics attainment in Year 5. The relative effectiveness of the primary school is also important for children of parents with at least one academic qualification, but the effect sizes 0.26 (highly effective) and 0.10 (medium effective) are not as strong as those identified for children with less qualified parents.

The Combined impact of Pre-school Experience and Primary School Effectiveness

Given that EPPE 3-11 has demonstrated both the importance of pre-school quality and effectiveness and the impact of primary school effectiveness for long lasting positive effects on later cognitive attainments, their joint effects were investigated. We sought to establish whether going to a high quality or more effective pre-school had a protective effect if a child went on to a less effective primary school, and whether 'home' children or those who went to a less effective or low quality pre-school did better later if they went to a more effective primary school.

We combined the two measures: pre-school quality and primary school academic effectiveness, and incorporated them in the same model to explore any interactions between pre-school and primary school effects. Results for Reading and Mathematics are shown in Figures 3.8 and 3.9. Due to smaller numbers, to obtain a clearer picture, medium and high effective primary schools were grouped together. In both cases (Reading and Mathematics) the reference group is no-pre-school and low effective primary school.

Figure 3.8 illustrates that children who did not attend any pre-school centre benefit if they go to a medium/high academic effective primary school later (ES 0.17) rather than to a low effectiveness primary school. Children who attended a low quality pre-school centre show only a very small benefit from a medium or highly effective primary school. For the groups of children who had attended a medium or high quality pre-school centre the academic effectiveness of their primary school made relatively little additional difference to their Reading attainment at Year 5 as the quality of the pre-school seems to have had a protective effect (if you compare their results with

the group who had attended a pre-school centre of low quality, this difference in ES is most distinct).

Figure 3.8: The combined impact of pre-school quality and primary school effectiveness on attainment in Reading at Year 5

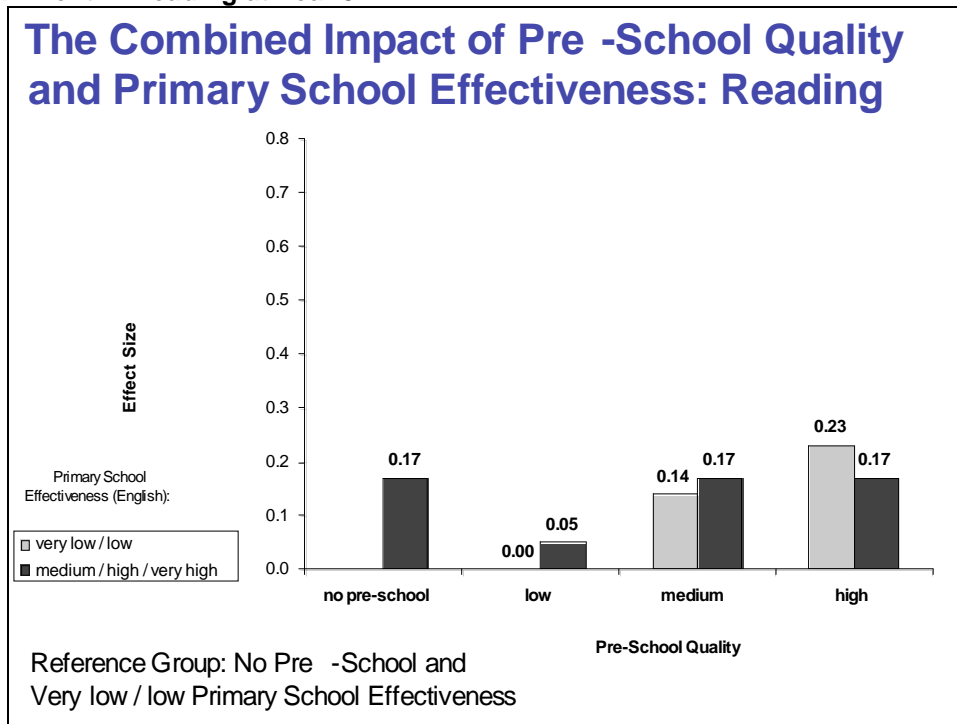


Figure 3.9: The combined impact of pre-school quality and primary school effectiveness on attainment in Mathematics at Year 5

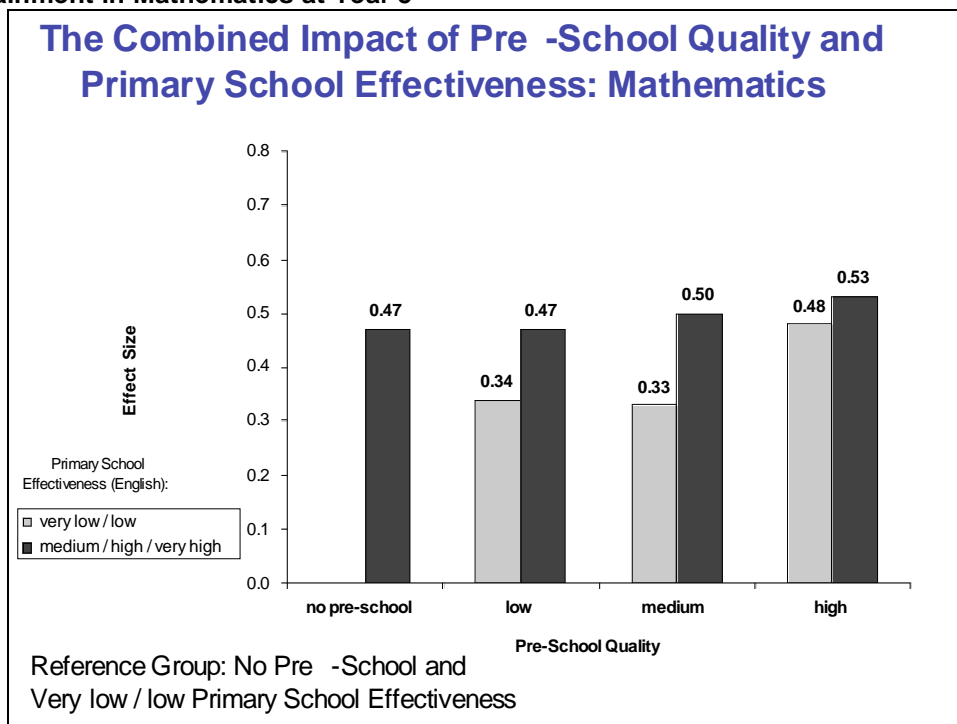


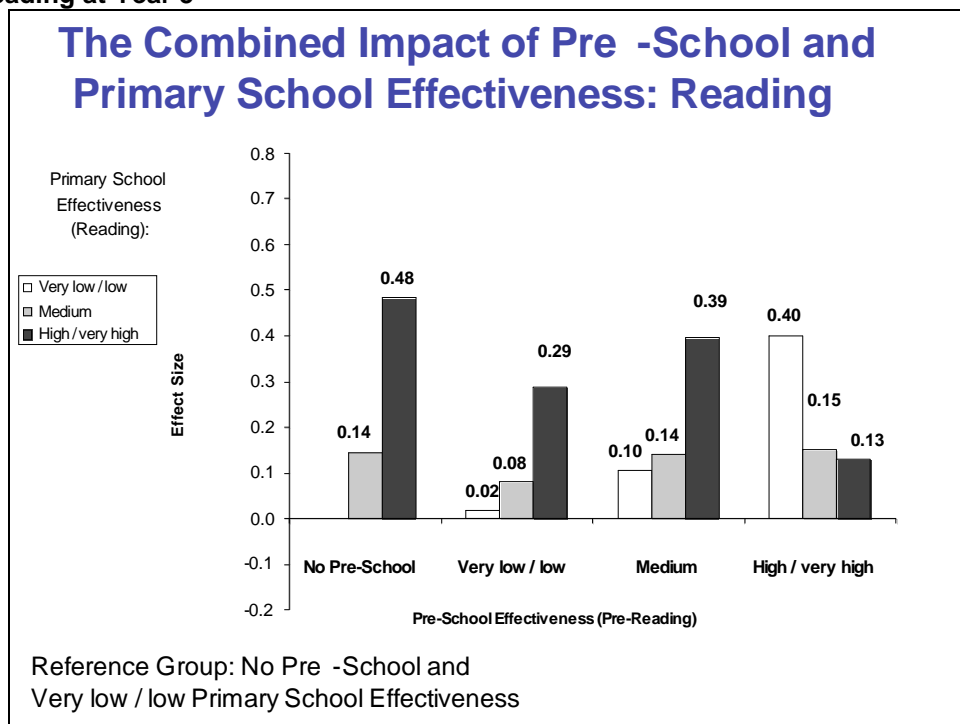
Figure 3.9 shows there are stronger effects, in line with earlier findings: Children who did not go to pre-school show a particularly strong benefit from attending a more academically effective primary school (ES 0.47) compared to 'home' children who went to a less academically effective primary school. Children who went to a low or medium quality pre-school centre and low

effective primary school later on are still doing better than those children who did not have any pre-school experience and went to a low effective primary school. Children who went to high quality pre-school are doing particularly well, even if they went to a low quality primary school later on (again indicative of a protective effect). For children who went to a high quality pre-school centre and a medium/high effective primary school, we find an additive effect. These children are doing best at the end of Year 5 controlling for the effect of all other background factors. For children who had attended medium quality pre-schools there is a difference in ES for attainment at Year 5 in Mathematics according to the effectiveness of their primary school (ES 0.50 for those in medium to high effective primaries but ES 0.33 for those in low effectiveness primaries).

The combined impact of pre-school effectiveness and primary school effectiveness

The combined effects of pre-school and primary school academic effectiveness were studied to establish whether going to a more effective pre-school had a protective influence if a child went on to a less effective primary school, and whether ‘home’ children or those who went to a less effective pre-school centre did better later if they went to a more effective primary school. Results for Reading and Mathematics are presented in Figure 3.10 and 3.11. The reference group for these analyses are children with no pre-school experience who attended a low academically effective primary school.

Figure 3.10: The combined impact of pre- and primary school effectiveness on attainment in Reading at Year 5



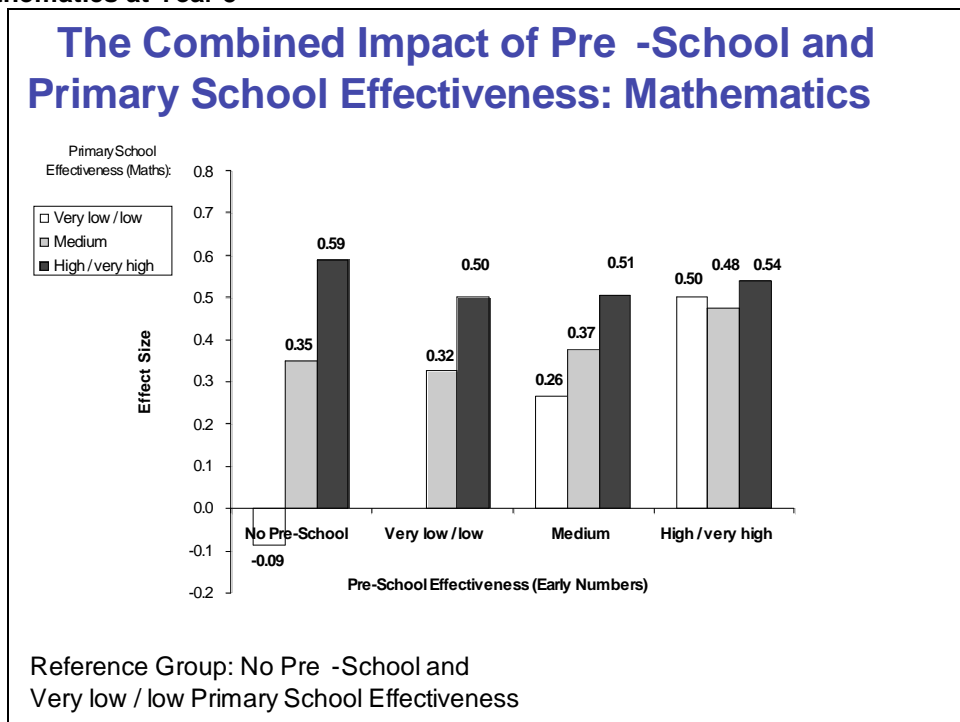
For Reading we find that children who did not attend any pre-school (the ‘home’ group) benefit especially if they go to a highly academically effective primary school. Children who attended a very low, low or medium effective pre-school centre in terms of promoting children’s Pre-reading, benefit a lot from the academic effectiveness of the primary school for English, but there is an additive effect, i.e. children who attended an academically highly effective primary school and a medium effective pre-school are still showing higher attainment than children who attended a highly effective primary school and a low effective pre-school centre.

For Reading, the patterns are particularly clear for the medium effective pre-school school group (this can be seen as more typically representative for the majority of children and has the larger

numbers). It can be seen that the relative difference in ES of attending a low academic effective primary compared with a high academic effective primary is 0.39.

Figure 3.11 indicates stronger effects for Mathematics and the pattern is clearer and more consistent than that for Reading. Children who went to a high academic effective primary school generally do well at Year 5 irrespective of their pre-school experience (ES 0.50-0.59). Children who attended no pre-school, or a low or medium effective pre-school, benefit especially from the academic effectiveness of the primary school in Mathematics. But children who had previously attended a highly effective pre-school, show higher attainment (compared to children who stayed at home and went to a low effective primary school) irrespective of the effectiveness of the primary school. This again points to the protective effect of attending a highly effective pre-school for later Mathematics outcomes at Year 5.

Figure 3.11: The combined impact of pre- and primary school effectiveness on attainment in Mathematics at Year 5



Summary of Pre- and Primary School Influences

Our analyses tested the net impact of different aspects of pre- and primary school experience while controlling for the influences of all other child, family and HLE background measures simultaneously and thus, provides well controlled net estimates of the size and statistical significance of any continuing pre-school effects as well as of primary school influence.

The results show that good pre-school experience (in terms of high quality and high effectiveness) still makes a difference to children’s longer term cognitive attainments even after 5 years full time in primary school education. However, there is no evidence of continued benefits related to just having attended a pre-school centre or not, or differences in later attainment outcomes related to differences in months duration of time in pre-school. This is a change to earlier findings reported at entry to primary school and in Year 1 (see Sammons et al., 2002; 2004a) where differences in outcomes were statistically significant especially in relation to duration of pre-school.

The results also illustrate that the general level of academic effectiveness of the primary school also matters for attainments in Reading and Mathematics at the end of Year 5. A high academic effective primary school seems to be especially important for those children who did not go to pre-school (the lowest attainments are identified for the ‘home’ group who went on to a low

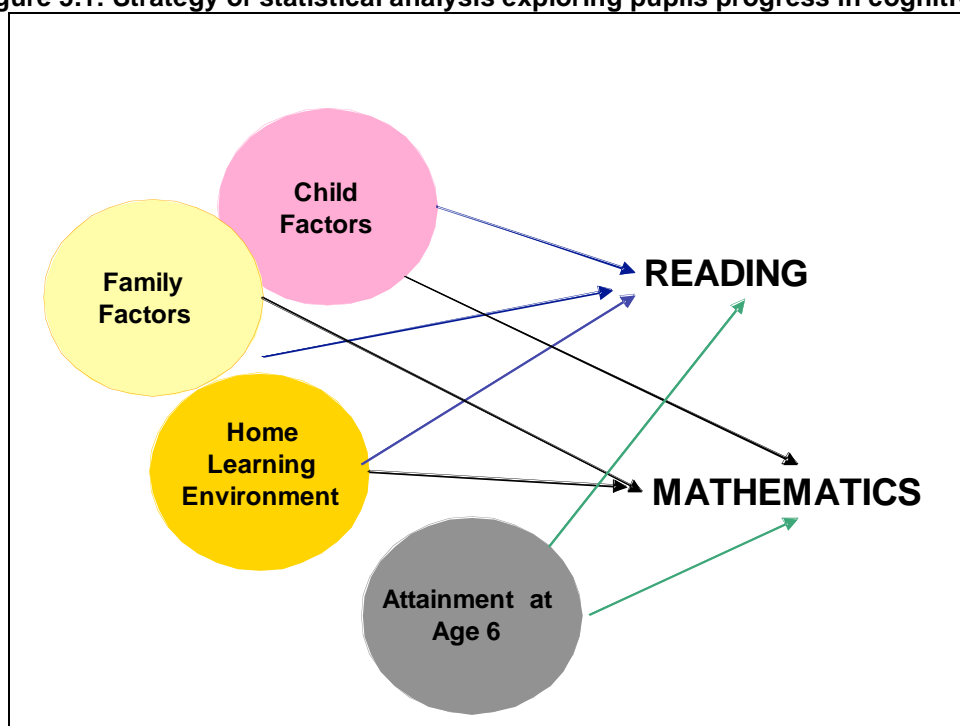
academically effective primary school). However, low quality pre-school appears to offer little long term benefit (in contrast to previously reported findings at younger ages and results for children who went to low quality pre-school are not significantly better than results for the home group). On the other hand attending high quality or more effective pre-school seems to act as a moderate to strong protective factor for children who go on to attend a less academically effective primary school.

Section 4: Exploring Children’s Reading and Mathematics Progress between Year 1 and Year 5

Pupils’ progress from Year 1 to Year 5 at primary school was investigated. The standardised NFER Reading and Mathematics assessments taken in Year 1 provide the baseline measures for these analyses of pupil progress over four school years (Year 1 to Year 5). The models allow for the multilevel structure of the data set by including the primary school attended at level 2. This is important in value added analyses of pupil progress commonly used in school effectiveness studies. We found that around eighteen per cent of the variation in pupils’ progress between Year 1 and Year 5 in our model is accounted for by the primary school attended. These findings are in line with other reported studies of primary school effects (see Mortimore et al., 1988; MacBeath & Mortimore, 2001).

Our analysis strategy is shown in Figure 5.1.

Figure 5.1: Strategy of statistical analysis exploring pupils progress in cognitive outcomes



We found that children who have highly qualified mothers (ES = 0.62 for mothers with a degree compared to no qualification) and who had a good HLE in their early years (ES = 0.47 for highest HLE category compared to lowest HLE category), made significantly better progress in Reading between Year 1 and Year 5. On the other hand children whose parents reported two or more developmental problems (ES = 0.44 compared to no developmental problems), children who grow up in low SES families (ES = 0.34 for ‘professional non-manual’ compared to ‘unskilled-manual’) and children who were eligible for free school meals (ES = 0.23) made significantly less progress between their first and their fifth year of primary school education.

For Mathematics the results show that boys (ES = 0.17 compared to girls), Indian children (ES = 0.68 compared to white UK) and children of more highly qualified mothers (ES = 0.41 for mothers with a degree compared to no qualification) and fathers (ES = 0.25 for fathers with a degree compared to no qualification) make greater gains in terms of progress over this period of primary school education. Low SES is moderately related to relatively less progress (ES = 0.25 for ‘professional non-manual’ compared to ‘skilled manual’). Interestingly children who still need EAL support in Year 5 (ES = 0.38) made significantly less progress in Mathematics. This result supports the conclusion that adequate language skills are not only important for gains in language related subjects but also for progress in Mathematics. Again, children who had a very

good early years HLE also show better progress (ES = 0.23 compared to those with low early years HLE), but the association is not as strong for Reading. Children's engagement in home computing activities (as reported by parents during Key Stage 1) also appear to support progress in Mathematics between Year 1 and Year 5 (ES = 0.14 and 0.18) for high and very high scores on the Home-computing factor and was associated with a gender difference, boys being more likely than girls to be reported as using computers at home (for further details see Sammons et al., 2007).

In addition, we sought to establish whether any characteristics of pre- or primary school experience were not only predictors of academic attainment in Year 5 but also of relative academic progress between Year 1 and Year 5. We found no evidence that just attending a pre-school or not (irrespective of the quality or the effectiveness of the pre-school centre) was associated with better progress in Reading or Mathematics during primary school.

However, there were some indications that children who went to highly effective pre-schools in terms of promoting Pre-reading, subsequently made better progress (between Year 1 and Year 5) in Reading in primary school than children who did not go to pre-school at all; although this just fails to reach statistical significance with this sample (ES= 0.20, $p = 0.06$). In addition, we found that children who went to highly effective pre-schools in terms of developing Pre-reading, later made significantly better progress in Reading in primary school compared to those who went to very low effective pre-schools (ES = 0.29).

In contrast to the Reading results, for Mathematics none of the pre-school indicators were found to be a significant predictor of better progress over the primary school period. Taken together it appears that the benefits of pre-school centre experience for Mathematics attainment seem to operate mainly by providing young children with a better start to primary school. Although this benefit is still evident for attainment in Year 5 it does not lead to increased academic progress once they start primary school. This is in line with earlier results reported in Sammons (2004a; 2004b).

We also investigated the influence of primary school academic effectiveness for the progress of the EPPE 3-11 children. These measures have already been shown to be highly significant predictors of children's cognitive attainment outcomes at Year 5. Our findings show that the effectiveness of the primary school also has a significant influence on children's progress in the direction predicted (i.e. positive effects for more academically effective primary schools) and that effects are stronger for Mathematics than for Reading for those attending schools of medium effectiveness. The ES on progress for those in a high compared to a low academically effective primary school was 0.29 for Mathematics, while for Reading it was similar at 0.26. This is somewhat larger than the net effect for SES on progress for comparison.

The findings here have implications for those concerned to reduce the equity gap in achievement because they indicate which sub-groups of children are most at risk of making poor progress during their time in primary school. Once again the highlight the relevance of the academic effectiveness of the individual primary school a child attends in promoting better progress during Key Stage 2.

Summary and Conclusions

EPPE 3-11 is a 10 year longitudinal research study. The overall objective of the study is to investigate the factors that influence young children's educational outcomes during pre-school and on into primary school. An educational effectiveness research design was adopted to investigate the influence of a range of child, family and home learning environment (HLE) influences and to identify the nature and extent of any pre-school and primary school influences on such outcomes at different ages (Sammons et al 2005., Siraj-Blatchford et al., 2006).

This report presents the results of a range of analyses related to the primary school phase of the research. The focus has been on analysing children's cognitive attainments in Year 5. A report on children's social/behavioural development at this age will be published separately, but early results are included in a report to the Equalities Review (Effective Pre-school and Primary Education 3-11 [EPPE 3-11] Team, 2007).

EPPE 3-11 involved the collection and analysis of a wide range of quantitative data about children's development, child, family and HLE characteristics and the characteristics of the pre-schools attended. Additional value added measures of primary school academic effectiveness have been derived from independent statistical analyses of National assessment sets conducted for all primary schools in England (Melhuish et al., 2006), as part of the study. These have been incorporated into the EPPE 3-11 database to provide indicators of the academic effectiveness of primary schools attended; to complement the measures on the pre-school settings collected in the original pre-school phase of the study. Thus, it is possible to explore both the separate and joint pre-school and primary school influences on children's outcomes in Year 5.

The Influence of Child Factors, Family Factors and HLE

The research collected detailed information on background characteristics through an interview with parents at entry to the study. Additional information was obtained through a questionnaire survey in Key Stage 1 (KS1). From this a rich database was created providing a range of measures of potentially important child, family and HLE characteristics, including details of the home learning environment. This has allowed the research to focus on the topic of educational equity, identifying average differences in attainment for different sub-groups of pupils in Year 5. By studying the extent of differences in patterns of development between Year 1 and Year 5 it was possible to identify those groups of children for whom the attainment gap in Reading and Mathematics has widened or reduced during Key Stage 2 and the factors most strongly associated with better or poorer progress.

Our statistical analyses investigated the influence of different child, family and HLE background factors on children's attainments at the end of Year 5. These contextualised analyses identify the unique (net) contribution of particular characteristics to variation in children's outcomes, while other background influences are controlled. For example, the impact of family SES is established while taking into account the influence of mother's qualification levels, low income, ethnicity, birth weight, HLE etc. This is important, because our research shows that much of the apparent difference in attainment associated with certain characteristics, for example, ethnic group membership, is attributable to other socio-economic and demographic factors (e.g. birth weight, income, language, family SES, parents' qualification levels and HLE).

Similar analyses were undertaken on cognitive outcomes assessed at the end of Year 1 in primary school. The impact of different child, family and HLE characteristics on attainment in Year 1 was compared to their impact on attainment at the end of Year 5. These analyses sought to establish the extent of change in the impact (strength and significance) of individual background factors while young children move through primary school.

The findings draw particular attention to the importance of the quality of the early years home learning environment (HLE) on children's longer term educational outcomes.

In addition to HLE, strong effects remain for parents' qualification levels especially that of the mother, low birth weight, need for EAL support and family SES are also important predictors and have a negative relationship to attainment.

Educational Influences

In addition to investigating background influences, EPPE 3-11 also explored the combined impact of pre-school experience and the influence of the academic effectiveness of the primary school. The aim of these analyses was to investigate questions such as whether children who did not go to pre-school or who had attended a less effective pre-school benefited more if they

went on to attend a more academically effective primary school. Another hypothesis tested was that high quality or highly effective pre-school experience would have a protective effect on children's later educational outcomes if they went on to attend a less effective primary school.

An additional set of value added analyses investigated pupils' academic progress from the end of Year 1 to the end of Year 5 of primary school education. The assessments at the end of Year 1 provided the baseline measures for these analyses of relative gains in Reading and Mathematics over time. In addition to the simple value added model that controls only for prior attainments, contextualised models were developed to investigate which child, family and HLE background factors and characteristics pre- and primary school experience are predictive for relative higher or lower progress in Reading and Mathematics.

The importance of educational experiences in shaping outcomes at Year 5 has been highlighted by the results reported in sections 3 and 4 of this report. Although 'home' children have begun to catch up from a lower starting point an attainment gap remains at the end of Year 5; though this also mainly reflects the relatively more disadvantaged backgrounds of these children.

It is shown that pre-school influences remain evident even after five years full time in primary school. However, at this stage attending any pre-school by itself is not sufficient to ensure better outcomes in the longer term. We find that both measures of the quality and of the effectiveness of the pre-school setting attended predict better cognitive outcomes. Poor quality pre-school, however, does not improve outcomes in Year 5, whereas medium and especially high quality pre-school experience provides moderate benefits. The results indicate that pre-school influences are somewhat stronger for Mathematics than for Reading.

EPPE 3-11 is the first large scale longitudinal study to investigate both pre-school and primary school influences on young children's attainment and progress. Results demonstrate that the academic effectiveness of the primary school attended has an additional positive and statistically significant influence on children's attainment in Year 5. In interpreting these results it is important to recognise that the measures of academic effectiveness were derived for all primary schools in England from analyses of the progress of different pupil cohort's National assessments using value added approaches and provide *independent* measures not based on the EPPE sample. In addition the research is unique in having investigated for the first time the *combined* influence of pre-school and primary school effects. For 'home' children in particular, the effectiveness of the primary school attended helps to raise attainment (for those who attend a highly effective primary school there is a particular boost to Mathematics attainment). By contrast, attending a high quality or more effective pre-school seems to act as a protective factor for children who go on to attend a less effective primary school.

Overview and discussion of Findings on Home, Pre-School, and Primary School Influences on Children's Attainment in Year 5

Children's background characteristics

- The results of the analyses of these influences have identified the size and nature of the equity gap in achievement for different groups of pupils and how it changes over time at different points in children's pre-school and school careers. The main findings indicate that other social and demographic factors are important in accounting for much of the equity gap in attainment at Year 5 evident in simple comparisons of average attainment levels for different ethnic groups. They can inform thinking on appropriate policy and practical strategies to reduce the achievement gap and enhance outcomes for vulnerable groups. The information is highly relevant to policy concerns to promote social inclusion and equality of opportunity and the results have contributed to the evidence base examined by the Government's Equalities Review (<http://www.theequalitiesreview.org.uk/>).

- The multilevel results indicate that, taken together, background influences on attainment in Year 5 are relatively weaker than they were in Year 1 (reducing in their ability to account for variations in children's attainment by about 50%). This is likely to indicate the increased contribution of schools and possible peer group influences and reductions in the importance of English as an additional language (EAL).
- Nonetheless, in raw terms the attainment gap at the end of Year 5 remains significant and has widened for some groups. The analyses of the net contribution of different characteristics through a study of changes in effect sizes indicates those pupil groups for which there has been a relative improvement, or by contrast a relative decline during Key Stage 2 although for some groups the attainment gap has actually changed direction (for example, boys and those of Indian ethnic background are now doing better in Mathematics in contrast to findings at younger ages).
- The results indicate that much of the apparent difference in attainment between ethnic groups (measured in terms of mean raw scores) is strongly related to differences in influential demographic factors (HLE, parents' qualifications, SES, income etc), although there are still some (relatively) low and high attaining groups.
- Overall we find that multiple disadvantage remains an important correlate of children's educational outcomes, in line with findings at younger ages. This result points to the persistence and strength of disadvantage and the importance of interventions to target support for the most vulnerable groups of children.
- The strongest net effects of background factors on Reading and Mathematics outcomes at Year 5 are for measures of early years HLE and parents' qualification levels, followed by low birth weight, need for EAL support, early health (for Mathematics) or developmental problems (for Reading) and family SES.
- The analyses produce new evidence of continuing pre-school effects for attainment in Reading and especially in Mathematics. In contrast to findings on the impact of longer duration (in months) of pre-school at age rising 5, 6 and 7 years, it is differences in the *quality and effectiveness* of pre-school that continue to contribute to better outcomes in the longer term, rather than just attending or not attending a pre-school setting or attending pre-school for a longer amount of time.
- Although 'home' children (those who did not attend any pre-school) have begun to catch up from a much lower starting point, an attainment gap remains. However, those children who attended low quality pre-school no longer show cognitive benefits after five years in primary school and their results are not significantly different from the 'home' group.
- The academic effectiveness of the primary school a child attends (measured independently by value added in National assessments) is a significant influence on later attainment. Those who went on to attend a more academically effective primary school showed significantly better attainment at Year 5.

Implications

The research provides new evidence concerning the *combined* effects of pre-school and primary school in shaping children's educational outcomes. The findings demonstrate that it is important to raise the quality and effectiveness of both.

The results show that for more disadvantaged children high quality and high effectiveness of the pre-school seems to be necessary to obtain long lasting benefits in cognitive outcomes. For less disadvantaged groups pre-school generally shows more impact, irrespective of quality. The research reveals the strength of the influence of early years HLE but also highlights interesting

interactions with quality of the pre-school and early years HLE indicating that this is likely to moderate the influence of pre-school. Again this points to the important role of parents and other carers in providing rich home learning experiences during the sensitive pre-school period of young children's development.

We can conclude that no one factor is the key to raising achievement – it is the *combination* of experiences over time that matters. The child who has more highly qualified parents, a better early years HLE, goes to a high quality, more effective pre-school setting and who then goes on to attend a more academically effective primary school has a combination of 'protective' experiences that benefit current and future educational attainment. However, even for children whose parents have little formal educational qualifications such protective experiences remain beneficial. In summary, our results demonstrate that schools which are successful in raising academic standards offer benefits to children's longer term attainments in Reading and Mathematics and this is particularly important for more disadvantaged groups of children who are already at risk of low attainment. In addition, results also indicate that the quality of the pre-school environment (at home and in pre-school settings) has long term implications for children's later attainment outcomes. Thus, interventions to improve the pre-school experiences of children are likely to reduce the likelihood of poor attainment in the long term and offer protection for those children who go on to attend less effective primary schools.

The implication of these findings is that policy development should seek to promote strategies to support improvements in HLE especially for vulnerable groups and also continue to work to improve the quality and effectiveness of pre-school provision. Pre-schools are well placed to identify children who may need extra support and could be guided to work with parents to improve HLE. The improvement of provision in poorer quality pre-schools also needs to be given a high priority, since poor quality provision does not appear to offer long term benefits in improved child outcomes at the end of Year 5, even though any pre-school experience was found to benefit children on a wide range of academic and social/behavioural outcomes at younger ages (rising five) when they started primary school.

In addition, the research indicates that the primary school attended also plays an important role. Improving the academic effectiveness of less effective primary schools will be particularly important for disadvantaged groups of pupils, since we find that attending an effective school is more critical in terms of academic outcomes for this group. The finding that primary school academic effectiveness is a more significant influence for disadvantaged pupils (especially those who didn't go to pre-school) is of particular importance to the achievement of the social inclusion as well as the standards agendas. There are clear implications for the role of inspection given Ofsted's role of monitoring standards and quality in both the early years and in schools.

In order to help reduce the achievement gap for multiply disadvantaged groups, actions to improve the HLE, pre-school and primary school experiences will be needed since improvements to any one in isolation would be insufficient to boost outcomes on its own. In addition, it is likely that targeted interventions for children who are well behind their peers in cognitive or social/behavioural development at the start of primary school will also be necessary to prevent a widening of the gap during Key Stage 1 and 2.

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Appendix 2: Characteristics of the Sample at the End of Year 5

The research design used to recruit the sample for the original EPPE study is described in detail in EPPE Technical Paper 1 (Sylva et al., 1999) and the main findings of Phase 1 are reported in Technical Paper 12 (Sylva et al., 2004). Details on the main findings of the analyses conducted on children's attainments and progress up to the end of Key Stage 1 (Year 2) can be found in Technical paper 11 (Sammons et al., 2004b).

Since the start of the study 10 years ago, the EPPE children have been assessed using cognitive assessments at various time points. This report refers to two time points in which cognitive assessments were taken for all children: at the end of Year 1 (age 6) and at the end of Year 5 (age 10). The assessments at these two time points seemed to be most comparable, because cognitive attainment was assessed with the same type of psychometric test in Reading and Mathematics.

This section provides descriptive statistics for the sample at the end of Year 5.

Tables A1.1a to A1.1c provide a brief summary of the characteristics of the EPPE 3-11 sample at the end of Year 5 for whom any cognitive outcome data (NFER Nelson standardised assessments in Reading and / or Mathematics) were collected (N = 2,556).⁸

Fifty-one per cent of the children are boys whereas forty-nine per cent are girls. There were almost a quarter of children in the sample whose ethnic background was not white UK and eleven per cent of the children had English as an additional language. However, the number of children who still needed support because of English being an additional language was smaller at the end of Year 5 (3.7 %). With respect to family structure fourteen per cent of the children lived in large families with 3 or more siblings.

Table A1.1a also shows the distribution of the early years home learning environment (HLE) index which is a combined measure of aspects of the quality of the home learning environment in the early years. A number of measures collected at the entry to study from the parent interviews provided an indication of aspects of the HLE in the early years. These are based on the frequency of engagement in specific activities involving the child, such as teaching the alphabet, reading to the child, listen to the child read, taking the child to the library etc. (as reported by the parents). Table A1.1a shows that forty-three per cent of the children in the sample belong to the two highest HLE categories, indicating that the HLE during the pre-school period was good or very good for these children. With regard to pre-school experience one can say that 237 'home' children were still in the sample (9.3 %).

⁸ This represents almost the whole sample as the responses of 7 children were still awaited when analysis was undertaken.

Table A1.1a: Selected characteristics of children who have valid cognitive data in Year 5 (N = 2556)
 Some figures do not include non-response to questions therefore the total is not always 2556 (100 %)

	n	%
Gender		
Male	1302	50.9
Female	1254	49.1
Ethnicity		
White UK Heritage	1921	75.2
White European Heritage	78	3.1
Black Caribbean Heritage	96	3.8
Black African Heritage	50	2.0
Indian Heritage	51	2.0
Pakistani Heritage	130	5.1
Bangladeshi Heritage	29	1.1
Mixed Heritage	141	5.5
Any Other Ethnic Minority Heritage	57	2.2
English as an Additional Language (EAL)	279	10.8
Child needs special EAL support	94	3.7
3 or more siblings	353	13.8
Home Learning Environment Index (during pre-school period):		
0 – 13	225	8.8
14 – 19	533	20.9
20 – 24	592	23.2
25 – 32	803	31.4
33 – 45	299	11.7
Type of Pre-School		
Nursery Class	484	18.9
Playgroup	492	19.2
Private Day Nursery	440	17.2
Local Authority Day Nursery	330	12.9
Nursery Schools	431	16.9
Integrated (Combined) Centres	142	5.6
Home	237	9.3

Table A1.1b shows that approximately nineteen per cent of the mothers and twenty-nine per cent of the fathers fall in the professional categories. The proportion of mothers who are skilled (non-manual or manual) was twenty-five per cent; for the father this proportion was quite similar (35.4 %). Twenty-one per cent of the mothers but only five per cent of the fathers were semi skilled or unskilled. Also, a third of the mothers, but only seven per cent of the fathers were unemployed or not working. For eighteen per cent there was no information about the SES status of the father available.

Table 1.1b: Selected characteristics of children who have valid cognitive data in Year 5 (n = 2556)

Some figures do not include non-response to questions therefore the total is not always 2,556 (100 %)

Social-economic status (SES) of Mother (during Key Stage 1 or earlier):		
Professional Non Manual	121	5.0
Other Professional Non manual	328	13.5
Skilled Non-Manual	397	16.3
Skilled Manual	219	9.0
Semi Skilled	435	17.9
Unskilled	73	3.0
Unemployed / Not working	800	32.9
Social-economic status (SES) of Father (during Key Stage 1 or earlier):		
Professional Non Manual	291	11.4
Other Professional Non manual	437	17.1
Skilled Non-Manual	254	9.9
Skilled Manual	672	26.3
Semi Skilled	91	3.6
Unskilled	34	1.3
Unemployed / Not working	180	7.1
No father information	445	17.9

Table A1.1c shows the combined family SES measure. Nineteen per cent of the children had been eligible for free school meals (FSM) in Year 5 (or at an earlier time point, if no information was available for Year 5), thirty-seven per cent of the children grow up in families whose annual salary was £15,000 or less.

An index of multiple disadvantage⁹ was created in the original EPPE research. Table A1.1c indicates that twenty-two per cent of the sample had no disadvantage. On the other hand, six per cent of the children were highly disadvantaged with 5 or more disadvantages.

⁹ The index combines poor child, family and HLE characteristics associated individually with lower attainment.

Table A1.1c: Selected characteristics of children who have valid cognitive data in Year 5 (n = 2556)
 Some figures do not include non-response to questions therefore the total is not always 2556 (100 %)

	n	%
Family Highest SES (during Key Stage 1 or earlier):		
Professional Non Manual	345	13.5
Other Professional Non manual	560	21.9
Skilled Non-Manual	456	17.8
Skilled Manual	517	20.2
Semi Skilled	192	7.5
Unskilled	43	1.7
Unemployed / Not working	410	16.0
Income indicator:		
Free School Meals (FSM) (at Year 5 or earlier)	497	19.4
No Free school meals	2051	80.2
Salary of family during Key Stage 1		
No salary	506	19.8
£ 2,500 – 17,499	436	17.1
£ 17,500 – 29,999	383	15.0
£ 30,000 – 37,499	247	9.7
£ 37,500 – 67,499	421	16.5
£ 67,500 – 132,000+	162	6.3
Employment status of mother during pre-school period:		
Not working	1216	47.6
Working part-time	766	30.0
Working full-time	394	15.4
Self-employed / Combination of part-time & self employed	116	4.5
Total Multiple Disadvantage Index		
0 (low disadvantage)	565	22.1
1	662	25.9
2	512	20.0
3	288	11.3
4	186	7.3
5 plus (high disadvantage)	151	5.9

In general, only a small proportion of cases had missing data (< 5 %) even for the measures of social background, which is as a result of the procedures for tracking children and good relations with primary schools, as well as regular data quality checks of the EPPE 3-11 data management team. Higher proportions of missing values occur for income-related variables like salary, socio-economic status (SES) or the eligibility for free school meals (FSM), which is also an additional low income indicator. A higher proportion of missing values for these kind of measures is a typical response pattern also found in other survey studies.¹⁰

Cognitive assessments

To take account of development and age, the study uses different assessment instruments for cognitive outcomes at different time points:

- Year 1: NFER-Nelson Primary Reading Level 1 and Mathematics 6 tests
- Year 5: NFER-Nelson Primary Reading Level 2 and Mathematics 10 tests.

To ensure comparability over time, an internal standardisation and normalisation procedure was applied. This procedure takes account of age effects within one school year. The scores presented in this paper are internally standardised to a mean of 100 and a standard deviation of 15. Therefore all children scoring better than 100 at a certain time point are scoring at or above the attainment level expected for their chronological age (belong to the upper half of the sample of that assessment, controlling for age-effects). Due to the use of internally standardised attainment scores, the scores can only be used to investigate the progress or improvement of certain groups of children *relative* to the total EPPE 3-11 sample, but cannot be used to show *absolute* progress over time.

Associations between Children's Attainments in different Outcomes and over time

Correlations can be used to explore associations between children's attainments in different outcomes and over time.¹¹ Children's attainments in the Year 5 assessments were positively correlated ($r=0.68$), indicating those who do well in Reading generally also do well in Mathematics at the end of Year 5. The correlation between Reading and Mathematics scores at the end of Year 1 (standardised test scores) was somewhat weaker ($r = 0.58$, not shown in Table A1.2).

Table A1.2: Correlations between children's standardised cognitive outcomes and with prior assessments

		Year 5	Year 5
	Assessment	Reading	Mathematics
Year 5	Mathematics	0.681 (n = 2525)	###
Year 1	Reading	0.565 (n = 2328)	0.542 (n = 2313)
	Mathematics	0.583 (n = 2322)	0.653 (n = 2208)

The cognitive attainments are not only highly associated with each other but also show moderate to high correlations with prior attainments (see Table A1.2). A particularly strong relationship is found for attainment in Mathematics in Year 1 and Year 5 ($r = 0.65$), but also attainment in Reading in Year 5 is fairly highly correlated with Reading attainment in Year 1 ($r = 0.57$). At this

¹⁰ To prevent loss of sample size for further analyses missing values for number of siblings, FSM and SES were imputed using 'the last observation carried forward' method. Please see Sammons et al., 2007 for a description of this imputation method. Family SES was calculated by combining mother's and father's occupational categories and recording the higher of the two (family SES data was missing for 1.3% of the sample after imputation of missing values).

¹¹ A correlation is a measure of statistical association that ranges from + 1 to -1.

stage the high correlations between cognitive assessments at different time points, indicate that the assessments are measuring similar aspects of attainment suggesting that the measures are likely to be reliable indicators of Reading abilities over time.

Appendix 3: Raw differences in attainment in Reading and Mathematics at the end of Year 5

Significant differences in cognitive attainments related to various child, family and home learning environment (HLE) characteristics have been reported at entry to pre-school (age 3 plus), later at entry to primary school (rising 5 years), at the end of Year 1 (age 6) and at the end of Year 2 (age 7). These characteristics were also predictors (but were less strongly associated) of different aspects of the social/behavioural development of the children. In this Appendix raw differences in cognitive attainments at the end of Year 5 for different groups of children (i.e. gender groups, ethnicity groups, etc.) are summarized. The findings at the end of Year 5 are broadly in line with the earlier reported findings (see Sammons et al. 2004a; 2004b). Table A.3.7 shows means and standard deviations by pre-school experience (yes/no). Further details of differences in attainment levels for different pupil groups are found in the full report (Sammons et al., 2007).

Table A3.1: Cognitive attainments at the end of Year 5 by ethnic group

	Reading			Mathematics		
	N	Mean	SD	N	Mean	SD
White UK Heritage	1915	101.37	15.08	1906	100.89	14.80
White European Heritage	78	97.38	14.39	76	99.17	13.84
Black Caribbean Heritage	96	97.36	10.95	94	98.98	14.57
Black African Heritage	50	97.09	13.12	50	96.31	13.76
Indian	51	98.36	12.73	51	103.17	17.30
Pakistani	130	89.16	11.22	129	91.05	13.74
Bangladeshi	29	89.33	12.84	29	91.69	16.92
Mixed Heritage	141	100.11	16.11	138	99.58	15.58
Any Other Ethnic Minority	56	96.47	14.71	56	99.05	15.15

Table A3.2: Cognitive attainments at the end of Year 5 and Language

	English as Mother Tongue			English as an Additional Language		
	N	Mean	SD	N	Mean	SD
Reading	2311	100.93	14.93	236	91.04	12.53
Mathematics	2295	100.60	14.82	235	94.18	15.58

Table A3.3: Cognitive attainments at the end of Year 5 and need of EAL (English as an Additional Language) Support

	Child needs no EAL support			Child needs EAL support		
	N	Mean	SD	N	Mean	SD
Reading	2179	100.67	14.89	94	87.66	12.94
Mathematics	2163	100.81	14.70	94	87.67	12.65

Table A3.4: Cognitive attainments at the end of Year 5 and Mother's Qualification Level

	No Qualifications			Vocational Qualification			Academic Qualification at 16 Years		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Reading	475	91.82	12.96	370	98.12	14.47	930	99.25	13.69
Mathematics	471	92.57	13.11	370	97.55	14.20	924	99.28	14.40
	Academic Qualification at 18 Years			Degree or Equivalent			Higher Degree		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Reading	212	103.75	12.96	318	110.97	14.00	111	114.78	12.76
Mathematics	211	104.34	14.55	314	110.00	12.69	111	112.12	12.71

Table A3.5: Cognitive attainments at the end of Year 5 by Family SES

	Reading			Mathematics		
	N	Mean	SD	N	Mean	SD
Professional non-manual	345	111.07	13.72	342	110.49	12.85
Other professional non-manual	558	105.09	14.50	556	104.62	14.02
Skilled non-manual	456	99.51	13.31	454	98.97	14.78
Skilled manual	515	95.51	14.21	513	96.21	14.18
Semi-skilled manual	191	94.74	12.06	188	95.05	13.51
Unskilled manual	42	93.05	15.94	43	93.52	13.82
Unemployed / Not working	409	93.86	13.19	403	94.04	13.72

Table A3.6: Cognitive attainments at the end of Year 5 by early years HLE

	Reading			Mathematics		
	N	Mean	SD	N	Mean	SD
HLE unknown	103	92.67	13.67	102	94.88	14.01
HLE index = 0-13	225	90.96	13.20	221	92.25	13.69
14-19	531	95.93	13.98	528	97.43	14.64
20-24	589	99.56	13.93	586	98.73	14.79
25-32	802	103.27	14.86	796	102.75	14.80
33-45	299	108.67	13.82	299	106.98	13.57

Table A3.7: Cognitive attainments at the end of Year 5 by pre-school experience (yes / no)

	Reading			Mathematics		
	N	Mean	SD	N	Mean	SD
Pre-School	2312	100.80	14.90	2298	100.79	14.85
No Pre-School	237	92.21	13.70	234	92.21	14.23

Appendix 4: Details of selected measures used in the EPPE study

A.4.1 The Multiple Disadvantage Index

The Multiple Disadvantage Index was developed as part of the Early Years Transition & Special Educational Needs (EYTSEN) Project which focuses on the identification of children 'at risk' of SEN). An index was created based on 10 indicators in total: three child variables, six parent variables, and one related to the early years home learning environment (HLE). All the variables were chosen because they related to low baseline attainment when looked at in isolation. Where indicators were closely related, such as English as an additional language (EAL) and ethnicity, only the most significant was included.

Child variables

- First language: English as an additional language
- Large family: 3 or more siblings
- Pre-maturity / low birth weight

Parent variables

- Mother's highest qualification level: no qualifications
- Social class of father's occupation: Semi-skilled, unskilled, never worked, absent father
- Father not employed
- Young Mother (Age 13-17 at birth of EPPE-child)
- Lone parent
- Mother not working / unemployed
- Low early years home learning environment (HLE)

A.4.2 The Key Stage 1 Home Learning Environment (HLE)

HLE Factors and the items loading on these factor:

- **Home Computing**
 - The Child plays on a computer by them self.
 - Respondent plays computer games with the child.
 - Respondent uses computer with the child in educational ways.
- **Parent-Child enrichment outing/activity outside the home.**
 - Respondent visits library with the child.
 - Respondent does sport/physical activity with the child.
 - Respondent goes on educational visits with the child.
- **Parent-child one-to-one interactions at home**
 - Respondent plays with the child using toys/games/puzzles.
 - Respondent reads to the child.
 - Respondent listens to the child read.
- **Expressive play**
 - The Child plays 'make believe' or pretend games.
 - The Child paints/draws/makes models.
 - The Child enjoys dance music and movement.

Appendix 5: Effect Sizes

To illustrate the impact of different factors on attainment or social behaviour in Year 1 effect sizes (ES) were calculated. Effect sizes are most commonly used in experimental studies and essentially measure the strength of mean differences. Glass et al., (1981) define ES as:

ES = (mean of experimental group)-(mean of control group)/pooled standard deviation

Or
$$\Delta = \frac{X_{Exp} - X_{Cont}}{SD_{pooled}}$$

Effect sizes were calculated for different child outcomes, using both the child level variance and coefficients for predictors included in the multilevel statistical models adopting the formulae outlined by Tymms et al., (1997).

For categorical predictors (e.g. gender or ethnicity) the effect size was calculated as:

ES = categorical predictor variable coefficient / $\sqrt{\text{child level variance}}$

Or

$$\Delta = \frac{\beta_1}{\sigma_e}$$

For continuous predictor variables (e.g. child age in months), the effect size describes the change on the outcome measure produced by a change of +/-one standard deviation on the continuous predictor variable, standardised by the within school SD, adjusted for covariates in the model – the level 1 SD:

$$\Delta = \frac{2 \beta_1 * SD_{x1}}{\sigma_e} \quad \text{where } x_1 = \text{continuous predictor variable}$$

Effect sizes can be useful for comparisons between different studies but interpretations must be made with caution and with reference to the outcomes concerned and controls used in models (Elliot & Sammons, 2003). For further discussion of effect sizes see Coe (2002). Effect sizes for some categorical measures in the EPPE research are large but apply to small numbers of children (e.g. the very low birth weight group or specific ethnic groups).

Glossary of terms

Age standardised scores Assessment scores that have been adjusted to take account of the child's age at testing. This enables a comparison to be made between the performance of an individual pupil, and the relative achievement of a representative sample of children in the same age group throughout the country or, in this case, the relative achievement of the EPPE sample.

Birth weight Babies born weighing 2500 grams (5lbs 8oz) or less are defined as below normal birth weight, foetal infant classification is below 1000 grams, very low birth weight is classified as 1001-1005 grams and low birth weight is classified as 1501-2500 grams (Scott and Carran, 1989).

British Ability Scales (BAS) This is a battery of assessments specially developed by NFER-Nelson to assess very young children's abilities. The assessments used at entry to the EPPE study and entry to reception were:

Block building - Visual-perceptual matching, especially in spatial orientation (only entry to EPPE study)

Naming Vocabulary – Expressive language and knowledge of names

Pattern construction – Non-verbal reasoning and spatial visualisation (only entry to reception)

Picture Similarities – Non-verbal reasoning

Early number concepts – Knowledge of, and problem solving using pre-numerical and numerical concepts (only entry to reception)

Copying – Visual-perceptual matching and fine-motor co-ordination. Used specifically for children without English

Verbal comprehension – Receptive language, understanding of oral instructions involving basic language concepts.

Centre/School level variance The proportion of variance in a particular child outcome measure (i.e. Pre-reading scores at start of primary school) attributable to differences between individual centres/schools rather than differences between individual children.

Child background factors Child background characteristics such as age, gender, ethnicity.

Contextualised models Cross-sectional multilevel models exploring children's cognitive attainment at entry to primary school, controlling for child, parent and home learning environment characteristics (but not prior attainment).

Controlling for Several variables may influence an outcome and these variables may themselves be associated. Multilevel statistical analyses can calculate the influence of one variable upon an outcome having allowed for the effects of other variables. When this is done the net effect of a variable upon an outcome controlling for other variables can be established.

Correlation A correlation is a measure of statistical association that ranges from + 1 to -1.

Duration In terms of the value added models, the duration of pre-school covers the time period between date of BAS assessment at entry to the EPPE study until entry to primary school. Note that the number of months of pre-school attended before the child entered the EPPE study is not included in this duration measure. A separate 'duration' measure of amount of time in pre-school prior to entering the study was tested but was not found to be significant (note that this 'duration' measure is confounded with prior attainment). In the contextualised models, duration of pre-school refers to the time period between entry to the target pre-school until entry to primary school. These duration measures provide a crude indication of length of pre-school experience.

ECERS-R and ECERS-E The American Early Childhood Environment Rating Scale (ECERS-R) (Harms et al., 1998) is based on child centred pedagogy and also assesses resources for indoor and outdoor play. The English rating scale (ECERS-E) (Sylva et al., 2003) was intended as a

supplement to the ECERS-R and was developed specially for the EPPE study to reflect the Desirable Learning Outcomes (which have since been replaced by the Early Learning Goals), and more importantly the Curriculum Guidance for the Foundation Stage which at the time was in trial stage.

Educational effectiveness Research design which seeks to explore the effectiveness of educational institutions in promoting a range of child/student outcomes (often academic measures) while controlling for the influence of intake differences in child/student characteristics.

Effect sizes (ES) Effect sizes (ES) provide a measure of the strength of the relationships between different predictors and the child outcomes under study. For further discussion see Appendix 5 and Elliot & Sammons (2004).

Family factors Examples of family factors are mother's qualifications, father's employment and family SES.

Hierarchical nature of the data Data that clusters into pre-defined sub-groups or levels within a system (i.e. young children, pre-school centres, LAs).

Home learning environment (HLE) factors Measures derived from reports from parents (at interview) about what children do at home, for example, playing with numbers and letters, singing songs and nursery rhymes.

Intervention study A study in which researchers 'intervene' in the sample to control variables i.e. control by setting, the adult:child ratios in order to compare different specific ratios in different settings. EPPE is not an intervention study in that it investigates naturally occurring variation in pre-school settings.

Intra-centre/school correlation The intra-centre/school correlation measures the extent to which the scores of children in the same centre/school resemble each other as compared with those from children at different centres/schools. The intra-centre/school correlation provides an indication of the extent to which unexplained variance in children's progress (i.e. that not accounted for by prior attainment) may be attributed to differences between centres/schools. This gives an indication of possible variation in pre-school centre/school effectiveness.

Multiple Disadvantage Index Based on three child variables, six parent variables, and one related to the home learning environment (HLE) which were considered 'risk' indicators when looked at in isolation. A child's 'multiple disadvantage' was calculated by summing the number of indicators the child was at risk on.

Multilevel modelling A methodology that allows data to be examined simultaneously at different levels within a system (i.e. young children, pre-school centres, LAs), essentially a generalisation of multiple regression.

Multiple regression A method of predicting outcome scores on the basis of the statistical relationship between observed outcome scores and one or more predictor variables.

Net effect The unique contribution of a particular variable upon an outcome while other variables are controlled.

Outliers Pre-school centres where children made significantly greater/less progress than predicted on the basis of prior attainment and other significant child, parent and home learning environment (HLE) characteristics.

Pedagogical strategies Strategies used by the educator to support learning. These include the face to face interactions with children, the organisation of the resources and the assessment practices and procedures.

Pre-reading attainment Composite formed by adding together the scores for phonological awareness (rhyme and alliteration) and letter recognition.

Prior attainment factors Measures which describe pupils' achievement at the beginning of the phase or period under investigation (i.e. taken on entry to primary or secondary school or, in this case, on entry to the EPPE study).

Quality of pre-school settings Measures of pre-school centre quality collected through observational assessments (ECERS-R, ECERS-E and CIS) made by trained researchers.

Sampling profile/procedures The EPPE sample was constructed by:

- Five regions (six LAs) randomly selected around the country, but being representative of urban, rural, inner city areas.
- Pre-schools from each of the 6 types of target provision (nursery classes, nursery schools, local authority day nurseries, private day nurseries, play groups and integrated centres) randomly selected across the region.

Significance level Criteria for judging whether differences in scores between groups of children or centres might have arisen by chance. The most common criteria is the 95% level ($p < 0.05$) which can be expected to include the 'true' value in 95 out of 100 samples (i.e. the probability being one in twenty that a difference might have arisen by chance).

Social/behavioural development A child's ability to 'socialise' with other adults and children and their general behaviour to others.

Socio-economic status (SES) Occupational information was collected by means of a parental interview when children were recruited to the study. The Office of Population Census and Surveys OPCS (1995) Classification of Occupations was used to classify mothers and fathers current employment into one of 8 groups: professional I, other professional non-manual II, skilled non-manual III, skilled manual III, semi-skilled manual IV, unskilled manual V, never worked and no response. Family SES was obtained by assigning the SES classification based on the parent with the highest occupational status.

Standard deviation (SD) A measure of the spread around the mean in a distribution of numerical scores. In a normal distribution, 68% of cases fall within one standard deviation of the mean and 95% of cases fall within two standard deviations.

Target centre A total of 141 pre-school centres were recruited to the EPPE research covering 6 types of provision. The sample of children was drawn from these target centres.

Value added models Longitudinal multilevel models exploring children's cognitive progress over the pre-school period, controlling for prior attainment and significant child, parent and home learning environment (HLE) characteristics.

Value added residuals Differences between predicted and actual results for pre-school centres /schools (where predicted results are calculated using value added models).

Year 1 Children completed assessments in the Spring term when aged between 5 years 6 months and 6 years 6 months.

Year 5 Children completed assessments in the Spring term when aged between 9 years 6 months and 10 years 6 months.

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