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

A longitudinal study funded by the DfES (2003 – 2008)

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 (DfES). 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 (EPPE 3-11 Team., 2007 in press). 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 whole (the pre-school and 'home') 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, home learning environment (HLE), and pre-school characteristics. Additional value added measures of primary schools derived from multilevel statistical analyses of National assessment data conducted for all primary schools in England (Melhuish et al., 2006a; 2006b) 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 on 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 assessments 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 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 environment (HLE) 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[1] of child, family and early years home learning environment (HLE)

Significant variations in average attainment scores were identified for different sub-groups of pupils in Year 5 (e.g. by gender, ethnicity, family soico-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 is 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, ethnicity, birth weight, HLE etc. This is important, because much of the apparent difference in attainment associated with certain characteristics, for example, ethnicity, 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 home learning 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

[1] Note that throughout the report the term "impact" is meant in it's statistical sense, referring to statistically significant predictors and their effect sizes in predicting attainment. It does not imply causality.

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 (EPPE 3-11 Team., 2007 in press), a broad ranging enquiry into the nature and influences that shape social inequality in Britain, which 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 assessment data). 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 school 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 and home learning environment (HLE) effects, evidence of continuing pre-school effects, and the contribution of the primary school attended.

Child, Family and Background effects

- Taken together, child, family and home 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 increased primary school and peer group influences.

- The quality of the early years home learning environment (HLE) and parents' (especially mothers') qualification levels remain 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).

Pre-school effects

- There is a continuing positive effect of attending higher quality or more effective pre-school settings on children's outcomes in Mathematics and Reading at the end of Year 5, once the influence of background factors has been taken into account.[2]

- Pre-school quality was more influential for Reading outcomes while pre-school effectiveness, in terms of promoting Early number concepts, was more influential for outcomes in Mathematics in Key Stage 2.

- Those children who attended a low quality pre-school no longer show a significant cognitive benefit in attainment after five years in primary school and their results are not significantly different from the 'home' group. This is a change in comparison with previous findings, reported at age 5 years, when children started primary school.

Primary school effects

- The academic effectiveness of the primary school a child attends (as measured by conducted value added analyses of National assessments[3]) has a significant effect on EPPE children's Reading and Mathematics attainment in Year 5. Children who had the benefit of attending a primary school identified as

[2] Early results on equivalent analyses of social/behavioural outcomes for the EPPE 3-11 sample also point to positive pre-school influences on children's development in these areas and are described in a separate report to the Equalities Review (EPPE 3-11 Team., 2007 in press).

academically more effective had better outcomes at age 10 than children who attended a less effective primary school.

- Effective primary schools made a greater difference to the later attainment of children who had not attended pre-school or who had attended a poor 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 can 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 years, especially for Mathematics and this is similar in size to the impact of having a high rather than a low HLE, or a mother with a high level of educational qualifications (degree 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, ethnicity, 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 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

[3] The analyses have been undertaken independent of the EPPE research for three full cohorts of pupils (2002 – 2004) and thought to establish academically less or more effective schools.

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 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. The emerging finding that social/behavioural development as well as Reading and Mathematics attainment is boosted by academically effective primary schools has important messages for the achievement of the Every Child Matters agenda; this shows that the promotion of better academic outcomes does not compete with the development of better social/behavioural development (a point discussed further in the Report to the Equalities Review, EPPE 3-11 Team., 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 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. 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). Results of analyses of children's outcomes in Key Stage 1 are reported by Sammons et al (2004a; 2004b).[4]

A further extension to the study is following children's development to the end of Key Stage 2 (age 11). This second phase of the 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 centres in the value added in terms of contribution to children's cognitive progress and social/behavioural development. The first phase of the research explored whether different types of pre-school settings 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 current report focuses on the first follow up of children's developmental progress in Key Stage 2 using measures of cognitive attainment at the end of Year 5. At this time point children were aged 9 - 10 years. It explores the impact a wide variety of child, parent and family factors, including aspects of the early years home learning environment (HLE) provided by parents during the years of pre-school and aspects of the later HLE during Key Stage 1 of primary school.

The 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 2556 children for whom valid cognitive data was collected at the end of Year 5. This represents 87 per cent of the children in the EPPE 3-11 sample for whom valid baseline data was collected on cognitive attainment at entry to primary school at age 5 and 93 per cent of the EPPE 3-11 sample for whom valid baseline data was collected on cognitive attainment at the end of Year 1.

Data on cognitive attainment was collected at 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 home learning environment (HLE) characteristics collected from parental interviews (in pre-school) and questionnaires (in Key Stage 1) in the original EPPE study.

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

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. 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 cognitive attainment assessed with standardised psychometric instruments (NFER-Nelson) at the end of Year 5 in Reading and Mathematics. At the end of Year 1 assessments of the same type (age-appropriate NFER-Nelson assessments) had been completed, so comparable measures of prior cognitive attainments are available.

Multilevel models provide more accurate assessments of the influence of different child or primary school characteristics. Furthermore earlier analyses enabled the calculation of value added estimates (residuals) of individual centre level effects for the EPPE 3-11 child sample that attended a pre-school centre (see Sammons et al., 2002 for details). These value added measures of centre 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 in promoting children's cognitive development 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., 2006a; 2006b).

Background information about child, parent and family characteristics, was obtained initially through parent interviews conducted soon after children were recruited to the EPPE 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. In most cases the parent interviews were conducted within 10 weeks of recruiting a child to the study and an excellent response rate (97

%) was achieved. It should be noted that most interviews were with children's mothers and usually took place at the child's pre-school centre, although for some working parents telephone interviews were found to be more convenient.

Subsequently parents were again asked to give some further information about child, parent and family characteristics when the children were in Key Stage 1 of primary school (approximately age 6 years) and this time information was obtained via a parent questionnaire. Details were sought regarding any change 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[5] obtained was eight-one per cent (very high for a survey study).

Structure of Report and Analyses

This report is divided into six sections. The first section provides some 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. The attainment differences reported in section 1 are 'raw' univariate attainment differences, whereas the effects reported in later sections are 'net' effects.

The second section deals with the question, to what extent do different child, family and HLE background characteristics account for variation in these children's Reading and Mathematics attainments at the end of Year 5. 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. Thus, for example, the influence of family Socio-Economic Status (SES) is established while taking into account the influence of mother's qualification levels, low income, ethnicity, birth weight, HLE etc. Results are reported in effect sizes (ES); a statistical measure of the relative strength of different predictors. It is of policy interest to establish the nature and strength of such background influences individually and in total, because they are relevant to issues of equity and social inclusion. EPPE 3-11 was commissioned by the Equalities Review (http://www.theequalitiesreview.org.uk) to provide information on such influences to inform the Cabinet Office Equalities Review.

The third section describes the extent of change in the influence of different background factors while young children move through primary school. Children's cognitive outcomes in Reading and Mathematics had already been assessed at a younger age using similar assessments (NFER-Nelson) at the end of Year 1 (age 6). 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 fourth 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. Lack of pre-school experience, particularly for more vulnerable groups of young children, was found to be an additional disadvantage. In addition to the effect of pre-school attendance, in these analyses measures of pre-school centre influence including the observed quality of pre-school provision (measured by the ECERS-E scale) and centre effectiveness (measured by value added residual estimates based on cognitive progress during the pre-school period) are tested to explore any

[5] Between the initial assessment at entry to pre-school and the Reception assessment 139 children were lost from the study (moved abroad or could not be traced). The response rate is based on the corrected sample of 3032 children.

continuing effect of pre-school at the end of Year 5 in primary school. This section also addresses the question of differential pre-school effects for different groups of children.

Further analyses sought to establish the association between primary school academic effectiveness and cognitive outcomes in Year 5 (based on value added effectiveness measures for primary schools that have been calculated independently using National assessment data for all primary schools in England linking KS1 and KS2 results) (Melhuish et al., 2006a; 2006b). In addition, analyses also explored whether certain groups of children benefit more from the academic effectiveness of the primary school attended than other children. The last part of Section 4 deals with the combined impact of different characteristics of pre-school experience (quality and effectiveness) and primary school academic effectiveness.

Section 5 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 (at the end of Year 1) in analysing progress over time.

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

Section 1: 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). In summary, six English Local Authorities (LAs) in five regions participated in the research with children recruited from six main types of provision: nursery classes, playgroups, private day nurseries, Local Authority (LA) day care nurseries, nursery schools and integrated (combined) centres. In order to enable comparison of centre and type of provision effects the project was designed to recruit 500 children, 20 in each of 20-25 centres, from the various types of provision. In some LAs certain forms of provision are less common and others more typical. Within each LA, centres of each type were selected by stratified random sampling and, due to the small size of some centres in the project (i.e. rural playgroups) more of these centres were recruited than originally proposed, bringing the sample total to 141 centres. In all 2,857 children in the pre-school sample were tracked to entry to reception. An additional sample of 315 'home' children (those who had not attended a pre-school setting) was recruited at entry to primary school, for comparison with those who had attended a pre-school sample, bringing the total sample to 3,172.

Since the start of the study 10 years ago, the EPPE children were assessed in their cognitive skills 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 (see Appendix 2 for further details on measurement).

This section provides descriptive statistics for the sample at the end of Year 5. 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., 2004a).

Tables 1.1a to 1.1c 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).[6]

Fifty-one per cent of the children are boys whereas forty-nine per cent are girls. There were 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 (EAL). Though, the number of children who still needed support because of having EAL 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 1.1a 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, listening to the child read, taking the child to the library etc. (as reported by the parents). Table 1.1a shows that forty-three per cent of the children in the sample belong to the two highest HLE categories, indicating that the early years HLE was good or very good for these children. 237 children (9.3 % of the total sample) did not go to any type of pre-school.

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

Table 1.1a: Selected characteristics of children who have valid cognitive data at 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	**330**	**12.9**
Nursery Schools	**431**	**16.9**
Integrated (Combined) Centres	**142**	**5.6**
'Home' sample	**237**	**9.3**

In terms of social class, approximately nineteen per cent of the mothers and twenty-nine per cent of the fathers fall in the professional categories. A quarter of mothers are skilled (non-manual or manual); for the father this proportion was quite similar (36.2 %). About a fifth 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 at 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 1.1c shows the details on the combined family SES measure. Nineteen per cent of the children had been eligible for free school meals (FSM) at Year 5 (or at an earlier time point, if no information was available for Year 5), thirty-seven per cent of the children were growing up in families whose annual salary was £15, 000 or less.

An index of multiple disadvantage[7] was created in the original EPPE research. Table 1.1c indicates, that twenty-two per cent of the sample had low disadvantage. On the other hand, six per cent of the children were highly disadvantaged with 5 or more disadvantages.

[7] The index combines poor child, family and home learning characteristics associated individually with lower attainment such as low birthweight, low family SES etc. For further details on the factors in the index see Appendix 5.

Table 1.1c: Selected characteristics of children who have valid cognitive data at 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.[8]

Cognitive assessments

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

- *Year 1*: Cognitive 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.

In Appendix 2 further details on the standardisation and normalisation procedure, as well as on the interpretation, of such scores are provided.

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.[9] Children's attainments in the Year 5 assessments were strongly 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 slightly weaker but still fairly strong (r = 0.58, not shown in Table 1.2).

Table 1.2: 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 1.2). A particularly strong relationship is

[8] To prevent loss of sample size for further analyses missing values for number of siblings, FSM and SES where imputed using 'the last observation carried forward' method. Please see Appendix 3 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).

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

found for attainment in Mathematics in Year 1 and Year 5 (r = 0.65), but also attainment in Reading at Year 5 is fairly highly correlated with Reading attainment in Year 1 (r = 0.57). At this 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. The impact of earlier attainments as predictors for later attainments will be explored in more detail in Section 5. Of particular interest will be the net influence of child, background and HLE characteristics at Year 5, when controlling for prior attainments of the children, because this will indicate whether some groups make more or less progress relative to others during Key Stage 2.

Differences in attainment for different groups of children

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 and behavioural development of the children. In this section differences in cognitive attainments at the end of Year 5 for different groups of children (i.e. gender groups, ethnicity groups, etc.) are explored. The findings at the end of Year 5 are broadly in line with the earlier reported findings (see Sammons et al., 2004a; 2004b).

It is important to stress that the reported differences do not control for the influence of any other variables. This means, for example, if we are looking at the size of differences between individual ethnic groups, these differences could also be due, at least in part, to SES and language differences between the ethnic groups. Section 2 of this report provides more detailed statistical analyses of these patterns using multilevel models to explore the net contribution of different factors and reports the relevant effect sizes, controlling for other factors. It will also address the issue of change of net contribution of different factors over time in terms of effect sizes.

Gender

At younger ages girls had been found to score more highly in most of the cognitive attainments. At the end of Key Stage 1 (Year 2), this pattern of results was found for Reading scores, but not anymore for Mathematics scores; we still find a significant gender effect for Reading outcomes with girls outperforming boys but no gender effect for Mathematics outcomes.

Table 1.3: Gender differences on Children's score on the EPPE Year 5 cognitive outcomes

	All			Boys			Girls		
	n	Mean	SD	n	Mean	SD	n	Mean	SD
Reading	2549	100.00	15.00	1300	99.05	15.25	1249	100.99	14.68
Mathematics	2532	100.00	15.00	1289	100.33	15.30	1243	99.66	14.68

Ethnicity and language

Investigating differences by ethnicity at the end of Year 5 we find a large difference in average scores for some groups, with Pakistani and Bangladeshi children having particularly low attainment in Reading and Mathematics (see Figures 1.1 and 1.2). Examining the charts, the Mathematics mean score for the Indian subgroup (103.2) is clearly above that of other groups although the differences need to be interpreted with caution due to the small numbers of some ethnic minorities. The remainder of this section will provide further insight in differences in cognitive attainments for certain minority groups over the years.

Figure 1.1: Cognitive attainment at Year 5 by ethnic groups: Reading

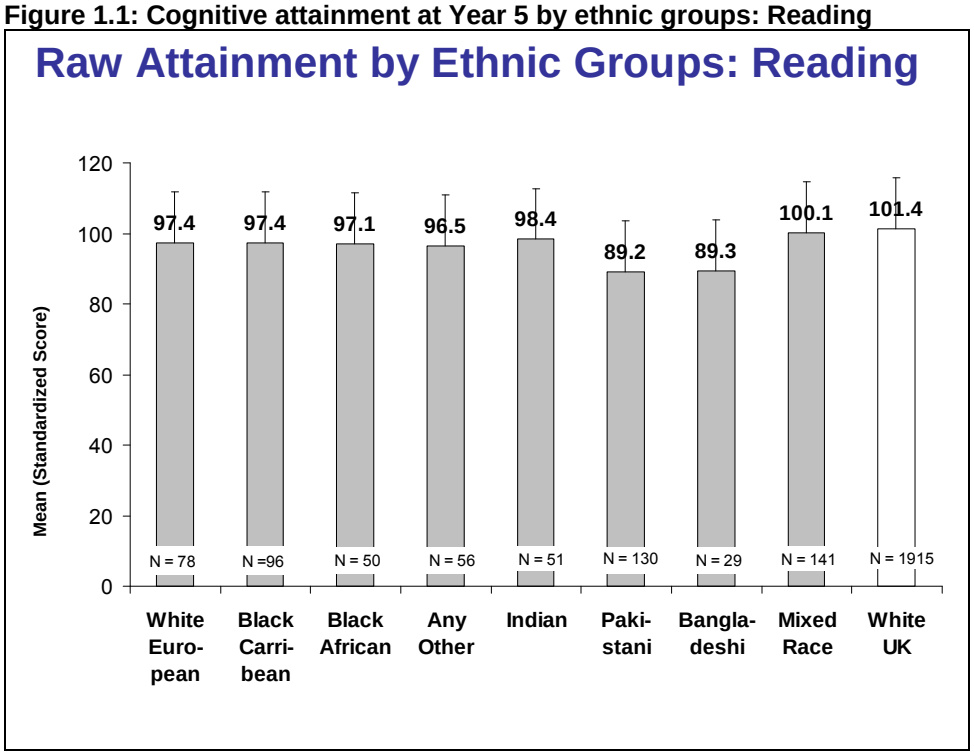
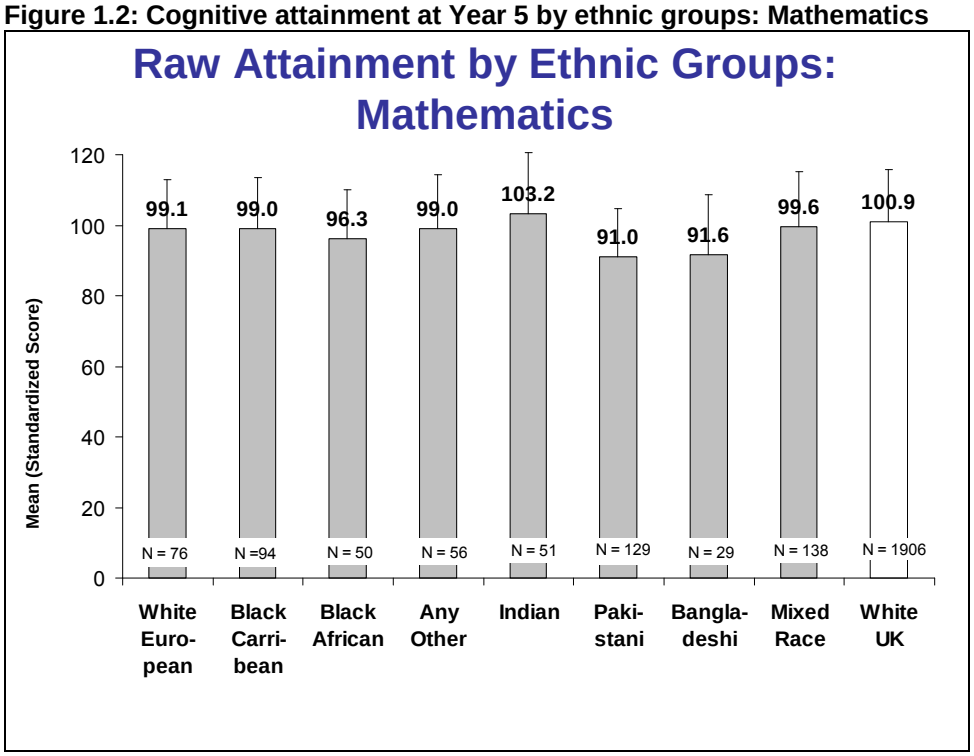


Figure 1.2: Cognitive attainment at Year 5 by ethnic groups: Mathematics



As might be expected, children's attainment in Reading differs strongly by mother tongue, with children with English as an Additional Language (EAL) still attaining lower scores on average (M= 91.0) than non EAL children (M = 100.9). However, at the end of Year 5 the need for EAL support distinguishes most clearly between lower and higher attainers: When looking at the whole sample, children who need such support in Year 5 have an average Reading score of only 87.6, whereas children without need of such support have an average of 100.8 in line with the average for all children.

Children show also a very similar pattern of attainments in Mathematics related to the mother tongue, and the attainment gap is almost as strong as for Reading (Means: EAL = 94.1, non-

EAL= 100.6, EAL support needed = 87.6, No EAL support needed = 100.8). It should be noted, that the group "No EAL support needed" includes children for whom English is the first language and l EAL children who do not require support.

The differences in average attainments are illustrated in Figures 1.3 and 1.4.[10]

Figure 1.3: Cognitive attainment at Year 5 by Mother language: Reading

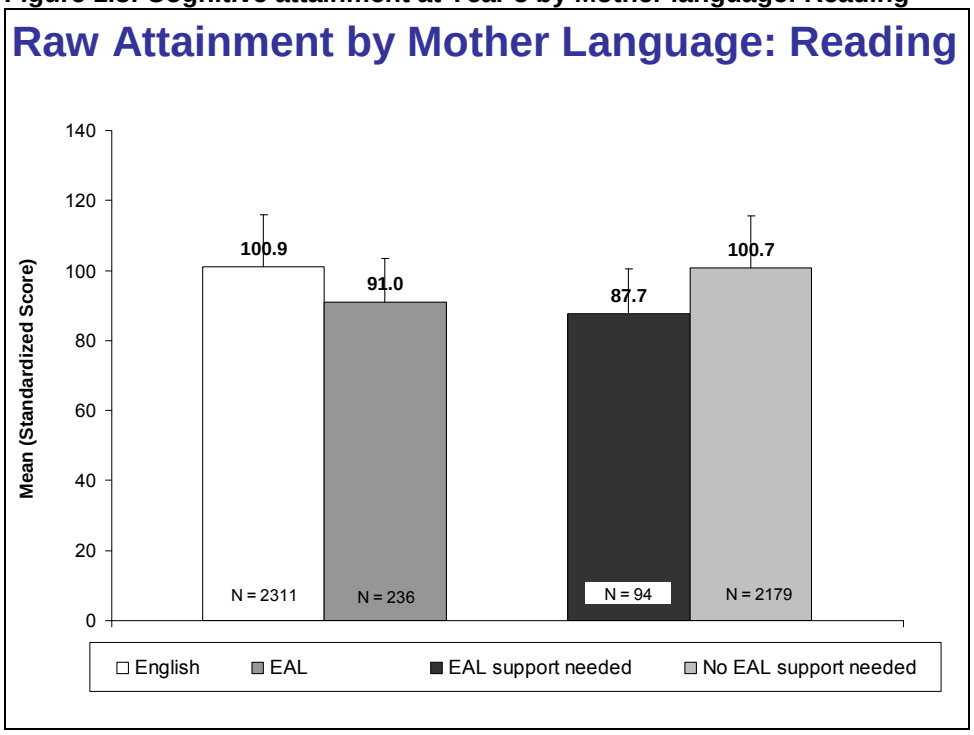
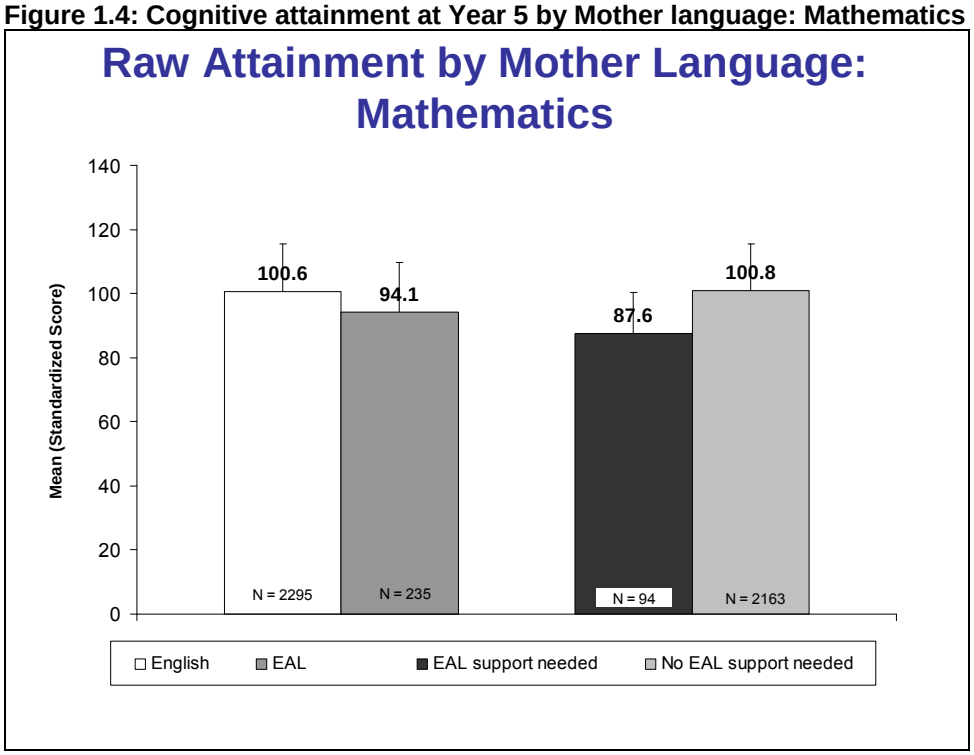


Figure 1.4: Cognitive attainment at Year 5 by Mother language: Mathematics



[10] Appendix 4 provides tables with means, standard deviations and group sizes for the group differences illustrated by charts in the main body.

Parents' qualification level

Mother's highest qualification level was shown to be a powerful predictor of attainment at earlier time points in the EPPE research (entry to pre-school, at entry to primary school, end of Year 1 and end of Year 2). In Year 5 this measure was still found to be highly significant. Figures 1.5 and 1.6 show attainments in Reading and Mathematics by mother's qualification. Children whose mothers have a higher degree show an average Reading score of 114.8 and an average Mathematics score of 112.1. Children of mothers with a degree are also far above average (Means: Reading = 111.0, Mathematics = 110.0). The lowest attainment is seen for children whose mothers' have no qualification (Means: Reading = 91.8, Mathematics = 92.5). If you analyze the differences in attainment by father's highest qualification you find the same pattern of results, although the association is slightly less powerful.

Figure 1.5: Cognitive attainment at Year 5 by Mother's Qualification: Reading

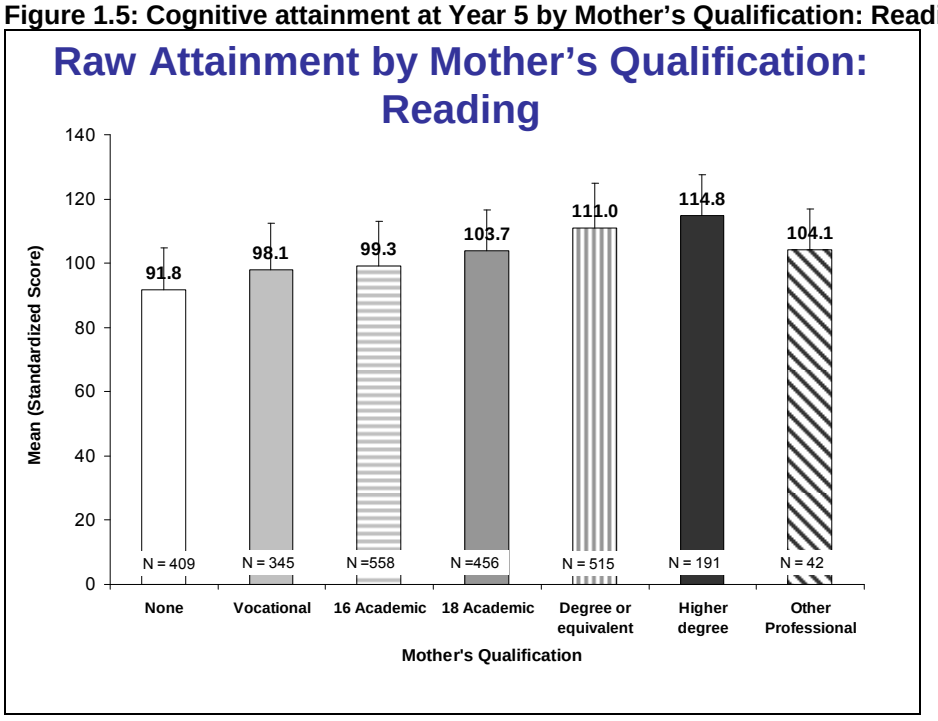
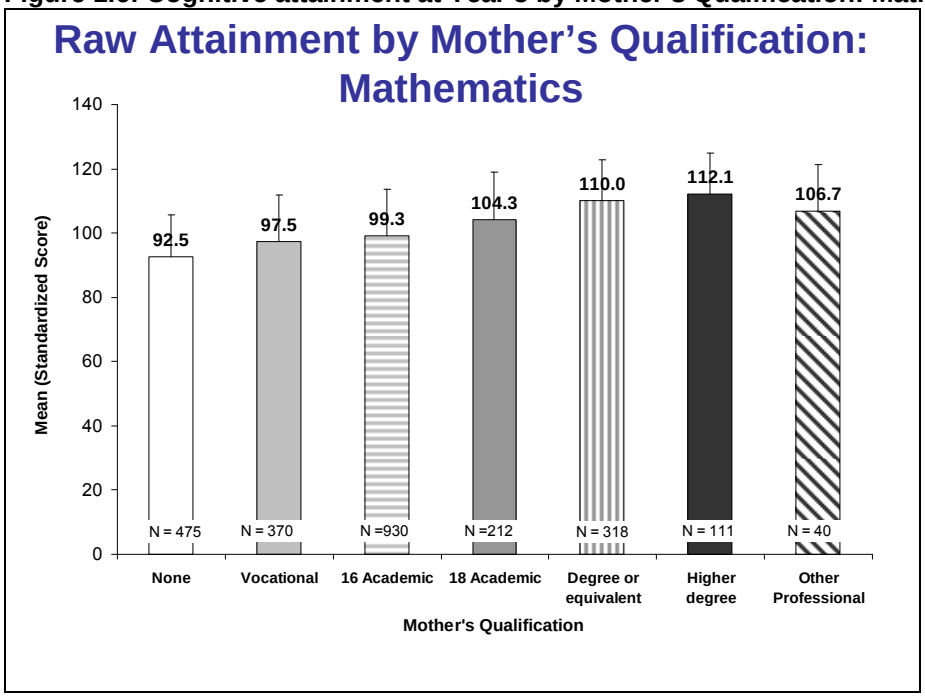


Figure 1.6: Cognitive attainment at Year 5 by Mother's Qualification: Mathematics



Socio-economic status (SES) and eligibility for free school meals (FSM)

Large attainment differences occur in Reading and Mathematics related to the socio-economic status (SES) of the family as found in the study of cognitive attainment measures at previous time points (entry to pre-school, entry to primary school, end of Year 1 and end of Year 2). Family SES is measured by the highest of mother or father's current or most recent employment status and showed a significant association with children's attainment levels at the end of Year 5. Children whose parents are in high SES (professional non-manual) employment have the highest average scores of any SES group, while children whose parents are unemployed or unskilled have the lowest scores on average (see Figures 1.7 and 1.8).

Figure 1.7: Cognitive attainment at Year 5 by Family SES: Reading

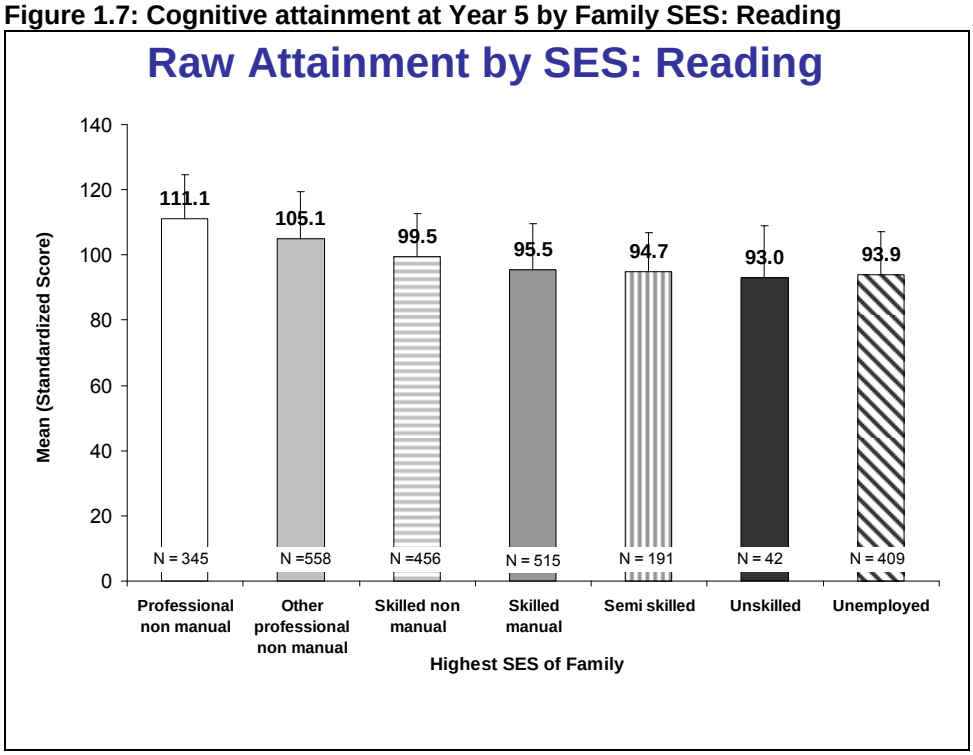
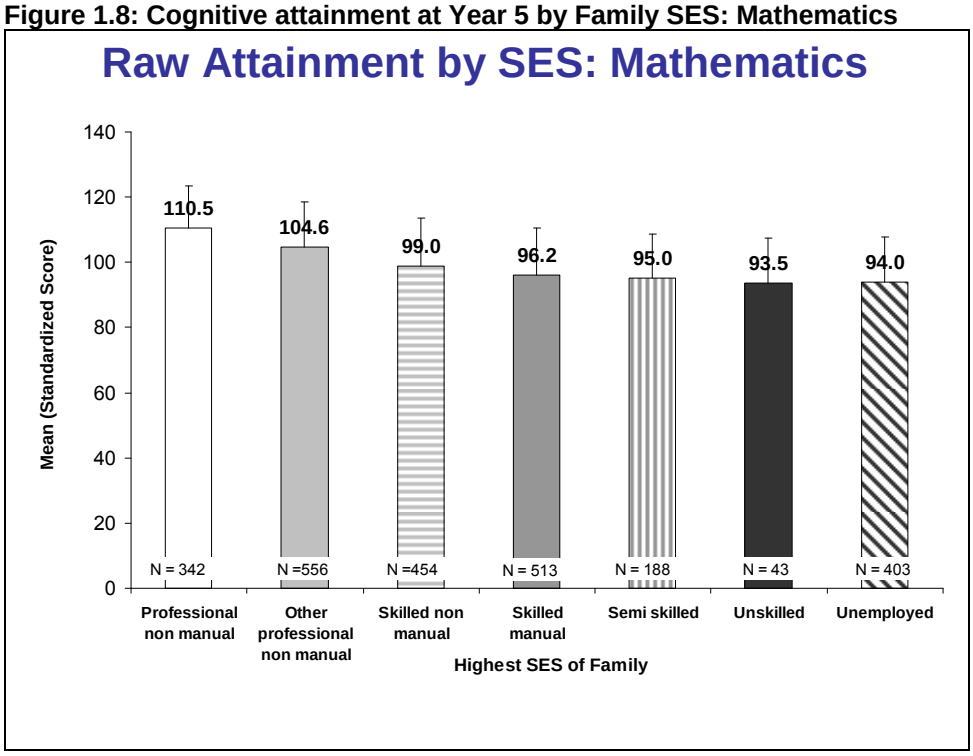


Figure 1.8: Cognitive attainment at Year 5 by Family SES: Mathematics



A child's eligibility for free school meals (FSM) provides an indicator of low family income (although it is recognised that not all children take up their entitlement). Table 1.4 shows that children who are reported to be eligible to receive free school meals (FSM) have lower average attainment on cognitive assessments compared to less disadvantaged families. The attainment gap is larger for Reading than for Mathematics. This pattern of results is in line with that found at younger ages, confirming that social disadvantage continues to show a statistically significant association with attainment. Section 3 of this report will give further insight into the changing influence of different child, family and HLE characteristics over the years.

Table 1.4: Cognitive attainment at the end of Year 5 and low income Indicator (Free school meals)

	Eligible for Free school meals (FSM)			Not eligible for Free school meals (Non FSM)		
	n	Mean	SD	n	Mean	SD
Reading	497	91.60	13.17	2044	102.04	14.72
Mathematics	491	92.40	13.82	2035	101.84	14.71

Special educational needs (SEN)

As might be expected, children identified by primary school records as having at least one special educational need in Year 5 or earlier showed significantly lower attainment in Reading (M = 89.2 versus 104.2) and Mathematics (M = 89.3 versus 104.1).

Table 1.5: Cognitive attainment at the end of Year 5 and SEN

	Special educational needs			No special educational needs		
	n	Mean	SD	n	Mean	SD
Reading	679	89.2	13.6	1787	104.2	13.4
Mathematics	670	89.3	13.3	1779	104.1	13.5

Multiple Disadvantage

Previous research has indicated that multiply disadvantaged children have poorer educational outcomes and trajectories than other non-disadvantaged children (for example see research on Educational Priority indices by Sammons et al., 1983). The multiple disadvantage index, created in the original EPPE research, showed a strong association with educational outcomes especially for cognitive attainment at entry to school and in Key Stage 1. The Year 5 analyses reveal a strong relationship with average cognitive attainment in Year 5. Children with no disadvantage had average scores of 106.2 (Reading) and 105.6 (Mathematics), in contrast children with five or more disadvantages had average scores of 89.4 (Reading) and 90.6 (Mathematics).

Table 1.6: Cognitive attainments at the end of Year 5 by Multiple Disadvantage Index

Multiple Disadvantage Index	Reading			Mathematics		
	n	Mean	SD	N	Mean	SD
0 (no disadvantage)	564	106.15	14.39	561	105.62	14.05
1	660	104.16	14.17	660	103.68	14.67
2	511	98.70	14.20	505	98.78	13.99
3	287	95.93	13.15	284	94.84	14.62
4	185	90.88	13.11	184	92.67	13.50
5 plus (high disadvantage)	151	89.43	12.68	149	90.56	12.30
All	2358	100.47	14.95	2343	100.32	14.97

Early years home learning environment (HLE)

The early years HLE has shown to have a strong significant positive impact on children's cognitive outcomes at earlier time points. At the end of Year 5, the early years HLE index still shows a strong linear relationship with average cognitive attainment. The better the home learning environment during the early years, the better the child's attainment at Year 5 (see Figures 1.9 and 1.10).

Figure 1.9: Cognitive attainment at Year 5 by early years HLE index: Reading

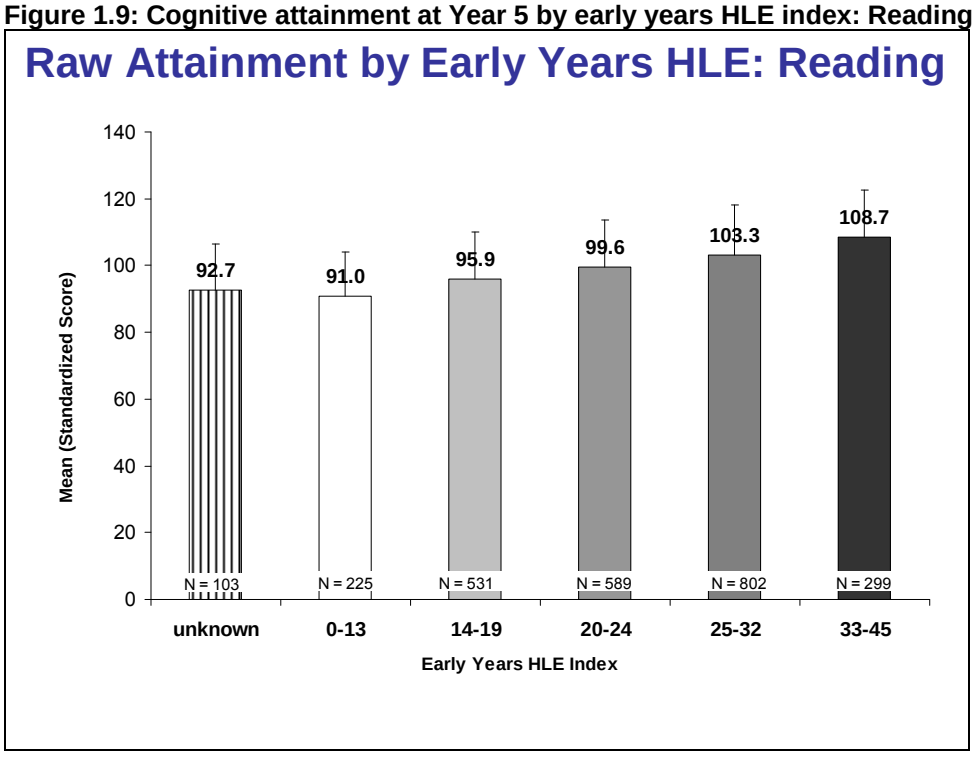
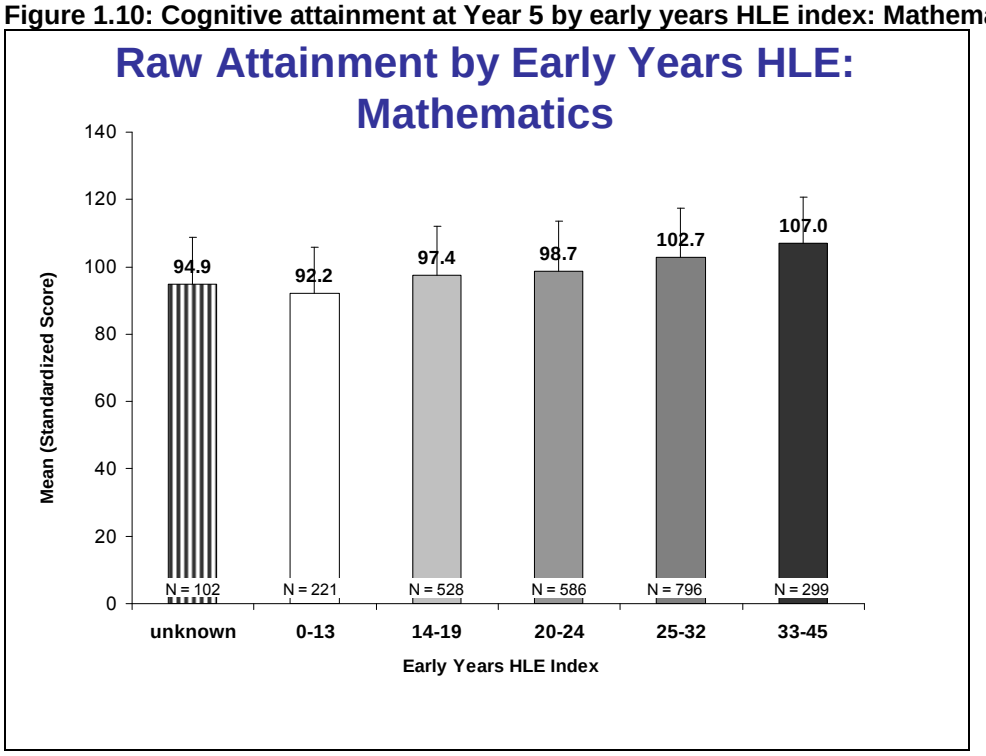


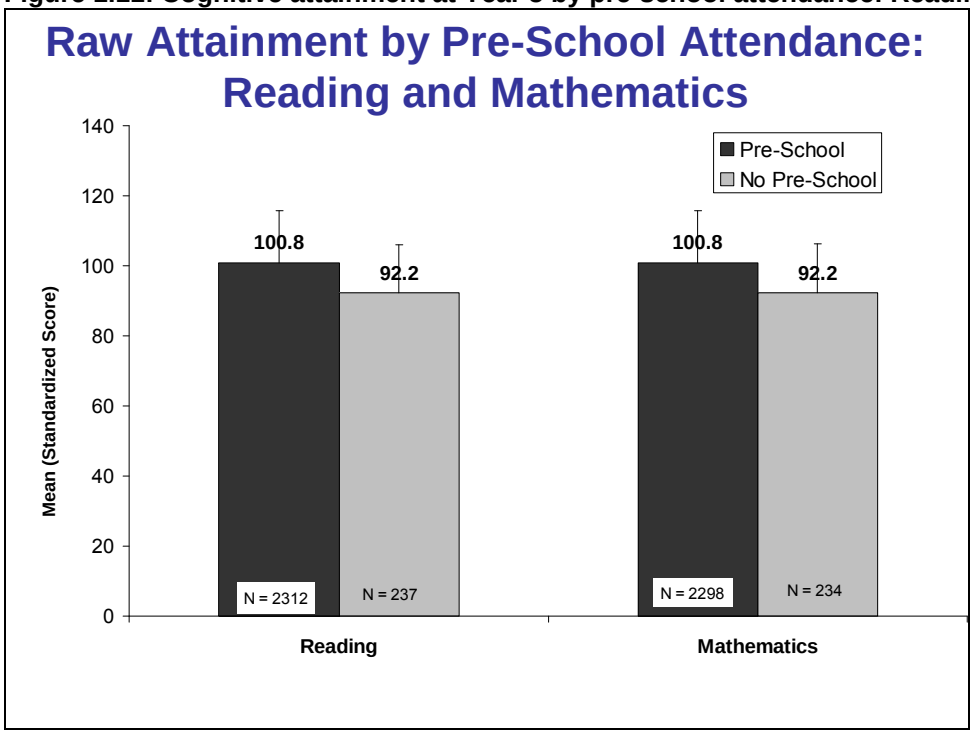
Figure 1.10: Cognitive attainment at Year 5 by early years HLE index: Mathematics



Pre-school

In previous analyses (start of primary school, at the end of Year 1, Year 2) results showed beneficial effects of attending a pre-school on cognitive outcomes compared with not attending a pre-school. At Year 5, it can be seen that children who attended pre-school still have higher average scores in the cognitive tests than children who did not go to pre-school (see Figure 1.11).

Figure 1.11: Cognitive attainment at Year 5 by pre-school attendance: Reading and Mathematics



Due to very different characteristics of the 'home' group (disadvantaged children are over-represented in this group) and very different characteristics of children who went to different

types of pre-school, these differences need to be interpreted with caution. Further analyses are required to separate net pre-school effects. Section 4 will investigate the impact of quality and effectiveness of pre-school in more detail, controlling for the influence of differences in background.

Primary School Effectiveness

The value added effectiveness measures for primary schools were calculated using National assessment data 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., 2006a; 2006b). These measures are thus independently derived and provide an indicator of the academic success of the school in promoting its pupils' progress. The relationship between value added effectiveness in English and the Reading outcomes of the EPPE 3–11 children, as well as the relationship between value added effectiveness in Mathematics and the Mathematics outcomes of the EPPE 3–11 children, was investigated.

Table 1.7 illustrates that the overall academic success of the school is related to average cognitive outcomes for the EPPE 3-11 sample. Children who went to a low effective primary school had an average of 98.6 in Reading and 97.9 in Mathematics, whereas children who went to a highly effective primary school had an average of 101.8 in Reading and 101.5 in Mathematics in Year 5. Section 4 will explore further how large the effect of primary school effectiveness is, when other influencing factors are controlled. It also answers the question: are there groups of children whose educational outcomes are more affected by primary school academic effectiveness than others?

Table 1.7: Cognitive attainments at the end of Year 5 by primary school effectiveness

Primary School Effectiveness	Reading			Mathematics		
	n	Mean	SD	N	Mean	SD
Low	400	98.55	13.98	439	97.85	15.21
Medium	1670	99.21	14.77	1628	99.70	14.75
High	264	101.84	14.83	255	101.47	14.49

It is not appropriate to explore any continuing influence of pre- or primary school on subsequent educational outcomes at the end of Year 5 unless proper statistical control is made of the influence of intake differences in terms of significant child, family and HLE characteristics. The next section therefore examines the net influence of different child, family and home learning environment characteristics in contextualised multilevel statistical models, which identify and separate the various influences simultaneously. The additional net influence of pre-school experience and primary school experience are then explored for the whole EPPE 3-11 sample and for relevant sub-groups.

Section 2: Children's Cognitive Attainments at the End of Year 5 in Primary School: The Impact of Different Child, Family and Home Learning Environment (HLE) Characteristics

This section presents the results of contextualised multilevel analyses establishing the pattern of relationships between various child, family and HLE characteristics and children's cognitive attainments at the end of Year 5. Background details about children's earlier childcare experiences, health, family and HLE during the pre-school period were obtained from parental interviews conducted when children entered the EPPE study and a parent questionnaire which was completed by the parents when children were approaching the end of Key Stage 1 of primary school education.

As potentially influencing background factors the following measures are available and 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 qualification, family income),
- Home learning environment (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 to age 7) such as the frequency of reading to the child, taking the child out to educational visits, computing activities, play, etc. (see Appendix 5 for details of these measures).

Figure 2.1: Strategy of statistical analysis of background influences

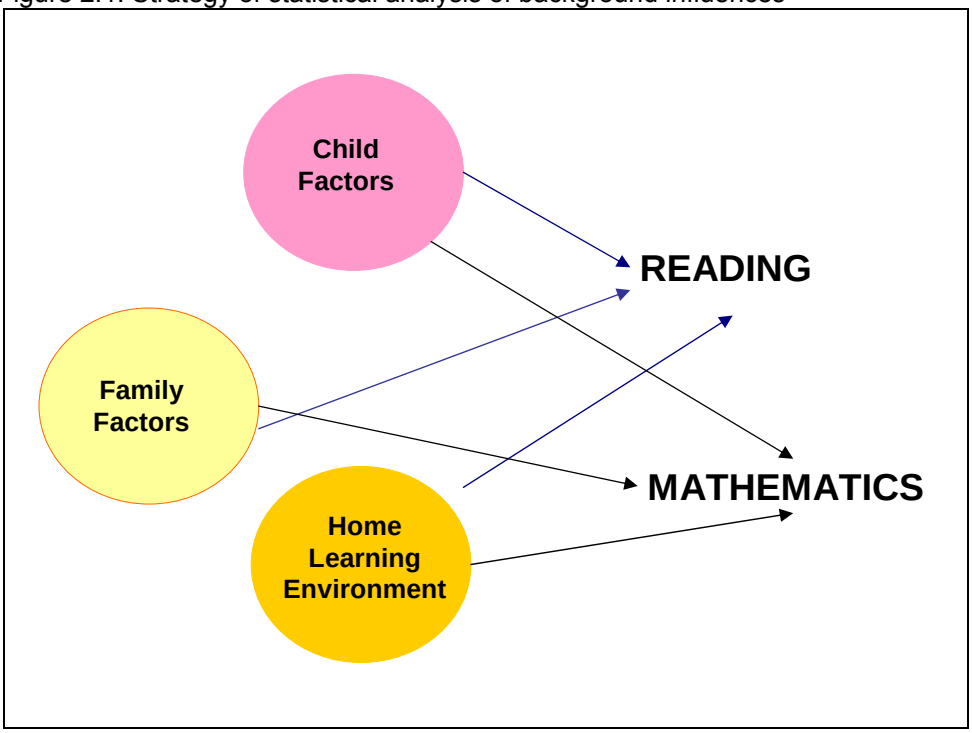


Figure 2.1 illustrates the strategy of statistical analysis. The analyses investigated whether the associations between cognitive attainments and these child, family and HLE factors remain statistically significant when children reach the end of Year 5 of primary school education[11]. The

[11] It should be noted 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 2.1.

analysis of the influence of child, family and HLE characteristics on cognitive outcomes is an important step as only on this basis, is it possible to separately identify and quantify the net influence of pre-school and primary school education, which will be explored in Section 4. 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 effects of particular child, family and HLE characteristics reported in this section were derived by contextualised multilevel analyses and therefore take into account any clustering related to the primary school attended.

Table 2.1 shows the null models with no explanatory variables included for the two cognitive outcomes. The intra-school correlation measures the extent to which the scores of children in the same primary school resemble each other as compared with those from children at different schools. The intra-school correlation for Mathematics and Reading indicate that approximately nineteen to twenty-one per cent of the variation of the children's scores is related to differences between individual primary schools, while the majority reflects differences between individual children. These proportions are a little bit higher than those identified in National assessments conducted at the end of Year 2. It should be noted, that approximately sixty per cent of the primary schools had only one EPPE child, the average number of EPPE children per school is 2.7 (maximum = 45). The results also do not account for the impact of pupil intake characteristics, subsequent models include intake control.

Table 2.1: Null model showing primary school and child level variance of Year 5 standardised and normalised scores in Reading and Mathematics

	Reading standardised score **Estimate (standard error[12])**	**Mathematics standardised score** **Estimate (standard error)**
School level variance estimate (se)	42.008 (6.305)	47.671 (6.245)
Child level variance (se)	184.2729 (6.227)	177.5971 (5.960)
Intra-school correlation	0.186	0.212
Number of children	2547	2530
Number of schools	957	953

A range of explanatory variables related to child, family and home environment characteristics where added in contextualised analyses. The results are reported in Table 2.2. A large number of potentially influential factors of early childhood and family background have been tested in the models for cognitive outcomes, including gender, SES, mother's qualification level and early years HLE and HLE towards the end of Key Stage 1. The results show the proportion of total variance in Year 5 academic attainment that is accounted for by such predictor measures. Overall background factors account for around twenty-eight per cent of the total variance in Reading attainment, for Mathematics the proportion is slightly lower at around twenty-two per cent. These findings are in accord with other studies of school effectiveness that tend to show background factors are somewhat more important predictors for Reading and Mathematics especially in the primary years (Scheerens & Bosker, 1997).

[12] The standard error provides a measure of the confidence limits associated with each estimate and is used to establish the statistical significance of the results.

Table 2.2: Contextualised models of Reading and Mathematics at Year 5 showing primary school and child level variance

	Reading standardised score Estimate (standard error)	Mathematics standardised score Estimate (standard error)
School level variance estimate (se)	2.533 (2.645)	17.397 (4.136)
Child level variance (se)	159.962 (5.132)	158.142 (5.326)
Intra-school correlation	0.016	0.099
% Reduction in school level variance	93.97	63.52
% Reduction in child level variance	13.19	11.31
% Reduction total variance	28.19	22.39

The intra-school correlation for Mathematics is somewhat higher than for Reading after control for background factors. This indicates that almost ten per cent of the variation in attainment in Mathematics is associated with the school attended. For Reading we find a very low intra-school correlation, indicating that only one to two per cent of the variance in attainment is associated with the school attended after controlling for background factors. However, it must be stressed that these results do not imply that the primary school a child attends does not matter for cognitive attainment. The low intra-school correlations found especially for Reading are also due to the fact, that many schools just have one EPPE child. We will show in the next sections, that the independently derived measures of the academic effectiveness of the primary school a child attends (based on National assessment data for whole cohorts) is a significant predictor for cognitive attainments in both Reading and Mathematics in Year 5 as well as for progress between Year 1 and Year 5.

The proportion of variance at the child level accounted for by child, family and HLE factors is similar for Reading and Mathematics, at around eleven per cent to thirteen per cent, being slightly higher for Reading (see Table 2.2). Whilst this represents a significant proportion, it is apparent that the majority of the variation in individual children's attainment at the end of Year 5 (age 10) is not attributable to factors such as gender, ethnicity, mother language or SES etc. Far more of the school level variance is accounted for by children's background characteristics, reflecting the importance of pupil intake factors in interpreting differences in attainment between schools.

EPPE 3-11 has already reported on the impact of background factors at earlier time points in primary school education (see Sammons et al., 2004a; 2004b for details). At the end of Year 1, where also NFER-Nelson assessments were also used for the assessment of academic attainment; fifteen to nineteen per cent of variation was taken up by the same background factors[13]. These proportions were higher than the proportion found at the end of Year 5. These results support the view that, taken together, the relative importance of background characteristics reduces as children move through school. This is an important conclusion and in line with findings from earlier research (see Sammons et al., 1993). The research also conducted further analyses of the influence of individual background factors in Year 1 compared to Year 5, and the results show that some background factors increased in their impact on cognitive attainment whereas others reduced. These results are reported in Section 3 and are

[13] With the exception of family salary and parental activities during Key Stage 1, as this information was not available at the point analyses were undertaken.

important to show for which groups of pupils the attainment gap widened or alternatively reduced in Key Stage 2.

The net influence of different child, family and HLE characteristics is summarised below. The net influence of different child, family and home environment characteristics is illustrated in Figures 2.2 and 2.3. In addition to the factors, the effect sizes (ES) for the single factors are given[14]. 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 plus. Appendix 6 gives full details of the multilevel estimates for each factor found to be statistically significant (Tables A.6.1 and A.6.2).

Figure 2.2: 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.

[14] 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 2.2 and 2.3. Details on effect sizes for other categories can be found in figures on the next pages.

Figure 2.3: 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
Birthweight	**0.42**	Normal birthweight higher attainment than very low birthweight
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 association between child factors and attainment in Reading at Year 5, we find that gender, birth weight, ethnicity, the number siblings, the need for EAL support and early developmental problems are found to be statistically significant predictors. For Mathematics at the end of Year 5 the following child characteristics are found to have significant net effect: birth weight, early health problems, ethnicity and number of siblings. Their relative strength is shown by the ES in Figure 2.3.

Gender
Gender differences in favour of girls were identified for Reading (ES = 0.10). This difference, though significant was small in size. This result is in line with results at earlier time points. Boys tend to show higher attainment than girls in Mathematics now, though this effect is not statistically significant. At earlier time points, girls showed significantly higher attainments in Mathematics than boys.

Birth weight
Children with very low birth weight had significantly lower attainments in Reading (ES = 0.40) and Mathematics (ES = 0.42) in Year 5 years than children with normal birth weight[15]. This is in line with findings at earlier time points, although interestingly at earlier time points the effect was stronger for Mathematics than for Reading.

Family size
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.

[15] 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).

Early developmental problems
Also, children whose parents reported early developmental problems at the beginning of the study showed lower attainment in Reading than children where no early developmental problems were reported (one developmental problem: ES = 0.17, more than one developmental problems: ES = 0.42). Early developmental problems did not have any significant influence on attainments in Mathematics in Year 5. But for Mathematics it is found that children who had 3 or more early health problems show lower attainment in Year 5 than those children who had none (ES = 0.45).

EAL and Ethnicity
Children who still needed support because having English as an additional language (EAL) 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. 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 ethnicity 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.

Family Measures

With regard to background characteristics we find the following family factors having a significant net effect on attainments in Reading and Mathematics: SES, parents' qualifications, eligibility for free school meals (FSM) and family's salary. The relative strength of the different factors is indicated by the ES.

Free School Meals
The free school meals (FSM) measure of low income showed a negative relationship with attainment in Year 5. The differences were moderate (ES = 0.27 for Reading, ES = 0.22 for Mathematics).[16]

Income
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 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 in line with previous reported effects of the employment status of the father.

Parent's highest qualifications
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 (for Reading, ES = 0.64 for mother having a degree versus no qualification, ES = 0.54 for Mathematics). See Figures 2.4 and 2.5 for details on effect sizes for other qualification levels compared to no qualification.

[16]Note that effects cannot be compared directly to effect sizes that have been reported for earlier time points, because for these analyses an improved imputed measure has been used (see Appendix 3 for details on the imputation method).

Father's qualification also has a statistically significant effect on attainment, but mother's qualification showed a stronger link to children's attainment (see Tables A.6.1 and A.6.2 in Appendix 6 for further details on effect sizes for different predictors).

Figure 2.4: The net effect of mother's qualification on Reading attainment at the end of Year 5

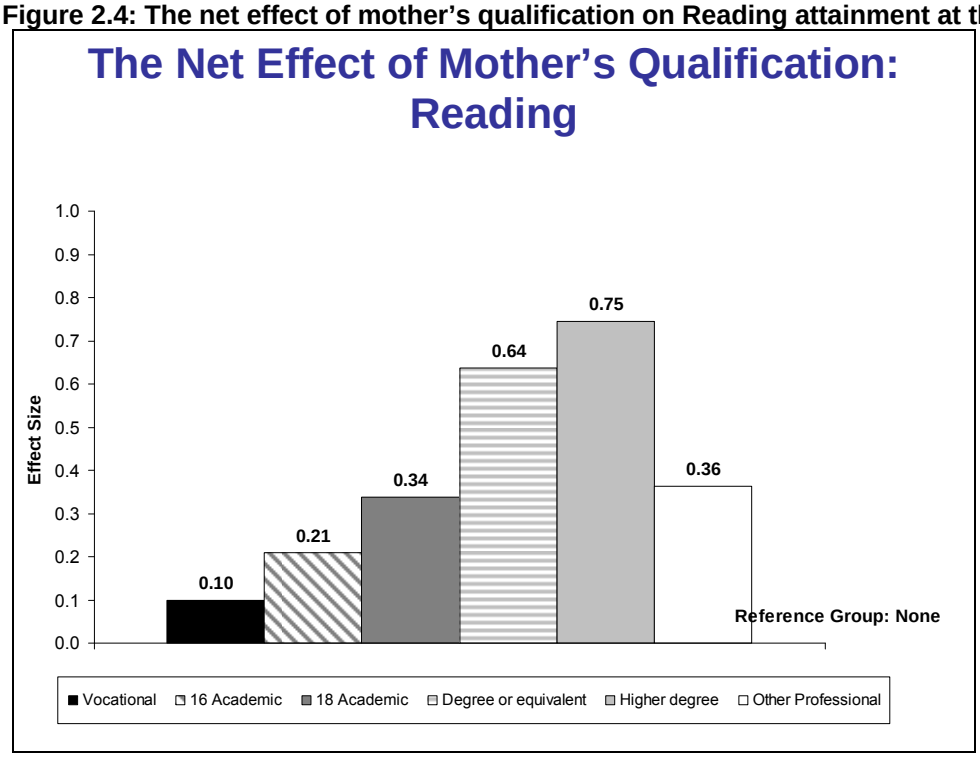
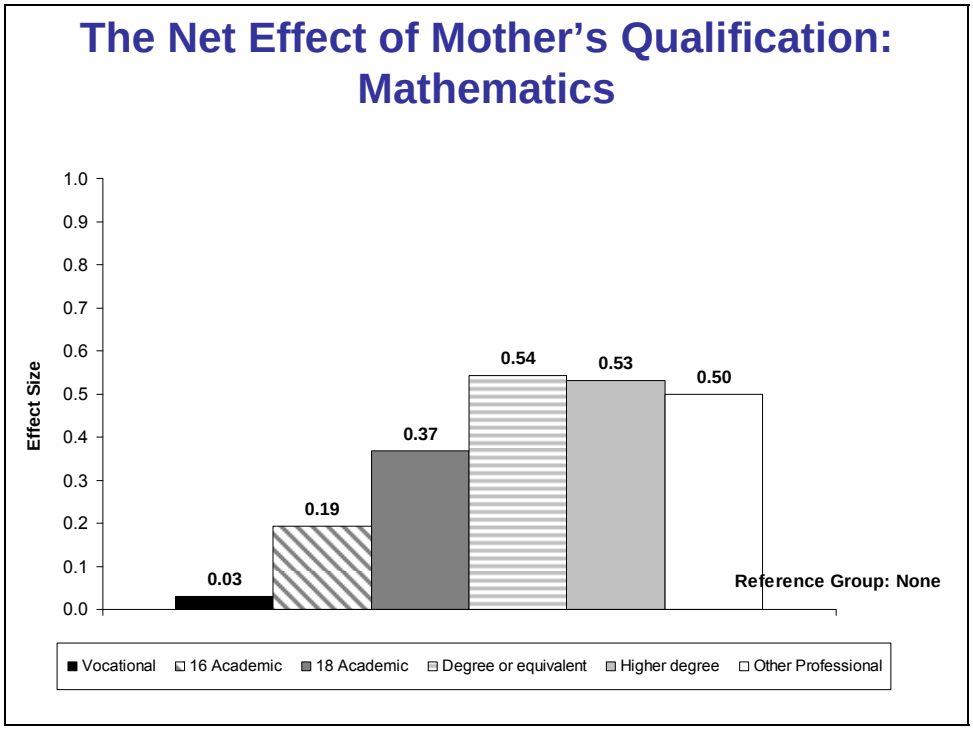


Figure 2.5: The net effect of mother's qualification on Mathematics attainment at the end of Year 5



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 Figures 2.6 and 2.7. Effect sizes can be quantified in the range between 0.11 and 0.36 for Reading outcomes and between 0.13 and 0.31 for attainment in Mathematics.

Figure 2.6: The net effect of family SES on Reading attainment at Year 5

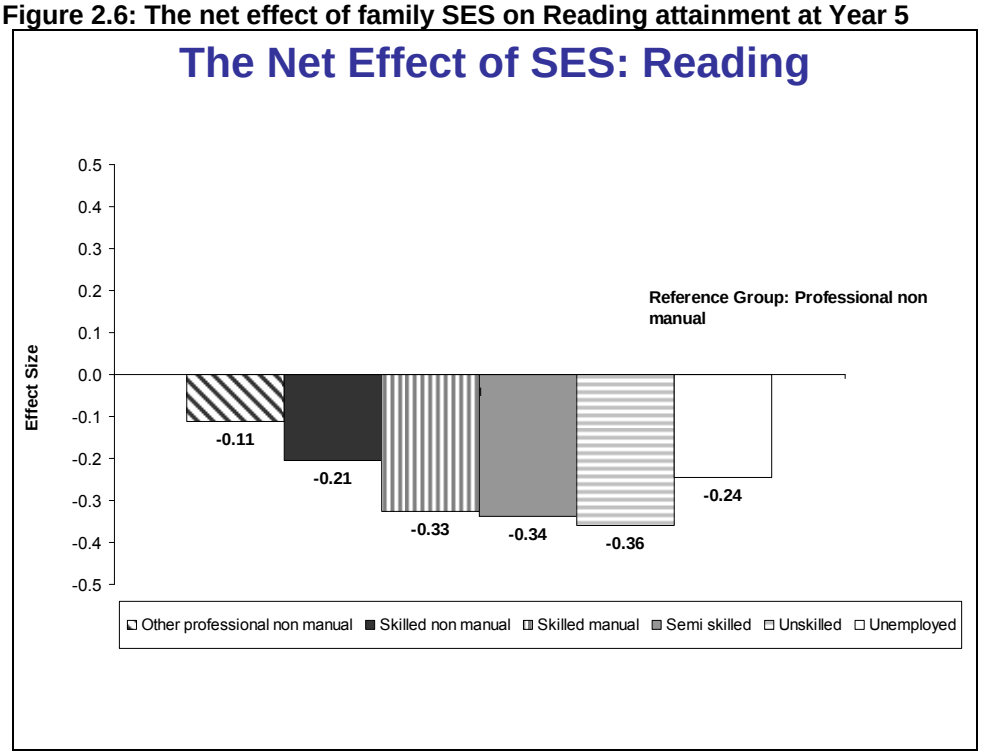
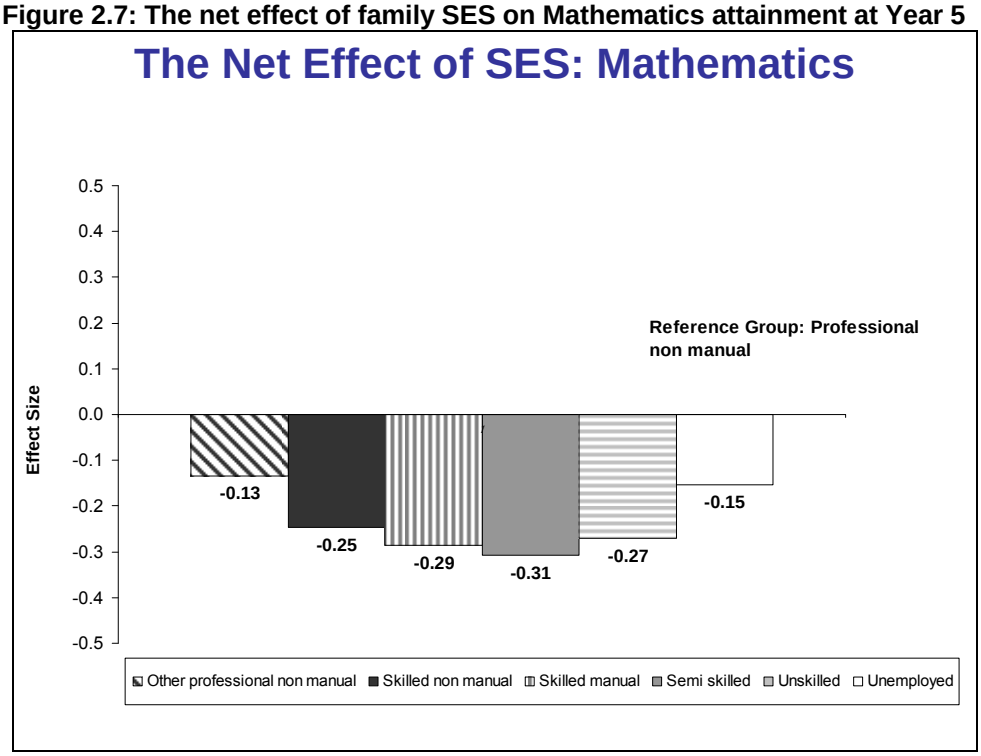


Figure 2.7: The net effect of family SES on Mathematics attainment at Year 5



Overall 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 qualifications are relatively more important than either income or SES in terms of affecting children's cognitive outcomes.

Early Years Home Learning Environment (HLE) Measures

A number of measures provide an indication of aspects of the HLE in 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 an overall early years HLE index with scores between 0 (very low early years HLE) to 45 (very high early years 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 age 10 after 5 years in primary school. 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 2.8 and 2.9). At earlier time points the impact of learning experiences at home on attainment in Mathematics were found to be slightly stronger, still the results illustrate the continued importance of these experiences. A high HLE rather than a low one has a similar positive effect on outcomes at Year 5, to having a mother with a degree versus one with no qualification. It should be noted that there are only modest correlations (r=0.32) between HLE and qualification levels.

Figure 2.8: The net effect of early years HLE on Reading attainment at Year 5

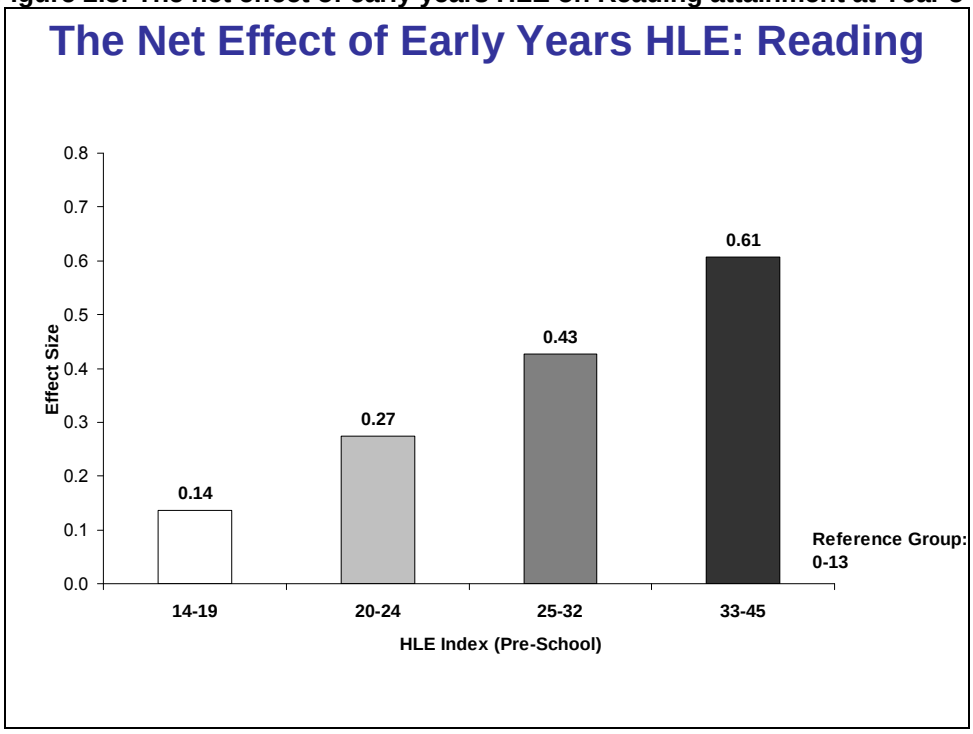
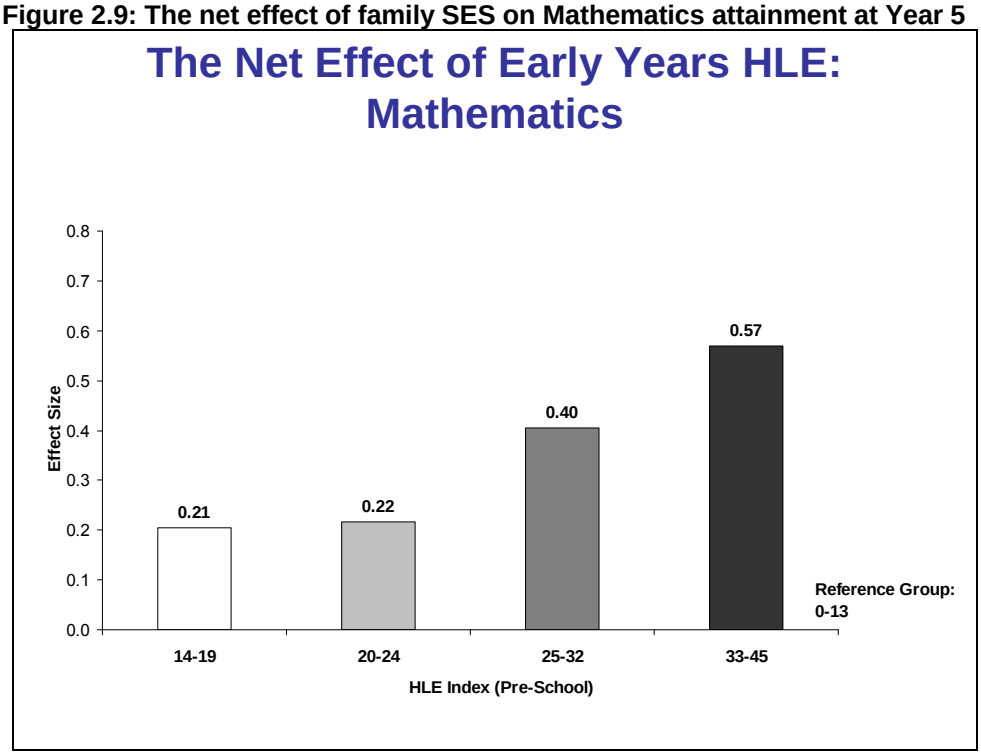


Figure 2.9: The net effect of family SES on Mathematics attainment at Year 5



Key Stage 1 Home Learning Environment (HLE)

As the learning environment at home during the pre-school period was shown to have a strong impact on children's academic attainments during pre-school, parents were again surveyed towards the end of Key Stage 1 about their interactions with their EPPE child at home via a parent questionnaire. They reported on activities such as the frequency of reading to the child, taking the child out on educational visits, computing activities, sport activities, dance, etc.

The individual measures have been aggregated to form four factors representing different parental activities during Key Stage 1: Home computing, One-to-one interaction, Expressive Play and Enrichment Outings (see Appendix 5). These factors were tested with respect to their influence on cognitive attainments at the end of Year 5 (age 10). The models continued to control for the impact of the early years HLE as this remained the stronger predictor even when KS1 HLE measures were included.

For Reading the results indicate, that moderate, high or very high scores on the One-to-one interaction factor are associated with lower attainment in Reading at the end of year five (ES = 0.16 for moderate and high, ES = 0.28 for very high). This effect might be explained by the fact that a lot of parental reading or listening to the child read during Key Stage 1 reflects that the child at this age is not a good reader and therefore needs a lot of support. On the other hand, children who scored low on this factor were not read to a lot by their parents during Key Stage 1, probably due to the fact that they were already good readers and read on their own.

Interestingly very high One-to-one interaction (compared to low) was also associated with lower attainment in Mathematics (ES = 0.23). These results stress the view that certain parental activities to support Literacy and Numeracy development of their children are especially important during the early pre-school period. Further analyses are being conducted to explore the characteristics of children in different HLE groups in KS1 in relation to SEN etc that may throw further light on these findings.

Moderate levels of home computing[17] (compared to low home computing), but not high or very high home-computing is associated with significant higher attainment in Reading (ES = 0.16). For Mathematics, moderate, high and very high home computing has a positive effect on attainment at the end of Year 5 (ES = 0.15 – 0.19).[18] Parents reported boys made much greater use of computers at home than girls and this was associated with better attainment in Mathematics.

In contrast, very high scores (but not high or medium scores) on the 'Expressive play' factor during Key Stage 1 were also related with poorer attainment in Mathematics at the end of Year 5 (ES = 0.19). This effect might be mediated by gender as 'Expressive play' activities are reported more often for girls than for boys, and girls are also showing lower attainment than boys. Further analyses will be conducted to explore this interesting interactive effect.

It should be noted that the KS1 HLE measures were collected by questionnaire survey rather than interview and thus the data may be somewhat less reliable than the measure of early years HLE.

Summary of Background Influences

The contextualised multilevel models tested the net impact of different child, parent and HLE measures while controlling for all other measures simultaneously and thus provides rigorous and conservative 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 related to other measures such as 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 other influences. It thus helps to tease out the strongest predictors (for reference see the earlier Figures 2.2 and 2.3 for a summary of the effect sizes). This is important in identifying the nature of the equity gap in achievement for different pupil groups and thus 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 (age 10). 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 not have stronger influence than they used to have. The general pattern is likely to reflect the impact of other influences such as attending school for a significant proportion of time, as well as variations between individual schools in their effectiveness, and also the growing influence of the peer group.

[17] Playing on the computer or using the computer in educational ways.

[18] There seems to be an interesting interaction between computing activities and gender differences in Mathematics attainment. If gender is tested without computing activities as a predictor in the model, the gender effect (in favour of boys) is statistically significant but not when controlling for computing activities. There's also a significant gender difference in computing activities, so the gender difference might be mediated by the frequency of computing activities. For consistent conclusions further analyses are required which will be conducted.

Section 3: Exploring the Impact of Background Factors on Children's Cognitive Attainments in Year 5 Compared to Year 1

This section presents the main results of multilevel contextualised models that have been conducted to compare the net effects of child, family factors and early years home learning characteristics on cognitive outcomes in Year 1 compared to Year 5. The change of net impact of different influencing factors reveals whether certain groups of children that showed lower attainment at the end of Year 1 have fallen further behind or begun to catch up by the end of Year 5. It also explores whether certain groups of children have further improved compared to the average in terms of their cognitive attainments during Key Stage 2.

The same set of predictors was tested as potential influencing factors on outcomes in Reading and Mathematics at Year 1 and Year 5. Comparisons were made on the basis of the effect sizes of the individual predictors. In the following description of the results rather than using absolute effect sizes, differences in effect sizes between Year 1 and Year 5 (Δ ES) are presented to indicate the extent of change in the impact of different background factors on cognitive attainment. The Δ ES are presented without an algebraic sign, but the direction of change is explained in the text.

Child Measures

The gender gap in Reading with girls showing higher attainment than boys is the same in both years (Δ ES = 0.01). For Mathematics the results indicate that the effect has reversed between Year 5 and Year 1 of primary education (Δ ES = 0.19), whilst girls showed slightly higher attainment than boys at the end of Year 1, at the end of Year 5 boys have not only caught up but 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 (Δ ES = 0.36) and Mathematics (Δ ES = 0.25) by Year 5.

The family size has also lost some of its impact on attainment in Reading (Δ ES = 0.12). With regard to early developmental problems, this factor has increased in its impact on attainment in Reading (Δ ES = 0.20), but slightly decreased in its impact on attainment in Mathematics (Δ ES = 0.12).

With regard to mother language the effect of 'needing EAL support' has decreased for Reading (Δ ES = 0.30). Children who need EAL support are still showing significantly lower attainment in Reading but the gap to those children who do not need EAL support has become smaller.

For ethnicity, we find that black African children had slightly higher attainment in Reading than White UK children in Year 1. In Year 5, they have fallen behind (Δ ES = 0.41). The same is true for children who are categorised as 'any other ethnic minority' (Δ ES = 0.30). Other ethnic groups have, compared to White UK children, stayed at the same level in Reading. For Mathematics the most striking result is the changed level of attainment found for Indian children. At Year 1 they had slightly lower scores than White UK children, at Year 5 they had not only closed the gap but had significantly higher scores (Δ ES = 0.62). Black African children have fallen further behind in Mathematics (Δ ES = 0.23), whereas Pakistani (Δ ES = 0.26) and Bangladeshi children (Δ ES = 0.16) have improved their attainments relative to White UK children during KS2.

Given the relatively small sizes of some ethnic groups in the EPPE 3-11 sample the 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.

Family Measures

It was found that the highest qualification level of the mother was a strong predictor of children's cognitive outcomes at Year 5 and at earlier time points. Investigating the change of strength of effect size between Year 1 and Year 5, the findings illustrate 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'. Differences in effect sizes (Δ ES) between Year 1 and Year 5 for attainment in Reading lie in the range between Δ ES = 0.13 (vocational) and Δ ES = 0.50 (higher degree). Only the group of 'Other professional' has lost some of its advantage compared to no qualification (Δ ES = 0.14). For Mathematics the results show slightly smaller change in effect size differences (Δ ES) between 0.01 and 0.30. In contrast, the influence of the highest qualification level of the father has become particularly stronger for outcomes in Mathematics (Δ ES between 0.05 and 0.37 for different qualification levels).

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. Differences in effect sizes (Δ ES) lie between 0.05 for the 'semi skilled' group and 0.24 for the group of families who were classified as 'skilled non manual'. For children of unskilled families the effect is not as pronounced anymore (Δ ES = 0.12), although they are still showing lower attainment compared to the professional non-manual group. For Mathematics the picture is not as consistent. The group of children whose parents were unemployed or not working has fallen further behind (Δ ES = 0.30), but for other groups the attainment gap has become smaller, i.e. Δ ES = 0.52 for the group of children whose parents were unskilled whose relative attainment position has improved. Taken together we can conclude that the association between parents' SES and attainment in Mathematics has slightly decreased.

Looking at eligibility for free school meals (FSM), the findings illustrate that the impact has become stronger for attainment in Reading (Δ ES = 0.15) but is little changed for attainment in Mathematics (Δ ES = 0.06).

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 the end of Year 5, controlling for all the other background variables. For attainment in Reading the influence seems to be of the same strength showing very little change (Δ ES approximately 0.05[19]) compared to Year 1. Looking at attainment in Mathematics, it appears that the impact has slightly decreased (Δ ES between 0.06 and 0.14). Nonetheless, it still is a strong predictor of attainment in Year 5.

Figures 3.1 and 3.2 summarize the extent of any change in effects. Taken together it appears that, for Reading more than Mathematics, the attainment gap related to some of the key background measures has further increased.

[19] HLE was tested as a categorical variable. For some the categories the effect size decreased minimal for other categories it increased minimal.

Figure 3.1: The impact of child, family factors and HLE on Reading skills 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.
Birthweight	**weaker**	Effect of birthweight 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 3.2: The impact of child, family factors and HLE on Mathematics skills 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.
Birthweight	**weaker**	Effect of birthweight 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 4: Children's Cognitive Attainments at the end of Year 5 in Primary School: The Impact of Pre-school and Primary School

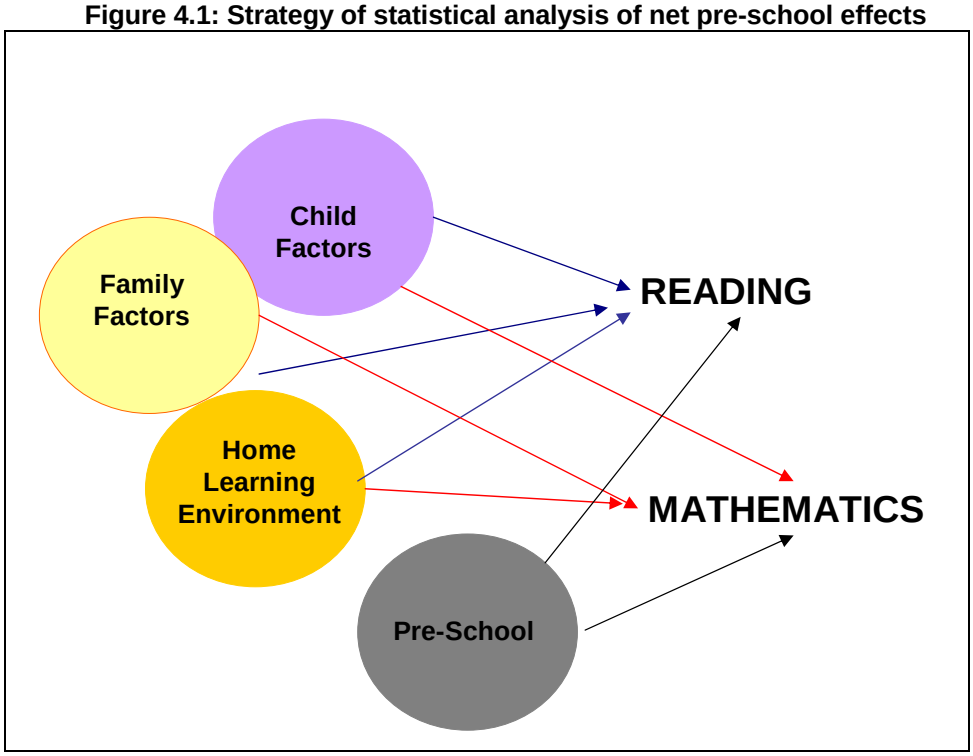
The contextualised analyses provide important evidence concerning the strength of background influences on young children's cognitive attainment at the end of Year 5. They illustrate that a range of child, parent and HLE factors continue to show a significant relationship with cognitive outcomes echoing earlier outcomes at entry to primary school and at the end of Year 1. Nonetheless 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. These results 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, 1998; Sammons et al., 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 effectiveness of primary school. An important feature of the original EPPE findings for the pre-school period relate to the positive impact of the pre-school centre experience on children's cognitive attainment at school entry and for the pre-school sample also on progress and developmental gains during the pre-school period up to Year 2 of primary school at age 7 years.

Given the consistency and strength of findings, that pre-school experience gave children a better start to school (see previous EPPE Technical Papers), 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. On the other hand, the children have already spent 5 years in primary school, so one could expect that the effectiveness of the primary school attended has a major impact on children's cognitive attainment and progress. Another EPPE 3-11 aim therefore investigates 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 of the analyses 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.

This section presents results of contextualized multilevel modelling analyses that have been used to investigate the described research questions.

The Impact of Pre-school Experience on Year 5 Attainment

Figure 4.1: Strategy of statistical analysis of net pre-school effects



Five aspects were considered to explore whether pre-school centre experience shows any continuing effect on Year 5 cognitive attainment: attendance at a pre-school centre compared to no pre-school, type of pre-school centre, duration, quality and effectiveness. In a further sub-section the combined impact of early years HLE and pre-school experience is also investigated (see Figure 4.1 for an illustration of the analysis strategy). The presentation of these complex results focuses on effect sizes and charts that are also easy to understand by those not familiar with advanced statistical modelling. Further details on estimates and their standard errors can be found in Appendix 6 (Tables A.6.3 – A.6.21).

The Impact of Pre-School Attendance, Duration of Pre-School Experience and Type of Pre-School

In Year 5, there are no longer 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 Years 1 and 2 (ages 6 and 7 respectively).

With respect to the simple comparison of children who attended a pre-school centre to those who did not (regardless of duration, type or quality) after control for background, effect sizes of 0.05 for Reading and 0.12 for Mathematics are found. However, it should be noted that the effect with a size of 0.12 would probably be statistically significant with a larger sample size (keeping in mind the relatively small number of children who did not go to pre-school). The statistically significant gender effect for Reading is for example, according to the effect size, as strong as the pre-school effect for Mathematics.

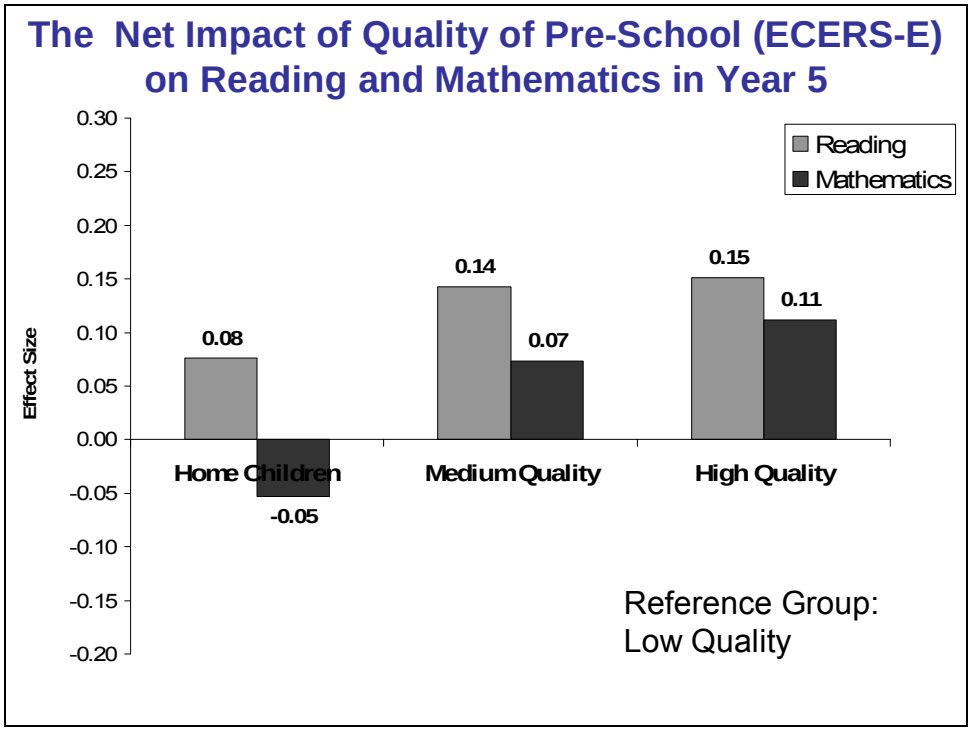
The Impact of Pre-school Centre Quality

Results at earlier time points also pointed to the positive impact of higher quality pre-school provision. Analyses divided the sample into groups of children whose pre-school experience could be classified as ranging from no quality (i.e. the 'home' group, approximately 9% of the

sample) through low (14%), medium (54%) and high quality (22%), based on individual pre-school centres' ECERS-E scores. 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 high (ES = 0.15) or medium (ES = 0.14) quality pre-school provision shows a modest continuing positive impact on Reading attainment at the end of Year 5 compared to the experience of a low quality pre-school centre (see Figure 4.2). Also children who stayed at home show no worse 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 4.2 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 than the low quality pre-school group. However, comparing the 'high quality' group with the group of children who stayed at home, an effect size of 0.16 is observed, not significant in these analyses (p = 0.11), but this effect may well have been significant with a larger sample size (keeping in mind the small number of 'home' children).

It appears that the quality of pre-school is somewhat more important to achieve pre-school effects on Reading attainments that last until the end of Year 5 whereas, for Mathematics, attending a medium or high quality pre-school centre also provides a small boost.

Figure 4.2: The impact of quality of pre-school on attainments in Reading and Mathematics at Year 5



The Impact of Pre-school Centre Effectiveness

The value added analysis of the cognitive attainment of children who attended a pre-school controlling for their prior attainment at entry to the study and background influences produced estimates of centre effectiveness (value added residuals which measure relative gains over the pre-school period compared to those predicted by the multilevel model). For details of these analyses, see Sammons, 2002. Examples of more and of less effective centres were found within each type of provision. For this reason, in tracking continuing influence of pre-school, residual measures of centre effectiveness were analysed in the same way as those for quality. In order to establish whether the effectiveness of the pre-school setting attended shows any continuing impact on attainment, further multilevel analyses were conducted on the Year 5 Reading and Mathematics outcomes. In these analyses effectiveness, in terms of promoting

progress in Pre-reading, was tested as a potential predictor for later Reading attainment and effectiveness, in terms of promoting progress in Early number concepts, was tested as a predictor for later Mathematics attainment.

Controlling for child, family and HLE influences, the results indicate that measures of centre effectiveness still show a positive net impact on children's attainment in both Reading and Mathematics at Year 5 (see Figures 4.3 and 4.4). These analyses revealed that children who had attended a more effective pre-school setting (effectiveness measured in terms of promoting progress in Pre-reading for later Reading attainment and effectiveness in Early number concepts for later Mathematics attainment) also show significantly better attainment than children who had attended no or only a low effective pre-school setting.

Figure 4.3: The impact of pre-school effectiveness (Pre-reading) on attainment in Reading at Year 5

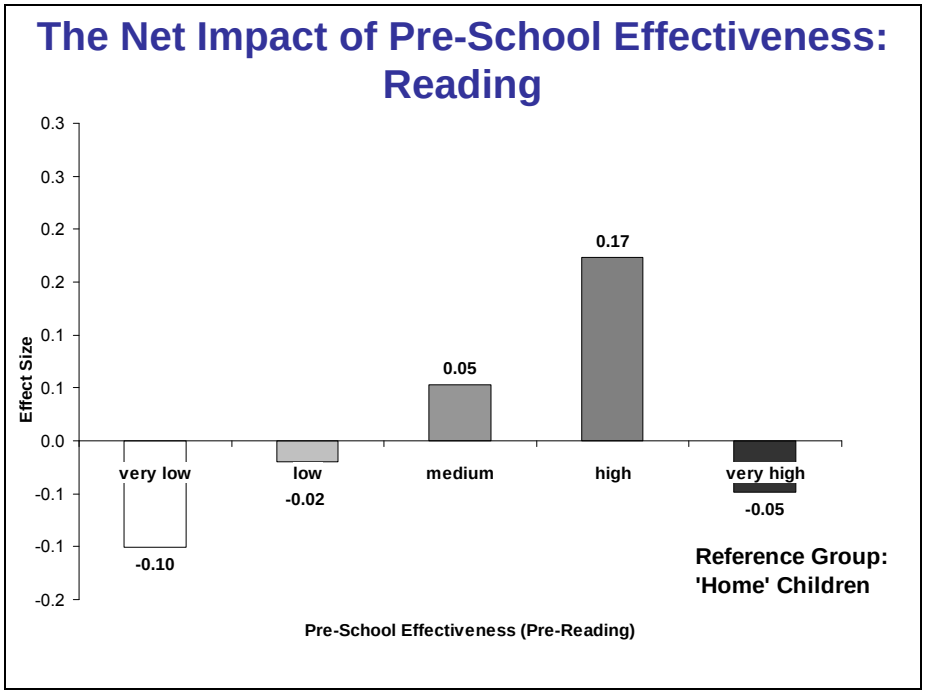
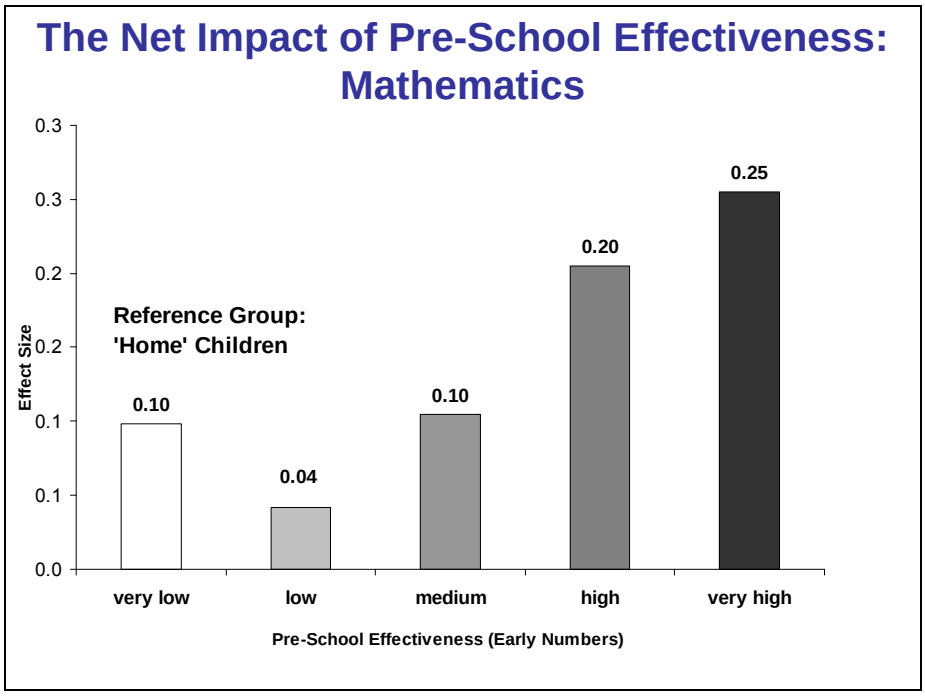


Figure 4.4: The impact of pre-school effectiveness (early numbers) on attainment in Mathematics at Year 5



Effects are notably stronger for Mathematics: Compared to 'no pre-school' children who went to high or very highly effective pre-schools have significantly higher attainment. The relationships between the effectiveness of pre-school attended and later Reading attainment is not completely consistent, there is a significant effect for high effective pre-schools compared to very low effective pre-schools, and an almost significant effect for highly effective pre-schools compared to 'no pre-school' ($p = 0.08$). But there is no significant effect for the most effective pre-schools (as measured by their earlier influence of Pre-reading) as can be seen in Figure 4.3. Further analyses suggest that this is likely to be due to the fact that high early years HLE is under represented in the group of children who went to the most effective pre-schools and there is an interaction between the impact of early years HLE and the impact of pre-school effectiveness on attainment in Reading which will be explored further in the next section. It should be noted that no significant differences were identified according to pre-school type in the analyses.

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

Given that the present analyses described above have already demonstrated modest effects for the quality and effectiveness of pre-school experience and strong effects for the early years HLE on later academic attainments, their joint effects were investigated. For this analysis the HLE-index was regrouped into three categories representing low, medium and high early years HLE.

Early Years HLE and Pre-school Attendance

Figure 4.5 shows the combined effect of early years HLE and pre-school attendance (yes/no), the reference group for these analyses is 'no pre-school and low HLE'. The chart illustrates the positive effect of a good early years HLE for the 'home' children. Children who did not go to pre-school and who scored medium on the HLE index show a small effect (ES = 0.10), those who had high HLE show a moderate benefit (ES = 0.32) compared to the home-children with low HLE. We further see for Reading, that a certain amount of additional parental support during the early years appears to be important for obtaining a positive effect of pre-school for Reading attainment that is still evident even after 5 years of full time in primary school. Children with medium and high early HLE tend to benefit from pre-school attendance (although differences in terms of effect sizes are small and not statistically significant), irrespective of quality or effectiveness, but children with low HLE do not show the same benefit.

For Mathematics the pattern is also very interesting: Figures 4.5 and 4.6 illustrates that the early years HLE has a strong positive influence on attainment in Year 5, controlling for other background factors such as SES or qualification of parents. But in contrast to the findings for Reading noted above, it is the group of children with low early years HLE that gets the strongest boost from attending any pre-school centre rather than none (ES = 0.16). For children with medium HLE, pre-school attendance does not seem to make any difference for attainment after 5 years of full time in primary school (ES = 0.20 versus 0.21). The group of children with high HLE not only get a boost through early years HLE, but also an additional advantage from the pre-school centre experience.

Figure 4.5: The combined impact of early years HLE and pre-school on Reading attainment at Year 5

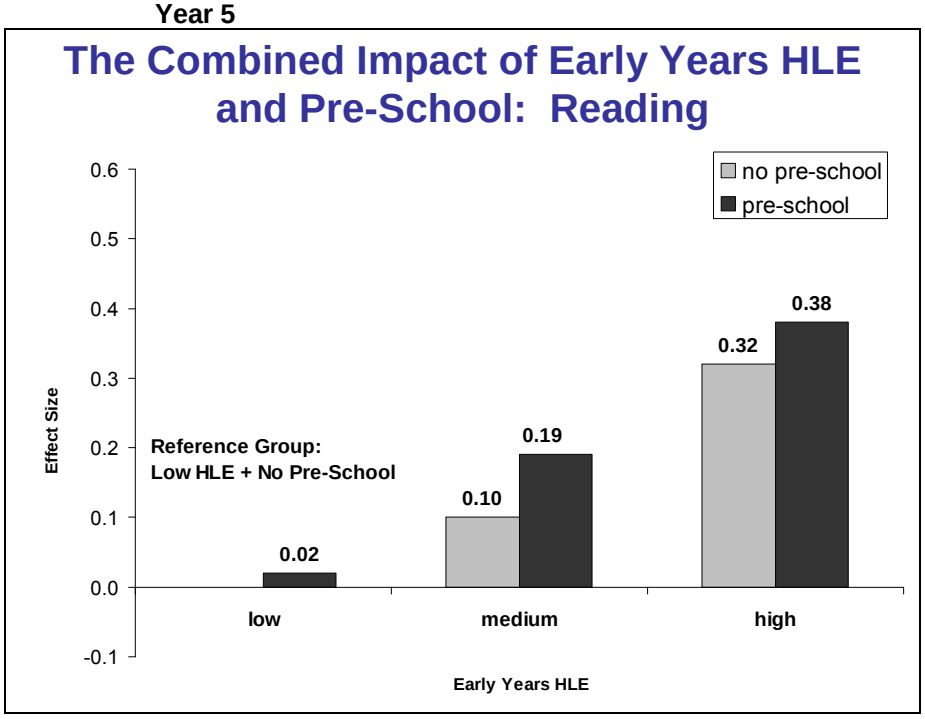
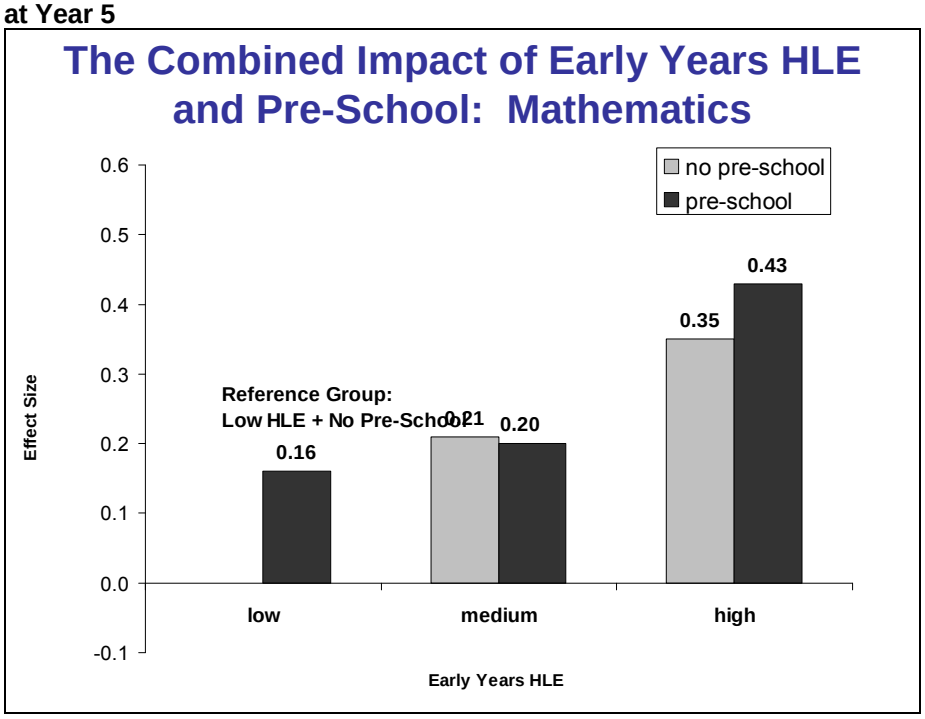


Figure 4.6: The combined impact of early years HLE and pre-school on Mathematics attainment at Year 5



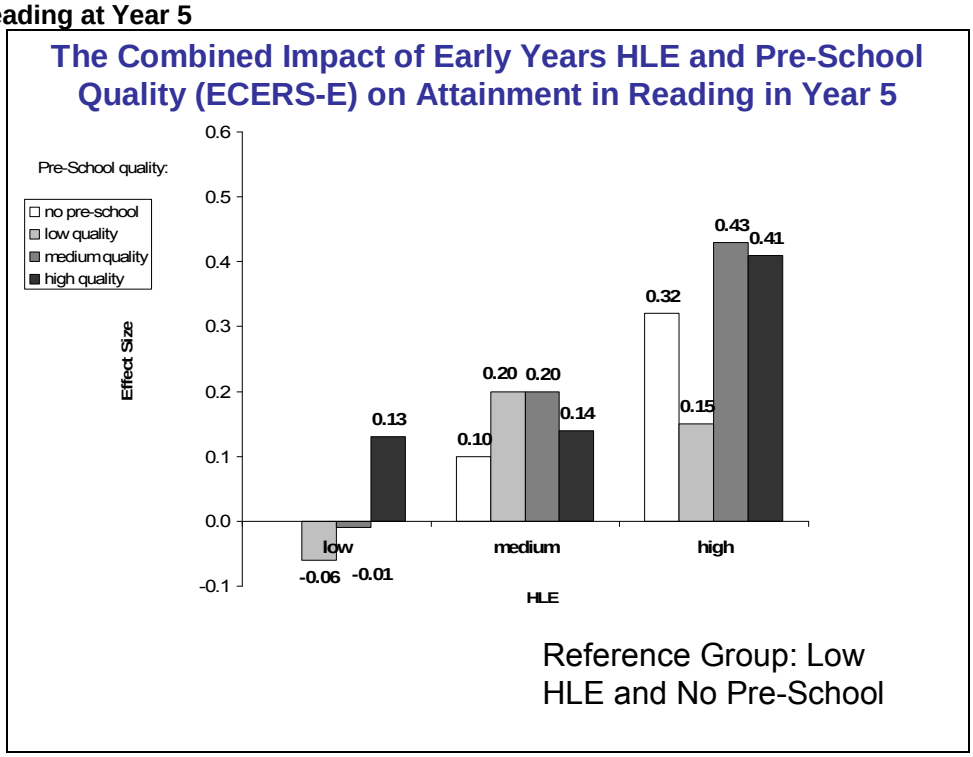
Early Years HLE and the Quality of the Pre-school

Further analyses were conducted investigating not just pre-school attendance but also the quality of the pre-school centre attended. This gives further insight into the way HLE and pre-school interact in influencing children's cognitive attainments in the longer term (see Figure 4.7). The reference group in these analyses is again the 'no pre-school and low HLE' group. Results are reported in terms of effect sizes. Please see the tables in Appendix 6 for statistical significances of the effects.

Figure 4.7 shows the chart for Reading and illustrates that children with low early years HLE gain a certain 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 due to the small sample size in this group).

Children who have high early years HLE and went to a medium or high quality pre-school are found to have the strongest positive long term benefit in Reading at the end of Year 5. 'Home' children also benefit particularly from high early years HLE and interestingly, they show higher Reading achievement than high HLE children who went to low quality pre-schools (Note however that children who went to low quality pre-school with high HLE are still doing better than children who went to low quality pre-school and had low or medium early years HLE). These findings underline again the importance of the quality of the pre-school centre for promoting Reading attainment and also the importance of early years HLE.

Figure 4.7: 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 attended a high quality pre-school (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. Compared to 'no pre-school and low HLE' ES are 0.22, 0.24 and 0.11 for low, medium and high quality pre-school, 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 experienced low HLE (ES = 0.21). In contrast, high early years HLE children show greater benefit from medium

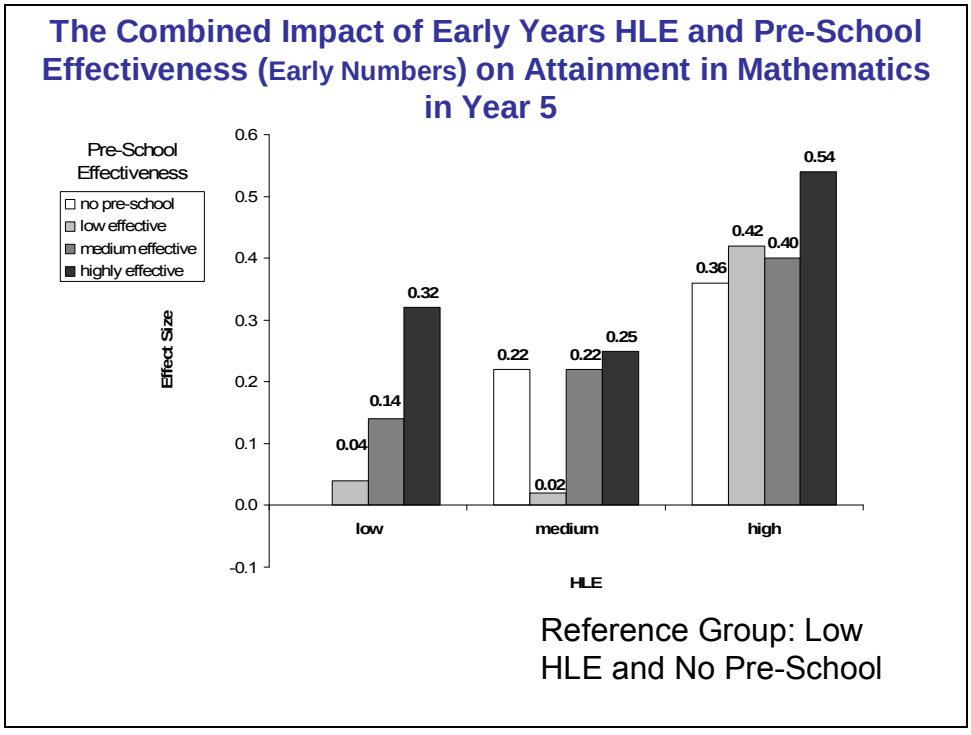
and high quality pre-school (ES for medium quality = 0.47, ES = for high quality = 0.47 compared to ES = 0.36 for 'high HLE and no pre-school').

To summarise, these results support the view that for longer term benefit only medium and high quality pre-school centres show sustained benefits on Reading and Mathematics attainment in Year 5. Moreover, the benefits of the pre-school-experience appear to be mediated by the quality of early years HLE experienced by children.

Early Years HLE and Pre-school Effectiveness

We also investigated the issue of differential pre-school effects of early years HLE and pre-school centre effectiveness. The results show the strongest and most consistent pattern for Mathematics and are illustrated in Figure 4.8. Children who have a low early years HLE obtain most advantage out of attending pre-schools that were highly effective in promoting earlier progress in Early number concepts (ES = 0.32 for highly effective pre-schools, ES 0.14 for medium 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 to children who did not go to pre-school and had low early years HLE. The children who show the best attainment are those children who have high early years HLE and go to highly effective pre-schools (ES 0.54). These children not only benefit from the high quality of their early years HLE, but get an additional strong boost from attending a more effective pre-school. These findings are in broad accord with those on quality reported earlier in this section.

Figure 4.8: 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 distinct but still a fascinating interaction effect was found: Children with low early years HLE do not show substantial long term benefit from pre-school irrespective of the effectiveness category of their pre-school (ES = 0.02[20], 0.03 and 0.03 for low HLE and low, medium and high effective pre-schools respectively). By contrast, children with medium HLE show a long-lasting modest effect from attending a medium effective pre-school. Compared to 'medium HLE and no pre-school' (ES = 0.10), ES for medium HLE and medium effective pre-

[20] The estimate of this effect has while being almost equal to 0 a negative sign.

school is 0.23. High-HLE children who went to highly effective pre-schools are doing best (ES = 0.48 compared to 'no pre-school and low HLE').

Different Pre-school Effects for different Groups of Children

Additional analyses were conducted to explore the question of whether attending a pre-school centre has 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

For the following analyses the sample had been divided into two groups: Children with no or just one disadvantage (44% of the sample) and children with two or more disadvantages (48% of the sample, approx 8% of the sample don't have a score on the Multiple disadvantage index due to missing values).

With respect to differential pre-school effects we find for Reading attainment at Year 5 that just attending a pre-school centre, irrespective of quality or effectiveness of the pre-school centre, still has a positive effect for the less disadvantaged children (ES = 0.35), but not for those children with more disadvantages (ES = 0.02). In Mathematics the results show the same pattern: for less disadvantaged children an effect of 0.29 (ES) is found for attending a pre-school versus not, the more disadvantaged children only show a very small effect (ES = 0.07).

But the results also indicate that the quality of the pre-school centre (measured by ECERS-E) is important. Compared to the group of children who attended a low quality pre-school centre, more disadvantaged children who went to a medium (ES = 0.15) or high quality (ES = 0.12) pre-school centre show somewhat better Reading attainment at the end of Year 5. But more disadvantaged children who did not go to pre-school also tend to do better than those who went to a low quality pre-school centre (ES = 0.13). For less disadvantaged children a different pattern is found: Children who did not go to pre-school are doing worse even after 5 years at primary school (ES = -0.24), children who went to medium or high quality pre-school tend to do better than children who went to low quality pre-schools (ES = 0.14 for medium quality, ES = 0.16 for high quality).

For Year 5 attainment in Mathematics the results point in the same direction: Children who attended a medium or high quality pre-school tend to have higher attainment than those who went to a low quality pre-school centre (ES = 0.14 for medium quality, ES = 0.11 for high quality). Children who did not go to pre-school do not have better average attainment than those who went to a low quality pre-school centre (ES = 0.04). For less disadvantaged children the findings show that children who did not go to pre-school are doing worse even after 5 years at primary school (ES = -0.27), however children who went to medium or high quality pre-school are not doing significantly better than children who went to low quality pre-schools (ES = 0.02 for medium quality, ES = 0.06 for high quality).

Looking at the effectiveness of the pre-school centre, we find that less disadvantaged children seem to benefit especially in their later attainment in Reading from attending highly effective pre-school centres compared to staying at home (ES = 0.22 for low effective, ES = 0.36 for medium effective, ES = 0.44 for highly effective pre-schools). However, the Pre-reading effectiveness of their pre-school centre does not seem to have an impact on the Reading attainment in Year 5 of the more disadvantaged children compared to staying at home (ES = -0.01 for low effective, ES = 0.01 for medium effective, ES = -0.04 for highly effective pre-schools).

In Mathematics the pattern of results is different. At the end of Year 5, the more disadvantaged children show better attainment than children who did not have any pre-school experience, if they went to a highly effective pre-school in promoting young children's Early number concepts (ES = 0.23). Medium or low effective pre-school centres do not appear to show any long term effect

after 5 years in primary school (ES = -0.01 for low effective, ES = 0.03 for medium effective pre-schools). Compared to staying at home, less disadvantaged children also show the highest benefit from highly effective pre-schools (ES = 0.33), but also get a long term boost from low (ES = 0.19) or medium effective (ES = 0.29) pre-schools.

These results provide some support for the view that higher quality and more effective pre-schools can provide a long term boost for more disadvantaged groups of children but the advantage is not always clear cut. The pattern of benefit for less disadvantaged children is more clear cut. Pre-school generally gives a long term boost especially higher quality and more effective pre-school.

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

For these 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 whose highest qualification level is none or vocational (25% of the sample). Vice versa, in the other group at least one parent has any higher qualification. This group forms the majority of the sample (73 %, approx 2% have missing values).

With regard to the effect of pre-school attendance, it appears that attending a pre-school makes a difference for the attainment in Reading at Year 5 for children of more qualified parents (ES = 0.13), but not much for children of low qualified parents (ES = 0.05). For Mathematics similar results are found though effect sizes are generally larger. Children of moderate or higher qualified parents take more advantage from attending any pre-school (ES = 0.20), irrespective of quality or effectiveness than children of less qualified parents (ES = 0.04).

The results also indicate that medium or high quality pre-schools provide a particular advantage to children of higher qualified parents for later Reading attainment (ES = 0.18, ES = 0.17) compared to low quality pre-school centres. After 5 years in primary school, no pre-school experience compared to a low quality pre-school (ES = 0.01) does not make a difference for these children. For children of low qualified parents effect sizes are small: ES = 0.01 for no pre-school, ES = 0.07 for medium quality pre-school, ES = 0.09 for high quality pre-school compared to pre-schools of low quality.

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 pre-school experience of low quality, children of low qualified parents who went to medium quality pre-school are doing slightly better (ES = 0.12), while children who went to high quality pre-school are doing substantially better (ES = 0.24). Children who did not go to pre-school are also doing slightly better than children who went to low quality pre-school although the difference is not statistically significant (ES = 0.09). For children of moderate to higher qualified parents, the quality of the pre-school does not seem to be that critical for the long term effect. Children who went to medium quality (ES = 0.05) or high quality (ES = 0.03) pre-school centres are not showing higher attainment than children who went to pre-school centres of low quality. But children of moderately to high qualified parents who stayed at home are doing significantly worse in Mathematics even after 5 years of primary education (ES = -0.17).

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 (ES = -0.13), but they tend to do slightly better if they went to a medium effective (ES = 0.11) or highly effective (ES=0.06) 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 moderate or highly qualified parents had, compared to those children with similar qualified parents and who did not go to pre-school, somewhat better Reading attainment at the end of Year 5 if they went to highly effective pre-schools (ES = 0.18) and slightly better attainment in Reading if they attended a medium (ES = 0.12) or low effective (ES= 0.08) pre-school centre.

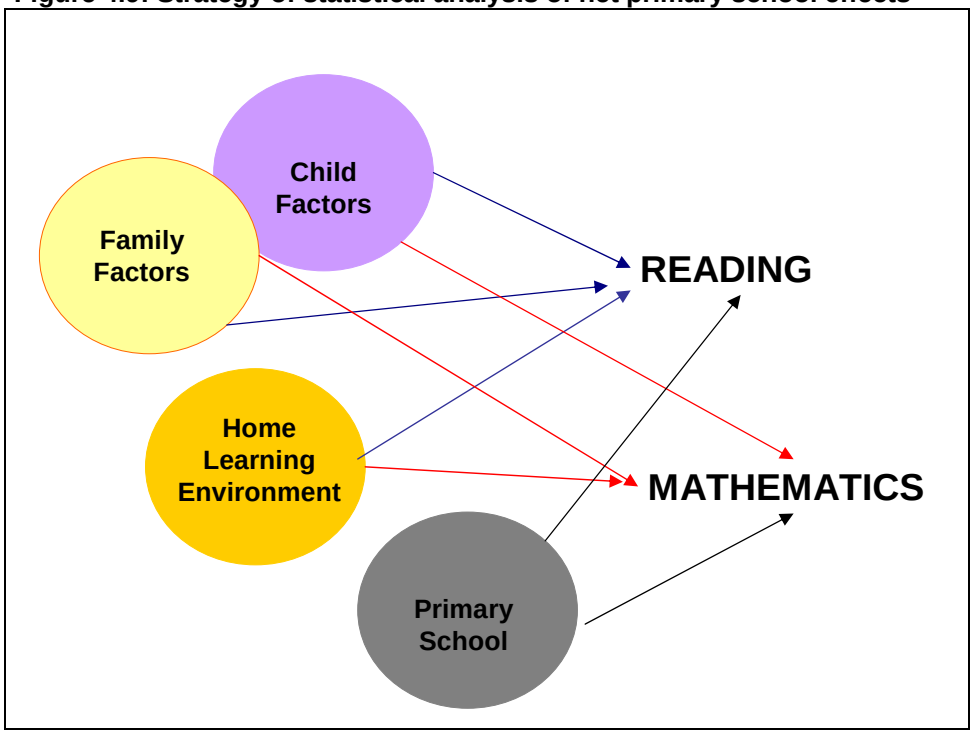
The findings for Mathematics are in line with the other findings. They indicate that children of low qualified parents benefit especially from highly effective pre-school (ES = 0.29), but not particularly from medium (ES = -0.01) or low effective pre-schools (ES = -0.14). Children of high qualified parents achieve higher attainment in Mathematics at the end of Year 5 if they had any pre-school experience irrespective of the effectiveness of the pre-school (ES = 0.15 for low effective, ES = 0.20 for medium effective, ES = 0.22 for highly effective pre-schools).

The findings in this section indicate that pre-school by itself seems to benefit less disadvantaged groups. However, for more disadvantaged children the quality and effectiveness of pre-school attended is important. Even so only weak to modest benefits on later attainment at Year 5 remain evident. Overall the predictive power seems to be stronger for Mathematics than for Reading. Low quality or low effective pre-school seems to be associated with poorer outcomes.

The Impact of Primary School Effectiveness

Contextualised multilevel analyses presented in Section 2 of this report have shown that school variation in attainment was strongly reduced after taking account of pupil intake characteristics. For attainment in Reading especially, the variance between schools almost disappeared after taking account of relevant background factors such as SES, parents' highest level of qualification and birth weight. This result is not surprising keeping in mind, that a large number of schools in the EPPE 3-11 sample are only attended by one EPPE child (see Section 2) and it should not be concluded wrongly that the characteristics of an individual school do not make any difference in promoting the academic progress of the children as is demonstrated in this section.

Figure 4.9: Strategy of statistical analysis of net primary school effects



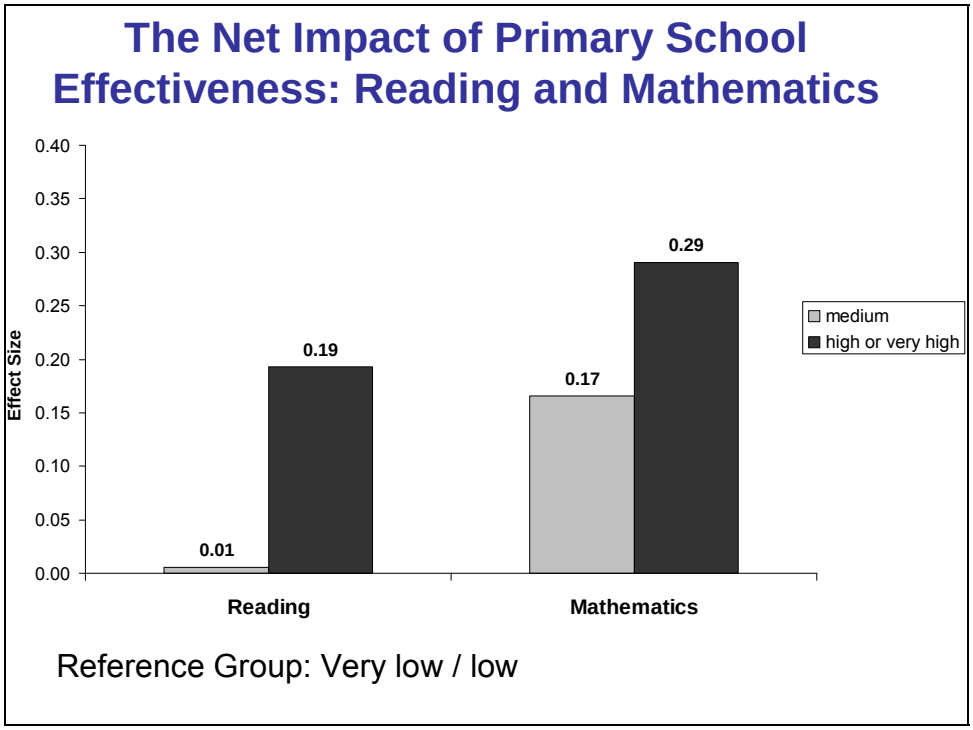
Analyses were conducted on the EPPE 3-11 data to establish the net impact of primary school academic effectiveness on cognitive outcomes without taking into account any characteristics of pre-school experience in the first instance (but all the other relevant background, HLE and child characteristics, see Figure 4.9 for an illustration of the strategy of statistical analyses). The value added effectiveness measures for primary schools were calculated using National assessment data 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., 2006a; 2006b). These measures are thus independently derived and provide a measure

of the academic success of the primary school in promoting its pupils' academic progress. The 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 the sample's outcomes in Mathematics.

From these analyses we conclude that the academic effectiveness of the primary school attended matters for longer term cognitive development (see Figure 4.10). It makes an identifiable and separate contribution to EPPE 3-11 children's later attainment at Year 5, after controlling for child, family and HLE influences.

Children who attended a very highly, highly or medium effective primary school in terms of Mathematics have significantly better scores in Mathematics than children who attended a low effective primary school. Children who attended a very highly or highly effective primary school in terms of Reading also have better Reading attainment at the end of Year 5 than children who attend a low effective primary school.[21]

Figure 4.10: The impact of primary school on attainments in Reading and Mathematics at Year 5.



Different influences of primary school effectiveness for different groups of children

In this part of the report the analyses explore any differential influences of primary school academic effectiveness on children's cognitive attainments at Year 5. Two measures of disadvantage are examined one being the Multiple disadvantage index and the second the highest qualification level of the parents.

Multiple disadvantage and the impact of primary school effectiveness

The sample was divided into two groups of children representing less and more disadvantaged children as described previously.

For attainment in Reading the results illustrate that the academic effectiveness of the primary school in English is relatively more important for the disadvantaged than for the less

[21] It is important to note that attainment in Reading and Mathematics was measured independently from the effectiveness by independent NFER-Nelson assessments.

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.[22]

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 from highly effective primary schools (ES = 0.14) but not that much from medium effective schools (ES = 0.06) compared with a low effective primary school. By contrast, more disadvantaged children show 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 because it demonstrates that primary school effectiveness is relatively more important as an influence on pupils' attainments at Year 5 for children who are more disadvantaged.

Parents' qualification level 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, it is seen for Reading that children of less 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 of moderate to high qualified parents 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, the primary school effectiveness is especially important for those whose parents have low qualification levels. Compared to those who attended low effective primary schools, children who go to highly (ES = 0.44) or medium academically effective (ES =0.35) primary schools have significantly higher average Mathematics scores at Year 5. The relative effectiveness of the primary school is also important for children of parents with moderate or higher qualifications, 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 certain characteristics of pre-school experience 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 influence 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 (according to the ECERS-E score of the pre-school) and primary school 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 4.11 and 4.12. Due to smaller numbers to obtain a clearer picture, medium and high effective primary schools were grouped together. In both cases

[22] Children with missing primary school effectiveness scores show higher attainment in the group of advantaged children. The scores of these children are very likely not available because they attend private schools.

(Reading and Mathematics) the reference group is no pre-school and low effective primary school.

Figure 4.11: The combined impact of pre-school quality and primary school effectiveness on attainment in Reading at Year 5.

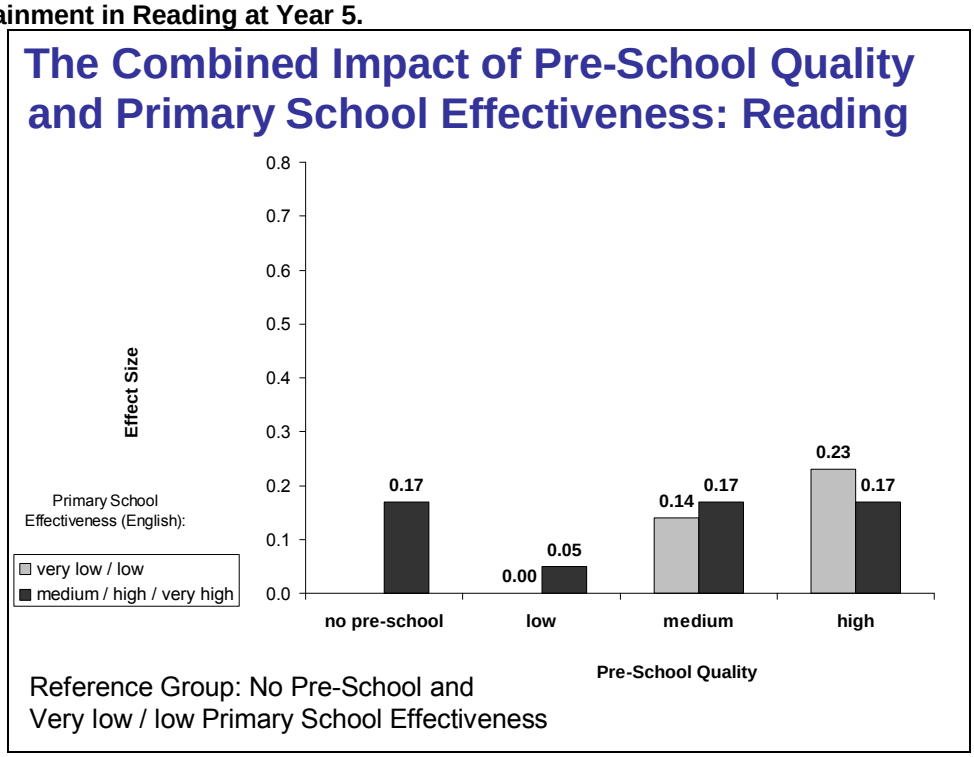
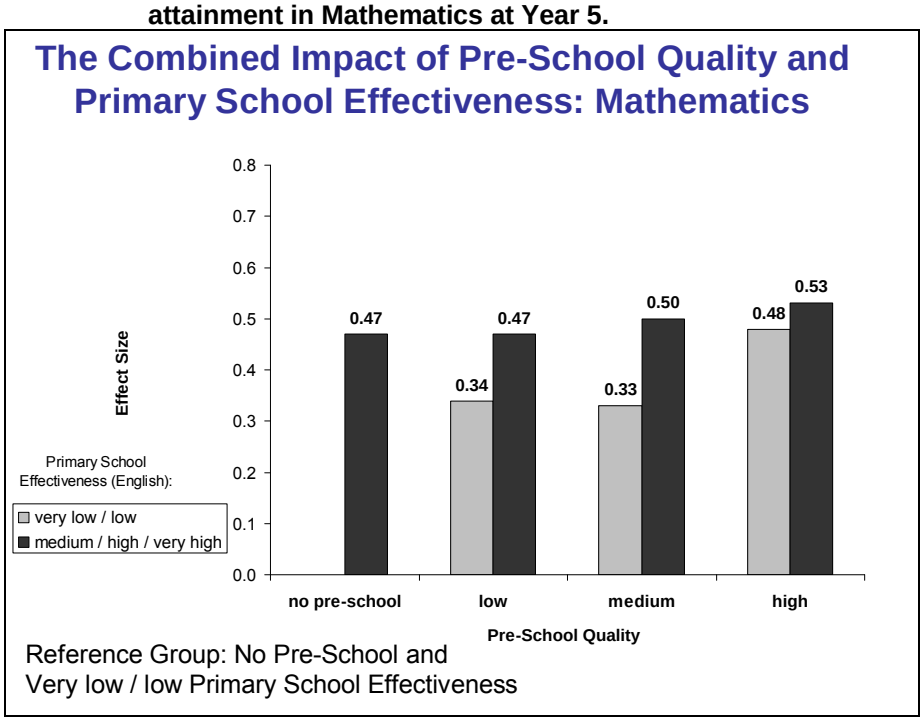


Figure 4.11, illustrates for Reading that children who did not attend any pre-school centre benefit especially if they go to a medium / high academic effective primary school later on (ES 0.17). Children who attended a low quality pre-school centre show only a very small benefit from a medium or highly effective primary school. For the groups of children who attended a medium or high quality pre-school centre and a medium/high effective primary school, we see that they are less affected by the academic effectiveness of the primary school, but that the quality of the pre-school also seems to have had a protective effect (if you compare with the group who attended a pre-school centre of low quality, this effect is most distinct).

Figure 4.12 shows stronger effects for Mathematics 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. 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 influence of all other background factors.

Figure 4.12: The combined impact of pre-school quality and primary school effectiveness on attainment in Mathematics at Year 5.



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

In addition to the single analyses of the impact of pre- and primary school academic effectiveness, these two measures were taken together and incorporated in the same model so that the combined effects could be studied. We sought 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 Figures 4.13 and 4.14. The reference group for these analyses are children with no pre-school experience who attended a low effective primary school.

Figure 4.13: The combined impact of pre- and primary school effectiveness on attainment in Reading at Year 5.

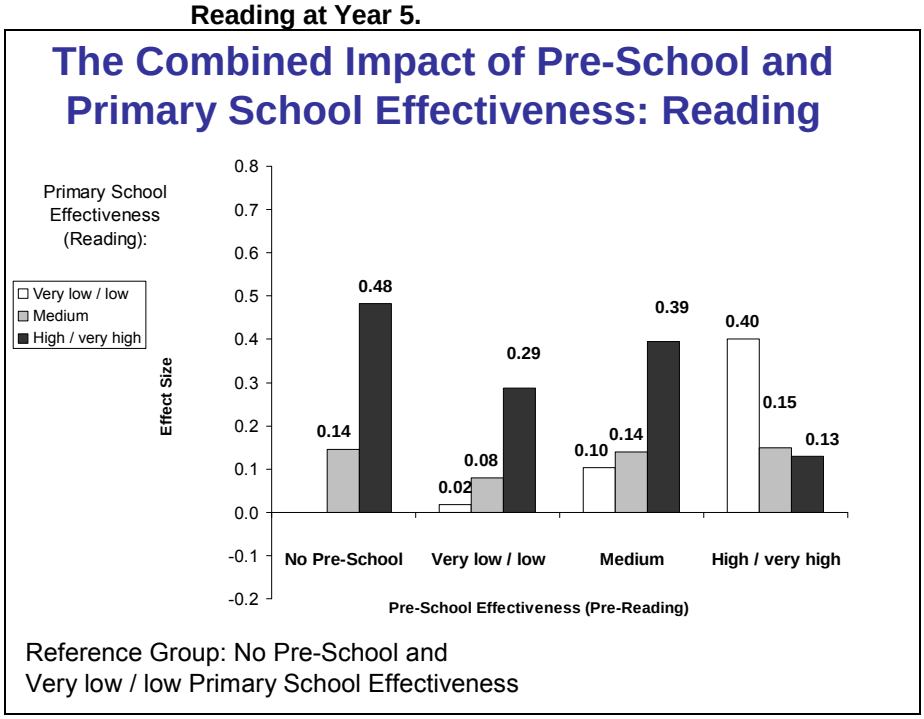


Figure 4.14: The combined impact of pre- and primary school effectiveness on attainment in Mathematics at Year 5.

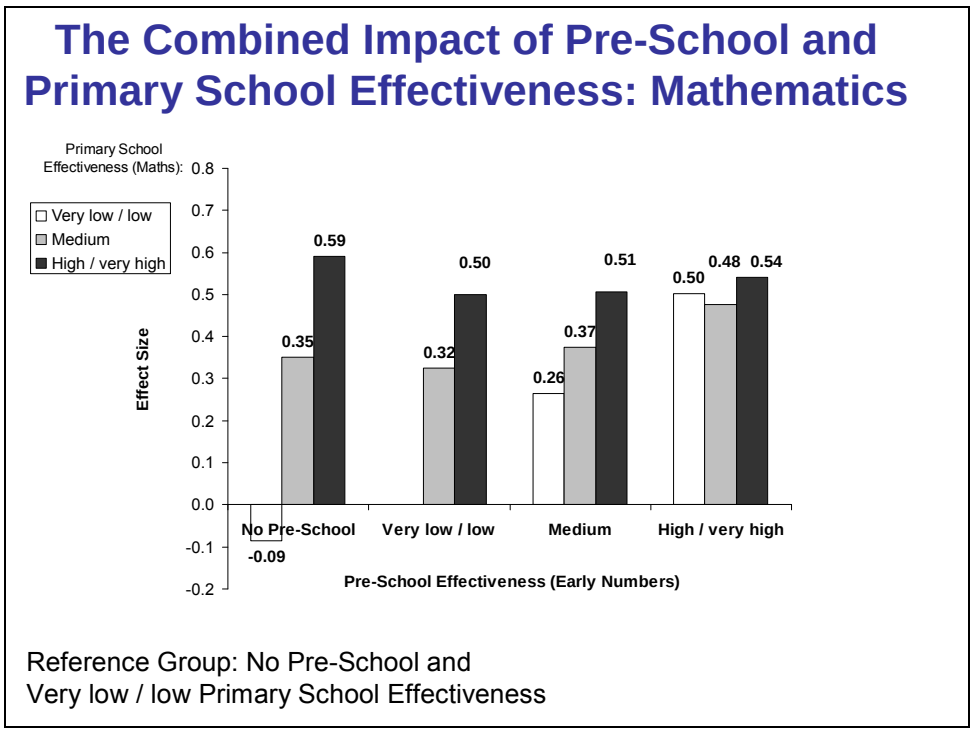


Figure 4.13 shows clearly for Reading that children who did not attend any pre-school (the 'home' group) benefit especially if they go to a highly effective primary school. Children who attended a very low, low or medium effective pre-school centre in terms of promoting children's Pre-reading, benefit 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 the group of children who attended a highly effective pre-school the additional impact of primary school effectiveness seems to be odd, because the 'low' group shows the highest attainment, but in these groups especially there are just a small number of children.

Figure 4.14 indicates stronger effects for Mathematics after control for background and the pattern is clearer and more consistent. Children who went to a high academic effective primary school generally do well in Year 5 irrespective of their pre-school experience (ES 0.50-0.59). Children who attended no pre-school, 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 high attainment (compared to children who stayed at home and went to a low effective primary school) almost no matter what the effectiveness of the primary school is. This again points to the preventive effect of attending a highly effective pre-school for later Mathematics outcomes at the end of Year 5.

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). In all cases the reference group is no pre-school and low effective primary school. Here we can see the relative difference in ES of attending a low academic effective primary compared with a high academic effective primary is 0.24.

Summary of Pre- and Primary School Influences

The contextualised multilevel models tested the net impact of different aspects of pre- and primary school experience while controlling for all other background measures simultaneously and thus provide rigorous and conservative estimates of statistical significance of any continuing pre-school effects as well as of primary school influence.

The contextualised analyses 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. Compared to earlier time points the strength of effects have decreased as might be expected, due to the length and variation in primary school experience and also probably reflecting the growing influence of the peer group.

The results also illustrated that the 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 attainment are for the no pre-school group who went on to a low academically effective primary school). However, low quality pre-school offers little long term benefit (in contrast to previously reported findings at younger ages). 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 5: Exploring Relative Cognitive Progress between Year 1 and Year 5 of Primary School Education

Young children's cognitive progress was investigated over the pre-school period from age 3 years plus to primary school entry (see Sammons et al., 2002). The results were used to identify measures of pre-school centre effects, based on value added analyses, tested in earlier sections of this report in relation to attainment at the end of Year 5.

Further analyses were conducted to explore academic progress from the end of Year 1 at primary school to the end of Year 5 at primary school. The assessments at the end of Year 1 provide the baseline measures for these analyses of pupil progress. The results of the simple value added models control only for prior cognitive attainments at the end of Year 1 for prediction of attainments in Reading and Mathematics at the end of Year 5.

Table 5.1 summarises the results for Reading and Mathematics progress. It can be seen that more of the total variance in Mathematics at the end of Year 5 is accounted for by prior attainment at the end of Year 1 than is the case for Reading (approximately thirty-two per cent for Reading, approximately forty-two per cent for Mathematics). The intra-school correlation is a measure of the variation in children's progress associated with the school level and is an indicator of potential differences in effectiveness. The intra-school correlations for Reading and Mathematics are very similar. It is possible that, this variation between schools, in progress, may reflect differences in teaching approaches and emphases during Key Stage 1 and Key Stage 2.

This is a further evidence of significant variation between schools in promoting young children's attainment (see also Section 3) and makes the study of primary school effects on educational outcomes that EPPE 3-11 is presenting extremely relevant. The intra-school correlations are fairly large indicating that around eighteen per cent of the variation in progress 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)

Table 5.1: Simple value added analysis of cognitive progress from the end of Year 1 in primary school to the end of Year 5 showing primary school and child level variance

	Reading (Year 5) standardised score Estimate (standard error)	**Mathematics (Year 5) standardised score** Estimate (standard error)
School level variance estimate (se)	27.433 (4.622)	24.016 (3.717)
Child level variance (se)	126.497 (4.524)	106.209 (3.743)
Intra-school correlation	0.178	0.184
% Reduction in school level variance	34.70	49.82
% Reduction in child level variance	17.82	40.44
% Reduction total variance	31.97	42.42
Number of children	2326	2306
Number of schools	865	863

Table 5.2 shows estimates for the influence of cognitive attainments at the end of Year 1 measured by NFER-Nelson Reading and Mathematics tests as predictors for attainments in Reading and Mathematics at the end of Year 5 (also measured by NFER-Nelson tests). Prior attainment in Reading was considered to be relevant for later attainment in Reading and prior attainment in Mathematics to be relevant for later attainment in Mathematics.

Table 5.2: Multilevel model estimates of prior attainment measures on Year 5 attainment in standardised Reading and Mathematics outcomes.

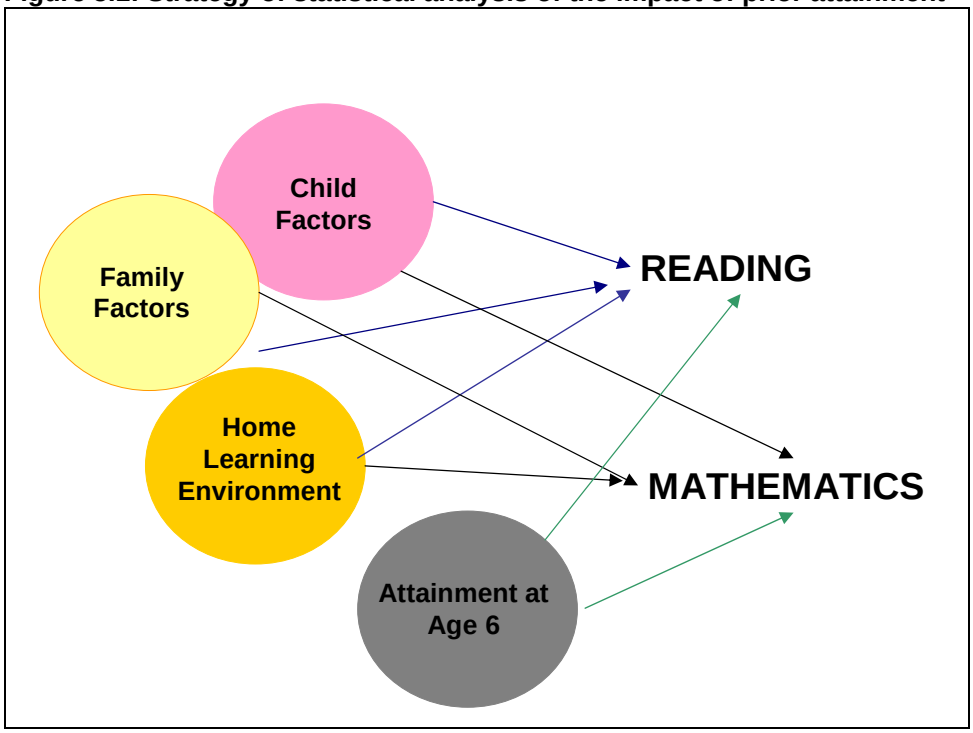
	Reading (Year 5) standardised score Estimate (se)	**Mathematics (Year 5) standardised score** Estimate (se)
Intercept	43.104*** (1.815)	35.6281*** (1.642)
Reading (Year 1) standardised score	0.571*** (0.018)	Not tested
Mathematics (Year 1) standardised score	Not tested	0.646*** (0.016)

*** p <0.001

The Impact of Child, Family and Home Learning Environment (HLE)

After the simple value added analyses, further analyses were undertaken to explore whether the child, family and HLE characteristics, found to be significant factors for cognitive attainment differences at the end of Year 5 were also associated with differential academic progress between Year 1 and Year 5 of primary school education (see Figure 5.1 for an illustration). It should be stressed that when working with standardised assessment measures, progress can only be explored relative to the sample and not in absolute terms (also see Appendix 2).

Figure 5.1: Strategy of statistical analysis of the impact of prior attainment



The findings indicate that children who have high qualified mothers (ES = 0.62 for mothers with 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. 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. Interestingly children who did home computing (ES = 0.14) moderately but not very often showed higher progress in Reading.

For Mathematics the results show that boys (ES = 0.17), Indian children (ES =0.68) and children of higher qualified mothers (ES = 0.41 for mothers with degree compared to no qualification) and fathers (ES = 0.25 for fathers with degree compared to no qualification) make greater gains in terms of progress over this period of primary school education. Low SES is 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), but the association is not as strong for Reading. Computing activities also appear to support the progress in Mathematics during Year 1 and Year 5 (ES = 0.14 and 0.18 for high and very high scores on the Home computing factor). Please note that effect sizes in brackets were only given for selected, most representative categories of predictor variables. Tables showing the exact estimates of the reported results and effect sizes for all the categories of the predictors can be found in Appendix 7.

Taken together the results reflect what has also been found by comparing differential effects of background factors on attainment in Year 5 and Year 1 (see Section 2).

The Impact of Pre- and Primary School Experience

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. There was 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. Given the fact that attendance of a pre-school centre was not a significant predictor of cognitive attainments in Year 5 this result is not surprising.

But there are indications that children who went to high effective pre-schools made better progress (between Year 1 and Year 5) in Reading than children who did not go to pre-school 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 high effective pre-schools made significantly better progress compared to very low effective pre-schools (ES = 0.29). We find also a weak tendency that children who attended a high quality pre-school made better progress in Reading over these four years than those who went to low quality pre-school (p = 0.08, ES = 0.14).

In contrast for Mathematics none of the pre-school indicators was 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 seem to operate mainly by providing young children with a better start to primary school, and that although this benefit is still evident for attainment in Year 5 (though reduced), this benefit does not lead to increased academic progress once they start primary school, except for Reading. This is in line with earlier results reported (see Sammons et al., 2004a; 2004b).

The last step of the analyses was to investigate the impact of primary school academic effectiveness on the progress of the EPPE 3-11 children using independently derived measures of academic effectiveness (derived from analyses of National assessment data for all primary

schools in England) (see Melhuish et al., 2006a; 2006b). These measures have already been shown to be highly significant predictors of children's cognitive attainment at Year 5 (see Section 3). The findings of the contextualised value added analyses also show that they are important indicators of children's relative progress (see Table 5.3). Effects are stronger for Mathematics than for Reading, echoing the results found for attainment in Year 5 without controlling for prior attainments.

Table 5.3: Multilevel model estimates of primary school effectiveness measures on Year 5 attainment in standardised Reading and Mathematics outcomes controlling for prior attainments in Year 1 and background factors

	Estimate	SE	Effect Size
Reading (Year 5) standardised score			
Medium effective primary school (English)	**0.504**	**0.748**	**0.05**
High effective primary school (English)	**2.829****	**1.058**	**0.26**
Reference Group: Low effective primary school (English)			
Mathematics (Year 5) standardised score			
Medium effective primary school (Mathematics)	**1.747***	**0.807**	**0.17**
High effective primary school (Mathematics)	**2.913***	**1.152**	**0.29**
Reference Group: Low effective primary school (Mathematics)			

* p< 0.05, ** p <0.01

These findings are highly relevant to policy makers because they indicate which sub-groups of children are most at risk of making poor progress during their time in primary school. Once again they highlight the relevance of the academic effectiveness of the individual primary school a child attends in promoting better cognitive outcomes at Year 5.

Section 6: Summary and Conclusions

EPPE 3-11 is a 10 year longitudinal research study that consists of a number of separate but related Tiers. 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 environment 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).

The original EPPE sample was recruited to the study at age 3 years plus and monitored to the end of Key Stage 1 (Year 2) in primary school. An additional 'home' sample of children (who had not attended a pre-school setting) was recruited when the pre-school sample started primary school (details of the main findings are described by Sylva et al., 2004). The EPPE 3-11 extension is following up the sample to the end of primary schooling (age 11 years plus). In addition to exploring pre-school influences, the EPPE 3-11 research is designed to identify the influence of primary school on children's educational outcomes, as well as to investigate any continuing pre-school effects. This report presents the results of a range of analyses related to Tier 2 of the primary school phase of the research. The focus has been on analysing children's cognitive attainments in Year 5 (age 10 years). A report on children's social/behavioural development at this age will be published separately (Sammons et al., In press - 2007).

EPPE 3-11 involved the collection and analysis of a wide range of quantitative data about children's development, child, family and home learning environment (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 data conducted for all primary schools in England (Melhuish et al., 2006a; 2006b) as part of Tier 1 of the study. These have been incorporated into the EPPE 3-11 data 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.

Standardised NFER tests of Reading and Mathematics were administered to provide internally standardised measures of children's educational outcomes in Year 5. A range of statistical methods has been used to investigate results for 2556 children for whom at least one cognitive attainment measure was collected in Year 5, representing eighty-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.

The aims of the analyses were:

- To explore the association between child, parent and home characteristics and children's attainments at the end of Year 5 (age 10).
- To compare the impact of child, parent and home characteristics on children's attainments in Year 5 to the impact at earlier age (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 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 influence of measures of pre-school process, particularly measures of quality and effectiveness on later child outcomes.
- To examine the combined impact of home learning environment (HLE) characteristics and pre-school characteristics.
- To investigate the influence of primary school academic effectiveness on cognitive attainment and progress (controlling for child, family and HLE characteristics).

- 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 Factors, Family Factors and HLE

The research collected detailed information about background characteristics through an interview with parents at entry to the study. Additional information was obtained through a questionnaire survey in Key Stage 1. From this a rich database was created providing a range of measures of potentially important child, family and home environment characteristics, including details of the home learning environment (HLE). This has allowed the research to focus on the topic of educational equity. Findings identifying average differences in attainment for different sub-groups of pupils in Year 5 were reported in Section 1 of the report (e.g. divided by gender, ethnic group, family SES, language, background etc). 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.

Statistical analyses (multilevel models) 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. Thus, for example, the predictive power of family SES, is established while taking into account the influence of mother's qualification levels, low income, ethnicity, birth weight, HLE etc (see Section 2). This is important, because our research shows that much of the apparent difference in attainment associated with certain characteristics, for example, ethnicity, is attributable to the influence of other socio-economic and demographic factors (e.g. birth weight, income, language, family SES, parents' qualification levels and HLE).

Similar analyses have been undertaken on cognitive outcomes assessed at the end of Year 1 in primary school. The predictive power of different child, family and HLE characteristics on attainment in Year 1 was compared to their predictive power 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 (see Section 3).

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. A more detailed exploration of the influence of the HLE investigates interactions between early years HLE and pre-school effects (see Section 5).

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 high 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 schools (see Section 4).

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 of pre- and primary school experience are predictive for relative higher or lower progress in Reading and Mathematics (see Section 5).

The importance of educational experiences in shaping outcomes at Year 5 has been highlighted by the results reported in sections 4 and 5 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 largely 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. It appears that both measures of the quality and the effectiveness of the pre-school setting attended predict better cognitive outcomes (early results from the analyses of social/behavioural outcomes also point to improved outcomes related to these features of better pre-school experiences and will be reported separately). 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 this 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 impact on children's attainment in Year 5 of primary school education. 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 cohorts National assessment data 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 close the attainment gap (for those who attend a high effective primary school there is a particular boost to Mathematics outcomes). 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 scores by about half). This is likely to indicate the

increased contribution of schools and possible peer group influences and reductions in the importance of 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 and emerging findings also point to better social/behavioural outcomes (to be reported separately). 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 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 terms of National assessment data) 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. They 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 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 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. In a later report we will also demonstrate similar positive benefits for social/behavioural development. In summary, our results provide no evidence to support the idea that pre-schools or primary schools that foster better academic outcomes are less successful at fostering social/behavioural development. They demonstrate that schools which are successful in raising academic standards offer benefits to children's longer term attainments in Reading and Mathematics and particularly so for more disadvantaged groups. In addition, they 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 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 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 the early years 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 in 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 (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 primary schools is particularly important for disadvantaged groups of pupils, since we find that attending an effective school is more critical for this group. The emerging finding that social/behavioural outcomes, as well as Reading and Mathematics attainments, are boosted by academically effective primary schools has important messages for the achievement of the Every Child Matters agenda, because it shows that the promotion of better academic outcomes is not at variance with the development of better social/behavioural development. 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: How accurate are the current measures as indicators of progress in primary education?

A.2.1 The measurement of cognitive attainment and the problem of the measurement of progress

In contrast to the situation in the natural sciences where we can often measure the characteristics of objects with objective and accurate measuring instruments on absolute scales, in educational studies we are faced with the problem of the measurement of complex constructs where measuring instruments have to be adjusted over time. Therefore it is easier to measure any physical characteristics like the height and weight of a child over years than to measure Reading, Mathematics or social/behavioural development over time. To have 'good Reading attainment' means something different for a child at age 6 than for a child at age 10, whereas the meaning of 'a height of 150 cm' remains the same over years.

Cognitive ability tests have been constructed that usually consist of a set of tasks or questions that are adjusted (standardised) to the expected attainment of children at a certain age. Obviously the tests cannot be the same at different time points. Children achieve discretionary scores in these tests, which are then transformed into standardised scores which are comparable irrespective of the age. A common standardisation is the use of IQ format scores, where the mean is 100 and the standard deviation is 15. The advantage of the use of these scores is, that they are easy interpretable and comparable. This means that a child who has a score of 115 is one standard deviation above the average in this specific sample at this specific time point whilst taking age effects into account. A child that achieves a score of 85 points is one standard deviation below average. With these standardisation procedures, performance is always measured relative to the norm for the sample. This has some advantages but also some disadvantages at the same time. For example, it is fairer to children who are relatively young for their year (e.g. summer born pupils) but no longer provides a criterion referenced measure of what children have achieved in terms of specific attainment at a particular point in time.

It also imposes some problems on the measurement of progress due to the lack of an absolute scale. If you look at standardised test scores of the same child at different time points, you can also only obtain progress relative to the sample. For example, if a child has a score of 100 at age 6 and age 10, this means that this child has made average progress, but not that raw attainment is the same at the two time points. Also, if a child had a score of 100 at age 6 and a score of 90 at age 10 this means, that the progress of the child was relatively less than the average of the sample as a whole, but it does not mean that this child did not make any progress at all.

These facts are important to get the right interpretation on standardised cognitive test scores at different time points.

A.2.2 Cognitive measures in the EPPE 3-11 study

EPPE has collected various cognitive outcomes at different time points which are shown in Table A2. During the pre-school period the British Ability Scales (Elliot, Smith & McCulloch, 1996) in verbal and non-verbal measures have been used. This report focuses on progress of the children in primary school education where Reading and Mathematics outcomes are available for the EPPE children at the end of Year 1 (age 6), the end of Year 2 (age 7) and the end of Year 5 (age 10). At Year 1 and Year 5 teacher administered NFER-Nelson assessments have been used, whereas for the age of 7 National Assessment data have been collected for the sample.

Table A2: Cognitive outcomes in the EPPE study

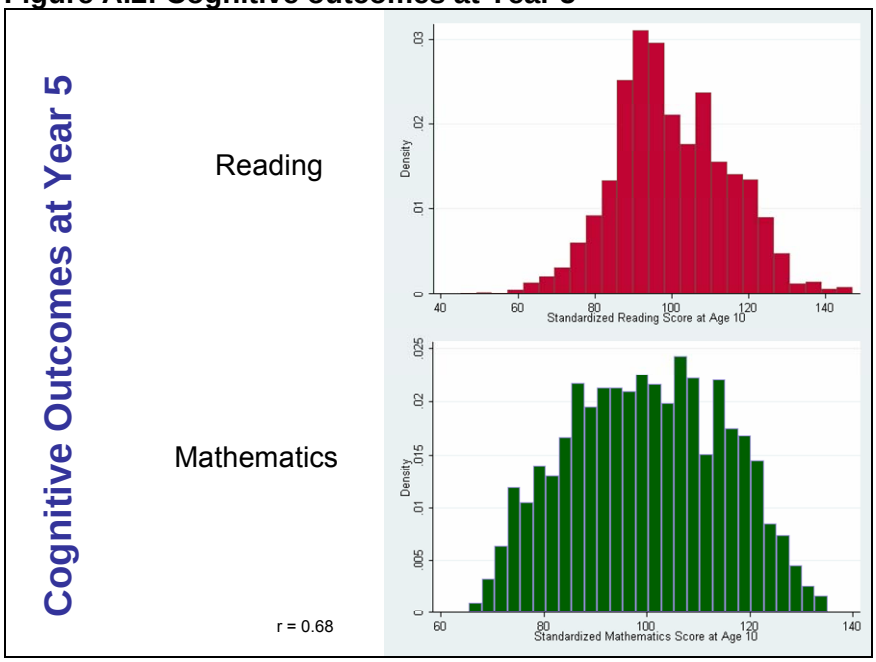
	Pre-School Measures at Entry to the EPPE Study	**Exit from Pre-School (Entry to Reception) – Baseline**	**End of Reception**	**Year 1**	**Year 2**	**Year 5**
Age	3.0 to 4 years 3 months	rising 5 years	age 5	age 6	age 7	age 10
Verbal	BAS – Scales: Verbal Comprehension, Naming Vocabulary	BAS – Scales: Verbal Comprehension, Naming Vocabulary	BAS – Scales: Word reading	Primary Reading standardised score (Level 1 / NFER-Nelson)	National Assessments: Reading, Writing (decimalised)	Primary Reading standardised score (Level 2/ NFER-Nelson)
		Letter Recognition, Phonological Awareness (Pre-reading)	Letter Recognition, Phonological Awareness, Dictation Tests			
Non-Verbal	BAS – Scales: Block building, Picture Similarities	BAS – Scales: Block building, Picture Similarities, Early Number Concepts	BAS-Scale Early Number Concepts	Maths 6 Standardised score (Level 1 / NFER-Nelson)	National Assessments: Mathematics (decimalised)	Maths 10 Standardised (Level 2 / NFER-Nelson)
Cognitive General		GCAS	GCAS			

A.2.3 National assessment data

National assessments are usually reported in levels which are fairly broad and categorise children only into a small number of attainment groups (6 groups from working towards level 1, level 1, through 2c, 2b, 2a to level 3). Within each level there can be quite a range of attainment. Therefore EPPE collected data on test scores within levels from schools which allowed the creation of more finely differentiated outcome measures (decimalised levels). However, there remain a couple of measurement issues with this type of assessment as these scores do not account for age differences (within a school class) and are not normally distributed. EPPE has undertaken standardisation and normalisation procedures to overcome this problem. Still, analyses on comparability of the data over the years indicate that there might be different factors influencing outcomes in National assessments compared to standardised tests. As at this stage of the study there is no second time point of National assessment data available to explore this topic further, progress in primary school in this paper is investigated by looking at NFER-Nelson standardised test scores at Year 1 and Year 5 (EPPE is collecting National assessment data at the end of Key Stage 2 though, so at that point the research team will examine this question in further detail).

A.2.4 NFER-Nelson assessment scores: Standardisation procedures, reliability and internal validity

Figure A.2: Cognitive outcomes at Year 5



The NFER-Nelson assessments provide a manual to transform raw test scores into age standardised scores. However, for the EPPE sample (which is not UK representative but relatively underachieving due to slightly higher numbers of disadvantaged children in the sample) the manual standardisation procedure does not account for variation especially found in younger age and under average achieving groups. Therefore it has been decided to apply a complex internal age standardisation and normalisation procedure to the cognitive outcomes in Year 1 and Year 5. This resulted in approximately normally distributed outcomes which do not show a correlation with age.

Figure A.2 shows the distribution of the standardised and normalised Reading and Mathematics scores at Year 5. The mean of the measures is 100 with a standard deviation of 15 (IQ format scores).

Reliability

Reliability in the psychometric sense refers to the necessary requirement for a good instrument, that an instrument should measure exactly the same if applied several times on the same subject and should be consistent. Reliability is a necessary pre-condition for validity. However, as there might also be changes over time in the outcome to be measured the concept of retest-reliability hits its borders especially in developmental studies.

For Reading we find a correlation of 0.56 between the assessments of Year 1 and Year 5, for Mathematics the correlation between Year 1 and Year 5 assessments is 0.65. These results lead to two conclusions:

1. Prior cognitive attainments are fairly good predictors of later attainments.
2. We can assume good retest-reliability.

Internal validity

The attainments in Reading and Mathematics in Year 1 show a correlation of 0.58 and in Year 5 a correlation of 0.68. These moderate to high correlations indicate that children who do well in Reading are more likely to also show high attainment in Mathematics and vice versa. The relationship is more distinct Year 5 than in Year 1. As both measures are cognitive outcomes, these correlations are also indicators of high internal validity (in the sense of psychometric validity).

Appendix 3: EPPE 3-11 imputation of missing data

In order to conduct analysis on as large a sample as possible from the EPPE 3-11 data, a select number of variables were subject to 'imputation' of values where item level data were missing, either due to item or wave non-response. The imputation methods employed as was 'last observation carried forward'. Specifically, the 'last observation' was data from the initial EPPE parent interview, conducted when the children were in Key Stage 1, aged about three years old or in the case of most 'home' children four years old.

The variables subject to imputation used in the analyses for this report were: Sibling count; Socio-economic status (SES) of mother / father.

Such data, where appropriate, was used to complete missing items from the Parent Questionnaire conducted at Key Stage 1, when the children were age 6 to 7 years old. In each case the variables in the source were comparable, in terms of scale or possible item response categories, with those in the target. This was not the case for parents' qualifications, and hence as yet this measure has not been subject to such imputation.

Appendix 4: Raw differences in attainment in Reading and Mathematics at the end of Year 5

Table A4.1: Cognitive attainments at the end of Year 5 by Ethnicity

	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 Heritage	51	98.36	12.73	51	103.17	17.30
Pakistani Heritage	130	89.16	11.22	129	91.05	13.74
Bangladeshi Heritage	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 Heritage	56	96.47	14.71	56	99.05	15.15

Table A4.2: Cognitive attainments at the end of Year 5 and Language

	English as Mother Tongue			English as an Additional Language (EAL)		
	N	Mean	SD	N	Mean	SD
Reading	2311	100.93	14.93	236	91.04	12.53
Mathematics	2295	100.61	14.82	235	94.18	15.58

Table A4.3: 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 A4.4: Cognitive attainments at the end of Year 5 by mother's qualification level

	Reading			Mathematics		
	N	Mean	SD	N	Mean	SD
Other professional	40	104.09	12.91	40	106.74	14.46
Higher degree	111	114.78	12.76	111	112.12	12.71
Degree or equivalent	318	110.97	14.00	314	110.00	12.69
Academic qualification at 18 years	212	103.75	12.96	211	104.34	14.55
Academic qualification at 16 years	930	99.25	13.69	924	99.28	14.40
Vocational qualification	370	98.12	14.47	370	97.55	14.20
No qualification	475	91.82	12.96	471	92.57	13.11

Table A4.5: 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 A4.6: 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

Appendix 5:Details of Selected Measures used in the EPPE Study

A.5.1 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 first language and ethnic groups, only the most significant was included.

Child variables

- First language: English as an additional language (EAL)
- 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.5.2 The Key Stage 1 Home Learning Environment (HLE)

HLE Factors and the items loading on these factor:

- **Home Computing**
  - The Child plays on computer by themself.
  - Respondent plays computer games with the child.
  - Respondent uses computer with the child in educational ways.

- **Parent-Child enrichment outing/activity outside 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 6: Results of contextualised multilevel analyses

Table A.6.1: Reading Contextualised Model (impact of child, parent, home environment and other measures on year 5 standardised Reading attainment)
*Statistically significant at 0.05 level **Statistically significant at 0.05 level
[#] Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Gender (girls compared to boys)	1.282*	0.528	0.10
Age at outcome test (centred around mean)	0.013	0.070	0.00
Birth weight (compared to normal birth weight)			
Missing data	0.167	1.990	0.01
Very low birth weight (<= 1500g)	- 5.085*	2.270	0.40
Low birth weight (1501g – 2500g)	0.679	1.032	0.05
Ethnic group (compared to White UK Heritage)			
White European Heritage	-4.402**	1.504	0.35
Black Caribbean Heritage	-0.319	1.382	0.03
Black African Heritage	-2.341	1.892	0.19
Indian Heritage	0.721	1.880	0.06
Pakistani Heritage	-2.927*	1.395	0.23
Bangladeshi Heritage	-4.368[#]	2.510	0.35
Mixed Race Heritage	-1.091	1.135	0.09
Any other ethnic minority Heritage	-1.873	1.779	0.15
No. of siblings (compared to singleton)			
Missing data	0.243	4.933	0.02
1-2	-0.843	0.745	0.07
3+	-2.657**	1.010	0.21
Need of EAL support in year 5 (compared to no need of EAL support)			
Missing data	-0.975	0.834	0.08
EAL support needed	-4.629**	1.475	0.37
Developmental problems (compared to none)			
Missing data	5.643	5.273	0.45
1	-2.151**	0.828	0.17
2+	-5.277*	2.508	0.42
Free School Meal Eligibility (FSM) (compared to not eligible)	-3.430	0.773	0.27
Family SES (compared to professional non manual)			
Missing data	-3.415	1.593	0.28
Other professional non manual	-1.400	1.021	0.11
Skilled non manual	-2.589*	1.189	0.21
Skilled manual	-4.105**	1.240	0.33
Semi-skilled manual	-4.261**	1.492	0.34
Unskilled manual	-4.550*	2.321	0.36
Unemployed / Never worked	-3.087	1.593	0.24

Table A.6.1 (continued)

	Estimate	SE	Effect Size
Mother's highest level of qualification (compared to no qualifications)			
Missing data	0.414	2.237	0.03
Vocational	1.236	0.982	0.10
Academic age 16	2.640**	0.816	0.21
Academic age 18	4.254**	1.195	0.34
Degree	8.032**	1.230	0.64
Higher Degree	9.413**	1.778	0.75
Other	4.589*	2.245	0.36
Father's highest level of qualification (compared to no qualifications)			
Missing data	-5.523	4.796	0.44
Vocational	1.436	1.053	0.11
Academic age 16	0.289	0.907	0.02
Academic age 18	1.346	1.238	0.11
Degree	3.877**	1.208	0.31
Higher Degree	3.586*	1.702	0.28
Other	-0.288	2.758	0.02
No father information	0.787	0.881	0.06
Family salary (compared to no salary) Missing data	4.569**	1.709	0.36
£ 2,500 – 17,499	-0.243	1.211	0.02
£ 17,500 – 29,999	1.566	1.265	0.12
£ 30,000 – 37,499	0.212	1.383	0.02
£ 37,500 – 67,499	2.425	1.335	0.19
£ 67,500 – 132,000+	3.387*	1.688	0.27
Early years HLE (compared to 0 - 13) Missing data	0.040	2.012	0.00
14-19	1.719#	1.040	0.14
20-24	3.440**	1.055	0.27
25-32	5.371**	1.051	0.43
33-45	7.641**	1.255	0.61
Key Stage 1 HLE			
One-to-one interaction (compared to low)			
Missing data	-6.115**	1.739	0.48
Moderate	-1.975*	0.896	0.16
High	-1.962*	0.855	0.16
Very High	-3.542**	1.054	0.28
Home computing (compared to low)			
Moderate	2.080*	0.853	0.16
High	1.049	0.805	0.08
Very High	0.889	1.004	0.07

Only significant predictors were kept in the model. Age was not a significant predictor for attainment in Reading, but improved model fit.

Table A.6.2: Mathematics Contextualised Model (impact of child, parent, home environment and other measures on year 5 standardised Mathematics attainment)
*Statistically significant at 0.05 level **Statistically significant at 0.05 level
Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Gender (girls compared to boys)	-0.928	0.566	0.07
Age at outcome test (centred around mean)	0.049	0.073	0.01
Birth weight (compared to normal birth weight)			
Missing data	2.791	2.026	0.22
Very low birth weight (<= 1500g)	-5.315	2.326	0.42
Low birth weight (1501g – 2500g)	-1.349	1.072	0.11
Ethnic group (compared to White UK Heritage)			
White European Heritage	-2.217	1.562	0.18
Black Carribean Heritage	1.504	1.471	0.12
Black African Heritage	-2.658	1.976	0.21
Indian Heritage	4.969*	2.029	0.39
Pakistani Heritage	-0.462	1.565	0.04
Bangladeshi Heritage	-0.866	2.612	0.07
Mixed Race Heritage	-0.761	1.187	0.06
Any other ethnic minority Heritage	1.190	1.870	0.09
Need of EAL support in year 5 (compared to no need of EAL support)			
Missing data	-2.420**	0.885	0.19
EAL support needed	-6.389**	1.529	0.51
Health problems (compared to none)			
1	-0.356	0.618	0.03
2+	0.202	1.056	0.02
3+	-5.560*	2.302	0.44
Free School Meal Eligibility (FSM) (compared to not eligible)	-2.807**	0.798	0.22
Family SES (compared to professional non-manual)			
Missing data	-1.536	3.204	0.12
Other professional non-manual	-1.656	1.055	0.22
Skilled non manual	-3.093	1.226	0.13
Skilled manual	-3.578	1.279	0.25
Semi-skilled manual	-3.822	1.541	0.28
Unskilled manual	-3.368	2.389	0.30
Unemployed / Never worked	-1.903	1.643	0.27

Table A.6.2 (continued)

	Estimate	SE	Effect Size
Mother's highest level of qualification (compared to no qualifications)			
Missing data	0.233	2.252	0.02
Vocational	0.370	1.011	0.03
Academic age 16	2.433**	0.840	0.19
Academic age 18	4.641**	1.236	0.37
Degree	6.840**	1.277	0.54
Higher Degree	6.682**	1.839	0.53
Other	6.288**	2.298	0.50
Father's highest level of qualification (compared to no qualifications)			
Missing	-3.775	3.361	0.30
Vocational	2.603*	1.084	0.21
Academic age 16	1.514	0.934	0.12
Academic age 18	0.898	1.279	0.07
Degree	4.384**	1.245	0.35
Higher Degree	5.091**	1.762	0.40
Other	1.101	2.819	0.09
No father information	0.863	0.905	0.07
Family salary (compared to no salary) Missing data	3.932*	1.751	0.31
£ 2,500 – 17,499	0.723	1.249	0.06
£ 17,500 – 29,999	2.578*	1.308	0.20
£ 30,000 – 37,499	2.201	1.429	0.18
£ 37,500 – 67,499	3.717**	1.384	0.30
£ 67,500 – 132,000+	3.873*	1.753	0.31
Early years HLE (compared to 0 - 13)			
Missing data	2.393	2.013	0.19
14-19	2.582*	1.075	0.21
20-24	2.711*	1.088	0.22
25-32	5.088**	1.088	0.40
33-45	7.140**	1.294	0.57
Key Stage 1 HLE			
One-to-one interaction (compared to low)			
Missing data	-3.409	1.877	0.27
Moderate	-1.035	0.921	0.08
High	-0.297	0.884	0.02
Very High	-2.334**	1.051	0.23
Home computing (compared to low)			
Moderate	2.088*	0.880	0.17
High	1.872*	0.830	0.15
Very High	2.420*	1.034	0.19

Table A.6.2 (continued)

	Estimate	SE	Effect Size
Expressive play (compared to low)			
Moderate	-1.285	0.890	0.10
High	-1.119	0.888	0.09
Very High	-2.334*	1.051	0.19

Only significant predictors were kept in the model. Age was not a significant predictor for attainment in Mathematics, but improved model fit.

Table A.6.3 Reading Contextualised Model: Net impact of pre-school attendance

	Estimate	SE	Effect Size
Pre-school **(compared to no pre-school)**	-.575	1.042	0.05

Table A.6.4 Mathematics Contextualised Model: Net impact of pre-school attendance

	Estimate	SE	Effect Size
Pre-school **(compared to no pre-school)**	1.567	1.128	0.12

Table A.6.5 Reading Contextualised Model: Net impact of pre-school quality measured by ECERS-E
*Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Quality (compared to low quality)			
No pre-school	0.960	1.230	0.08
Medium quality	1.795*	0.788	0.14
High quality	1.898*	0.919	0.15

Table A.6.6 Mathematics Contextualised Model: Net impact of pre-school quality measured by ECERS-E
Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school Quality (compared to no pre school)			
Low quality	0.825	1.319	0.06
Medium quality	1.613	1.154	0.13
High quality	1.980#	1.256	0.16

Table A.6.7 Reading Contextualised Model: Net impact of pre-school effectiveness (Pre-reading)
*Statistically significant at 0.05 level (tested one-tailed)

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to no pre-school)			
Very low effective	-1.261	1.570	-0.10
Low effective	-0.248	1.237	-0.02
Medium effective	0.662	1.070	0.05
High effective	2.180*	1.249	0.17
Very high effective	-0.606	1.387	-0.05

Table A.6.8 Reading Contextualised Model: Net impact of pre-school effectiveness (Pre-reading)
*Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to very low effective)			
No pre-school	1.261	1.570	0.10
Low effective	1.014	1.397	0.08
Medium effective	1.923	1.256	0.15
High effective	3.441*	1.414	0.27
Very high effective	0.655	1.510	0.05

Table A.6.9 Mathematics Contextualised Model: Net impact of pre-school effectiveness (Early number concepts) *Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to no pre-school)			
Very low effective	1.239	1.877	0.10
Low effective	0.525	1.480	0.04
Medium effective	1.319	1.151	0.10
High effective	2.579*	1.340	0.20
Very high effective	3.209*	1.663	0.25

Table A.6.10 Reading Contextualised Model: Net combined impact of early years HLE and pre-school **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	-1.024	2.276	0.08
Medium HLE, no pre-school	1.282	2.288	0.10
High HLE, no pre-school	4.016#	2.254	0.32
Low HLE, pre-school	0.191	1.529	0.02
Medium HLE, pre-school	2.405	1.586	0.19
High HLE, pre-school	4.820**	1.566	0.38

Table A.6.11 Mathematics Contextualised Model: Net combined impact of early years HLE and pre-school **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	2.222	2.278	0.18
Medium HLE, no pre-school	2.657	2.343	0.21
High HLE, no pre-school	4.467#	2.339	0.35
Low HLE, pre-school	2.018	1.620	0.43
Medium HLE, pre-school	2.571	1.666	0.21
High HLE, pre-school	5.483**	1.648	0.35

Table A.6.12 Reading Contextualised Model: Net combined impact of early years HLE and quality of pre-school **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school quality and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	-1.091	2.274	-0.09
Medium HLE, no pre-school	1.250	2.284	0.10
High HLE, no pre-school	3.970#	2.253	0.32
Low HLE, low quality pre-school	-0.795	1.905	-0.06
Medium HLE, low quality pre-school	2.480	2.064	0.20
High HLE, low quality pre-school	1.860	1.831	0.15
Low HLE, medium quality pre-school	-0.155	1.593	-0.01
Medium HLE, medium quality pre-school	2.565	1.655	0.20
High HLE, medium quality pre-school	5.374**	1.600	0.43
Low HLE, high quality pre-school	1.595	1.771	0.13
Medium HLE, high quality pre-school	1.790	1.859	0.14
High HLE, high quality pre-school	5.124**	1.744	0.41

Table A.6.13 Mathematics Contextualised Model: Net combined impact of early years HLE and quality of the pre-school **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school quality and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	2.218	2.278	0.18
Medium HLE, no pre-school	2.671	2.343	0.21
High HLE, no pre-school	4.496#	2.339	0.36
Low HLE, low quality pre-school	2.578	1.999	0.20
Medium HLE, low quality pre-school	2.749	2.165	0.22
High HLE, low quality pre-school	3.652#	1.920	0.29
Low HLE, medium quality pre-school	1.301	1.683	0.10
Medium HLE, medium quality pre-school	3.028#	1.732	0.24
High HLE, medium quality pre-school	5.789**	1.682	0.46
Low HLE, high quality pre-school	3.523#	1.888	0.28
Medium HLE, high quality pre-school	1.428	1.962	0.11
High HLE, high quality pre-school	5.966**	1.842	0.47

Table A.6.14 Reading Contextualised Model: Net combined impact of early years HLE and effectiveness of pre-school (Pre-reading) *Statistically significant at 0.05 level, **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school effectiveness (Pre-reading) and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	-1.035	2.276	0.08
Medium HLE, no pre-school	1.263	2.288	0.10
High HLE, no pre-school	3.959#	2.255	0.31
Low HLE, low effective pre-school	-0.246	1.909	0.02
Medium HLE, low effective pre-school	0.884	1.975	0.07
High HLE, low effective pre-school	3.748*	1.746	0.30
Low HLE, medium effective pre-school	0.318	1.584	0.03
Medium HLE, medium effective pre-school	2.897#	1.650	0.23
High HLE, medium effective pre-school	4.705**	1.605	0.37
Low HLE, high effective pre-school	0.281	1.784	0.02
Medium HLE, high effective pre-school	2.318	1.909	0.18
High HLE, high effective pre-school	6.075**	1.736	0.48

Table A.6.15 Mathematics Contextualised Model: Net combined impact of early years HLE and effectiveness of pre-school (Early number concepts) *Statistically significant at 0.05 level, **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school effectiveness (Early number concepts) and early years HLE (compared to 'no pre-school and low HLE')			
Early years HLE missing	2.228	2.278	0.18
Medium HLE, no pre-school	2.738	2.343	0.22
High HLE, no pre-school	4.485#	2.339	0.36
Low HLE, low effective pre-school	0.559	2.098	0.04
Medium HLE, low effective pre-school	0.277	2.318	0.02
High HLE, low effective pre-school	5.266**	1.946	0.42
Low HLE, medium effective pre-school	1.776	1.665	0.14
Medium HLE, medium effective pre-school	2.758	1.714	0.22
High HLE, medium effective pre-school	5.098**	1.680	0.40
Low HLE, high effective pre-school	3.973*	1.964	0.32
Medium HLE, high effective pre-school	3.189	2.020	0.25
High HLE, high effective pre-school	6.747**	1.852	0.54

Table A.6.16 Reading Contextualised Model: Net impact of primary school effectiveness (English) *Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Primary School Effectiveness (compared to low effective)			
Medium effective	0.068	0.748	0.01
High effective	2.433*	1.064	0.19
Missing effectiveness score	2.826*	1.139	0.22

For the majority of children whose primary school effectiveness score is missing, this is due to the fact, that these children attend private primary schools.

Table A.6.17 Mathematics Contextualised Model: Net impact of primary school effectiveness (Mathematics) *Statistically significant at 0.05 level, **Statistically significant at 0.01 level

	Estimate	SE	Effect Size
Primary School Effectiveness (compared to low effective)			
Medium effective	2.080*	0.885	0.17
High effective	3.650**	1.265	0.29
Missing effectiveness score	2.537*	1.292	0.20

For the majority of children whose primary school effectiveness score is missing, this is due to the fact, that these children attend private primary schools.

Table A.6.18 Reading Contextualised Model: Net combined impact of pre-school quality and primary school effectiveness (English)

	Estimate	SE	Effect Size
Pre-school quality and primary school effectiveness (English)			
(compared to 'no pre-school and low effective primary school')			
No pre-school, medium/high effective primary school	2.128	2.280	0.17
Low quality pre-school, low effective primary school	0.061	2.679	0.00
Low quality pre-school, medium/high effective primary school	0.677	2.218	0.05
Medium quality pre-school, low effective primary school	1.704	2.245	0.14
Medium quality pre-school, medium/high effective primary school	2.134	2.110	0.17
High quality pre-school, low effective primary school	2.842	2.549	0.23
High quality pre-school, medium/high effective primary school	2.105	2.165	0.17

Table A.6.19 Mathematics Contextualised Model: Net combined impact of pre-school quality and primary school effectiveness (Mathematics) *Statistically significant at 0.05 level, **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school quality and primary school effectiveness (Mathematics)			
(compared to 'no pre-school and low effective primary school')			
No pre-school, medium/high effective primary school	5.891*	2.337	0.47
Low quality pre-school, low effective primary school	4.223	2.646	0.34
Low quality pre-school, medium/high effective primary school	5.902**	2.244	0.47
Medium quality pre-school, low effective primary school	4.171#	2.278	0.33
Medium quality pre-school, medium/high effective primary school	6.332**	2.114	0.50
High quality pre-school, low effective primary school	5.997*	2.608	0.48
High quality pre-school, medium/high effective primary school	6.656**	2.189	0.53

Table A.6.20 Reading Contextualised Model: Net combined impact of pre-school effectiveness (Pre-reading) and primary school effectiveness (English) *Statistically significant at 0.05 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school effectiveness (Pre-reading) and primary school effectiveness (English) (compared to 'no pre-school and low effective primary school')			
No pre-school, medium effective primary school	1.826	2.287	0.14
No pre-school, high effective primary school	6.088	4.130	0.48
Low effective pre-school, low effective primary school	0.229	2.456	0.02
Low effective pre-school, medium effective primary school	1.000	2.193	0.08
Low effective pre-school, high effective primary school	3.621	3.337	0.29
Medium effective pre-school, low effective primary school	1.298	2.258	0.10
Medium effective pre-school, medium effective primary school	1.760	2.102	0.14
Medium effective pre-school, high effective primary school	4.970*	2.314	0.39
High effective pre-school, low effective primary school	5.063*	2.577	0.40
High effective pre-school, medium effective primary school	1.893	1.736	0.15
High effective pre-school, high effective primary school	1.629	2.575	0.13

Table A.6.21 Mathematics Contextualised Model: Net combined impact of pre-school effectiveness (early number concepts) and primary school effectiveness (Mathematics) *Statistically significant at 0.05 level, **Statistically significant at 0.01 level, # Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school effectiveness (early number concepts) and primary school effectiveness (Mathematics) (compared to 'no pre-school and low effective primary school')	6.426**	2.316	0.51
No pre-school, medium effective primary school	5.496*	2.377	0.44
No pre-school, high effective primary school	8.506#	4.482	0.68
Low effective pre-school, low effective primary school	1.077	2.908	0.09
Low effective pre-school, medium effective primary school	5.155*	2.322	0.41
Low effective pre-school, high effective primary school	7.354*	3.140	0.59
Medium effective pre-school, low effective primary school	4.386*	2.238	0.35
Medium effective pre-school, medium effective primary school	5.789**	2.124	0.46
Medium effective pre-school, high effective primary school	7.426**	2.409	0.59
High effective pre-school, low effective primary school	7.389**	2.769	0.59
High effective pre-school, medium effective primary school	7.049**	2.231	0.56
High effective pre-school, high effective primary school	7.866**	2.958	0.63

Appendix 7: Results of Contextualised Multilevel Analyses Controlling for Prior Attainment

Table A.7.1: Reading Contextualised Model controlling for prior attainment (impact of child, parent, home environment and other measures on year 5 standardised Reading attainment)
All the predictors that turned out to be significant predictors or predictors improving model fit of Year 5 attainment (see Appendix 6) have kept in the model.

*Statistically significant at 0.05 level **Statistically significant at 0.05 level
Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Gender (girls compared to boys)	0.607	0.492	0.06
Age at outcome test (centred around mean)	-0.046	0.066	0.02
Birth weight (compared to normal birth weight)			
Missing data	0.921	1.832	0.08
Very low birth weight (<= 1500g)	-1.029	2.107	0.09
Low birth weight (1501g – 2500g)	1.513	0.960	0.14
Ethnic group (compared to White UK Heritage)			
White European Heritage	-2.093	1.386	0.19
Black Carribean Heritage	-1.262	1.383	0.11
Black African Heritage	-2.302	1.811	0.21
Indian Heritage	0.097	1.773	0.01
Pakistani Heritage	-2.176	1.355	0.20
Bangladeshi Heritage	-0.987	2.395	0.09
Mixed Race Heritage	-0.947	1.071	0.09
Any other ethnic minority Heritage	-2.075	1.722	0.19
No. of siblings (compared to singleton)			
Missing data	-0.179	4.826	0.02
1-2	-0.643	0.692	0.06
3+	-1.326	0.939	0.12
Need of EAL support in Year 5 (compared to no need of EAL support)			
Missing data	0.157	0.782	0.01
EAL support needed	-1.670	1.412	0.15
Developmental problems (compared to none)			
Missing data	0.248	4.736	0.02
1	-0.543	0.781	0.05
2+	-4.849*	2.360	0.44
Free School Meal Eligibility (FSM) (compared to not eligible)	-2.505**	0.727	0.23

Table A.7.1 (continued)

	Estimate	SE	Effect Size
Family SES (compared to professional non manual)			
Missing data	1.622	4.178	0.15
Other professional non manual	-0.705	0.942	0.06
Skilled non manual	-1.867#	1.104	0.17
Skilled manual	-2.934#	1.148	0.27
Semi-skilled manual	-2.794*	1.392	0.25
Unskilled manual	-3.712*	2.165	0.34
Unemployed / Never worked	-2.440#	1.477	0.22
Mother's highest level of qualification (compared to no qualifications)			
Missing data	-0.278	2.068	0.03
Vocational	1.733#	0.917	0.16
Academic age 16	2.452**	0.756	0.22
Academic age 18	3.515**	1.106	0.32
Degree	6.787**	1.145	0.62
Higher Degree	7.695**	1.650	0.70
Other	2.533	2.123	0.23
Father's highest level of qualification (compared to no qualifications)			
Missing data	-0.510	4.265	0.05
Vocational	1.140	0.979	0.10
Academic age 16	-0.107	0.840	0.01
Academic age 18	0.081	1.153	0.01
Degree	1.756	1.134	0.16
Higher Degree	2.466	1.573	0.22
Other	-1.884	2.494	0.17
No father information	-0.158	0.824	0.01
Family salary (compared to no salary)			
Missing data	4.534**	1.593	0.41
£ 2,500 – 17,499	-1.007	1.120	-0.09
£ 17,500 – 29,999	-0.150	1.168	-0.01
£ 30,000 – 37,499	-1.634	1.282	-0.15
£ 37,500 – 67,499	0.027	1.235	0.00
£ 67,500 – 132,000+	0.898	1.562	0.08
Early years HLE (compared to 0 - 13)			
Missing data	-1.538	1.838	0.14
14-19	1.305	0.974	0.12
20-24	2.755**	0.989	0.25
25-32	3.918**	0.985	0.36
33-45	5.213**	1.172	0.47

Table A.7.1 (continued)

	Estimate	SE	Effect Size
Parental activities during Key Stage 1			
One-to-one interaction (compared to low)			
Missing data	-6.494**	1.639	0.59
Moderate	-1.233	0.831	0.11
High	-1.648*	0.798	0.15
Very High	-2.557**	0.980	0.23
Home computing (compared to low)			
Moderate	1.531*	0.782	0.14
High	0.159	0.741	0.01
Very High	0.234	0.922	0.02

Table A.7.2: Mathematics Contextualised Model (impact of child, parent, home environment and other measures on year 5 standardised Mathematics attainment) controlling for prior attainment

All the predictors that turned out to be significant predictors or predictors improving model fit of Year 5 attainment (see Appendix 6) have been kept in the model.

*Statistically significant at 0.05 level **Statistically significant at 0.05 level
Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Gender (girls compared to boys)	-1.699**	0.483	0.17
Age at outcome test (centred around mean)	-0.006	0.063	0.00
Birth weight (compared to normal birth weight)			
Missing data	3.075	1.718	0.30
Very low birth weight (<= 1500g)	-1.447	2.013	0.14
Low birth weight (1501g – 2500g)	0.247	0.918	0.02
Ethnic group (compared to White UK Heritage)			
White European Heritage	-1.782	1.312	0.18
Black Carribean Heritage	2.091	1.360	0.21
Black African Heritage	-2.111	1.738	0.21
Indian Heritage	6.903**	1.748	0.68
Pakistani Heritage	1.749	1.361	0.17
Bangladeshi Heritage	2.053	2.271	0.20
Mixed Race Heritage	-0.748	1.027	0.07
Any other ethnic minority Heritage	1.818	1.700	0.18
Need of EAL support in Year 5 (compared to no need of EAL support)			
Missing data	-1.008	0.759	0.10
EAL support needed	-3.839**	1.348	0.38

Table A.7.2 (continued)

	Estimate	SE	Effect Size
Health problems (compared to none)			
1	0.425	0.528	0.04
2+	0.380	0.892	0.04
3+	-2.415	2.069	0.24
Free School Meal Eligibility (FSM) (compared to not eligible)	-0.821	0.695	0.08
Family SES (compared to professional non manual)			
Missing data	-0.498	0.898	0.05
Other professional non manual	-1.425	1.049	0.14
Skilled non manual	-1.665	1.090	0.16
Skilled manual	-2.481#	1.322	0.25
Semi-skilled manual	-0.233	2.049	0.02
Unskilled manual	-1.207	1.413	0.12
Unemployed / Never worked	0.955	2.928	0.09
Mother's highest level of qualification (compared to no qualifications)			
Missing data	-1.141	1.910	0.11
Vocational	0.742	0.871	0.07
Academic age 16	2.072**	0.717	0.21
Academic age 18	3.963**	1.050	0.39
Degree	4.136**	1.098	0.41
Higher Degree	4.235**	1.575	0.42
Other	4.668*	1.994	0.46
Father's highest level of qualification (compared to no qualifications)			
Missing	-3.479	2.820	0.34
Vocational	1.310	0.926	0.13
Academic age 16	0.712	0.793	0.07
Academic age 18	1.332	1.092	0.13
Degree	2.547*	1.075	0.25
Higher Degree	4.167**	1.493	0.41
Other	0.830	2.339	0.08
No father information	0.366	0.778	0.04
Family salary (compared to no salary) Missing data	1.149	1.503	0.11
£ 2,500 – 17,499	-0.302	1.066	-0.03
£ 17,500 – 29,999	0.564	1.115	0.06
£ 30,000 – 37,499	0.075	1.224	0.01
£ 37,500 – 67,499	0.501	1.185	0.05
£ 67,500 – 132,000+	0.671	1.501	0.07

Table A.7.2 (continued)

	Estimate	SE	Effect Size
Early years HLE (compared to 0 - 13)			
Missing data	1.153	1.694	0.11
14-19	0.835	0.933	0.08
20-24	0.660	0.945	0.07
25-32	1.541	0.947	0.15
33-45	2.362*	1.120	0.23
Parental activities during Key Stage 1			
One-to-one interaction (compared to low)			
Missing data	-0.223	1.627	0.02
Moderate	-0.522	0.785	0.05
High	0.143	0.757	0.01
Very High	-1.252	0.926	0.12
Home computing (compared to low)			
Moderate	1.344#	0.742	0.13
High	1.410*	0.700	0.14
Very High	1.829*	0.874	0.18
Expressive play (compared to low)			
Moderate	-0.666	0.752	0.07
High	-0.353	0.754	0.04
Very High	-1.832*	0.891	0.18

Table A.7.3 Reading Contextualised Model controlling for prior attainment: Net impact of pre-school attendance

	Estimate	SE	Effect Size
Pre-school **(compared to no pre-school)**	0.302	0.988	0.03

Table A.7.4 Mathematics Contextualised Model controlling for prior attainment: Net impact of pre-school attendance

	Estimate	SE	Effect Size
Pre-school **(compared to no pre-school)**	-0.634	0.978	0.06

Table A.7.5 Reading Contextualised Model controlling for prior attainment: Net impact of Pre-school quality measured by ECERS-E
*Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Quality (compared to low quality)			
No pre-school	0.798	1.165	0.07
Medium quality	1.202	0.752	0.11
High quality	1.545#	0.880	0.14

Table A.7.6 Mathematics Contextualised Model controlling for prior attainment: Net impact of Pre-school quality measured by ECERS-E
Just failed to reach statistical significance at 0.05 level

	Estimate	SE	Effect Size
Pre-school Quality (compared to no pre school)			
Low quality	-1.191	1.149	0.12
Medium quality	-0.634	1.003	0.06
High quality	-0.179	1.095	0.02

Table A.7.7 Reading Contextualised Model controlling for prior attainment: Net impact of Pre-school effectiveness (Pre-reading) *Statistically significant at 0.05 level (tested one-tailed)

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to no pre-school)			
Very low effective	-0.957	1.478	-0.09
Low effective	-0.587	1.165	-0.05
Medium effective	0.319	1.010	0.03
High effective	2.199#	1.185	0.20
Very high effective	-0.805	1.318	-0.07

Table A.7.8 Reading Contextualised Model controlling for prior attainment: Net impact of Pre-school effectiveness (Pre-reading) *Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to very low effective)			
No pre-school	0.957	1.478	0.09
Low effective	0.370	1.325	0.03
Medium effective	1.276	1.193	0.12
High effective	3.157*	1.351	0.29
Very high effective	0.152	1.445	0.01

Table A.7.9 Mathematics Contextualised Model controlling for prior attainment: Net impact of pre-school effectiveness (Early number concepts) *Statistically significant at 0.05 level

	Estimate	SE	Effect Size
Pre-school Effectiveness (compared to no pre-school)			
Very low effective	-0.465	1.605	0.05
Low effective	-1.201	1.298	0.12
Medium effective	-0.696	1.000	0.07
High effective	-0.850	1.171	0.08
Very high effective	0.947	1.497	0.09

Appendix 8: 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 ⁄√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:

$\Delta = \frac{2\ \beta_1 * SD_{x1}}{\sigma_e}$ where $_{x1}$=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, 2004). 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.

'at risk' The ETYSEN report acknowledges that the term 'at risk' is a complex one which will differ depending on the particular criteria used. In the ETYSEN study cognitive risk is defined as 1 sd below national average and strong cognitive risk as 1 sd below sample average. These provide definitions of children who may be seen to be 'at risk' on the basis of their cognitive attainment at entry to pre-school.

Attendance The number of sessions attended at the target centre by an EPPE child from entry to study (BAS assessment) to leaving the target pre-school (based on pre-school centre registers). This measure provides a crude indicator of amount of target pre-school experience.

Baseline measures Assessments taken by the EPPE child at entry to the study. These assessment scores are subsequently employed as prior attainment measures in a value added analysis of pupils' cognitive progress.

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.

Compositional effects The impact of peer group measures on a child's individual outcomes. For example, when the characteristics of children in a centre (measured as a centre level aggregated variable) show a significant relationship with outcomes at the individual child level, after controlling for the same variable at the individual level. For further details see Harker (2001).

***Confidence intervals at the 95%* level** A range of values which can be expected to include the 'true' value in 95 out of 100 samples (i.e. if the calculation was repeated using 100 random samples).

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 form + 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.

General Cognitive Ability (GCA) A measure of children's overall cognitive ability, incorporating non-verbal and verbal BAS sub-scales.

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 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 Based on three child variables, six parent variables, and one related to the home learning environment 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 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 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 were drawn from these target centres.

Total BAS score By combining 4 of the BAS sub-scales (2 verbal and 2 non-verbal) a General Cognitive Ability score or Total BAS score at entry to the study can be computed. This is a measure of overall cognitive ability.

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 characteristics.

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