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Effective Pre-school Provision Northern Ireland (EPPNI) PRE-SCHOOL EXPERIENCE AND KEY STAGE 2 PERFORMANCE IN ENGLISH AND MATHEMATICS

by the EPPNI Research Team

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RESEARCH REPORT

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Effective Pre-school Provision in Northern Ireland (EPPNI)

Overview of the Project

This longitudinal study assesses the attainment and development of children followed from the age of 3 until the end of Key Stage 2 (age 11). 683 children from 80 pre-school centres, and 151 children who had not attended pre-school, were recruited to the study in Northern Ireland. Both qualitative and quantitative methods have been used to explore the effects of pre-school experience on children's cognitive attainment and social/behavioural development. In addition to the effects of pre-school experience, the study has investigated the contribution to children's development of individual and family characteristics such as gender, family size, parental education and socio-economic status. This overview describes the research design in investigating the impact of pre-school provision on children's developmental progress. A parallel study is being carried out in England (EPPE).

Previous Research on the Effects of Early Education in the UK

There has been little large-scale, systematic research on the effects of early childhood education in the UK. The 'Start Right' Enquiry (Ball 1994; Sylva 1994) reviewed the evidence of UK research and concluded that small-scale studies suggested a positive impact but that large-scale research was inconclusive. The Start Right enquiry recommended more rigorous longitudinal studies with baseline measures so that the 'value added' to children's development by pre-school education could be established.

Research evidence in many countries has indicated positive outcomes for children associated with various kinds of pre-school provision (Melhuish 1993; Sylva & Wiltshire 1993; Borge & Melhuish, 1995; Schweinhart & Weikart 1997; NICHD, 2002; Montie, Xiang, & Schweinhart, 2006; Melhuish & Petrogiannis, 2006). In the UK some researchers have examined the impact of particular characteristics, e.g. gender and attendance on children's adjustment to nursery classes (Davies & Brember 1992), or adopted cross-sectional designs to explore the impact of different types of pre-school provision (Davies & Brember 1997). Feinstein, Robertson & Symons (1998) attempted to evaluate the effects of pre-schooling on children's subsequent progress using birth cohort study data, but birth cohort designs have limitations for the study of the influence of pre-school education. Cohort studies may also be limited by the time lapse and many changes in the nature of pre-school provision that have occurred since the original data were collected.

In the UK there is a long tradition of variation in pre-school provision both between types (e.g. Playgroup, Local Authority or Private Nursery or Nursery Classes) and in different parts of the country reflecting funding and geographical conditions (i.e. urban/rural and local access to centres). In the 1990's several reports (House of Commons Select Committee 1989; DES Rumbold Report 1990; Ball 1994) questioned whether pre-school education in the UK was as effective as it might be and urged better co-ordination of services and research into the impact of different forms of provision (Siraj-Blatchford 1995). The EPPNI and EPPE projects were the first large-scale studies in the UK on the effects of different kinds of pre-school provision relating pre-school experience and type and characteristics of centres to child development.

Overview of Research Design

The EPPNI project has investigated three issues with implications for policy and practice:

- the effects on children of different types of pre-school provision,
- the 'structural' (e.g. adult-child ratios) and 'process' characteristics (e.g. interaction styles) of more effective pre-school centres, and
- the interaction between child, family and pre-school provision.

The research design was chosen to enable investigation of the progress and development of individual children (including the impact of personal, socio-economic and family characteristics), and the effect of pre-school centres on children's outcomes.

The aims of the EPPNI Project

- To compare and contrast the developmental progress of 800+ children from a wide range of social and cultural backgrounds who have differing pre-school experiences.
- To establish whether some forms of pre-school experience are more effective than others in promoting children's cognitive and social/emotional development during the pre-school years (ages 3-4) and the primary years (up to age 11 years).
- To discover the pre-school characteristics found to be most effective.
- to investigate differences in the progress of different groups of children, e.g. children from disadvantaged backgrounds and both genders.
- To investigate the effects of pre-school education on educational performance in primary school in a way which allow the possibility of longitudinal follow-up at later ages to establish any long-term effects.

The sample: centres and children

In order to maximise the likelihood of identifying the effects of various types of provision, the EPPNI sample was stratified by type of centre and geographical location. The centres were chosen to include a selection of Nursery Classes/Schools, Playgroups, Private Day Nurseries, Reception Classes and Reception Groups. Thus examples of all major types of pre-school centres in Northern Ireland were included in the study.

683 children were recruited from 80 pre-school centres from all Education & Library Boards (ELBs) in Northern Ireland. Children and their families were selected randomly in each centre to participate in the EPPNI Project. All parents gave written informed consent for their children to participate. In order to examine the impact of no pre-school provision, an additional sample of 151 children with no pre-school experience were recruited from the Year 1 classes that EPPNI children entered.

The progress and development of pre-school children in the EPPNI sample has been followed until the end of Key Stage 2 of primary school (age 11 years), although only data on Key stage 2 results have been obtained after Key Stage 1. Details about length of sessions and number of sessions normally attended per week have been collected to enable the amount of pre-school education experienced to be quantified for each child in the sample.

Child assessments

Earlier Child Measures: At the start of the study (3+ years), at school entry, and at the end of the P1 and P2 years children were assessed on cognitive performance using standardised assessments. At the end of P3 children's Key Stage 1 results were collected. In addition at each assessment stage social/behavioural profiles were completed by a teacher who knew the child well. These measures have been described and discussed in earlier reports from the project and are covered in the report summarising the project up to the end of the P3 year (Melhuish et al., 2006).

Child Measures at the End of Key Stage 2: Key Stage 2 assessment results were collected where possible from the central records of Key Stage 2 scores and where that was not possible directly from the primary school that each child had attended.

Child and family characteristics

Parental interview: Shortly after entry to the study one of the child's parents or guardians was interviewed. Usually the interview was with the child's mother. Parents were interviewed either in person when they were at the pre-school centre, or by telephone. The interview contained questions dealing with the parents, the family, the child's health, development and behaviour, the child's activities in the home, the use of pre-school provision and the childcare history. Information on individual 'child factors' such as language, birth order and early health and development was collected. Parent interviews provided detailed information about parent education, occupation and employment history, family structure and pre-school attendance. In addition, details about the child's day care history and parental involvement in educational activities (e.g. reading to child, teaching nursery rhymes, television viewing etc), and also the activities of the child have been collected and analysed. Additional information was collected from parents when the child was 6-7 years of age.

Pre-school Characteristics and Processes

Interviews and observations: Researchers interviewed centre managers on: group size, child staff ratio, staff training, aims, policies, curriculum, parental involvement, etc. 'Process' characteristics such as the day-to-day functioning within settings (e.g. child-staff interaction, child-child interaction, and structuring of children's activities) were also studied. The revised Early Childhood Environment Rating Scale (ECERS-R) (Harms, Clifford & Cryer, 1998), and the Caregiver Interaction Scale (Arnett 1989) were also administered. In addition four additional ECERS sub-scales (ECERS-E) (Sylva, Siraj-Blatchford & Taggart, 2003, 2010), describing educational provision in terms of: Language, Mathematics, Science and the Environment, and Diversity were also used in each pre-school centre.

Case Studies

In addition to the quantitative data collected about children, their families and their pre-school centres, detailed qualitative data has been collected using case studies. EPPNI therefore uses mixed methodology. The case studies were chosen retrospectively on the basis of the analyses of ECERS-R, ECERS-E and Inspection Reports. The case studies (Quinn et al., 2004) use a variety of methods of data gathering, including documentary analysis, interviews and observations and the results help to illuminate the characteristics of more successful pre-school centres and assist in generating guidance on good practice. Particular attention has been paid to parent involvement, teaching and learning processes, child-adult interaction and social factors in learning.

Identifying continuing effects of pre-school centres until the end of Key Stage 2

The EPPNI research has explored the possible effects of pre-school provision on later progress and attainment in primary school until the end of Key Stage 2. Children's educational experiences are complex and over time different institutions may influence development for better or worse. This study allows the relative strength of any continuing effects of pre-school attendance to be ascertained.

The Linked Study in England 1997-2010

The Effective Pre-school and Primary Education (EPPE) project is a linked project and has been summarised by Sylva, Melhuish, Sammons, Iram Siraj-Blatchford and Taggart (2010). The study explored the characteristics of different kinds of early years provision and examines children's development in pre-school, and influences on their later adjustment and progress at primary school up to the age of 11 years (Key Stage 2) in England. It identified aspects of pre-school provision that have a positive impact on children's attainment, progress, and development, and so provide guidance on good practice. The research involved 141 pre-school centres randomly selected throughout 5 regions of England. The study investigated all main types of pre-school centre provision then available in England and is currently following children through to age 16+ years. The data from England and Northern Ireland offer opportunities for potentially useful comparisons.

EXECUTIVE SUMMARY

The Effective Pre-school Provision in Northern Ireland (EPPNI) project is a longitudinal study that has investigated the development of children between the ages of 3 and 11 years. Both qualitative and quantitative methods have been used to explore the effects of pre-school experience on children's attainment and progress on cognitive and social/behavioural development. In addition to pre-school effects, the study investigates the contribution to children's development of individual and family characteristics such as gender, family size, parental education and socio-economic status. A parallel study is being carried out in England (Effective Pre-school & Primary Education – EPPE). The EPPNI and EPPE projects are the first large-scale studies in the UK to investigate the effects of different kinds of pre-school provision, and to relate experience in pre-school centres to child development. The data from England and Northern Ireland offer opportunities for potentially useful comparisons.

The EPPNI and EPPE projects investigate three issues that have important implications for policy and practice, and that have been dealt with in a number of reports:

- The effects on children of different types of pre-school provision,
- The characteristics of more effective pre-school centres, and
- The role of child and family characteristics and type of pre-school provision.

683 children were recruited from 80 pre-school centres from all Education & Library Boards in Northern Ireland. Children and their families were selected randomly in each centre to participate in the EPPNI project. In order to examine the impact of no pre-school provision, 151 children without pre-school experience were recruited from the Year 1 classes attended by EPPNI children. The progress and development of the children has been followed from age 3 until the end of Key Stage 2 of primary school.

End of Key Stage 2 Summary

This report considers children's educational attainment in English and mathematics at the end of primary school (age 11). Children's educational attainment in English and mathematics was derived from their national Key Stage 2 assessments. The analyses have considered the child's level of Key Stage 2 attainment in terms of the effects of child, family, home environment and preschool experience variables as well as the child's ability at the start of primary school. In the summary below the relationships discussed are statistically significant when the influence of other measures is controlled. The findings identify general tendencies for different groups of children, but may not apply to every individual in a group. Note that the data (except for Key Stage 2 results) on children and families were based on information collected before Key Stage 1.

Summary of the effects of independent variables

The limited discrimination provided by Key stage 2 categories mean that the significant results reported here are likely to provide conservative estimates of the effects of previous experience and characteristics upon literacy and numeracy at age 11. There is a case for providing more finely discriminating measures of Key Stage 2 attainment. The analyses found a number of significant effects of independent variables upon children's educational attainment in English and mathematics at the end of Key Stage 2. These are summarised below after allowing for other child, parent, home and preschool characteristics. In considering these results it is clear that some variables influence attainment and some influence both attainment at age 11 and progress over the primary school years.

Where an analysis of attainment indicates that some factor influences children's development, but the analysis of progress does not reveal a significant effect for that factor, this indicates that the significant effect for that variable probably occurred prior to school entry and that during the time in primary school no further effect has occurred.

Where both attainment and progress analyses reveal significant effects this indicates that the variable has had an effect up to the end of Key Stage 2 (11 years), and that the overall attainment at the end of Key Stage 2 is affected because the variable continues to exert an effect across the primary school years sufficient to boost performance beyond the level of similar children..

Attainment at Key Stage 2 is influenced by a range of background factors that include, child age, birth weight, gender, early developmental problems, lone parent status, mother's and father's qualification, family socio-economic status, area level child poverty and the home learning environment. Of these background factors some affect attainment only and some also affect progress across the primary school years.

Child Variables

Birth weight: A child's birth weight influences attainment in English and mathematics, but not progress. This suggests that the effect on attainment at Key Stage 2 is through the effects on a child's attainment up to start of primary school.

Gender: For English girls do better than boys in attainment and in progress over the primary school years, but there are no gender effects for mathematics with girls and boys doing similarly well at Key Stage 2.

Early developmental problems: Where a child had a developmental problem early in life, the effects of this are still apparent in terms of decreased attainment and progress in Key Stage 2 English and mathematics.

Age: A child's age in relation to others in the school year is an important predictor of both attainment and progress in English and mathematics, with older pupils doing distinctly better.

Socio-Economic Status Variables

Parental Socio-Economic Status: Household socio-economic status is related to attainment in English and mathematics. For English and mathematics children where the household SES is unskilled, semi-skilled, or skilled (or unemployed for mathematics) do significantly less well in attainment. For mathematics the unskilled, semi-skilled, or skilled groups also do less well in progress over the primary school years than the professional group.

Area Child Poverty Mean: Children from areas where there is more poverty attained lower levels of attainment in English and mathematics. There were no subsequent effects on progress indicating that these effects are absorbed in start of school performance.

Parental Variables

Mothers' Education/ Qualifications: Lower maternal education is associated with lower attainment and progress in English and mathematics, indicating that the effects continue across the primary school years.

Fathers' Education/Qualifications: Lower paternal education is associated with lower attainment in English and mathematics. There are no significant effects upon progress over the primary school years and the effects are less significant than those for mother's education.

Home variables

Home Learning Environment: The Home Learning Environment (HLE) is related to attainment in English and mathematics at Key Stage 2; the higher the HLE the better the child's attainment. The effects are stronger for English and the HLE is also related to progress over the primary school years in English.

Pre-school

Type of Pre-school: After allowing for the effects of background factors there is clear evidence of pre-school effects persisting to the end of Key Stage 2 for children who attended a nursery school/class or playgroup. The beneficial effects for children who attended nursery school/classes on playgroups appear to be the result of the generally higher quality of these types of provisions. There were no significant effects associated with other types of pre-school.

Quality of Pre-school: After allowing for the effects of background factors there is clear evidence of quality of pre-school effects persisting to the end of Key Stage 2. High quality pre-schools show consistent effects that are reflected not only in improved attainment in Key Stage 2 English and mathematics, but also improved progress in mathematics over the primary school years. Children who attended high quality pre-schools were 2.4 times more likely in English, and 3.4 times more likely in mathematics, to attain level 5 than children without pre-school experience.

Pre-school Peer Group Composition:

Where the pre-school had a higher percentage of children whose mothers had a degree then attainment in Key Stage 2 English tended to be higher. This finding suggests that there are peer group influences upon child attainment. The effect was only just statistically significant.

Conclusion

In a technologically sophisticated world a population's educational attainment is likely to be increasingly important for a nation's economic development. This study shows the factors that can influence such attainment. The effects associated with various child and family background variables in this study are very similar to those frequently reported in other studies. In addition pre-school education is important. In Northern Ireland, certain types of pre-school, in particular nursery classes/schools and playgroups, have an influence upon academic attainment at the end of primary school and that these effects are linked to high quality pre-school experience for the children. The beneficial effects of high quality pre-school are seen more strongly for mathematics and can even produce greater progress in mathematics during the primary school years. This indicates that high quality pre-school not only improves children's ability at the start of school but also can improve the capacity for learning in subsequent years. Hence high quality pre-school is an important part of a nation's infrastructure for education of the population and economic development.

INTRODUCTION

The Effective Pre-school Provision in Northern Ireland (EPPNI) project is a research study of children's progress and development from age three to eleven years, and how progress relates to their pre-school centre experience and family background.

In the first stage of the study parents were interviewed concerning child and family characteristics. Children were also assessed on social/behavioural and cognitive development. The data provided can be used to investigate educational attainment in relation to a range of parental, family, child, home and preschool factors. This paper considers children's educational attainment at the end of Key Stage 2, and the progress from entry to primary school to the end of primary school (end of Key Stage 2) relating children's attainment and progress to child, parental, family, home and childcare history variables. A wide range of variables is considered and the nature of associations between family background and children's development are explored.

METHOD

SAMPLE

The focus of the EPPNI study is on the effects of pre-school experience upon children's development. The EPPNI sample was stratified by type of centre and geographical location. The first stage of the study involved 683 children recruited from 80 pre-school centres, including 188 children from 16 nursery classes/schools, 157 children from 15 Playgroups, 117 children from 19 Private Day Nurseries, 103 children from 9 Reception Classes, and 118 children from 21 Reception Groups. The distribution of the sample is shown in Table 1. The children were aged between 3 years and 4 years 6 months (mean 43.3 months; S.D. = 5.5 months) at the beginning of the study.

In addition to the children in pre-school centres there were 151 children recruited to the study who had not attended a pre-school centre (Home children). These children were recruited from the same primary schools attended by the pre-school children at the start of Year 1 in Primary School.

Table 1: Distribution of Children across Pre-school Settings and Areas

Area	Nursery class/school	Playgroup	PDN	Reception class	Reception group	Home	Total
Belfast	33	32	28	29	9	11	142
West	33	30	14	35	9	43	164
North-east	34	30	41	8	31	30	174
South-east	37	26	22	11	38	21	155
South	51	39	12	20	31	46	199
Total	188	157	117	103	118	151	834

For 7 families, parents were unavailable for interview. Thus there were data from parental interviews for 676 children of the pre-school sample, plus 151 children with no pre-school experience. When children were in the last year of primary school they were assessed by the Northern Ireland Key Stage 2 assessments. The children's attainment on the Key Stage 2 assessments for English and mathematics were obtained for 770 of the EPPNI children.

DATA COLLECTION

Parental interview

Shortly after the child and family were recruited to the study, one of the child's parents or guardians was interviewed. In the vast majority of cases the interview was with the child's mother. Parents were interviewed either in person when they were at the pre-school centre, or occasionally by telephone. The interview followed a semi-structured format with answers to most questions being coded into an established set of categories, and a small number of open-ended questions that were coded post hoc. The length of the interviews varied, depending on the complexity of the information to be collected, the conciseness of the parents and other factors. A typical interview might take between twenty and forty minutes of the parent's time depending upon the complexity of the information supplied by the parent. The interview contained questions dealing with the parents, the family, the child's health, development and behaviour, the child's activities in the home, the use of pre-school provision and the childcare history. A measure of the Home Learning Environment (HLE) was derived from the interview, which was an index of the learning opportunities provided in the home during the pre-school period. The HLE has been found to be highly predictive of children's cognitive and social development (e.g. Melhuish et al., 2008a; Sammons et al, 2008a, b). The various measures derived from the parental interview in the EPPNI study have been described previously in Melhuish et al., (2006).

Pre-school Centres

683 children in the study attended one of the following types of pre-school

Nursery Schools/Classes	N=16
Playgroups	N=15
Private Day Nurseries	N=19
Reception Classes	N= 9
Reception Groups	N=21

For the centres attended by the children in the study interviews were conducted with the pre-school centre manager. The topics covered in this interview included group size, child staff ratio, staff training, aims, policies, curriculum, and parental involvement. The information from these interviews is in a report by Quinn et al, (2002).

In addition to the visits to the centres to conduct interviews there were visits to collect observational data. Process characteristics such as the day-to-day functioning within settings (e.g. child-staff interaction, child-child interaction, and structuring of children's activities) were studied. Two measures of pre-school quality were used;

i) the Early Childhood Environment Rating Scale (ECERS-R; Harms, Clifford & Cryer 1998) and

ii) the Early Childhood Environment Rating Scale – Extension (ECERS-E, Sylva, Siraj-Blatchford & Taggart, 2003, 2010).

ECERS-R and ECERS-E are measured on a 1-7 scale where 1= inadequate, 3= minimally adequate, 5= good, and 7= excellent.

The variations in pre-school centres in the EPPNI study in quality have been described previously (Melhuish et al, 2002a). It was found that the pre-school centres in EPPNI showed wide variation in ECERS-R scores but very little variation in ECERS-E scores. This probably reflected the fact that ECERS-E had been developed to reflect the development of

the early years curriculum in England, while Northern Ireland had followed a different path. As the ECERS-R was the most discriminating measure of pre-school quality it appeared to be the most appropriate measure of pre-school centre quality for Northern Ireland (see Melhuish et al., 2002a). Therefore it was decided that ECERS-R scores would be used as the basis for quality of pre-school measures in subsequent analyses. The ECERS-R subscales and their items that are scored on a 1-7 scale can be seen in Appendix A.

Child Measures at the Start of Primary School

At school entry, a trained researcher administered a battery of cognitive assessments. These included the British Ability Scales II (Elliott, Smith & McCulloch, 1996) subscales of pattern construction, verbal comprehension, naming vocabulary, knowledge of similarities seen in pictures and early number concepts. Also scales of knowledge of the alphabet, rhyme and alliteration (literacy measures) (Bradley & Bryant, 1985; Clay, 1985) were also administered, which were then combined to give an overall measure of pre-reading ability. In addition an overall measure of cognitive ability combining all the cognitive assessments was calculated. The results for cognitive development from the EPPNI study up to the start of primary school have been described in Melhuish et al., (2002b).

Educational attainment at the end of Key stage 2.

Teachers assess pupils' work as part of their day-to-day teaching. They observe how pupils carry out various classroom activities, they mark their work and, from time to time, they set short classroom tests to judge what progress children are making in a subject. In addition to these normal classroom assessments, teachers are required to use 2 Assessment Units in English, mathematics to help confirm their judgment of the level at which each child is working in these subjects.

The overall subject level for English is arrived at by combining the teacher's assessment of pupils in the following Attainment Targets:

1. Talking and Listening;
2. Reading; and
3. Writing.

The overall subject level in mathematics is arrived at by combining the teacher's assessment of pupils in the following Attainment Targets:

1. Processes in Mathematics;
2. Number; Measures;
3. Shape and Space; and
4. Handling Data.

Teachers consider the child's work over a period of time and make judgments about the level at which each child is working, using the Level Descriptions in each Attainment Target. They also use the outcomes of Assessment Units, to confirm their assessment of each child.

Assessment Units are short, informal tasks supplied by the Northern Ireland Council for the Curriculum, Examinations and Assessment (CCEA). Teachers choose from a selection of Units, the most appropriate ones to confirm their classroom assessments of each pupil. The Units are used as part of normal classroom work and pupils may not even be aware when a Unit has been used. At least 2 Assessment Units are used per subject between January and April. These are marked by the teacher, to help arrive at a judgment of the level at which a child is working. The results are reported to parents at the end of the school year. The majority of children at the end of Key Stage 2 (Year 7) will be working at Level 4 or 5. This is illustrated in Table 2 showing Northern Ireland KS2 results for English and Maths over the period 2000/01 to 2008/09.

Table 2: Key Stage 2 Assessments¹ 2000/01 - 2008/09

	00/01	01/02²	02/03	03/04³	04/05	05/06	06/07⁴	07/08⁵	08/09⁶
	%	%	%	%	%	%	%	%	%
Level 4 or above									
English	72.8	73.9	75.6	-	76.6	78.0	78.0	78.8	80.1
Maths	75.7	77.0	78.2	-	79.0	80.0	79.5	80.6	81.3
Level 5 or above									
English	19.8	20.8	22.1	-	23.2	25.1	26.0	27.7	29.1
Maths	37.7	38.1	39.8	-	40.1	41.7	39.8	41.1	41.9

- NOTES: 1 Excludes Special and Independent schools.
 2 Due to industrial action Key Stage 2 assessments for 2001/02 are incomplete for approximately 9% of schools.
 3 Due to industrial action Key Stage results are not available for 2003/04.
 4 Three schools did not submit Key Stage 2 results for 2006/07.
 5 In 2007/08 2 did not submit KS2 results.
 6 In 2008/09 1 primary school did not submit Key Stage results.

RESULTS

Analysis of Data

The analyses in this report consider the children's educational achievement in two ways; attainment at the end of Key Stage 2 (age 11), and progress over the primary school years, i.e. from entry to primary school to the end of Key Stage 2.

Attainment: these analyses answer the question 'What affects the child's level of development at the end of Key Stage 2?' In analysing attainment the child, socio-economic (area & parent), parent, family, home and childcare characteristics affecting the child's level of attainment at the end of Key Stage 2 were considered. The child's earlier level of attainment is not taken into account.

Progress over the primary school years: - These analyses answer the question 'What affects the progress the child makes during primary school?' In analysing progress, the same predictor variables used in attainment were analysed, but, in addition, the child's level of attainment at the beginning of primary school is taken into account. The strategy of analysing the end of Key Stage 2 outcomes where attainment at the start of primary school is used as a predictor variable is the equivalent to analysing the child's progress as the initial level of attainment is taken into account.

There are consequences of this strategy for progress models.

1. The child's level of functioning at the beginning of primary school will absorb the effects of several child, parent, family and home factors, where their effects do not persist additively over the primary school period.
2. Where children are not showing high levels of attainment in relation to their age at the start of primary school, there is more scope for progress for such children. Hence such children may show bigger progress effects, without necessarily showing high attainment at the end of the first three years of primary school.

There are a range of alternative measures taken at the start of primary school that could be used as pre-test measures for the assessment of progress over the course of primary school. In particular measures of numeracy (early number concepts), literacy (pre-reading), and general cognitive ability combining all cognitive scores would be candidates for start of school (pre-test) measures in the analysis of progress over primary school in English and mathematics. The correlations between all of the potential pre-test measures and Key Stage 2 English and mathematics were examined and for both Key Stage 2 outcomes the general cognitive ability was the start of primary school measure with the highest correlation as shown in Table 3. These correlations between cognitive scores at age 5 and educational attainment at age 11 show the important predictive power of earlier cognitive ability for later educational outcomes.

Table 3: Correlations between Start of primary and Key Stage 2 measures

Start of primary measures	Key Stage 2 attainment	
	English	Maths
Pre-reading	0.50	0.46
Early Number	0.44	0.46
General cognitive ability	0.56	0.55

As the general cognitive ability at the start of primary school was the measure most predictive of Key Stage 2 attainment it was chosen as the pre-test measure for analyses of progress in both English and mathematics over the primary school years.

The outcome variables are attainment in KS2 English and mathematics. These data were available as categories, i.e. levels of child attainment. As the outcomes are categorical ordinary linear regression would be inappropriate so multinomial logistic regression, which can deal with categorical outcomes, is the appropriate statistical analysis procedure.

The predictor variables are entered into a multinomial logistic regression model simultaneously ("enter" method) using SPSS software. Variables with statistically significant ($p < .05$) effects were retained in the model. Other factors were removed one at a time to ensure all variables with statistically significant effects were retained. The final regression models for each outcome retained only the predictor variables with statistically significant effects on the outcome. The chosen significance level of $p < .05$ (conventional criterion) means that there is a less than 5% chance that the observed result is due to chance.

Predictor variables tested for effects upon Key Stage 2 English and mathematics are below.

Child characteristics

Age in school year
Gender
Birth weight
Perinatal health difficulties
Previous developmental problems (0-3 years)
Previous behaviour problems (0-3 years)
Previous health problems (0-3 years)

Parental characteristics

Highest socio-economic status in household
Mother's qualifications
Father's qualifications
Mother's age
Father's age

Family characteristics

Lone versus dual parent status
Number of siblings
Birth position
Life events

Home characteristics

Home learning environment (HLE)
Rules about bedtime
Rules about TV
Play with friends at home
Play with friends elsewhere

Childcare history

Total relative care before entering the study
Total individual care before entering the study
Total group care before entering the study

Area

Education and Library Board (ELB)
Index of Area Deprivation
Area Child poverty mean

Various measures of deprivation were considered. They were all highly correlated. Therefore it was sensible to choose one and the child poverty index seemed most appropriate.

Pre-school experience variables

Quality of pre-school – ECERS-R score

Type of pre-school

Duration of time spent in pre-school

Adult/Child Ratio

Staff qualifications

Pre-school Group composition

Within each pre-school centre the study had a representative sample of children. Hence an average of the children's scores, leaving out the target child's score, gives a measure of the rest of the preschool group's composition. Such a composition variable is a useful way to incorporate analysis of peer group effects during the pre-school period. This report looks at pre-school composition in terms of:

- i) average cognitive ability of children in the pre-school at the start of the study, and
- ii) percentage of children's mothers with a degree

Educational outcomes at Key stage 2

There were data available for 770 pupils from the EPPNI study. Their Key Stage 2 levels for English and mathematics are shown in Table 4 below.

Table 4: Key Stage 2 levels for the EPPNI sample

Key Stage 2 level	English	Mathematics
1	2	1
2	19	19
3	126	111
4	370	258
5	253	381
Total	770	770

The low frequencies for levels 1 and 2 make separate analysis for these levels not feasible. Hence the levels 1, 2 and 3 were combined giving the distributions in Table 5.

Table 5: Key Stage 2 levels for the EPPNI sample

Key Stage 2 level	English	Mathematics
3 or below	147 (19.1%)	131 (17%)
4	370 (48.1%)	258 (33.5%)
5	253 (32.8%)	381 (49.5%)
Total	770 (100%)	770 (100%)

The effect of predictors was considered in terms of whether the predictor significantly influenced the likelihood of attaining

1. level 4 as opposed to level 3 or below, and also
2. level 5 as opposed to level 3 or below.

The statistical procedure used to do this was multinomial logistic regression. The outcomes were Key Stage 2 attainment in English or mathematics. Continuous predictor variables were used as covariates in the models and categorical predictors were used as factors in the models. The models estimated the probability of the observed difference in levels occurring by chance. Where this probability was less than .05 then the explanation of a chance effect was rejected and the predictor was regarded as having a statistically significant effect upon the outcome. This is the conventional criterion of statistical significance.

Analysing Attainment and Progress at Key Stage 2.

The analyses firstly considered which child and family background predictors (covariates or factors) had significant effects upon the outcomes. Consistently the same predictor variables emerged as significant. These were Birth weight, Gender, Early developmental problems, Lone parent status, Mother's and father's qualifications, household socio-economic status (SES), Home Learning Environment, and Area index of child poverty,.

Next the effects of pre-school variables were tested. Firstly the effect of attending pre-school or not was tested in the models, Secondly the effects of type of pre-school was tested, by comparing the following types of pre-school with the no pre-school group.

1. Nursery class/school
2. Playgroup
3. Private day nursery
4. Reception class
5. Reception group

Thirdly the effects of quality of pre-school were tested. The ECERS-R scores were categorised into low, medium and high quality. Low quality referred to the bottom 25% (<4.09), medium quality referred to the middle 50% (4.10 to 5.19), and high quality referred to the top 25% (>5.20). Treating the pre-school quality measure in this way allows the low, medium, and high quality groups to be compared to the no pre-school group.

Additionally, for analyses with the pre-school group only, the effects of other pre-school variables i.e., adult/child ratio, pre-school staff qualifications, duration of time spent in pre-school, and pre-school group composition were tested for their effects upon KS2 English and mathematics.

In the following description of the results of analyses the variables that were found to have statistically significant effects upon Key Stage 2 English and mathematics are covered, and their effects described. Where a potential predictor variable is not mentioned this was because no statistically significant effect emerged when all other variables were taken into account. In the analyses tabled in the results section most predictor variables are categorical. However age in school year, birth weight, home learning environment and area child poverty were used as continuous variables to increase the accuracy of estimates. In addition these latter variables were also recoded into categories in order to undertake analyses that provide easily interpretable estimates of effect sizes (odd ratios). Analyses involving the recoded variables and quality of pre-school are in Appendix B, and these analyses provide the estimates of likelihood (odds ratios) of achieving level 5 in KS2 that are quoted in the results for background variables.

The effects of background variables

In considering child, parent, family, home and area background variables essentially similar patterns of results emerged from all statistical models as shown in Tables 6 to 11 below. Before detailing pre-school effects, the results for background variables are summarised as several are significant predictors of attainment and/or progress in English and mathematics at Key stage 2. The effects are considerably stronger and more apparent for attaining level 5 than for attaining level 4. Similar results for background variables emerged in all analyses. Where estimates of likelihood (odds ratio) are quoted these derive from the tables in Appendix 2.

Child variables

The child's age in relation to others in the school year is an important predictor of both attainment and progress in English and mathematics, with older pupils doing better. The

odds of attaining level 5 (as compared with level 3) increase by 13-14% for each month of age. A child's birth weight continues to show its effects in terms of attainment in English and mathematics, but not progress. This suggests that the effect on attainment at Key Stage 2 is through the effects on a child's attainment up to start of primary school. Children with a birth weight of 3500 grammes or more are 4.5 to 5 times more likely than a child with a birth weight of 2500 grammes or less to attain level 5 in English or mathematics. For English girls do better than boys in attainment and in progress over the primary school years, being almost twice as likely to attain level 5 in English as boys. Also where a child had a developmental problem early in life, the effects of this are still apparent in terms of decreased attainment and progress in Key Stage 2 English and mathematics. Children who had an early developmental problem are 4 times less likely to attain level 5 in English and 5 times less likely for mathematics.

Parent Variables

Where the child has a lone parent the attainment and progress is likely to be lower in English at Key stage 2, with a child of a lone parent being 4 times less likely to attain level 5 than a similar child with dual parents. Where the mother has lower educational qualifications then the child is likely to do less well in both attainment and progress in English and mathematics. Where a mother has no qualifications her child is 12 times less likely, than a similar child of a mother with a degree, to attain level 5 in KS2 English, (6 times for mathematics). There is also a similar but weaker effect for father's education upon attainment only. The socio-economic status of the household, defined in terms of the highest occupational status of either parent, is also related to attainment in English and mathematics. For English and mathematics children where the household SES is unskilled, semi-skilled, or skilled (unemployed also for mathematics) do significantly less well in attainment in than where household SES in professional. Children from the unskilled/semiskilled group are almost 8 times less likely for English and 5 times less likely for mathematics to attain level 5 than children from the professional group. The intermediate SES group do not significantly differ from the professional group. For mathematics the unskilled, semi-skilled, or skilled groups also do less well in progress over the primary school years than the professional group (statistically significant in pre-school and type of pre-school models and almost significant in quality of pre-school models).

Home

The Home Learning Environment is related to attainment in English and mathematics at Key Stage 2; the higher the HLE the better the child's attainment. The effects are stronger for English and the HLE also related to progress over the primary school years in English. Children from a home in highest 20% for HLE are over 5 times more likely for English and almost 3 times more likely for mathematics to attain level 5 than children from homes in the lowest 20% for HLE.

Area

Where the child lives in an area of greater deprivation (measured by the child poverty index) they show lower levels of attainment in English and mathematics. For those in the most deprived 20% areas they are over 2.5 times for English, and over 3.5 times for mathematics, less likely to attain level 5 at KS2, than similar children in the 20% most advantaged areas.

Pre-school versus no pre-school

The results for the final models for Key Stage 2 English that tested for pre-school versus no pre-school effects are summarised in Table 6 below. The attainment model considers predictors affecting the level of attainment at Key Stage 2. The progress model considers progress from the start of primary school to Key Stage 2 through adding start of primary cognitive ability as a predictor. Below the table the essential results are summarised.

For the tables of results that follow (tables 6-12) where there is no entry in a cell (-) this is because there is no significant effect, otherwise for significant effects the level of probability of the result occurring by chance is indicated. Where the probability of the effect occurring by chance is less than .05 then the effect is regarded as statistically significant, and the lower the probability, the more statistically significant the result.

Table 6: Results for final models for KS2 English that include pre-school versus no pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year	-	.0001	.0001	.0001
Birth weight	.017	-	.002	-
Gender	-	-	.007	.025
Developmental Problems	.0001	.001	.003	-
<i>Parent variables</i>				
Lone Parent	-	-	.004	.004
<i>Mothers qualifications (degree as comparison)</i>				
None	.013	-	.0001	.005
16 years (vocational or academic)	-	-	.001	-
18 years (vocational or academic)	-	-	.017	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.012	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	-	-
Semi- or unskilled	-	-	.010	-
Skilled (manual or non-manual)	-	-	.016	-
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	.042	-	.0001	.035
<i>Area variables</i>				
Area index of child poverty	-	-	.008	-
<i>Pre-school variables</i>				
Pre-school vs. no pre-school	-	-	-	-

The pre-school vs. no pre-school comparison is not statistically significant. Therefore, having allowed for background variables, there is no evidence of an overall significant effect of attending any pre-school for attainment in KS2 English. The limited discrimination of the Key Stage 2 categories may reduce the likelihood of finding significant results and had more discriminating measures of literacy been available then overall pre-school effects might have been found.

The results for the final models for Key Stage 2 mathematics that tested for pre-school versus no pre-school effects are summarised in Table 7 below.

Table 7: Results for final models for KS2 mathematics that include pre-school versus no pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year		.0001	.0001	.0001
Birth weight	-	-	.004	-
Gender	-	-	-	-
Developmental Problems	.0001	.003	.0001	.009
<i>Parent variables</i>				
Lone Parent	-	-	-	-
<i>Mothers qualifications (degree as comparison)</i>				
None	-	-	.0001	.031
16 years (vocational or academic)	-	-	.017	-
18 years (vocational or academic)	-	-	.041	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.024	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	.026	-
Semi- or unskilled	-	-	.009	.049
Skilled (manual or non-manual)	-	-	.014	.044
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	-	-	.011	-
<i>Area variables</i>				
Area index of child poverty	-	-	.008	-
<i>Pre-school variables</i>				
Pre-school vs. no pre-school	-	-	.014	-

Having allowed for background variables, there is a significant beneficial effect of attending a pre-school for attainment in KS2 mathematics, which shows itself in terms of increased likelihood of getting a level 5 rather than level 3 or less, with the pre-school group being twice as likely to attain level 5 as the no pre-school group. However there is no effect of pre-school for progress indicating that this overall pre-school effect appears to be absorbed by the ability of the child at the start of school.

Type of Pre-school

The results for the final models for Key Stage 2 English that tested for type of pre-school effects are summarised in Table 8 below.

Table 8: Results for final models for KS2 English that include type of pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year	-	.002	.0001	.0001
Birth weight	.012	-	.001	-
Gender	-	-	.011	.027
Developmental Problems	.0001	.001	.003	-
<i>Parent variables</i>				
Lone Parent	-	-	.004	.004
<i>Mothers qualifications (degree as comparison)</i>				
None	.009	-	.0001	.009
16 years (vocational or academic)	.049	-	.0001	-
18 years (vocational or academic)	-	-	.011	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.017	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	-	-
Semi- or unskilled	-	-	.010	-
Skilled (manual or non-manual)	-	-	.025	-
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	.048	-	.0001	.026
<i>Area variables</i>				
Area index of child poverty	.033	-	.004	-
<i>Pre-school variables</i>				
Nursery school/class	-	-	.003	-
Playgroup	.037	-	-	-
Private day nursery	-	-	-	-
Reception class	-	-	-	-
Reception group	-	-	-	-

Allowing for background variables, there is a significant beneficial effect of attending a nursery school/class for KS2 English attainment, in terms of increased likelihood of getting a level 5 rather than level 3 or less, with the nursery school/class group being over 3 times more likely to attain level 5 as the no pre-school group. Also there is a significant beneficial effect of attending a playgroup for attainment in KS2 English, which shows itself in terms of increased likelihood of getting a level 4 rather than level 3 or less, with the playgroup children being about twice as likely to attain level 4 as the no pre-school group. The other types of pre-school do not show statistically significant effects. However the beneficial effects of type of pre-school are not found in the progress model as the effects of type of pre-school appear to be accounted for in cognitive ability at the start of primary school.

The results for the final models for Key Stage 2 mathematics that tested for type of pre-school effects are summarised in Table 9 below.

Table 9: Results for final models for KS2 mathematics that include type of pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
Child variables	attainment	progress	attainment	progress
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year	-	.001	.0001	.0001
Birth weight	-	-	.002	-
Gender	-	-	-	-
Developmental Problems	.0001	.003	.0001	.012
Parent variables				
Lone Parent	-	-	-	-
<i>Mothers qualifications (degree as comparison)</i>				
None	-	-	.001	-
16 years (vocational or academic)	-	-	.025	-
18 years (vocational or academic)	-	-	-	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.037	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	.030	-
Semi- or unskilled	-	-	.008	.046
Skilled (manual or non-manual)	-	-	.016	.047
Intermediate	-	-	-	-
Home variables				
Home learning environment	-	-	.008	-
Area variables				
Area index of child poverty	-	-	.006	-
Pre-school variables				
Nursery school/class	-	-	.003	-
Playgroup	-	-	.025	-
Private day nursery	-	-	-	-
Reception class	-	-	-	-
Reception group	-	-	-	-

Having allowed for background variables, there is a significant beneficial effect of attending a nursery school/class or playgroup for attainment in KS2 mathematics, with an increased likelihood of getting a level 5 rather than level 3 or less, and the nursery school/class group being almost 3 times as likely to attain level 5, while the playgroup children are over twice as likely to attain level 5, as the no pre-school group. However the beneficial effects of type of pre-school are not found in the progress model as the effects of type of pre-school appear to be accounted for in cognitive ability at the start of primary school

Quality of Pre-school

The results for the final models for Key Stage 2 English that tested for quality of pre-school effects are summarised in Table 10 below.

Table 10: Results for final models for KS2 English that include quality of pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year	-	.0001	.001	.0001
Birth weight	.014	-	.002	-
Gender	-	-	.009	.035
Developmental Problems	.0001	.001	.002	-
<i>Parent variables</i>				
Lone Parent	-	-	.005	.006
<i>Mothers qualifications (degree as comparison)</i>				
None	.004	-	.0001	.003
16 years (vocational or academic)	-	-	.001	.041
18 years (vocational or academic)	-	-	.012	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.015	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	-	-
Semi- or unskilled	-	-	.026	-
Skilled (manual or non-manual)	-	-	.027	-
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	.039	-	.0001	.034
<i>Area variables</i>				
Area index of child poverty	0.38	-	.009	-
<i>Pre-school variables</i>				
Low quality pre-school	-	-	-	-
Medium quality pre-school	-	-	-	-
High quality pre-school	.029	-	.013	-

Having allowed for background variables, there is a significant beneficial effect of attending a high quality pre-school for attainment in KS2 English, with an increased likelihood of getting a level 4 or level 5 rather than level 3 or less. The high quality group is 2.4 times as likely to attain level 5 as the no pre-school group. The low and medium quality pre-schools do not show statistically significant effects. However the beneficial effects of attending high quality pre-school are not found in the progress model as the effects of quality of pre-school for literacy appear to be accounted for in cognitive ability at the start of primary school.

The results for the final models for Key Stage 2 mathematics that tested for quality of pre-school effects are summarised in Table 11 below.

Table 11: Results for final models for KS2 mathematics that include quality of pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year		.001	.0001	.0001
Birth weight	-	-	.003	-
Gender	-	-	-	-
Developmental Problems	.0001	.003	.0001	.008
<i>Parent variables</i>				
Lone Parent	-	-	-	-
<i>Mothers qualifications (degree as comparison)</i>				
None	-	-	.0001	.016
16 years (vocational or academic)	-	-	.011	-
18 years (vocational or academic)	-	-	.027	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.019	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	.027	-
Semi- or unskilled	-	-	.012	-
Skilled (manual or non-manual)	-	-	.020	-
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	-	-	.010	-
<i>Area variables</i>				
Area index of child poverty	.044	-	.004	-
<i>Pre-school variables</i>				
Low quality pre-school	-	-	-	-
Medium quality pre-school	-	-	-	-
High quality pre-school	.012	.037	.003	.009

Having allowed for background variables, there is a significant beneficial effect of attending a high quality pre-school for attainment in KS2 mathematics, which shows itself in terms of increased likelihood of getting a level 4 or 5 rather than level 3 or less, with the high quality group being 3.4 times as likely to attain level 5 as the no pre-school group.

The benefits of high quality pre-school persist into progress in numeracy over the primary school years, which are shown in terms of increased likelihood of getting a level 4 or a level 5 rather than level 3 or less, even after allowing for children's initial level of cognitive ability at the start of primary school.

Pre-school group only analyses

In these analyses only children who had attended a pre-school were included and the analyses tested for the effects of several pre-school characteristics, which were pre-school adult/child ratio, pre-school staff qualifications, pre-school group composition in terms of:

iii) average cognitive ability of children in the pre-school at the start of the study,
and

iv) percentage of children's mothers with a degree

Of these pre-school characteristics only pre-school group composition in terms of percentage of children's mothers with a degree showed any significant effect. In this case the effect was only just statistically significant and applied only to the comparison between attaining level 3 or below versus level 5 for KS2 English, and not for progress over the primary school years. The results for KS2 English are shown in Table 12. There was no pre-school composition effect for mathematics.

Table 12: Results for final models for KS2 English that include composition of pre-school

Predictor	Significance of predictor			
	attaining level 4 versus 3 or below		attaining level 5 versus 3 or below	
	<i>attainment</i>	<i>progress</i>	<i>attainment</i>	<i>progress</i>
<i>Child variables</i>				
Start of primary cognitive ability	n/a	.0001	n/a	.0001
Age in year	.041	.0001	.0001	.0001
Birth weight	-	-	-	-
Gender	-	-	.010	-
Developmental Problems	.0001	.003	.004	-
<i>Parent variables</i>				
Lone Parent	-	-	.003	.001
<i>Mothers qualifications (degree as comparison)</i>				
None	.045	-	.001	.016
16 years (vocational or academic)	-	-	.018	-
18 years (vocational or academic)	-	-	-	-
<i>Fathers qualifications (degree as comparison)</i>				
None	-	-	.013	-
16 years (vocational or academic)	-	-	-	-
18 years (vocational or academic)	-	-	-	-
<i>Household SES (professional as comparison)</i>				
Unemployed	-	-	-	-
Semi- or unskilled	-	-	.029	-
Skilled (manual or non-manual)	-	-	-	-
Intermediate	-	-	-	-
<i>Home variables</i>				
Home learning environment	.034	-	.0001	.006
<i>Area variables</i>				
Area index of child poverty	-	-	-	-
<i>Pre-school variables</i>				
Composition % mothers with degree	-	-	.048	-

DISCUSSION

This report considers the effects of a range of variables, reflecting child and family background and pre-school experience, upon children's performance in Key Stage 2 English and mathematics. The data for Key Stage 2 outcomes available are in terms of 5 levels of attainment with very few children obtaining the lowest levels 1 and 2. Thus the comparisons are effectively reduced to three categories, level 3 or below, and levels 4 and 5. This restricted range of measurement provides limited discrimination of pupils' performance, and limits the sensitivity of testing for the effects of potential predictors. The limited discrimination provided by Key stage 2 categories mean that the significant results reported here are likely to provide conservative estimates of the effects of previous experience and characteristics upon literacy and numeracy at age 11 (i.e., more differentiated measures of literacy and numeracy might have produced more and larger effects). The report considers not only attainment in English and mathematics at the end of Key Stage 2 but also progress in those subjects over the primary school years, and the effect of any variable is quoted after allowing for all other variables analysed.

Some variables influence attainment, while some influence both attainment and progress. Where attainment but not progress is affected this indicates that the significant effect for that variable has occurred prior to school entry and that during the time in primary school no further effect has occurred. Where both attainment and progress analyses reveal significant effects this indicates that the variable continues to exert an effect across the primary school years sufficient to boost performance beyond the level of otherwise similar children..

When the background variables are considered, consistently the same variables prove to be significant. Also effects can be found for both attainment and progress, and the effects are most apparent when considering the likelihood of attaining level 5 in Key Stage 2.

Child variables

For every month a child is older there is a relative increase of 13-14% in the odds of attaining level 5 in English or mathematics at Key Stage 2. Similar effects of age in year in England have been reported by Crawford, Dearden & Meghir (2007). A child's birth weight shows its effects in terms of attainment in English and mathematics. Low birth weight (<2500 grammes) children are 4-5 times less likely to attain level 5 in English or mathematics at KS2 than higher birth weight children. There is no effect on progress during primary school, suggesting that the effect on KS2 attainment is via effects on a child's attainment up to start of primary school. For English girls do better than boys in attainment and in progress over the primary school years, with girls being twice as likely as boys to attain level 5. However girls and boys perform similarly in mathematics. Where a child had a developmental problem early in life, the effects of this are still apparent in terms of decreased attainment and progress in Key Stage 2 English and mathematics, with a 4-5 fold lower likelihood of attaining level 5.

Parent Variables

Where the child has a lone parent attainment and progress in English is likely to be lower, and a child of a lone parent is 4 times less likely to attain level 5 than a similar child with dual parents. Also lower maternal education is associated with lower attainment and progress in English and mathematics. Where a mother has no qualifications her child is 12 times less likely, than a similar child of a mother with a degree, to attain level 5 in KS2 English, (6 times for mathematics). There is a similar but weaker effect for father's education upon attainment only. Similarly household socio-economic status is related to attainment in English and mathematics. For English and mathematics children where the household SES is unskilled, semi-skilled, or skilled (or unemployed for mathematics) do significantly less well in attainment. For mathematics the unskilled, semi-skilled, or skilled groups also do less well in

progress over the primary school years than the professional group. Children from the unskilled/semiskilled group are almost 8 times less likely for English, and 5 times less likely for mathematics, to attain level 5 than children from the professional group.

Home

The Home Learning Environment (HLE) is related to attainment in English and mathematics at Key Stage 2; the higher the HLE the better the child's attainment. The effects are stronger for English and the HLE is also related to progress over the primary school years in English. Children from a home in the highest 20% for HLE are over 5 times more likely for English, and almost 3 times more likely for mathematics, to attain level 5 than children from homes in the lowest 20% for HLE. These results strongly resemble those found in the EPPE study in England (Melhuish et al., 2008a).

Area

Where the child lives in an area of greater deprivation (measured by the child poverty index) they show lower levels of attainment in English and mathematics. For those in the most deprived 20% areas they are over 2.5 times for English, and over 3.5 times for mathematics, less likely to attain level 5 at KS2, than similar children in the 20% most advantaged areas. Similar area or neighbourhood effects have been reported for the USA (Chase-Lansdale et al., 1997) and for England (McCulloch & Joshi, 2001).

Pre-school

Only those pre-school effects that are significant after controlling for all background characteristics are discussed. The results do not indicate an overall pre-school effect for KS2 English but there is an overall pre-school effect for mathematics, with children who had been to pre-school being twice as likely to attain level 5 as no pre-school children. These overall effects appear to be absorbed by the child's ability at the start of school in that there is no overall pre-school effect upon progress in mathematics, when ability at the start of primary school is controlled.

When the analyses consider type of pre-school the effects upon attainment in English and mathematics are significant only for children who attended nursery/school class or playgroup. Again these effects appear to be absorbed by the child's ability at the start of school in that there is no remaining significant effect upon progress over the primary school years.

The results that consider pre-school centres in terms of their observed quality (ECERS-R scores) are very consistent. For attainment in English and mathematics those children who attended a high quality pre-school outperform the no pre-school group. Where progress is considered, high quality pre-school again is associated with improved progress for mathematics in that there is a significant advantage for the high quality pre-school group over the no pre-school group. This indicates that for children who attended high quality pre-school centres, that their mathematics learning in primary school is enhanced additionally in the primary school years, in addition to any benefit accrued up to the start of primary school. The high quality group is 2.4 times as likely to attain level 5 in English, and 3.4 times as likely to attain level 5 in mathematics, as the no pre-school group. While there are benefits of high quality pre-school that are apparent for both Key Stage 2 subjects, the benefits are distinctly stronger for mathematics, and that these effects also apply to progress in the primary school years. There are no significant benefits of attending low or medium quality pre-school in comparison with the no pre-school group.

The results reported here are consistent with the results at the end of the primary school reported in the EPPE study in England (Sammons et al., 2008a; Melhuish et al., 2008b). In the EPPE study similar effects were found for birth weight, gender, early developmental

problems, parent education and socio-economic status, and the home learning environment. The EPPE study also found that higher quality pre-school was associated with higher attainment in English and mathematics at the end of primary school.

The quality of nursery schools/classes and playgroups in Northern Ireland is more likely to be in the high quality category than for other types of pre-school in Northern Ireland (private day nurseries, reception classes and reception groups). A previous report on the observed quality of children's experiences in pre-school centres in the EPPNI study (Melhuish et al., 2002a) found that the quality of playgroups in Northern Ireland was previously found to be superior to that found in playgroups in England and this difference appeared to be related to the higher level of training of staff within playgroups in Northern Ireland (Melhuish et al., 2002a). Also staff in nursery schools/classes had higher qualifications and training than staff in other pre-school centres, which probably contributed to their higher quality scores. Thus the more frequent beneficial effects found to be associated with nursery schools/classes and playgroups is consistent with the findings for effects related to the quality of pre-school, in that 82% of the children in the high quality pre-school category had attended nursery schools/classes or playgroups.

The outcome variables in the analyses in this report were Key Stage 2 English and mathematics that were measured in 5 levels. The very low frequency of levels 1 and 2 meant that effectively outcomes were analysed in terms of 3 categories, levels 1-3, 4 and 5. This restricted range of measurement provides limited opportunity for potentially significant effects to emerge in analyses. It is possible that some potential predictors of academic attainment that were found to have non-significant effects here might be found to have significant effects with outcome measurements that had greater discrimination. The limited discrimination provided by Key stage 2 categories mean that the results reported here are conservative estimates of the effects of previous experience and characteristics upon literacy and numeracy at age 11.

To some extent the EPPNI findings are not new; for example the adverse impact of social disadvantage on children's development has been established wherever it has been studied. Other areas in which the EPPNI findings are supported elsewhere include:

1. Positive effects of pre-school education have been shown in the U.S., Sweden, Norway, Germany, Canada, England and New Zealand (Melhuish, 2004, Sylva et al., 2010).
2. Developmental benefits are associated with greater staff training/qualifications in the U.S. (Peisner-Feinberg et al., 2001) and in England (Sylva et al., 2010).
3. The contribution of quality to children's developmental progress has been shown in many studies, often using the ECERS observational scale (Melhuish, 2004; Sammons et al., 2008a).
4. The findings on disadvantage, as reflected in the effects associated with parental education and socio-economic status, are mirrored elsewhere (Feinstein, 2003; also see Melhuish, 2004) and are the basis of policy initiatives all over the world (Raffo et al., 2009).
5. EPPNI is one of few studies, EPPE in England (Melhuish et al., 2008b; Sylva et al., 2010) being another, to demonstrate that pre-school experience continues to affect children's development through to the end of primary school and possibly beyond.

British cohort studies with less control of background factors also indicate the benefit of pre-school education over none. Osborn and Milbank (1987) report on 8500 children born in 1970 and found that pre-school generally boosted cognitive attainment at ages 5 and 10. Also Goodman and Sianesi (2005) analysed data from a cohort born in 1958 and found that pre-school education led to improvements in cognitive scores, including mathematics and reading at age 7. Although these effects diminished in size, they remained significant up to age 16. In adulthood, pre-school experience was associated with an increased probability of obtaining qualifications, of being employed, and a 3-4% wage gain at 33.

Research in other parts of the world also supports the importance of pre-school education for children's later educational attainment. In the US the Early Childhood Longitudinal Study, a nationally representative sample of children who entered kindergarten in 1998, was used by Magnuson, Meyers, Ruhm and Waldfogel (2004), who found that pre-kindergarten (pre-school) increases mathematics and reading skills at kindergarten entry. Using the same sample Loeb et al., (2007) find that the gains are greatest if pre-school starts between 2 and 3 years of age as found by Sammons et al., (2002) in England. Other US research also finds benefits for children from pre-school education (Gormley, Phillips, & Gayer, 2008). Also Aboud (2006) found that pre-school boosted primary school achievement in Bangladesh, with similar results reported for ten countries by Montie, Xiang & Schweinhart (2006). Other recent research also compares children having pre-school experience versus none. Berlinski, Galiani & Manacorda (2007) used administrative data in research in Uruguay. A period of expansion of preschool in the 1990's allowed this study to compare a) siblings with and without preschool and b) regions that varied in speed of preschool expansion. Controlling for background characteristics, both comparisons indicated clear benefits of pre-school for school performance in primary and secondary school. Similarly Berlinski, Galiani & Gertler (2006) used the expansion of the preschool education in Argentina in the 1990's to establish that there was an association between changes in school performance and increases in pre-school education amongst regions of the country. Recent US evidence indicated that high quality pre-school may have influences upon academic attainment as late as age 15 (Vandell et al, 2010).

Such evidence has fuelled an increasing interest in the provision of pre-school education for all children as a means of advancing the school readiness and later attainment of children (Zigler, Gilliam and Jones, 2006), and it has been argued that the longer term benefits far outweigh the costs involved, particularly for disadvantaged groups (Heckman 2006). Some authors argue that pre-school experience is critical for children's future competence, coping skills, health, and success in the labour market, and consequently the social and economic health of the nation (e.g. McCain & Mustard, 1999).

Conclusions

In a technologically sophisticated world a population's educational attainment is likely to be increasingly important for a nation's economic development. This study shows the factors that can influence such attainment. The effects associated with various child and family background variables in this study are very similar to those frequently reported in other studies. In addition pre-school education is important. The EPPNI project has provided clear evidence of the benefits of pre-school education for children in Northern Ireland. A previous report (Melhuish et al., 2006) concluded that children in Northern Ireland benefit more from nursery school, nursery class or playgroup than from other types of pre-school provision. In this report the results clearly indicate that certain types of pre-school in Northern Ireland, nursery classes/schools and playgroups, have an influence upon academic attainment at the end of primary school and that these effects are linked to high quality pre-school experience for the children. The limited discrimination provided by Key stage 2 categories mean that the significant results reported here are likely to provide conservative estimates of the effects of previous experience and characteristics upon literacy and numeracy at age 11. There is a case for providing more finely discriminating measures of

Key Stage 2 attainment. With the majority of children scoring near to the top of the current rating scale there is little opportunity to distinguish between average and high attainment. With greater discrimination the effects of policy variation or other factors might be more easily distinguished.

The beneficial effects of high quality pre-school are seen more strongly for mathematics and can even produce greater progress in mathematics during the primary school years. This indicates that high quality pre-school can improve the capacity for numeracy learning in subsequent years. These results suggest that, for literacy, early patterns of language development are laid down in the pre-school years, and thereafter, that children continue on a trajectory of literacy development in accordance with the level of competence that they demonstrate at the end of pre-school, but, in numeracy, the formation of concepts, reasoning, spatial awareness etc. continues to develop well into the primary years; and providing children with good learning skills in pre-school has continuing benefits on their progress across the primary years?

With regard to policy implications, those types of pre-school provision that provide high quality experience for children, i.e., nursery classes, nursery schools and playgroups, should be expanded in their coverage of the population rather than other types of provision. Also further consideration should be given to ensuring that all children receive high quality pre-school provision as low quality provision is not associated with benefits for children.

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**APPENDIX A: ECERS-R Subscales and items
(Harms, Cryer & Clifford, 2004)**

Subscale	Item number	Item description
Space and Furnishings	1	Indoor space
	2	Furniture for routine care, play & learning
	3	Furnishings for relaxation and comfort
	4	Room arrangement for play
	5	Space for privacy
	6	Child-related display
	7	Space for gross motor play
	8	Gross motor equipment
Personal Care Routines	9	Greeting/departing
	10	Meals/snacks
	11	Nap/rest
	12	Toileting/ diapering
	13	Health practices
Language-reasoning	14	Books and pictures
	15	Encouraging children to communicate
	16	Using language to develop reasoning skills
	17	Informal use of language
Activities	18	Fine motor
	19	Art
	20	Music/movement
	21	Blocks
	22	Sand/water
	23	Dramatic play
	24	Nature/science
	25	Math/number
	26	Use of TV, video and/or computer
	27	Promoting acceptance of diversity
Interaction	28	Supervision of gross motor activities
	29	General supervision of children (other than gross motor)
	30	Discipline
	31	Staff-child interaction
	32	Interactions among children
Program Structure	33	Schedule
	34	Free play
	35	Group time
	36	Provision for children with disabilities
Parents and Staff	37	Provision for parents
	38	Provision for personal needs of staff
	39	Provision for professional needs of staff
	40	Staff interaction and cooperation
	41	Supervision and evaluation of staff
	42	Opportunities for professional growth

APPENDIX B: Multinomial Logistic Regression Results involving Quality of Pre-school

Table B.1: Results of Multinomial logistic regression for KS2 English attainment

KS2 English Probability of level 4 rather than level 3	B	Std. Error	Wald	df	Sig.	Odds Ratio	95% Confidence Interval	
							Lower	Upper
4.00 Intercept	-.246	2.602	.009	1	.925			
<i>CHILD</i>								
Age in year	.052	.031	2.784	1	.095	1.053	.991	1.120
<i>Birth weight</i>								
<2500 vs. 2500to3000 gram	-.394	.453	.757	1	.384	.674	.278	1.638
<2500 vs. 3000to3500 gram	-.655	.403	2.649	1	.104	.519	.236	1.143
<2500 vs. 3500to4000 gram	-.793	.423	3.516	1	.061	.452	.197	1.037
<2500 vs. 4000plus gram	-.966	.474	4.150	1	.042	.381	.150	.964
Girls vs. boys	.146	.21	.464	1	.496	1.157	.760	1.762
No prob. Vs Early Dev Prob.	1.687	.390	18.691	1	.000	5.402	2.514	11.604
<i>PARENT</i>								
Dual vs. lone parent	.254	.417	.369	1	.543	1.289	.569	2.920
<i>Mother's qualifications</i>								
Degree vs. no quals	1.451	.515	7.924	1	.005	4.266	1.554	11.713
Degree vs. age16 quals	1.061	.485	4.782	1	.029	2.889	1.116	7.477
Degree vs. age18 quals	.870	.506	2.960	1	.085	2.387	.886	6.431
<i>Father's qualifications</i>								
Degree vs. no quals	.207	.403	.264	1	.607	1.230	.558	2.712
Degree vs. age16 quals	.154	.412	.141	1	.708	.857	.382	1.921
Degree vs. age18 quals	.116	.450	.066	1	.797	.891	.369	2.151
<i>FAMILY SES</i>								
Prof. vs. Intermediate	.619	.549	1.274	1	.259	1.858	.634	5.445
Prof. vs. Skilled	.825	.551	2.240	1	.134	2.282	.775	6.721
Prof. vs. Semi or unskilled	.557	.596	.874	1	.350	1.746	.543	5.614
Prof. vs. Unemployed	1.052	.666	2.496	1	.114	2.862	.776	10.552
<i>Home Learning Environment</i>								
Lowest 20% vs. next 20%	-.448	.312	2.062	1	.151	.639	.347	1.177
Lowest 20% vs. middle 20%	-.151	.329	.212	1	.645	.859	.451	1.637
Lowest 20% vs. next to top 20%	-.405	.316	1.646	1	.199	.667	.359	1.238
Lowest 20% vs. top 20%	-.525	.343	2.342	1	.126	.591	.302	1.159
<i>AREA child poverty</i>								
Lowest 20% vs. next 20%	.111	.306	.131	1	.717	1.117	.614	2.034
Lowest 20% vs. middle 20%	-.676	.332	4.142	1	.042	.508	.265	.975
Lowest 20% vs. next to top 20%	-.360	.337	1.142	1	.285	.698	.361	1.350
Lowest 20% vs. top 20%	-.329	.396	.693	1	.405	.719	.331	1.562
<i>PRE-SCHOOL</i>								
No pre-school vs. Low Quality	-.404	.339	1.424	1	.233	.668	.344	1.296
No pre-school vs Medium Qual.	-.360	.283	1.611	1	.204	.698	.401	1.216
No pre-school vs High Quality	-.750	.349	4.602	1	.032	.473	.238	.937

KS2 English Probability of level 5 rather than level 3	B	Std. Error	Wald	df	Sig.	Odds Ratio	95% Confidence Interval	
							Lower	Upper
5.00 Intercept	-4.301	3.017	2.032	1	.154			
<i>CHILD</i>								
Age in year	.120	.037	10.718	1	.001	1.127	1.049	1.211
<i>Birth weight</i>								
<2500 vs. 2500to3000 gram	-.731	.562	1.693	1	.193	.482	.160	1.448
<2500 vs. 3000to3500 gram	-.809	.496	2.656	1	.103	.446	.168	1.178
<2500 vs. 3500to4000 gram	-1.541	.507	9.242	1	.002	.214	.079	.578
<2500 vs. 4000plus gram	-1.438	.566	6.456	1	.011	.237	.078	.720
Girls vs. boys	.662	.251	6.982	1	.008	1.940	1.187	3.170
No prob. Vs Early Dev Prob.	1.429	.443	10.390	1	.001	4.176	1.751	9.959
<i>PARENT</i>								
Dual vs. lone parent	1.386	.491	7.978	1	.005	4.000	1.529	10.468
<i>Mother's qualifications</i>								
Degree vs. no quals	2.482	.569	19.056	1	.000	11.966	3.926	36.471
Degree vs. age16 quals	1.717	.499	11.848	1	.001	5.566	2.094	14.795
Degree vs. age18 quals	1.339	.518	6.674	1	.010	3.816	1.382	10.543
<i>Father's qualifications</i>								
Degree vs. no quals	1.108	.445	6.207	1	.013	3.028	1.267	7.239
Degree vs. age16 quals	.456	.436	1.091	1	.296	1.577	.671	3.708
Degree vs. age18 quals	.541	.482	1.262	1	.261	1.718	.668	4.416
<i>FAMILY SES</i>								
Prof. vs. Intermediate	1.098	.557	3.885	1	.050	2.999	1.006	8.936
Prof. vs. Skilled	1.554	.569	7.475	1	.006	4.732	1.553	14.421
Prof. vs. Semi or unskilled	2.043	.681	8.985	1	.003	7.711	2.028	29.319
Prof. vs. Unemployed	1.606	.791	4.122	1	.042	4.981	1.057	23.471
<i>Home Learning Environment</i>								
Lowest 20% vs. next 20%	-1.109	.404	7.551	1	.006	.330	.149	.728
Lowest 20% vs. middle 20%	-.677	.425	2.542	1	.111	.508	.221	1.168
Lowest 20% vs. next to top 20%	-1.191	.399	8.912	1	.003	.304	.139	.664
Lowest 20% vs. top 20%	-1.713	.418	16.815	1	.000	.180	.080	.409
<i>AREA child poverty</i>								
Lowest 20% vs. next 20%	.120	.379	.100	1	.752	1.127	.536	2.369
Lowest 20% vs. middle 20%	-.359	.411	.763	1	.382	.698	.312	1.563
Lowest 20% vs. next to top 20%	-.357	.409	.763	1	.382	.699	.314	1.560
Lowest 20% vs. top 20%	-.971	.444	4.777	1	.029	.379	.159	.905
<i>PRE-SCHOOL</i>								
No pre-school vs. Low Quality	-.241	.411	.344	1	.557	.786	.351	1.758
No pre-school vs. Medium Qual.	-.217	.359	.363	1	.547	.805	.398	1.629
No pre-school vs. High Quality	-.878	.426	4.245	1	.039	.416	.180	.958

Table B.2: Results of Multinomial logistic regression for KS2 mathematics attainment

KS2 mathematics Probability of level 4 rather than level 3	B	Std. Error	Wald	df	Sig.	Odds ratio	95% Confidence Interval	
							Lower	Upper
4.00 Intercept	1.192	2.734	.190	1	.663			
<i>CHILD</i>								
Age in year	.052	.034	2.353	1	.125	1.053	.986	1.125
<i>Birth weight</i>								
<2500 vs. 2500to3000 gram	-.309	.475	.423	1	.516	.734	.290	1.863
<2500 vs. 3000to3500 gram	-.445	.423	1.106	1	.293	.641	.280	1.468
<2500 vs. 3500to4000 gram	-.636	.445	2.042	1	.153	.529	.221	1.267
<2500 vs. 4000plus gram	-.668	.499	1.787	1	.181	.513	.193	1.365
Girls vs. boys	.125	.232	.291	1	.590	1.133	.720	1.785
No prob. Vs Early Dev Prob.	1.534	.422	13.206	1	.000	4.639	2.028	10.613
<i>PARENT</i>								
Dual vs. lone parent	.088	.454	.038	1	.846	1.092	.449	2.660
<i>Mother's qualifications</i>								
Degree vs. no quals	.797	.525	2.305	1	.129	2.219	.793	6.207
Degree vs. age16 quals	.313	.495	.399	1	.528	1.367	.518	3.607
Degree vs. age18 quals	.484	.515	.884	1	.347	1.623	.591	4.455
<i>Father's qualifications</i>								
Degree vs. no quals	.378	.438	.744	1	.388	1.460	.618	3.447
Degree vs. age16 quals	-.100	.449	.050	1	.823	.904	.375	2.182
Degree vs. age18 quals	-.226	.493	.209	1	.647	.798	.304	2.097
<i>FAMILY SES</i>								
Prof. vs. Intermediate	.419	.573	.535	1	.465	1.521	.494	4.678
Prof. vs. Skilled	.911	.574	2.516	1	.113	2.486	.807	7.659
Prof. vs. Semi or unskilled	.640	.622	1.057	1	.304	1.896	.560	6.416
Prof. vs. Unemployed	.724	.693	1.090	1	.297	2.062	.530	8.026
<i>Home Learning Environment</i>								
Lowest 20% vs. next 20%	-.759	.342	4.914	1	.027	.468	.239	.916
Lowest 20% vs. middle 20%	-.571	.367	2.418	1	.120	.565	.275	1.160
Lowest 20% vs. next to top 20%	-.241	.339	.507	1	.476	.786	.405	1.526
Lowest 20% vs. top 20%	-.453	.368	1.518	1	.218	.636	.309	1.307
<i>AREA child poverty</i>								
Lowest 20% vs. next 20%	.209	.332	.398	1	.528	1.233	.644	2.361
Lowest 20% vs. middle 20%	-.746	.361	4.267	1	.039	.474	.233	.962
Lowest 20% vs. next to top 20%	-.135	.349	.150	1	.699	.874	.441	1.731
Lowest 20% vs. top 20%	-.656	.449	2.141	1	.143	.519	.215	1.250
<i>PRE-SCHOOL</i>								
No pre-school vs. Low Quality	-.213	.357	.357	1	.550	.808	.401	1.627
No pre-school vs Medium Qual.	-.326	.303	1.156	1	.282	.722	.399	1.307
No pre-school vs High Quality	-.903	.381	5.620	1	.018	.405	.192	.855

KS2 mathematics Probability of level 5 rather than level 3	B	Std. Error	Wald	df	Sig.	Odds ratio	95% Confidence Interval	
							Lower	Upper
5.00 Intercept	-.376	2.803	.018	1	.893			
<i>CHILD</i>								
Age in year	.132	.035	14.455	1	.000	1.142	1.066	1.222
<i>Birth weight</i>								
<2500 vs. 2500to3000 gram	-.729	.519	1.973	1	.160	.482	.174	1.334
<2500 vs. 3000to3500 gram	-1.210	.456	7.028	1	.008	.298	.122	.730
<2500 vs. 3500to4000 gram	-1.648	.472	12.189	1	.000	.192	.076	.485
<2500 vs. 4000plus gram	-1.493	.526	8.051	1	.005	.225	.080	.630
Girls vs. boys	-.047	.237	.040	1	.841	.954	.600	1.516
No prob. Vs Early Dev Prob.	1.672	.409	16.737	1	.000	5.325	2.390	11.866
<i>PARENT</i>								
Dual vs. lone parent	.896	.459	3.810	1	.051	2.449	.996	6.022
<i>Mother's qualifications</i>								
Degree vs. no quals	1.759	.518	11.539	1	.001	5.807	2.105	16.023
Degree vs. age16 quals	1.098	.477	5.292	1	.021	2.997	1.176	7.636
Degree vs. age18 quals	.941	.492	3.653	1	.056	2.563	.976	6.728
<i>Father's qualifications</i>								
Degree vs. no quals	1.122	.432	6.739	1	.009	3.070	1.316	7.162
Degree vs. age16 quals	.437	.438	.994	1	.319	1.548	.656	3.655
Degree vs. age18 quals	.539	.485	1.237	1	.266	1.714	.663	4.432
<i>FAMILY SES</i>								
Prof. vs. Intermediate	.737	.556	1.754	1	.185	2.089	.702	6.215
Prof. vs. Skilled	1.289	.561	5.283	1	.022	3.629	1.209	10.894
Prof. vs. Semi or unskilled	1.610	.630	6.534	1	.011	5.000	1.456	17.178
Prof. vs. Unemployed	1.498	.734	4.160	1	.041	4.471	1.060	18.855
<i>Home Learning Environment</i>								
Lowest 20% vs. next 20%	-.773	.363	4.541	1	.033	.462	.227	.940
Lowest 20% vs. middle 20%	-.483	.388	1.550	1	.213	.617	.289	1.319
Lowest 20% vs. next to top 20%	-.640	.348	3.388	1	.066	.527	.267	1.042
Lowest 20% vs. top 20%	-1.071	.372	8.304	1	.004	.343	.165	.710
<i>AREA child poverty</i>								
Lowest 20% vs. next 20%	-.226	.341	.438	1	.508	.798	.409	1.558
Lowest 20% vs. middle 20%	-.946	.379	6.218	1	.013	.388	.185	.817
Lowest 20% vs. next to top 20%	-.278	.369	.567	1	.452	.758	.368	1.561
Lowest 20% vs. top 20%	-1.296	.451	8.247	1	.004	.274	.113	.663
<i>PRE-SCHOOL</i>								
No pre-school vs. Low Quality	-.399	.373	1.141	1	.285	.671	.323	1.395
No pre-school vs Medium Qual.	-.559	.323	3.003	1	.083	.572	.304	1.076
No pre-school vs High Quality	-1.221	.402	9.198	1	.002	.295	.134	.649



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