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Pre-school experience and cognitive development at the start of primary school

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Abstract

This longitudinal study assesses the attainment and development of children followed between the ages of 3 and 7 years. Over 700 children were recruited to the study during 1998 and 1999 from 80 pre-school centres. Both qualitative and quantitative methods (including multilevel modelling) are used to explore the effects of pre-school experience on children's cognitive attainment and social/behavioural development at entry to school and any continuing effects on such outcomes up to 7 years of age. In addition to the effects of preschool experience, the study investigates the contribution to children's development of individual and family characteristics such as gender, family size, parental education and employment. This overview describes the research design and discusses a variety of research issues (methodological and practical) in investigating the impact of pre-school provision on children's developmental progress. A parallel study is being carried out in England (EPPE).

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Pre-school Experience and Cognitive Development at the Start of Primary School.

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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 1. Over 700 children were recruited to the study during 1998 and 1999 from 80 pre-school centres in Northern Ireland. Both qualitative and quantitative methods are used to explore the effects of pre-school experience on children's cognitive attainment and social/behavioural development at entry to school and any continuing effects on such outcomes up to 8 years of age. In addition to the effects of pre-school experience, the study investigates the contribution to children's development of individual and family characteristics such as gender, family size, parental education and employment. This overview describes the research design and discusses a variety of research issues (methodological and practical) 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 British 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 elsewhere on the effects of different kinds of pre-school environment on children's development (Melhuish et al. 1990; Melhuish 1993; Sylva & Wiltshire 1993; Schweinhart & Weikart 1997; Borge & Melhuish, 1995; National Institute of Child Health Development 1997) suggests positive outcomes. 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 but birth cohort designs may not be appropriate for the study of the influence of pre-school education. The absence of data on children's attainments at entry to pre-school means that neither the British Cohort Study (1970) nor the National Child Development Study (1958) can be used to explore the effects of pre-school education on children's progress. These studies are also limited by the time lapse and many changes in the nature of pre-school provision that have occurred. To date no research using multilevel models (Goldstein 1987) has been used to investigate the impact of both type of provision and individual centre effects. Thus little research in the UK has explored whether some forms of provision have greater benefits than others.

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). A series of reports (House of Commons Select Committee 1989; DES Rumbold Report 1990; Ball 1994) have questioned whether Britain's pre-school education is as effective as it might be and have urged better co-ordination of services and research into the impact of different forms of provision (Siraj-Blatchford 1995). The EPPNI and EPPE projects are thus the first large-scale studies in the UK on the effects of different kinds of pre-school provision relating experience in particular centres and type of centre to child development.

Overview of Research Methods

The EPPNI and EPPE projects investigate three issues that have important 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 and family characteristics and the kind of pre-school provision a child experiences.

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 individual pre-school centres on children's outcomes at entry to school, through to age 8.

The 8 aims of the EPPNI Project

- To produce a detailed description of the 'career paths' of a large sample of children and their families between entry into pre-school education and the first four years of primary school.
- 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 separate out the effects of pre-school experience from the effects of education in the primary school period years 1, 2, 3 and 4.
- 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 first years of primary school (up to Key Stage 1; 8 years of age).
- to discover the individual characteristics (structural and process) of pre-school education in centres 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 medium-term effects of pre-school education on educational performance at age 8 in a way which will allow the possibility of longitudinal follow-up at later ages to establish long-term effects, if any.
- to relate the use of pre-school provision to parental labour market participation.

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 and schools, playgroups, private day nurseries, reception classes and reception groups. Thus examples of all major types of pre-school centre in Northern Ireland were included in the study.

Over 700 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. All parents gave written permission for their children to participate. In order to examine the impact of no pre-school provision, an additional sample of

150 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 is being followed over five years until the end of Key Stage 1 of primary school. 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. Two complicating factors are that a substantial proportion of children have moved from one form of pre-school provision to another (e.g. from playgroup to nursery class) and some will attend more than one centre in a week. Careful records are necessary in order to examine issues of stability and continuity, and to document the range of pre-school experiences to which individual children can be exposed.

Child assessments

Child Measures at 3+ years

Around the third birthday, or up to a year later if the child entered pre-school provision after three, each child was assessed by a researcher on four subscales of the British Ability Scales, BASII (Elliott et al 1996). These tasks were; verbal comprehension, naming vocabulary, picture similarities, and block building. The Adaptive Social Behaviour Inventory (ASBI) (Hogan et al 1992), which provides a profile of the child's social and behavioural adjustment, was completed by the member of the pre-school staff who knew the child best. If the child changed pre-school before school entry, he or she was assessed again.

Child Measures at start of P1

At school entry, a trained researcher administered a similar battery of cognitive assessments. These included pattern construction, verbal comprehension, naming vocabulary, picture similarities, and early number concepts. Knowledge of the alphabet, rhyme and alliteration (literacy measures) were also administered. These literacy measures were then computed to give an overall measure of pre-reading ability. The Year 1 teacher completed the Child Social Behaviour Questionnaire (CSBQ), which was an extended version of the ASBI and provided a social/behavioural profile.

Child Measures at the End of P1

Children were again assessed individually at the end of their first year of primary school. The measures included early number concepts, BAS word reading, Marie Clay dictation and literacy measures. A CSBQ social/behavioural profile was again completed by the primary 1 teacher.

Child Measures at the End of P2

Further assessments are made at the end of Year 2. In addition to NFER-NELSON standardised assessments of reading and mathematics, information on school progress, attendance and special needs is collected. Goodman's Social Behaviour Inventory is completed by the P2 teacher as a measure of the child's social behaviour.

Child Measures at the End of P3

At age 7, children are invited to report themselves on their attitudes to school. The Goodman's Social Behaviour Inventory is again completed by the P3 teacher.

Child Measures at the End of Key Stage 1

The end of Key Stage 1 results will be collected directly from the school that each child attends.

Measuring child/family characteristics known to have an impact on children's development

Parental interview

Shortly after the initial assessments of cognitive and social/behavioural development had been completed, 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 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 fifteen 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.

Information on individual 'child factors' such as gender, language and birth order was collected.

Family factors were also investigated. 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) have been collected and analysed.

Pre-school Characteristics and Processes

Regional 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 Early Childhood Environment Rating Scale (ECERS), which has been recently adapted (Harms, Clifford & Cryer 1998), and the Caregiver Interaction Scale (Arnett 1989) were also administered. The ECERS includes the following sub-scales:

- Space and furnishings
- Personal care routines
- Language reasoning
- Activities
- Interaction
- Programme structure
- Parents and staffing

In addition four additional ECERS sub-scales (ECERS-E) (Sylva et al 1998), describing educational provision in terms of: Language, Mathematics, Science and the Environment, and Diversity were also used in each pre-school centre.

The full list of variables analysed is shown on pages 14 and 15.

Case Studies

In addition to the quantitative data collected about children, their families and their pre-school centres, detailed qualitative data will be collected using case studies. The case studies were chosen retrospectively on the basis of the analyses of ECERS-R, ECERS-E and Inspection Report. This will add the fine-grained detail to how processes within centres articulate, establish and maintain good practice. There are case studies of three pre-school centres in EPPNI and these will be detailed in a separate report.

The methodology of the EPPNI project is thus mixed. These detailed case studies will use a variety of methods of data gathering, including documentary analysis, interviews and observations and the results will help to illuminate the characteristics of more successful pre-school centres and assist in generating guidance on good practice. Particular attention will be paid to parent involvement, teaching and learning processes, child-adult interaction and social factors in learning. Inevitably there are difficulties associated with the retrospective study of process characteristics of centres and it will be important to examine field notes and pre-school centre histories to establish the extent of change during the study period.

Analytic Strategy

The EPPNI research was designed to enable the linking of three sets of data: information about children's attainment and development (at different points in time), information about children's personal, social and family characteristics (e.g. age, gender, SES etc), and information about pre-school experience (type of centre and its characteristics).

Longitudinal research is essential to enable the impact of child characteristics (personal, social and family) to be disentangled from any influence related to the characteristics of pre-school centre attended. Given the disparate nature of children's pre-school experience it is vital to ensure that the influences of age at assessment, amount and length of pre-school experience and pre-school attendance record are accounted for when estimating the effects of pre-school education. This information is also important in its own right to provide a detailed description of the range of pre-school provision experienced by different children and any differences in the patterns of provision used by specific groups of children/parents and their relationship to parents' labour market participation. Predictor variables for attainment at entry to primary school will include prior attainment (verbal and non-verbal sub scales), social/emotional profiles, and child characteristics (personal, social and family).

The extent to which it is possible to explain (statistically) the variation in children's scores on the various measures assessed at entry to primary school will provide evidence about whether particular forms of pre-school provision have greater benefits in promoting development by the end of the pre-school period. Analyses will test out the impact of measures of pre-school process characteristics, such as the scores on various ECERS scales and pre-school centre structural characteristics such as ratios. This will provide evidence as to which measures are associated with better cognitive and social/behavioural outcomes in children.

Identifying continuing effects of pre-school centres until the end of Key Stage 1

In the EPPNI research it is planned to explore the possible mid-term effects of pre-school provision on later progress and attainment in primary school until the end of Key Stage 1. Children's educational experiences are complex and that over time different institutions may influence cognitive and social/behavioural development for better or worse. This study will allow the relative strength of any continuing effects of pre-school attendance to be ascertained, in comparison with the primary school influence.

The Linked Study in England 1997-2003

The Effective Provision of Pre-school Education (EPPE) project is a linked project and is under the directorship of Professor Kathy Sylva, Professor Edward Melhuish, Professor Pam Sammons, and Professor Iram Siraj-Blatchford. The study explores 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 age 7 years. It will help to identify the 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 involves 141 pre-school centres randomly selected throughout 5 regions of England. The study investigates all main types of pre-school provision attended by 3 to 4 year olds in England: Playgroups, Private Day Nurseries, Nursery Classes, Nursery Schools, Local Authority Nurseries and Combined Centres. The data from England and Northern Ireland offer opportunities for potentially useful comparisons.

Summary

The EPPNI project studies the complicated effects of amount and type of pre-school provision experienced by children and their personal, social and family characteristics on subsequent progress and development. Assessment of both cognitive and social/behavioural outcomes are made. The relationships between pre-school characteristics and children's development can be explored. The results of these analyses and the findings from the qualitative case studies of selected centres can inform both policy and practice. Comparisons with the English study (EPPE) can further illuminate the interpretation of results.

Executive Summary

837 children were assessed on cognitive development at the start of their first year in primary school. 685 of these children had been followed during their time in 80 pre-school centres throughout Northern Ireland. 152 were children from the same primary schools who had not attended a pre-school centre. The families of all, except 7, children were interviewed. This report presents the analysis of the children's cognitive development in terms of a range of background and pre-school factors. The main results are presented below for the different kinds of factors that show associations with aspects of children's cognitive development, after allowing for all other background factors.

Child

- Gender had a significant effect upon one cognitive variable, pre-reading, where girls do better than boys.
- Unsurprisingly, age affects all variables with older children doing better.
- Children with lower birth weights do significantly worse on attainment for all aspects of cognitive development except pre-reading. There are no effects for progress across the pre-school period and this implies that the effects of birth weight are absorbed in the measures taken at the start of the study.
- Children who had developmental problems in the first three years had lower levels of cognitive ability on all of the sub-scales except non-verbal. Verbal skills were also lower for children with previous behavioural problems. These factors did not affect progress over the pre-school period so their effects seem to have been absorbed by the start of the study.

Parent and Socio-Economic Factors

- Where children live in areas of higher deprivation, as measured by the child poverty index, they score less well on verbal skills, early number concepts and general cognitive skills.
- The socio-economic status of the family has significant effects upon attainment in verbal, non-verbal and general cognitive skills. The effects persist for non-verbal skills in terms of progress over the pre-school period.
- Mothers' qualifications influence all cognitive variables for attainment and also progress in all cognitive variables, except early number concepts, over the pre-school period.
- Fathers' qualifications influence all cognitive variables, except non-verbal skills, for both attainment and progress over the pre-school period.

Family and Home Factors

- Where children lived in larger families with more than three siblings, they showed lower attainment in early number concepts.
- The home learning environment had consistently strong effects on attainment on all cognitive abilities. This variable also affected progress on pre-reading.

Pre-School Factors

- The home versus pre-school comparison had effects on attainment for the verbal, non-verbal and general cognitive skills subscales, with children who had attended these pre-school centres attaining higher scores on these subscales in comparison to Home children.
 - **Nursery schools** showed significant effects for the subscales Verbal, Non-verbal and General Cognitive Skills in comparison to Home children.
 - **Playgroups** showed effects for verbal skills.
 - **Private day Nurseries** showed effects for the Verbal and Non-verbal subscales.
 - **Reception groups** showed effects for non-verbal and General Cognitive Skills.
- The type of pre-school attended by a child had effects for progress on verbal, non-verbal and general cognitive skills over the pre-school period.

Nursery classes/schools showed a significant effect for verbal skills with children who had attended nursery classes/schools showing more progress in comparison to children who had attended reception classes.

Playgroups and Private Day Nurseries had significant effects for non-verbal and general cognitive progress with children who had attended these settings showing less progress in comparison to children who had attended reception classes.

- There were some effects for aspects of quality of pre-school as measured by the Early Childhood Environment Rating Scales (ECERS-R and ECERS-E). Children attending centres with higher total ECERS-R/language scores showed progress over the pre-school period for non-verbal skills. There was also an effect on progress for early number concepts for the maths subscale of ECERS-E.
- The composition of the pre-school group that a child attended was found to be consistently related to all aspects of cognitive development. In particular where a child was part of a group where the other children in the group were rated as more cooperative, then the child had higher levels of development at the start of primary school. This effect may be partly due to the pre-school staff finding it easier to instruct children when there is a high level of co-operation, and partly to peer group effects whereby children learn developmentally advantageous behaviour from their peers, as greater co-operation is associated with enhanced development more generally.

Summary Table for attainment and progress models

	Compositional variables	ECERS-E maths	ECERS-R language	ECERS-R Adult facilities	ECERS-R space	Time in target centre	ELB area	Pre-school type (progress)	Pre-school/home Comparison	Rules about bedtime	Home Learning Environment	No. of siblings	Developmental event	Father's qualifications	Mother's qualifications	Socio Economic Status	Child deprivation index	Previous beh. problems	Previous dev. problems	Birth weight	Gender	Age
Attainment Pre-school/home																						
Verbal skills									✓		✓			✓	✓	✓	✓	✓	✓	✓		✓
Non-verbal skills									✓		✓		✓		✓	✓				✓		✓
Number concepts											✓			✓	✓		✓		✓	✓		✓
Pre-reading											✓			✓	✓				✓	✓	✓	✓
Cognitive skills									✓		✓			✓	✓	✓	✓	✓	✓	✓		✓
Progress up to start of P1																						
Verbal skills								✓						✓	✓							✓
Non-verbal skills								✓							✓	✓				✓		✓
Number concepts																						✓
Pre-reading											✓			✓	✓							✓
Cognitive skills								✓						✓	✓							✓

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 eight years (Key Stage I), 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 on child and family characteristics and social/behavioural and cognitive development at the start of the study can be used to investigate social/behavioural and cognitive development at 3–4 years in relation to a range of parental, family, child, home and childcare factors. This analysis has been done and is reported in EPPNI Technical Paper 2, (Melhuish et al., 2001).

This paper considers the cognitive development of children at the start of primary school, and the progress across the pre-school period, in relation to the range of variables available in the EPPNI study that measure characteristics of the children, their parents, their family, their home and childcare history. The possible effects of a wide range of variables reflecting child characteristics, family background and pre-school experience upon children's development are explored.

The 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 study involved 685 children recruited from 80 pre-school centres, including 189 children from nursery classes, 157 children from playgroups, 118 children from private day nurseries and 221 children from reception groups/classes. These 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. For 7 families, parents were unavailable for interview. In addition 152 children with no pre-school experience, and for whom all parental interviews were available, were recruited to the study at the start of primary school. Hence this paper is based on the analysis of data for 678 children with pre-school experience and 152 children with no pre-school experience.

Method of Data Collection

Distribution of Children Across Pre-school Settings

Area	Nursery class/school	Playgroup	PDN	Reception class/group	Home	Total
Belfast	34	32	28	38	11	143
West	33	30	14	44	43	164
North-east	34	30	41	39	30	174
South-east	37	26	22	49	22	156
South	51	39	13	51	46	200
Total	189	157	118	221	152	837

Parental interview

Shortly after the initial assessments of cognitive and social/behavioural development had been completed, 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 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 fifteen 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.

Child assessments

Around the child's third birthday, or up to a year later if the child entered pre-school provision after three, each child was assessed by a researcher on four subscales of the British Ability Scales, BASII (Elliott et al 1996). These tasks were; verbal comprehension, naming vocabulary, picture similarities, and block building. The Adaptive Social Behaviour Inventory (ASBI) (Hogan et al 1992), which provides a profile of the child's social/behavioural development, was completed by the member of the pre-school staff who knew the child best. If the child changed pre-school before school entry, he or she was assessed again.

At school entry, a trained researcher administered a similar battery of cognitive assessments. These included pattern construction, verbal comprehension, naming vocabulary, picture similarities, and early number concepts. Knowledge of the alphabet, rhyme and alliteration (literacy measures) were also administered. These literacy measures were then computed to give an overall measure of pre-reading ability. The Year 1 teacher completed the Child Social Behaviour Questionnaire (CSBQ), which was an extended version of the ASBI and provided a social/behavioural profile of the child.

Data Collection on Pre-school Centre Characteristics

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.

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. The Early Childhood Environment Rating Scale (ECERS-R) that has been recently adapted (Harms, Clifford & Cryer 1998) was administered.

The ECERS-R includes the following sub-scales:

- Space and furnishings
- Personal care routines
- Language reasoning
- Activities
- Interaction
- Programme structure
- Parents and staffing

In addition four sub-scales (ECERS-E) (Sylva et al 1998) describing educational provision and based on Desirable Learning Outcomes were used:

- Language

- Mathematics
- Science and the Environment
- Diversity

The Caregiver Interaction Scale (CIS) (Arnett 1989) was administered at the same time and this provided measures of caregiver-child interaction in terms of positive relations, punitiveness, permissiveness and detachment.

Analysis of results

The analyses presented in this report consider the children's cognitive development in two ways; attainment up to the start of primary school, and progress over the pre-school period.

Attainment: these analyses answer the question 'What affects the child's level of development at the start of primary school?'

In analysing attainment, the child, socio-economic (area & parent), parent, family, home childcare, and pre-school characteristics affecting the child's level of attainment at the start of primary school are considered. The child's earlier attainment is not taken into account. Attainment analyses can be done that include a comparison between the home and pre-school groups.

Progress over the pre-school period: These analyses answer the question 'What affects the progress the child makes over the pre-school period?'

In analysing progress, all possible predictor variables used in attainment are analysed, but, in addition, the child's age-adjusted level of functioning at the start of the study is taken into account.

There are consequences of this strategy for progress models.

1. The child's level of functioning at the start of the study will absorb the effects of several child, parent, family and home factors, where their effects do not also affect progress over the pre-school period.
2. Where children are not showing high levels of attainment in relation to their age at the start of the study, there is more scope for progress for such children. Hence such children may show bigger progress effects, without necessarily showing high attainment at the start of primary school.
3. Progress analyses can only be done for the children in the pre-school groups as the data on development at the start of the study is only available for these children. The home group of children entered the study at the start of primary school.

The predictor variables considered in these analyses are listed in full below

Parental characteristics

Socio-economic status
Mother's level of employment
Father's level of employment
Mother's qualifications
Father's qualifications
Mother's age
Father's age
Age mother left education
Age father left education
Marital status

Family characteristics

Lone parent
Number of siblings
Birth position
Life events

Child characteristics

Age
Gender
Birth weight
Perinatal health difficulties
Previous developmental problems
Previous behaviour problems
Previous health problems

Home characteristics

Home learning environment
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
Time in target centre before entering the study

Pre-school experience variables

Type of pre-school
Adult/Child Ratio
Number of sessions
Duration of time spent in pre-school

Area

Education and Library Boards

ECERS-R

ECERS-R total score
ECERS-R sub-scales scores;
Space and furnishings
Personal care routines
Language reasoning
Activities
Interaction
Programme structure
Parents and staff facilities

ECERS-E

ECERS-E total score
ECERS-E sub-scales scores;
Maths
Literacy
Science/environment
Diversity

Caregiver Interaction Scales (CIS) sub-scales

Positive Relations
Punitiveness
Permissiveness
Detachment

Index of Area Deprivation

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, and showed the largest correlations with child outcomes.

Compositional variables

Within each pre-school centre the study has a representative sample of children recruited within the setting up phase of the project. Hence an average of the children's scores on a characteristic, leaving out the target child's score, gives a measure of the rest of the pre-school group's composition in terms of that characteristic. Such a composition variable is a useful way to incorporate analysis of peer group effects during the pre-school period. Composition variables were computed for:

Child cognitive ability
Child co-operation
Child peer sociability
Child confidence
Child anti-social behaviour
Child worried behaviour
Mother's education

Attainment at the end of pre-school (beginning P1)

Verbal Skills

The stages of the analysis for attainment in verbal skills are shown in detail, illustrating each stage of the analysis with a table of significant results. This shows how the process of analysis proceeds for each dependent variable. Subsequent analyses for child outcomes are presented more briefly only showing the detail for the initial and final stages of the analysis.

Verbal skills are measured by combining the child's scores on verbal comprehension and picture naming subtests of the BASII (Elliott et al 1996). At the beginning of the analyses the effect of child characteristics were considered.

The Child's level in Verbal Attainment at the start of primary school was analysed in terms of the effects of the following child variables:

- Gender
- Age at assessment
- Birth weight
- Perinatal Problems
- Health problems in the first 3 years
- Developmental problems in the first 3 years
- Behaviour problems in the first 3 years

The statistically significant variables ($p < .05$) were kept in the analysis and the non-significant variables were dropped. The chosen significance level (conventional cut-off point) of $p < 0.05$ means that there is a less than 5% chance that the observed result is due to chance. The model was then used to test whether there was any significant difference between the home children and the pre-school groups of children in the study. The first stage results, where only child characteristics and pre-school type are included in the analysis, are shown in table 1.

Table 1: Verbal Attainment: Individual Child CharacteristicsR²=0.12Adjusted R²=0.10

F (11,817) p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.24	.000
Birth weight	.09	.004
<i>Developmental problems compared with none</i>		
Low problems	.04	ns
High problems	-.07	.041
<i>Behavioural problems compared with none</i>		
Low problems	-.04	ns
High problems	-.11	.001
Pre-school centres attended by child (in comparison to home children)		
Nursery classes/schools	.19	.000
Playgroups	.19	.000
Private Day Nurseries	.24	.000
Reception classes	.07	ns
Reception Groups	.09	.027

The analysis of the results for verbal skills shows significant effects for age, birth weight, developmental problems, behavioural problems and the home versus pre-school type comparison. Older children and heavier birth weight children scored significantly better in verbal skills. Also results show children exhibiting high developmental and behavioural problems scored less well when compared with children with no developmental or behavioural problems.

There is a significant difference between the home and most pre-school groups of children with children who attended Nursery Classes, Playgroups, Private Day Nurseries and Reception Groups showing higher levels of verbal attainment at the start of primary school after allowing for the children's characteristics compared with home children. Children who attended Reception Classes showed equivalent attainment to Home Children.

However this difference could be due to parent, family and home differences between the two groups. Hence to test this possibility, further variables reflecting parent, family and home characteristics were added progressively to the analysis to see if the difference between home and pre-school groups persisted. The next step in this process was to include the effects of socio-economic variables. This was done in two ways, (1) by including a measure of the level of deprivation in the area in which the child was living. The variable chosen as most appropriate was the child poverty index for the child's ward, and (2) by including variables reflecting the socio-economic status of the family. The results are shown in Table 2

Table 2: Verbal Attainment: Child and Socio-economic factorsR²=0.19Adjusted R²=0.17

F (18,803) p< .0001

	Standardised Beta	Significance
Child variables		
Age	.25	.000
Birth weight	.07	.026
<i>Developmental problems compared with none</i>		
Low problems	.03	ns
High problems	-.07	.042
<i>Behavioural problems compared with none</i>		
Low problems	-.04	ns
High problems	-.08	.015
Pre-school centres attended by child (in comparison to home children)		
Nursery classes/schools	.16	.000
Playgroups	.18	.000
Private Day Nurseries	.16	.000
Reception classes	.07	ns
Reception Groups	.07	ns
Socio-economic characteristics		
Deprivation/ child poverty index	-.13	.000
<i>SES compared with professional</i>		
Intermediate	-.10	.050
Skilled non-manual	-.14	.003
Skilled manual	-.16	.000
Semi-skilled	-.16	.000
Unskilled	-.15	.000
Unemployed	-.15	.000

This table shows that in addition to the previously mentioned child characteristics there are strong effects for socio-economic factors with the child poverty index and socio-economic status of family showing separate significant effects. The children of professional parents achieved higher verbal scores at the start of P1 than children in any other social strata. Also children who are rated highly on the child poverty index (ie children from more socially deprived areas) attained lower scores in verbal skills.

These results also show that, although reduced, the difference between home and pre-school groups persists when individual child characteristics and socio-economic factors are taken into account. Children from Nursery Classes/Schools, Playgroups and Private Day Nurseries all attained better scores in Verbal Skills than Home Children at the start of P1. Children who had attended Reception Groups or Classes attained similar scores to those of Home Children.

The next step was to include variables reflecting mother and fathers' levels of education in addition to socio-economic status. This analysis is shown in table 3

Table 3: Verbal Attainment: Child, SES and Parental FactorsR²=0.22Adjusted R²=0.19

F (29,792)=7.82 p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.24	.000
Birth weight	.08	.015
<i>Developmental problems compared to none</i>		
Low problems	.03	ns
High problems	-.07	.020
<i>Behavioural problems compared to none</i>		
Low problems	-.05	ns
High problems	-.07	.024
Pre-school centres attended by child (in comparison to home children)		
Nursery classes/schools	.14	.001
Playgroups	.15	.000
Private Day Nurseries	.10	.022
Reception classes	.06	ns
Reception Groups	.06	ns
Socio-economic factors		
Deprivation/Child poverty Index	-.10	.006
<i>SES compared with professional</i>		
Intermediate	-.05	ns
Skilled non-manual	-.07	ns
Skilled manual	-.07	ns
Semi-skilled	-.11	.014
Unskilled	-.10	.009
Unemployed	-.11	.012
Parents		
<i>Mothers' quals in comparison to none</i>		
16 vocational	.02	ns
16 academic	.01	ns
18 vocational	.04	ns
18 academic	.10	.014
Degree or above	.16	.002
<i>Fathers' quals in comparison with none</i>		
16 vocational	.05	ns
16 academic	.12	.003
18 vocational	.06	ns
18 academic	.05	ns
Degree or above	.13	.006
Father not resident	.08	.044

The results indicate that the difference between home and pre-school groups still persists although further reduced, after allowing for child characteristics, socio-economic status, mothers' education and fathers' education. The children of mothers and fathers with an 18 academic or degree/above qualification attained higher scores in verbal skills than children whose parents have no qualifications. Once again children from a semi-skilled, unskilled and unemployed background attained lower scores than children from a professional background. However children from an intermediate, skilled non-manual or skilled manual background scored equivalently to children from

the professional groups in verbal skills at the start of P1. This shows that some of the socio-economic factors were absorbed by the parent variables.

Besides socio-economic status and parental education, other home related factors may affect children's attainment, and these factors may differ between home and pre-school groups and lead to the difference between home and pre-school groups in verbal attainment. Earlier work in the project (Melhuish, Quinn, Sylva, Sammons, Siraj-Blatchford, Taggart, McSherry & McCrory 2001), had indicated the powerful contribution that learning activities in the home can make to developmental progress. Other family-related factors may also be associated with developmental progress. Possibly home and pre-school groups differ in these home and family-related characteristics and this may account for the persisting difference in verbal attainment. To test this possibility the variable previously computed to reflect differences in home characteristics such as the Home Learning Environment (HLE), and family variables, such as number of siblings were added to the analysis. The significant results of this subsequent analysis can be seen in Table 4.

Table 4: Verbal skills attainment: Final ModelR²=0.23Adjusted R²=0.20

F (30,790)=7.88 p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.25	.000
Birth weight	.07	.023
<i>Developmental problems compared to none</i>		
Low problems	.03	ns
High problems	-.07	.024
<i>Behavioural problems compared to none</i>		
Low problems	-.05	ns
High problems	-.07	.028
Pre-school centres attended by child (<i>in comparison to home children</i>)		
Nursery classes/schools	.13	.003
Playgroups	.14	.001
Private Day Nurseries	.10	.021
Reception classes	.04	ns
Reception Groups	.05	ns
Socio-economic factors		
Deprivation/Child poverty Index	-.10	.006
<i>SES compared with professional</i>		
Intermediate	-.04	ns
Skilled non-manual	-.06	ns
Skilled manual	-.06	ns
Semi-skilled	-.09	.033
Unskilled	-.10	.012
Unemployed	-.09	.029
Parents		
<i>Mother's quals in comparison to none</i>		
16 vocational	.02	ns
16 academic	.01	ns
18 vocational	.03	ns
18 academic	.09	.031
Degree or above	.14	.006
<i>Father's quals in comparison with none</i>		
16 vocational	.06	ns
16 academic	.11	.006
18 vocational	.06	ns
18 academic	.04	ns
Degree or above	.12	.008
Father not resident	.07	ns
Home		
Home Learning Environment	.10	.004

These results show the impact of the home learning environment upon verbal attainment at the start of primary school. The difference between home and pre-school groups is now less than at the beginning of these analyses but it is still a statistically significant difference. This means that the home group of children were doing less well on verbal skills than some of the pre-school groups after socio-economic status, parental education and home learning environment were considered.

Children in Nursery Class, Playgroup and Private Day Nursery all attained higher scores in verbal in comparison to home children at the start of P1, while children from Reception Classes or Groups scored equivalently to the Home Children.

Results also showed that children from a home rated as having a rich learning environment attained higher scores in verbal skills.

The analysis was continued to further test for the effects of adding the following variables to the analysis:

- Lone parent status
- Father's employment
- Mother's employment
- Amount of time in non-parental relative care
- Amount of time in non-parental individual care
- Amount of time in-group care
- Occurrence of events with potential developmental significance (e.g. Divorce, bereavement)
- Other aspects of home activities (e.g. Rules about TV, and bedtime)
- Amount of peer play in and out of home

These additional variables reflecting family background characteristics that might further influence the child's verbal skills did not produce any further significant differences to the results. The pattern of results shown in this series of regression analyses showed that the home group do less well in verbal attainment than children who attended Nursery Class/School, Playgroup and Private Day Nursery, even after allowing for a wide range of parent, family, home and area characteristics. However, it is also apparent that the relative size of this difference (reflected in the Standardised Beta statistic) is reduced as each set of variables reflecting these background differences is added to the analysis. This reduction in size of effect reflects the differences between the home group and the pre-school group in these background characteristics.

Progress analyses for Verbal skills

Progress on verbal skills refers to the child's score on verbal skills having allowed for the child's level of cognitive ability at the start of the study. In the first stage of analysis, progress was examined as a function of the following individual child characteristics:

- Gender
- Age at assessment
- Perinatal problems
- Health problems before start of study
- Developmental problems before start of study
- Behavioural problems before start of study
- Cognitive ability (age-adjusted) at start of study

Note: The child's age-adjusted cognitive ability at the start of the study is included because a pre-school progress model is being analysed.

After retaining the significant individual child variables, the variables for type of pre-school were also added to the analysis. The results can be seen in table 5.

Table 5: Verbal Progress: Individual child FactorsR²=0.39Adjusted R²=0.39

F (6,672)=73.26 p< .0001

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at Start of study	.58	.000
Child Variables		
Age	.25	.000
Pre-school type compared with Reception Classes		
Nursery Classes/schools	.09	.033
Playgroups	.14	.001
Private Day Nurseries	.12	.004
Reception Groups	.02	ns

In this analysis, the child's cognitive ability at the start of the study, age at assessment and type of pre-school are the significant predictor variables retained in the regression model. There were a greater number of child variables included as significant predictors in the attainment model previously described, however the effects of several variables are encapsulated in their effects upon the cognitive ability scores at the start of the study. Therefore when this variable is included in the progress analysis, the variation in cognitive ability scores absorb the effect of existing variations in a range of other variables and hence they no longer show significant effects upon progress.

When considering the effect of type of pre-school this analysis shows that there are significant differences and that children from nursery classes/schools, playgroups and private day nurseries all show more progress than children in reception classes, and that children from reception groups are not significantly different from those in reception classes.

The analysis of progress so far does not allow for socio-economic, parent, family or home characteristics that might explain these differences associated with type of pre-school. Hence in the next analyses the variables reflecting the following list were included as predictors of progress.

List of predictor variables analysed

Area level of deprivation -child poverty mean
 Socio-economic status of family
 Mother's education
 Father's education
 Mother's level of employment
 Father's level of employment
 Lone parent
 Number of siblings
 Home learning environment
 Rules about bedtime
 Rules about TV
 Play with friends at home
 Play with friends elsewhere
 Total relative care before entering the study
 Total individual care before entering the study
 Total group care before entering the study
 Time in target centre before entering the study
 Adult: child ratio in the target centre
 Duration of the child's stay in the target centre

Child attend the target centre full-time or part-time
 ECERS-R totals and sub-scales
 ECERS-E totals and sub-scales
 Compositional variables
 CIS sub-scales

The final results, retaining significant predictor variables are shown in table 6.

Table 6: Progress analysis for verbal skills: final model

$R^2=0.45$

Adjusted $R^2=0.43$

$F(24,601)=20.53$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive Ability at Start of study	.56	.000
Child Variables		
Age	.22	.000
Pre-school type compared with Reception Class		
Nursery Class/School	.02	ns
Playgroup	.11	.009
Private Day Nursery	.02	ns
Reception Group	.03	ns
Parents		
<i>Fathers' quals in comparison with none</i>		
16 vocational	.09	.006
16 academic	.09	.031
18 vocational	.05	ns
18 academic	.07	ns
Degree or above	.15	.001
Father not resident	.03	ns
<i>Mothers' quals in comparison with none</i>		
16 vocational	.01	ns
16 academic	.01	ns
18 vocational	.02	ns
18 academic	.10	.010
Degree or above	.05	ns
ELB area in comparison to Southern		
Belfast	-.00	ns
Western	-.03	ns
North Eastern	.00	ns
South Eastern	-.11	.003
Pre-school characteristics		
Time in target centre before start of study	.11	.003
ECERS-R sub-scales		
ECERS-R Space	.08	.044
Compositional variables		
Co-operation/conformity	.08	.011

This analysis shows that the effects of type of pre-school have been considerably reduced when the contribution of a full range of relevant variables is considered. The only remaining effect for type of pre-school is that children from playgroups show more progress in verbal skills across the pre-

school period than children in reception classes. Children from other types of pre-school show no significant differences from children in reception classes once other relevant variables are taken into account.

The other significant variables include both mother and fathers' education, the Education and Library Board area, and some aspects of pre-school experience; the time spent in the pre-school centre before the start of the study, the ECERS-R subscale score for space and furnishings, and the overall co-operation/conformity score of other children in the same pre-school group.

Considering ELB areas, children from the South Eastern pre-schools show less progress than children from the Southern pre-schools, while children from other ELB areas seem equivalent with the Southern pre-schools. This result persists despite allowing for a wide range of child, area, socio-economic, parent, family and home characteristics. There appear to be as yet unexplained differences for pre-school experiences between Education and Library Board areas.

Considering pre-school variables, a wide range was tested for their effect upon pre-school progress.

These variables included:

The time in the target pre-school centre before the study started

The ECERS-R and ECERS-E total and subscale scores

Adult: child ratio

And several compositional variables reflecting the average score for other children in the pre-school group in terms of:

Co-operation and compliance

Peer sociability

Confidence

Independence

Anti-social behaviour

Worried behaviour

Pre-school cognitive ability

And Mother's education

Children who had spent more time in the target centre before the start of the study showed more progress in verbal attainment across the pre-school period. Children in the pre-school centres scoring more highly on the ECERS-R subscale space and furnishings, reflecting better physical resources, showed more progress in verbal skills. Children in centres where the other children were rated as more co-operative also showed more verbal skills progress.

Beginning of P.1 Non-verbal

Non-verbal Skills Attainment

Children's non-verbal skills at the beginning of primary school were considered in terms of the child characteristic variables. A model was produced and used to test whether there was any significant difference between the home and pre-school children after allowing for child characteristics. The results of this analysis are shown on table 7.

Table 7: Non-Verbal Attainment: Individual Child Variables

$R^2=0.19$

Adjusted $R^2=0.18$

$F(7,821)=27.08$ $p < .0001$

	Standardised Beta	Significance
Child Variables		
Age	.35	.000
Birth weight	.13	.000
Pre-school centres attended by child <i>(in comparison to home children)</i>		
Nursery Classes/schools	.16	.000
Playgroups	.02	ns
Private Day Nurseries	.06	ns
Reception Classes	.13	.002
Reception Groups	.13	.000

Significant effects for age, birth weight and the home versus pre-school type distinction, on non-verbal attainment were found. Older children and children with high birth weights attained higher scores on non-verbal skills at the start of P1. The results also indicated that children who attended Nursery Classes/Schools, Reception Classes and Reception Groups all showed significantly better attainment than Home children in non-verbal skills at the start of P1. Children from Playgroups and Private day Nurseries achieved equivalent scores to Home Children.

However this difference could be accounted for by the other predictor variables reflecting socio-economic, parent or family characteristics previously listed. Therefore to test this possibility all the other variables were added in to the analysis to see if any difference between home and pre school children remained.

The results are shown in table 8.

Table 8: Non-verbal attainment for home versus pre-school – final modelR²=0.29Adjusted R²=0.27

F (20,807)=16.47 p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.35	.000
Birth weight	.10	.001
Pre-school centres attended by child (<i>in comparison to home children</i>)		
Nursery classes/schools	.08	.047
Playgroups	-.05	ns
Private Day Nurseries	-.08	.050
Reception classes	.08	ns
Reception Groups	.09	.014
Socio-economic factors		
<i>SES in comparison with professional</i>		
Intermediate	-.02	ns
Skilled Non-manual	-.09	ns
Skilled manual	-.11	.009
Semi-skilled	-.07	ns
Unskilled	-.08	.019
Unemployed	-.06	ns
Parents		
<i>Mothers' quals compared with none</i>		
16 vocational	.05	ns
16 academic	.16	.000
18 vocational	.11	.004
18 academic	.16	.000
Degree and above	.23	.000
Home		
Home Learning Environment	.14	.000
Developmental Event	.08	.008

This model shows that as well as the child variables, socio-economic factors also have strong effects, with children from both skilled manual and unskilled family backgrounds scoring significantly worse than those children from professional backgrounds on non-verbal attainment at the start of P.1. The other significant variables included mothers' qualifications, home learning environment and developmental event.

Those children whose mothers achieved qualifications of 16 academic and above attained higher scores than those children whose mothers have no qualifications.

The Home Learning Environment had a powerful effect. The better the score on the HLE index the higher the attainment on non-verbal skills at the start of P1.

The results show that there was a significant difference between home and some pre-school children when all the other predictor variables are taken into account, with children from Nursery Classes, Private Day Nurseries and Reception Groups attaining higher scores in non-verbal skills when compared with Home Children at the start of P1. Children from Playgroups and Reception Classes score equivalently to Home Children.

Non-Verbal Skills

Analysis for progress on non-verbal skills at start of Primary 1

In this first stage of the analysis, progress was looked at in terms of individual child characteristics. The significant child variables were kept and the variables for type of pre-school added into the model, as shown in table 9.

Table 9: Non-Verbal Progress: Individual Child Variables

$R^2=0.38$

Adjusted $R^2=0.38$

$F(7,671)=59.70$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of study	.45	.000
Child Variables		
Gender	-.07	.031
Age	.34	.000
Type of pre-school in comparison with Reception Classes		
Nursery school/class	-.03	ns
Playgroup	-.13	.001
Private Day Nurseries	-.14	.001
Reception Groups	.02	ns

In this analysis, the child's cognitive ability at the start of the study, age at assessment, gender and type of pre-school are significant predictor variables.

When the individual characteristics were initially added into the model, many previously significant variables no longer showed these significant effects because they were accounted for by the cognitive ability at the start of the study.

In relation to pre-school type those children who attended playgroups and private day nurseries both showed less progress on non-verbal skills than children in reception classes. Children from nursery schools and reception groups showed no significant difference from those children in reception classes.

However once again the analysis for progress so far doesn't allow for the many other predictor variables. Hence each set of variables was progressively entered into the regression model with only the statistically significant variables being retained. The final model is shown in table 10.

Table 10: Non-Verbal Progress: Final ModelR²=0.44Adjusted R²=0.42

F (23,614)=20.67 p< .0001

	Standardised Beta	Significance
Pre-school Cognitive outcome		
Cognitive ability at start of study	.38	.000
Child Variables		
Age	.35	.000
Type of pre-school in comparison with Reception Class		
Nursery School/class	-.07	ns
Playgroup	-.18	.000
Private Day Nurseries	-.15	.002
Reception Groups	-.01	ns
Socio-economic factors		
<i>SES compared with professional</i>		
Intermediate	.01	ns
Skilled non-manual	-.04	ns
Skilled manual	-.04	ns
Semi-skilled	-.03	ns
Unskilled	-.05	ns
Unemployed/student	-.09	.012
Parents		
Mothers' quals in comparison with none		
16 vocational	.02	ns
16 academic	.11	.013
18 vocational	.07	ns
18 academic	.14	.001
Degree or above	.10	.034
ELB area in comparison with Southern		
Belfast	.03	ns
Western	-.14	.000
<i>North Eastern</i>	-.06	ns
South Eastern	-.09	.023
ECERS sub-scales		
ECERS-R/Language	.09	.021
Compositional variables		
<i>Child co-operation/ conformity</i>	.11	.001

These analyses indicate that when the full range of variables is introduced the type of pre-school attended shows significant effects. Children from playgroups and private day nurseries show significantly less progress in comparison to children from reception classes.

The table also shows that in addition to the individual child characteristics there are strong effects from family characteristic variables with the mothers' qualifications and socio-economic factors both showing separate significant effects.

Those children whose mothers' achieved 16 academic, 18 academic or degree/postgraduate all showed greater progress than those children of mothers with no qualifications. In relation to socio-

economic status, those children whose parents are unemployed showed much less advancement in non-verbal skills at the beginning of P.1.

The other significant variables include Education and Library Board area, ECERS-R subscale score for language, and the overall co-operation /conformity of other children within the pre-school.

Regarding the ELB area variables, children from the Western and South Eastern showed significantly less progress than children from Southern ELB pre-school centres.

Those children from pre-schools who scored higher on ECERS-R language tended to show more progress on non-verbal skills.

Also children who attended pre-schools where the overall average co-operation was higher tended to show more progress on non-verbal skills up to the start of P.1

Early Number Concepts (Numeracy) Attainment: Home versus Pre-school

The following regression analyses the attainment of pre-school and home children. A range of child characteristics was entered into the regression at this stage as possible predictor variables and the significant variables were retained.

Table 11: Number Concepts Attainment: Individual Child Factors

$R^2=0.13$

Adjusted $R^2=0.12$

$F(8,827)=15.05$ $p < .0001$

	Standardised Beta	Significance
Child Variables		
Age	.31	.000
<i>Developmental problems compared with none</i>		
Low problems	.01	ns
High problems	-.09	.007
Pre-school centres attended by child <i>(in comparison to home children)</i>		
Nursery classes/schools	.09	.047
Playgroups	.04	ns
Private Day Nurseries	.19	.000
Reception classes	.08	ns
Reception Groups	.09	.017

This analysis, considers a range of individual child characteristics and the home versus pre-school groups distinction. Age, developmental problems and the home versus pre-school groups distinction all have significant effects on children's early number concept attainment.

Older children scored higher than younger children and children with a high level of developmental problems before the study scored lower in comparison to children with no developmental problems. A high level of developmental problems is defined here as parental concerns about the child's development during the first three years as being serious enough to require professional help.

Children who had attended Nursery Classes, Private day Nurseries and Reception Groups tended to score higher than those children who had no pre-school experience (home children). However, the difference shown between pre-school and home children at this stage could be due to other variables such as home, family, area or socio-economic factors. To test for this possibility the other predictor variables were progressively added into the analysis.

Table 12: Early Number Attainment: Final ModelR²=0.25Adjusted R²=0.23

F (20,800)=12.80 p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.33	.000
Birth weight	.09	.003
<i>Developmental problems compared to none</i>		
Low problems	-.01	ns
High problems	-.08	.007
<i>Socio-economic factors</i>		
Deprivation/child poverty index	-.13	.001
Parents		
Mothers' quals in comparison with none		
16 vocational	.01	ns
16 academic	.02	ns
18 vocational	.03	ns
18 academic	.05	ns
Degree or above	.19	.000
Fathers' quals in comparison with none		
16 vocational	.04	ns
16 academic	.06	ns
18 vocational	.05	ns
18 academic	.06	ns
Degree or above	.11	.008
Father not resident	.03	ns
Home		
Home Learning Environment	.11	.001
<i>No. of siblings in comparison to none</i>		
1 sibling	-.07	ns
2 siblings	.00	ns
3+ siblings	-.10	.021

When all other relevant variables were entered into the regression birth weight, parent's qualifications, child poverty index, home learning environment (HLE) and number of siblings were all seen to significantly affect children's early number concept attainment.

Age and developmental problems still have significant effects and children with heavier birth weights score significantly higher than children with lighter birth weights. Children with mothers who had gained a degree or above qualification scored higher in comparison to children whose mothers had no qualifications. This trend was also true in relation to fathers' qualifications.

Children living in areas of greater deprivation (higher child poverty index) tended to score lower on early number concepts while children who had been rated higher on the HLE index also tended to score higher on early number concepts. Family size also had a significant effect on early number concept attainment with children who had three or more siblings scoring lower in comparison to children who had no siblings.

At this stage of the analysis there is no significant difference between the attainment of home and pre-school children regarding early number concepts. This indicates that the previously found

differences in these groups have been accounted for by the additional background factors available for this analysis.

Progress of Early Number Concepts Over Pre-School Period

Table 13: Early Number Progress: Individual Child Characteristics

$R^2=0.39$

Adjusted $R^2=0.39$

$F(6,672)=72.18$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of study	.53	.000
Child Variables		
Age	.31	.000

In the context of this paper, progress across the pre-school period refers to the child's ability at the end of pre-school (start of P1) having allowed for the child's ability at the start of the study. Hence, progress on early number concept attainment refers to the child's score on early number concept attainment, allowing for the child's level of cognitive ability at the start of the study. In the first stage progress was examined as a function of individual child characteristics, with age-adjusted cognitive ability at the start of P1 and age retained as the significant predictor variables. At this stage there is no significant difference made in the amount of progress made by children according to the type of pre-school they had attended.

Table 14: Progress for Early Number Concepts: Final modelR²=0.47Adjusted R²=0.46

F (16,609)=33.63 p< .0001

	Standardised Beta	Significance
Pre-school Cognitive outcome		
Cognitive ability at start of study	.48	.000
Child Variables		
Age	.33	.000
Parents		
<i>Fathers' quals in comparison to none</i>		
16 vocational	.02	ns
16 academic	.00	ns
18 vocational	.04	ns
18 academic	.07	.042
Degree and above	.13	.001
Not resident	.05	ns
ELB area in comparison with Southern		
Belfast	-.17	.000
Western	-.21	.000
North Eastern	-.16	.000
South-Eastern	-.20	.000
Pre-school processes		
Time in centre	.10	.002
ECERS sub-scales		
ECERS-E/Maths	.09	.005
Compositional variables		
Mothers' quals	.08	.029
Co-operation/conformity	.10	.001

When all variables were added into the regression, age and cognitive ability at start of study were still retained as significant predictor variables.

Fathers' qualifications were also significant with children whose fathers had gained an academic qualification at age 18 years or had attained a degree or above qualification showing more progress than children whose fathers had no qualifications.

While there was no significant difference in the levels of progress shown by children according to pre-school type, several pre-school processes were significant predictor variables of progress on early number concept attainment. Children who had spent more time in their pre-school centre before the start of the study showed more progress as did children who had attended pre-school centres which had scored higher on the ECERS/maths subscale.

The composition of the pre-school group was also significant. Children who had attended pre-school centres where the average level of mothers' qualifications for the rest of the group was higher tended to show more progress. This was also true for children who had attended pre-school centres where the average co-operation score for the rest of the group was higher. Children who attended pre-schools in all other Education and Library Boards showed significantly less progress in early number concepts than children attending pre-schools in the Southern Education and Library Board.

Attainment on General Cognitive Ability

The General Cognitive Ability (GCA) score is the summation of the BAS (II) verbal, non-verbal and early number concepts.

Table 15: General Cognitive Ability Attainment: Individual Child Factors

$R^2=0.19$

Adjusted $R^2=0.18$

$F(7,821)=27.23$ $p < .0001$

	Standardised Beta	Significance
Child Variables		
Age	.37	.000
Birth weight	.14	.000
Pre-school centres attended by child <i>(in comparison to home children)</i>		
Nursery classes/schools	.18	.000
Playgroups	.08	.047
Private Day Nurseries	.16	.000
Reception classes	.11	.006
Reception Groups	.13	.001

At the beginning of the analysis, when the effect of child characteristics were considered, general cognitive ability showed significant effects for age, birth weight and the home versus pre-school group distinction with children who had attended all types of pre-school obtaining higher scores than the home group. Older children and children of higher birth weights attained more on general cognitive ability.

However, this difference could still be due to parent, family, home or area differences between the two groups. To test this possibility, additional variables were progressively added to the analyses.

Table 16: General Cognitive Ability: Final model

R²=0.34

Adjusted R²=0.31

F (28,792)=14.29 p< .0001

	Standardised Beta	Significance
Child Variables		
Age	.38	.000
Birth weight in grams	.11	.000
<i>Developmental problems compared with none</i>		
Low problems	.01	ns
High problems	-.07	.026
Pre-school centres attended by child (<i>in comparison to home children</i>)		
Nursery classes/schools	.10	.013
Playgroups	.01	ns
Private Day Nurseries	-.01	ns
Reception classes	.08	ns
Reception Groups	.08	.022
Socio-economic factors		
Deprivation/child poverty index	-.09	.005
<i>SES in comparison with professional</i>		
Intermediate	-.02	ns
Skilled non manual	-.06	ns
Skilled manual	-.07	ns
<i>Semi-skilled</i>	-.06	ns
<i>Unskilled</i>	-.08	.023
<i>Unemployed/ student</i>	-.05	ns
Parents		
Mothers quals in comparison with none		
16 vocational	.04	ns
16 academic	.10	.020
18 vocational	.08	.042
18 academic	.13	.000
Degree or above	.22	.000
Fathers quals In comparison with none		
16 vocational	.04	ns
16 academic	.06	ns
18 vocational	.03	ns
18 academic	.05	ns
Degree or above	.11	.012
<i>Father not resident</i>	.04	ns
Home		
Home Learning Environment	.14	.000

The above table represents the final regression model containing only the significant variables after all variables have been entered into the regression. At this stage, developmental problems have a significant effect with children who had previous high levels of developmental problems scoring lower in comparison to children with no previous developmental problems.

Parental qualifications also affect children’s scores with children whose mothers had gained 16 academic or above scoring higher in comparison with children whose mothers had no qualifications.

Children whose fathers had a degree or above also scored higher than children whose fathers had no qualifications. The Home Learning Environment showed powerful effects, with children from homes rated as having rich learning environments attaining higher scores in general cognitive ability.

After allowing for the full range of variables in the analyses the difference between the home and pre-school groups is still significant although somewhat reduced. Children who had attended Nursery Classes/Schools and Reception Groups achieved significantly higher scores on general cognitive ability than Home Children. Children from Playgroups, Private Day Nurseries or Reception Classes achieved equivalent Score to Home children in general cognitive ability at the start of P1.

Again this would indicate that the previously found differences for children from Playgroups, Private Day Nurseries and Reception Classes has been accounted for by the differences of the two groups in the range of background characteristics considered.

Table 17: Progress in General Cognitive Ability: Individual Child Factors

$R^2=0.54$

Adjusted $R^2=0.53$

$F(7,671)=110.27$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of Study	.61	.000
Child Variables		
Age	.38	.000
Gender	-.05	.050

Children who had scored higher on their age-adjusted pre-school cognitive ability at the start of the study also scored higher on general cognitive ability at the beginning of primary 1.

Older children scored higher than younger children and girls scored higher than boys.

After allowing for individual child characteristics there was no significant difference between the amount of progress made by children attending different types of pre-school. However, this does not allow for other relevant variables. The final model containing all significant variables is shown in the next table.

Table 18: Progress in General Cognitive Ability: Final ModelR²=0.60Adjusted R²=0.58

F (23,614)=39.90 p< .0001

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of Study	.54	.000
Child variables		
Age	.38	.000
Pre-school type in comparison with Reception classes		
Nursery Class	-.05	ns
Playgroup	-.10	.007
Private Day Nursery	-.10	.011
Reception Group	-.00	ns
Parents		
<i>Fathers quals in comparison to none</i>		
16 vocational	.04	ns
16 academic	.03	ns
18 vocational	.01	ns
18 academic	.07	.019
Degree and above	.12	.001
Father not resident	.02	ns
<i>Mothers quals in comparison with none</i>		
16 vocational	.02	ns
16 academic	.06	ns
18 vocational	.05	ns
18 academic	.12	.000
Degree or above	.10	.018
ELB area in comparison with South		
Belfast	-.07	.041
Western	-.12	.000
North Eastern	-.10	.002
South Eastern	-.16	.000
Compositional variables		
Child cognitive	.06	.048
Co-operation/conformity	.09	.001

When all relevant variables were entered into the regression, gender differences were no longer significant. Only statistically significant variables were retained in the final regression model shown in table 18.

Parental qualifications showed significant effects on children's overall cognitive scores. Children whose fathers gained qualifications 18 academic and degree or above scored higher than children whose fathers had no qualifications. The trend was similar for mothers' qualifications. Children attending pre-school in the Southern Education and Library Board appeared to make significantly more progress than children whose pre-school centre was in the other Education and Library Boards.

Children who had attended pre-school centres where the average cognitive ability score for the rest of the group was high, tended to score more highly on the general cognitive ability. The trend was similar for children that had attended pre-school centres where the average cooperation score for the rest of the group was high.

When family, area and compositional variables were entered into the analysis significant differences between the pre-school types became apparent with children from playgroups and private day nurseries making less progress than children from reception classes. Reception Group and Nursery School/Class children appeared to be equivalent to children in Reception Classes in terms of progress made on overall cognitive scores at the start of P1.

Pre-reading Attainment

Table 19: Pre-reading Attainment: Individual Child Factors

R²=0.08

Adjusted R²=0.07

F (9,826)=8.27 p< .0001

	Standardised Beta	Significance
Child Variables		
Gender	-.10	.002
Age	.24	.000
<i>Developmental problems compared with none</i>		
Low problems	-.02	ns
High problems	-.08	.017
Pre-school centres attended by child (<i>in comparison to home children</i>)		
Nursery classes/schools	.13	.003
Playgroups	.06	ns
Private Day Nurseries	.17	.000
Reception classes	.02	ns
Reception Groups	.07	ns

A similar set of analyses was used for the sub-scale pre-reading which is a composite of rhyme, alliteration and alphabet scores. As indicated in table 19, after allowing for gender, age at assessment, and previous developmental problems, there is a significant difference between home and pre-school groups. Children who attended Nursery Classes/Schools and Private Day Nurseries tended to score higher on pre-reading than the home group at the start of P1.

Generally older children and girls score higher on pre-reading at the start of primary school. Children with high levels of developmental problems during the first 3 years do significantly worse in comparison with children with no history of developmental problems.

As previously stated however, the difference related to pre-school experience could be due to other home, family, parent or area effects. To test this possibility a separate analysis was carried out for each stage with the final model retaining only statistically significant variables. The results can be seen in table 20.

Table 20: Pre-reading Attainment: Final ModelR²=0.26Adjusted R²=0.24

F (16,811)=16.62 p< .0001

	Standardised Beta	Significance
Child Variables		
Gender	-.08	.007
Age	.22	.000
Developmental problems compared with none		
Low problems	-.02	ns
High problems	-.09	.004
Parents		
Mothers quals in comparison with none		
16 Vocational	.04	ns
16 Academic	.10	.026
18 Vocational	.08	.044
18 Academic	.14	.000
Degree and above	.27	.000
Fathers quals in comparison with none		
16 Vocational	.08	.011
16 Academic	.13	.001
18 Vocational	.07	.035
18 Academic	.04	ns
Degree and above	.18	.000
Not Resident	.03	ns
Home		
HLE	.22	.000

As shown in the above table, after allowing for individual child characteristics, parental education, Home Learning Environment and Education and Library Board the home versus pre-school distinction disappears. This indicates that any differences between children with pre-school experience and the home children groups are accounted for in this set of variables.

There is a general tendency for children of mothers with 16-academic and above qualifications to score higher on pre-reading compared with children whose mothers had no qualifications.

There appears to be no difference in the scores of children whose fathers obtained an 18-academic qualification, had no qualifications or who were not resident. Children from all other groups scored significantly higher than children whose fathers had no qualifications.

A persistent finding is that the higher the score on the Home Learning Environment index, the higher the child's score on the outcome measurement. The results here show that age and Home Learning Environment are the strongest predictors of a child's score on pre-reading at the beginning of primary 1.

Pre-reading Progress

Table 21: Pre-reading Progress: Individual Child Characteristics

$R^2=0.28$

Adjusted $R^2=0.08$

$F(3,675)=87.78$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of study	.49	.000
Child Variables		
Gender	.18	.000
Age	-.09	.007

To see if progress on pre-reading differed for children from different types of pre-school, progress was analysed as a function of individual child characteristics. As indicated in table 21, after allowing for the range of child variables, there was no difference in the progress of children from different types of pre-school.

The full range of variables was considered in subsequent analyses. Only statistically significant predictors were retained in the final regression model. The results are shown in table 22.

Pre-reading Progress

Table 22: Pre-reading Progress: Final Model

$R^2=0.40$

Adjusted $R^2=0.37$

$F(22,609)=18.09$ $p < .0001$

	Standardised Beta	Significance
Pre-school cognitive outcome		
Cognitive ability at start of study	.34	.000
Child Variables		
Age	.24	.000
Parents		
<i>Mothers quals in comparison with none</i>		
16 Vocational	-.00	ns
16 Academic	.01	ns
18 Vocational	.02	ns
18 Academic	.10	.012
Degree and above	.12	.025
<i>Fathers quals in comparison with none</i>		
16 Vocational	.09	.006
16 Academic	.06	ns
18 Vocational	.05	ns
18 Academic	.03	ns
Degree and above	.15	.001
Not Resident	.05	ns
ELB area in comparison with South		
Belfast	-.10	.010
Western	-.14	.000
North Eastern	-.09	.035
South Eastern	-.09	.024
Home		
HLE	.21	.000
Regular Bedtime	-.07	.036
Compositional variables		
Mother's qualification	.10	.001
Child confidence	-.10	.018
Child co-operation/conformity	.08	.043

The inclusion of age-adjusted cognitive ability scores at the start of the study absorbs the effects of existing variation in a range of other variables, which no longer show significant effects.

Age and HLE are again powerful predictors of pre-reading progress at the beginning of primary 1.

A child from a home that assigns a regular bedtime for the child tends to make more progress on pre-reading.

Parental qualifications obtained are again statistically significant.

A persistent effect is related to the Education and Library Board where the pre-school centre is situated. Children from Belfast Education and Library Board, Western Education and Library Board, North Eastern Education and Library Board and South Eastern Education and Library Board appear to make less progress than children from the Southern Education and Library Board. This, as previously stated, is an, as yet, unexplained difference.

Considering the child's peer group, children tended to score higher on pre-reading if they attended pre-school with a group of children whose mothers had obtained higher qualifications. The higher the peer group level of co-operation in pre-school, the better the child did on pre-reading in primary 1. However, if the peer group scored higher on confidence, the child's pre-reading score in primary 1 tended to be depressed. These compositional effects were independent.

The analyses appear to indicate that progress across the pre-school period does not differ for children from different types of pre-school settings.

Summary

One of the questions addressed in this report is whether the children without pre-school centre experience (home group) differ in cognitive development at the start of primary school from children with pre-school centre experience (pre-school groups). Initially children with no pre-school experience are compared to children who had attended different types of pre-school centre allowing initially for individual child characteristics. Where there was a significant effect between the home children and children who attended a particular type of centre the home group scored less well than children who had pre-school experience. However, these differences could be due to background characteristics. Hence subsequent analyses progressively add socio-economic, parent, family and home factors to see whether the difference between home and pre-school groups could be accounted for by these background characteristics. For most cognitive measures the home/pre-school difference still remains statistically significant when additional background variables have been added to the analysis. In all cases the effect of the home/pre-school distinction reduces, as more and more variables are included in the analysis. For early number concepts and pre-reading the effect of this reduction is such that the home/pre-school distinctions do not remain statistically significant when every socio-economic, parent, family and home variable that is available have been added to the model. However for verbal, non verbal and general cognitive skills the home/pre-school differences are still significant even when every socio-economic, parent, family and home variable that is available have been added to the model. Nursery classes/schools have a significant effect on non-verbal, verbal and general cognitive skills with children who had attended these centres scoring better in comparison to children with no pre-school experience. Private Day Nurseries had a significant effect on non-verbal and verbal skills with children who had attended these centres scoring better on verbal skills but worse on non-verbal skills in comparison to children with no pre-school experience. Children who had attended Reception Groups scored better on non-verbal and general cognitive skills and children who had attended Playgroups scored better on verbal skills in comparison to children who had no pre-school experience. Children from Reception Classes appeared equivalent to the children with no pre-school experience.

Hence it would be appropriate to conclude that pre-school centre experience produces enhanced verbal, non-verbal and general cognitive skills at the start of primary school, as compared with children without such pre-school experience, even when background factors are taken into account.

This study has used a wider range of background factors than other comparable studies. Notably this study includes a measure of the home learning environment, which has proved to have powerful effects on cognitive development variables. This variable itself might be affected by pre-school experience in that parents with children at a pre-school centre will be exposed to a wider range of alternative learning activities for their children than parents without such experience. This may in turn affect their behaviour with their children at home and hence influence the home learning environment. Pre-school staff may encourage this process either explicitly or implicitly. Indeed those pre-school centres that do influence parental activities with their children are likely to be amongst the most effective in enhancing children's development.

Having addressed the issue of the home versus pre-school groups comparison, the next issues addressed concern the factors affecting the attainment of children at the start of primary school and affecting the progress of children over the pre-school period. The results of these analyses are summarised here in terms of the child, socio-economic, parent, family, home and pre-school factors found to produce significant effects. Note that many variables tested for their effects did not produce significant effects at all and these factors are not dwelt on here.

Several child variables affect aspects of attainment on cognitive development. Age is obviously always important, and also birth weight, previous developmental health and behaviour problems within the child's first 3 years, have effects that are maintained up until the start of primary school. The effects of these variables appear to have stabilised by the time the child enters the study, usually after three years, as these variables do not maintain their effects in progress analyses where cognitive

development at the start of the study is included. Hence differences associated with these variables at the start of the study are neither increased nor decreased over the course of the pre-school period.

Socio-economic measures included in this study are of two types; area deprivation as measured by the ward child poverty index, and the socio-economic status of the family based upon the highest rated of both parents' occupations. Children living in wards with higher levels of deprivation do less well, allowing for all other factors, on verbal skills, early number concept and general cognitive skills. Children from families with lower socio-economic status similarly do less well on verbal, non-verbal and general cognitive skills. These effects seem to have much less influence on progress over the pre-school period than for attainment, and only in one case, for progress on non-verbal skills, does socio-economic status of the family have a significant effect. This suggests that most socio-economic effects are accounted for in development at the start of the study.

The parent variables and socio-economic variables are strongly related. However it was found that both mothers' and fathers' qualifications had important additional effects in analyses even after allowing for the socio-economic factors. Mothers' qualifications had perhaps the most consistent pattern of effects of all the parent and socio-economic factors. It is interesting to find that fathers' qualifications also become a strong predictor of cognitive development at the start of primary school. At the start of the study fathers' qualifications had little effect once mothers' qualifications were allowed for. Over the pre-school period it appears that factors associated with the father are asserting more of an effect and this is reflected in the results for both attainment and progress for all cognitive measures apart from non-verbal skills. The general pattern is that qualifications of 18+ academic and above are associated with better cognitive scores as compared with where the parent has no qualifications. This pattern holds for both mothers and fathers.

Besides the socio-economic and parent factors, considerable information was collected on the family, and some family factors were tested for their effects. Family size had a significant effect on early number concepts with children who have three or more siblings scoring less well in comparison to only children. This effect seems to be absorbed in the scores of children at the start of the study in that there are significant effects for attainment but not for progress over the pre-school period. However, these differences associated with family size seem to be maintained across the pre-school period. As mentioned in an earlier report, such associations between development and family size may reflect the consequence of some parents having less time for individual attention to children when many siblings are present. Of the other family factors only the presence of an event with potential developmental significance (e.g. bereavement, divorce) had any significant associations. This factor was related to attainment but not progress for non-verbal skills. The effect was not strong and the factor was only present for a small proportion of the sample.

The study also measured some other aspects of home life and in particular the home learning environment had consistent and strong effects on attainment. These effects were present for every cognitive measure. Where the home learning environment was high, higher attainment at the start of primary school was found. Overall this was the most consistent and powerful factor across all analyses (apart from age). However, in only one case, pre-reading, did this factor have an effect on progress over the pre-school period. This suggests that most of the effects of this variable are occurring before the pre-school period. Another small significant effect on progress on pre-reading over the pre-school period occurred for another aspect of the home, whether family had rules about bedtime (a proxy for degree of regulation/organisation in the family).

In considering the pre-school variables affecting cognitive development, type of pre-school affected verbal, non-verbal and general cognitive skills for progress over the pre-school period. There were no differences associated with type of pre-school for early number concepts or pre-reading. Where significant effects for type of pre-school were found, the results were very different depending on whether the outcome was verbal skills or non-verbal skills and general cognitive skills. For the type of pre-school comparisons, reception class was chosen as the comparison group.

For verbal skills, for progress over the pre-school period, only children from playgroups showed significantly more progress than children from reception classes. All other children were not significantly different in progress on verbal skills to children from reception classes.

For non-verbal and general cognitive skills, in terms of progress, children from both Playgroups and Private Day Nurseries showed lower levels of progress than children from Reception Classes. Children from Nursery Classes/Nursery Schools, Reception Groups and Reception Classes, i.e. the education sector of pre-school, all seem equivalent in their progress on non-verbal and general cognitive skills across the pre-school period. These types of pre-school effects exist after all other variables have been taken into account.

While not originally in the research aims, the study was able to analyse the results in terms of the Education and Library Board areas where pre-schools were located. In the analysis there were consistent differences associated with Education and Library board areas. The Southern Education and Library Board was used as the comparison group for other Education and Library Board areas. In verbal skills for progress over the pre-school period the South Eastern area had lower progress than children from the Southern area. For non-verbal skills, for progress, children from the Western and South Eastern areas fared less well than those from the Southern Education and Library Board. For early number concepts and general cognitive skills there were no area differences for attainment, but children from all areas showed less progress than those from the Southern Education and Library Board. For pre-reading progress children from all other areas did worse than children from the Southern Education and Library Board. Generally children from the Southern Education and Library Board are doing better than children from other areas, particularly for progress over the pre-school period.

The reasons for these area differences remain a mystery. Analyses for all socio-economic, demographic and pre-school characteristic variables available have not found a difference between areas that seem at all likely to account for the area differences reported here. It could be that purely by chance the study selected a particularly advantageous group of pre-schools in the Southern ELB. While unlikely, it is a possibility. Alternatively maybe some as yet untapped pre-school practice difference is related to these area effects.

With regard to other aspects of pre-school experience, there are some limited effects associated with some subscales of the Early Childhood Rating Scales (ECERS-R and ECERS-E). The subscale language (ECERS-R) was associated with improved progress on non-verbal skills. The maths subscale (ECERS-E) was associated with improved progress on the early number concepts measure. This is to be expected as early number concepts is an early measure of numeracy. It was a little surprising that these aspects of observed pre-school experience did not show more consistent or stronger effects but possibly the type effects mask the effects of these variables to some extent.

In addition to these effects, there were consistent effects for the composition of the pre-school group. For verbal skills, a child had greater progress in pre-school groups where the other children in the group had higher levels of cooperation. For non-verbal skills, this positive effect of group composition for cooperation was present for progress. Similar effects for progress were found for general cognitive skills. For pre-reading, the same effect for cooperation was found for progress, however in addition there were group composition effects also for mothers' qualifications and for child confidence. The composition variable for mothers' qualifications produced positive effects whereas the composition variable for confidence produced negative effects upon the child's pre-reading. These composition effects may be partly due to pre-school staff finding it easier to instruct children where cooperation is high and partly due to peer group effects whereby children learn developmentally advantageous behaviours from their peers. Generally greater cooperation is associated with enhanced development in a wide range of other behaviours, both cognitive and social.

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