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Pre-school experience and literacy and numeracy development at the end of year 2 of primary school

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Abstract

This longitudinal study assesses the attainment and development of children followed from the age of 3 until the end of Key Stage 1 (age 8). 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).

Keywords

primary, 2, year, end, development, school, numeracy, pre, literacy, experience

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Effective Pre-school Provision Northern Ireland (EPPNI)

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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 (age 8). 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 UK research and concluded that small-scale studies suggested a positive impact but that large-scale research was inconclusive. The Start Right enquiry recommended more rigorous longitudinal studies with baseline measures so that the 'value added' to children's development by pre-school education could be established.

Research evidence 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 pre-school education in the UK 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 four primary years (4-8 years).

- 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 (ELB) 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 cognitive tasks of the British Ability Scales, BASII (Elliott et al 1996). These tasks were; verbal comprehension, naming vocabulary, knowledge of similarities seen in pictures, and block building. A profile of the child's social and behavioural adjustment (Hogan, Scott, and Bauer, 1992)) 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 the Start of P1
At school entry, a trained researcher administered a similar battery of cognitive assessments. These included pattern construction, verbal comprehension, naming vocabulary, knowledge of similarities seen in pictures 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 a social behavioural profile of the child.

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 similar social behavioural profile of the child was again completed by the primary 1 teacher.

Child Measures at the End of P2
Further assessments were 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 was collected. Goodman's Strengths & Difficulties Questionnaire and related measures were completed by the P2 teacher as measures 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 Strengths & Difficulties Questionnaire and related measures were 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 twenty and forty minutes of the parent's time depending upon the complexity of the information supplied by the parent.

The interview contained questions dealing with the parents, the family, the child's health, development and behaviour, the child's activities in the home, the use of pre-school provision and the childcare history.

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), and also the activities of the child 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, Siraj-Blatchford & Taggart, 2003), 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 page 16.

Case Studies

In addition to the quantitative data collected about children, their families and their pre-school centres, detailed qualitative data has been collected using case studies. The case studies were chosen retrospectively on the basis of the analyses of ECERS-R, ECERS-E and Inspection Reports. The case studies add 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. The detailed case studies use a variety of methods of data gathering, including documentary analysis, interviews and observations and the results help to illuminate the characteristics of more successful pre-school centres and assist in generating guidance on good practice. Particular attention has been paid to parent involvement, teaching and learning processes, child-adult interaction and social factors in learning. Inevitably there are difficulties associated with the retrospective study of process characteristics of centres and it is 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 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 the age of 7 years at the end of Key Stage 1 in England. 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 Integrated 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

This report considers children's literacy and numeracy development at the end of the second year of primary school. These aspects of cognitive development are considered in two ways, overall attainment at the end of P2 and progress over the first and second years of statutory schooling.

Attainment: these analyses answer the question 'What affects the child's level of development at the end of P2?' 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 end of primary two are considered. The child's attainment earlier is not taken into account. Attainment analyses include a comparison between the home group and the different pre-school groups, as well as comparisons between different types of pre-school.

Progress over the first and second years of primary school: These analyses answer the question 'What affects the progress the child makes over the P1 and P2 period?' In analysing progress, all possible predictor variables used in attainment are analysed, but, in addition, the age-adjusted child's level of functioning at the beginning of primary school is taken into account. Comparisons between the home and pre-school groups, as well as comparisons between different pre-school types are considered for the progress analyses.

Summary of the effects of independent variables

Significant effects of independent variables upon children's literacy and numeracy development are summarised here, after allowing for other child, parent and home characteristics. The summary deals with the overall pattern of results across all attainment and progress analyses. In considering these results it is clear that some variables influence attainment, some influence progress and some influence both attainment and progress.

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

When a variable shows a significant effect on progress but not on attainment, this indicates that the effect occurs over the first two years of primary school, but that the effect has been a 'catching up' effect whereby some children have reached a similar level as other children but from a lower starting point at the beginning of primary school.

Where both attainment and progress analyses reveal significant effects this indicates that the variable has had an effect over the first two years of school, and that the overall attainment at the end of P2 is affected either because

a. the effect over the school period is more than a 'catching up' effect or
b. the variable exerted an influence in the pre-school period that affected the start of school performance and that the effect continues into the first two years of primary school.

Child Variables

- Gender affected children's scores on literacy, with girls attaining better scores than boys at the end of the first two years of primary school.
- Heavier birth weight children attained higher scores on literacy and numeracy compared with lower birth weight children. Also heavier birth weight children made more progress on numeracy over the first two years of primary school.

Socio-Economic Status (SES) Variables

While the specific details varied between analyses involving socio-economic status effects, the overall pattern below emerged.

Compared with children with parents from a Professional socio-economic status, children from;

- All other SES backgrounds either attained lower scores or made less progress on literacy, and usually both applied, over the first two years of primary school.
- The children with parents in unskilled occupations also attained lower scores and made less progress in numeracy over the first two years of primary school.

- Children who live in more deprived areas attained lower scores and made less progress in literacy than children from relatively more affluent areas over the first two years of primary school.

Parental Variables

Parental qualifications were important for literacy and numeracy attainment.

- Mothers' qualifications were significant for both literacy and numeracy. Compared with children whose mothers do not have any qualifications; children whose mothers had any type of qualification attained higher scores on numeracy; and children whose mothers have degree or above also scored better on literacy.
- In addition children whose mother's had 16 academic, 18 academic or Degree plus qualifications showed more progress in numeracy over the first two years of primary school.

- Fathers' qualifications were related to children's attainment on both literacy and numeracy. Compared with children whose fathers do not have any qualifications, children whose fathers have 16 vocational, 18 academic or degree and above qualifications scored better on literacy and numeracy. The effects for fathers' qualifications become greater if mothers' qualifications are not considered simultaneously.

Fathers' employment was associated with literacy attainment.

- Compared with children whose fathers are employed full time, children whose fathers are self employed attained lower scores on literacy and made less progress in literacy over the first two years of primary school. As with all findings summarised here this effect emerged after allowing for all the other differences between children and families measured in the study. Possibly self-employed parents have less time to spend with children in activities such as reading that foster literacy development.

Home Variables

- Play with friends was significant for numeracy, as compared with children who did not experience any play with friends outside of their own home, children who had a moderate level of such play attained better scores on numeracy.
- Children who had a regular bedtime attained higher scores on numeracy than children without a bedtime routine, and also made more progress in numeracy over the first two years of primary school, possibly indicating the influence of a structured home environment.
- The biggest effect for home background was for the Home Learning Environment where the higher the rating on the home learning index, the better children's scores were on both literacy and numeracy. The effects occur primarily in the pre-school period in that while the Home Learning Environment exerts powerful effects upon overall attainment, there are no additional significant effects for progress over the pre-school period.

Type of Pre-school

Compared with children who did not attend pre-school, children who attended;

- Nursery Class/School or Playgroup provision attained higher scores on literacy, and made more progress in literacy and numeracy over the first two years of primary school.
- Reception Class showed more progress in numeracy over the first two years of primary school.

Considering differences amongst those children who attended some type of pre-school and making comparisons against those who attended Reception Groups, children who attended;

- Nursery Class/School provision appeared to attain higher scores on literacy and numeracy, and also made more progress in literacy and numeracy over the first two years of primary school.
- Playgroups attained higher scores on literacy, and made more progress in literacy over the first two years of primary school.
- Private Day Nurseries attained better scores on numeracy, and made more progress in literacy and numeracy over the first two years of primary school.
- Reception Class attained higher scores on numeracy and made more progress in numeracy over the first two years of primary school.

These results indicate the continuing positive effects of pre-school experience even during the first two years of primary school.

Pre-school staff qualifications

Pre-school leader's qualifications were significant for literacy.

- Compared with children who attended pre-school where the leader did not have any qualifications, children who attended pre-school where the leader has a Bachelor of Education qualification scored higher on literacy.

Pre-school Characteristics

Pre-school ratings on the ECERS-R and ECERS-E subscales were significant for literacy and numeracy.

- Children who attended pre-schools that were rated higher on the ECERS-R subscale, Care scored lower and made less progress in literacy.
- Children who attended pre-schools that were rated higher on the ECERS-R subscale, Parent and staff facilities, scored lower and made less progress in numeracy.
- Children who attended pre-schools that scored higher on the ECERS-R subscale, Programme structure, scored higher and made more progress in literacy.
- Children who attended pre-schools that were rated higher in their provision of Science attained better scores and made more progress in numeracy.
- Children who attended pre-schools that scored higher on the ECERS-R subscale, Activities, made more progress in literacy.

The different effects for different aspects of the ECERS ratings suggest that pre-schools would be better putting more effort into programme structure, science provision and range of activities rather than concentrating resources on routine care activities or parent & staff needs. It is likely given the restricted resources within pre-school centres that focussing on maintaining good provision in one or two areas may detract from the quality of other aspects of provision.

Pre-school peer group composition

- When children had attended a pre-school group where mothers were better qualified, they attained higher scores on numeracy and made more progress in literacy by the end of P2. This result indicates the continued effects of peer group influences.

Summary Table of Significant Effects

	Age	Gender	Birth weight	Previous Health Problems	Pre-school/Home Comparison	Pre-school Type Comparison	Socio-Economic Status	Area Deprivation: Child poverty	Mothers' Qualifications	Fathers' Qualifications	Fathers' Employment	Home Learning Environment	Peer Play away from home	Regular bedtime	Individual Care	ELB Area	ECERS-R Care	ECERS-R Activity	ECERS-R Parent/Staff	ECERS-R Programme Structure	ECERS-E Science	Pre-school Leader's Qualifications	Interaction: Positive Relations	Interaction: Punitiveness	Composition/ Mothers' Qualifications
Effects on Attainment at the end of two years of primary school (P2)																									
Home Vs Pre-school																									
Literacy		✓	✓		✓		✓	✓	✓	✓	✓	✓													
Numeracy			✓						✓	✓		✓	✓	✓	✓	✓									
Pre-school Type																									
Literacy			✓			✓	✓	✓	✓	✓		✓					✓			✓		✓			
Numeracy			✓			✓	✓		✓			✓							✓		✓		✓	✓	✓
Effects on Progress over the first two years of primary school																									
Home Vs Pre-school																									
Literacy					✓		✓				✓					✓									
Numeracy			✓	✓	✓		✓		✓					✓		✓									
Pre-school Type																									
Literacy						✓	✓	✓								✓	✓	✓		✓					✓
Numeracy	✓					✓			✓					✓		✓			✓		✓		✓	✓	

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, 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 technical paper 2 (Melhuish et al, 2001). Social/behavioural and Cognitive attainment and progress across the pre-school years has also been analysed and reported in earlier technical papers 4 and 5 (Melhuish et al. 2002). Analyses have been completed and reported for cognitive attainment of children at the end of P1, and their progress across the first year of primary school in technical paper 6 (Quinn et al, 2003). Analyses have also been completed for children's social/behavioural attainment at the end of P1 and their progress during the first year of primary school.

This paper considers the literacy and numeracy development of children at the end of Primary 2, and the progress across the first and second years of statutory schooling, 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. A wide range of variables is considered and the nature of associations between family background and 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 first stage of the study involved 683 children recruited from 80 pre-school centres, including 188 children from nursery classes, 157 children from Playgroups, 117 children from Private Day Nurseries and 221 children from Reception Groups/Classes. The children were aged between 3 years and 4 years 6 months (mean 43.3 months; S.D. = 5.5 months) at the beginning of the study. For 7 families, parents were unavailable for interview. Hence this paper is based on the analysis of data from 676 parental interviews of the original sample. 151 children with no pre-school experience, for whom all parent interviews were collected, were also recruited to the study at the beginning of their P1 year. Data for these children are included for relevant analyses.

Method

Data Collection

Distribution of Children across Pre-school Settings

Area	Nursery class/school	Playgroup	Private Day Nurseries	Reception class/group	Home	Total
Belfast	33	32	28	38	11	142
Western	33	30	14	44	43	164
North Eastern	34	30	41	39	30	174
South Eastern	37	26	22	49	21	155
Southern	51	39	12	51	46	199
Total	**188**	**157**	**117**	**221**	**151**	**834**

Parental interview

Shortly after the child and family were recruited to the study, one of the child's parents or guardians was interviewed. In the vast majority of cases the interview was with the child's mother. Parents were interviewed either in person when they were at the pre-school centre, or by telephone. The interview followed a semi-structured format with answers to most questions being coded into an established set of categories, and a small number of open-ended questions that were coded post hoc. The length of the interviews varied, depending on the complexity of the information to be collected, the conciseness of the parents and other factors. A typical interview might take between twenty and forty minutes of the parent's time depending upon the complexity of the information supplied by the parent. The interview contained questions dealing with the parents, the family, the child's health, development and behaviour, the child's activities in the home, the use of pre-school provision and the childcare history.

Child Assessments at Entry to P1

At school entry, a trained researcher administered a battery of cognitive assessments. These included pattern construction, verbal comprehension, naming vocabulary, knowledge of similarities seen in pictures and early number concepts (BAS II, Elliott et al 1996). Knowledge of the alphabet, rhyme and alliteration assessments (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, which is an expanded version of the Adaptive Social behaviour Inventory (ASBI, Hogan et al., 1992) to provide measures of social/behavioural development

Child Assessments at the End of P2.

At the end of P2, trained researchers administered the NFER-Nelson standardised assessments of literacy and numeracy (Primary Reading Test Level 1 and Mathematics 6). Information was collected on school attendance and special needs and the P2 teachers completed the Strengths and Difficulties Questionnaire (Goodman, 2001), and related measures of social/behavioural development).

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) that has been recently adapted (Harms, Clifford & Cryer 1998) and the ECERS-E (Sylva et al., 2003) were administered. The Caregiver Interaction Scale (Arnett 1989) was 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 sub-scales (ECERS-E) (Sylva et al., 2003) describing educational provision and based on Desirable Learning Outcomes were used:

- Language
- Mathematics
- Science and the Environment
- Diversity

The Caregiver-Interaction Scale developed by Arnett (1989) provided ratings of the following four aspects of staff- child interactions:

- Positive relations between staff and children
- Punitiveness
- Permissiveness
- Detachment.

Analysis of relationship of family factors and pre-school experience

The analyses presented in this report consider the children's cognitive development in two ways; attainment up to the end of the second year of primary school (P2), and progress over the first two years of primary school.

Attainment: these analyses answer the question 'What affects the child's level of development at the end of P2?'

In analysing attainment the child, socio-economic (area & parent), parent, family, home and childcare characteristics affecting the child's level of attainment at the end of P2 are considered. The child's earlier level of cognitive functioning is not taken into account. Attainment analyses include a comparison between the home group and the different pre-school groups as well as comparing the different pre-school types.

Next progress over the first and second years of statutory schooling is considered. These analyses answer the question 'What affects the progress the child makes over the P1 and P2 period?'

In analysing progress, all possible predictor variables used in attainment are analysed, but, in addition, the child's level of cognitive functioning at the start of P1 is taken into account.

The strategy of analysing the end of P2 cognitive outcomes in a regression model where the start of P1 cognitive scores are always used as potential predictor variables is the equivalent to analysing the child's progress in cognitive outcomes as the initial level of cognitive development is taken into account.

There are consequences of this strategy for progress models.

1. The child's level of functioning at the start of P1 will absorb the effects of several child, parent, family and home factors, where their effects do not persist additively over the first two years of primary school.
2. Where children are not showing high levels of attainment in relation to their age at the start of P1, there is more scope for progress for such children. Hence such children may show bigger progress effects, without necessarily showing high attainment at the end of the first two years of primary school.

Literacy and Numeracy scores for children were the outcome variables in a series of regression analyses. Each end of P2 measure was analysed as a factor of;

a) Home versus pre-school attainment
b) Pre-school type attainment
c) Home versus pre-school progress across the P1 and P2 period
d) Pre-school type progress across the P1 and P2 period

The predictor variables were entered into a regression model using the "enter" method. The variables that had statistically significant ($p<.05$) effects were retained in the model. The other factors were removed one at a time to ensure all variables with statistically significant effects were retained. The final regression models for each outcome variable retained only the predictor variables found to have statistically significant effects on the outcome variable. The chosen significance level (conventional cut-off point) of $p < .05$ means that there is a less than 5% chance that the observed result is due to chance.

The predictor variables considered in analyses are listed in full below

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

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

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.

Family characteristics
Lone parent
Number of siblings
Birth position
Life events

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

Childcare history entering the study
Total childcare by a relative e.g. grandmother before entering the study
Total chilcare by an individual nonrelative carer, e.g. a childminder, before entering the study
Total group childcare before entering the study
Time in target pre-school centre before entering the study

Pre-school experience variables
Type of pre-school
Adult/Child Ratio
Number of sessions per week
Duration of time spent in pre-school in months
Pre-school leader qualifications

Area
Education and Library Board (ELB) area where the child lives

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 Scale (CIS)
Positive Relations
Punitiveness
Permissiveness
Detachment

Compositional variables
Within each pre-school centre the study has a representative sample of children recruited during 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

Results

Distribution of Scores

This section of the report presents the distribution of the children's scores on literacy and numeracy measures at the end of the second year of primary school (P2). Descriptive statistics (mean, standard deviation) are presented for literacy and numeracy examining children's mean scores as a group, by gender, by pre-school type, by parental socio-economic status and according to mothers' qualifications.

Table 1: The distribution of children's scores on literacy and numeracy at the end of P2 for the whole sample and by gender.

	Literacy		Numeracy	
Gender	Mean	sd	Mean	sd
Boys	16.55	5.51	16.75	4.92
Girls	17.54	5.59	16.91	4.88
Both	17.05	5.57	16.83	4.90

Table 1 shows the distribution of scores for literacy and numeracy at the end of P2 for the complete sample and by gender. Girls appeared to attain higher mean score on both literacy and numeracy at the end of P2 with the smallest difference between the mean scores observed for numeracy.

Table 2: The distribution of children's scores on literacy and numeracy at the end of P2 by pre-school type.

	Literacy		Numeracy	
Pre-school Type	Mean	sd	Mean	sd
Nursery Class/School	18.15	5.79	17.40	4.87
Playgroup	17.10	5.34	16.79	4.44
Private Day Nursery	17.74	5.40	18.32	4.20
Reception Class	17.53	5.12	18.15	5.22
Reception Group	17.22	5.14	16.68	4.45
Home	14.65	5.66	14.23	5.05

Children who attended nursery class/school provision appeared to attain the highest mean score on literacy at the end of P2. Children who attended private day nurseries appeared to attain the

highest mean score on numeracy at the end of P2, followed closely by children who attended reception classes. Children who did not experience any type of pre-school appeared to attain the lowest mean score on both literacy and numeracy at the end of P2.

Table 3: The distribution of children's scores on literacy and numeracy at the end of P2 by parental socio-economic status.

	Literacy		Numeracy	
Socio-economic status	Mean	sd	Mean	sd
Professional	19.87	5.54	18.83	4.05
Intermediate	17.38	5.60	17.66	4.50
Skilled non-manual	16.88	5.13	17.02	4.79
Skilled manual	15.68	5.90	15.50	5.08
Semi-skilled	15.86	4.89	15.52	4.95
Unskilled	16.85	4.57	13.59	4.74
Unemployed	14.34	5.27	14.20	5.59

Generally, children whose parents have a higher socio-economic status attain higher mean scores on literacy and numeracy at the end of P2. For instance, children from a professional background achieve the highest mean score on both cognitive measures. Children from an unemployed family background attain the lowest mean score on literacy. Children from an unskilled socio-economic status attain the lowest score on numeracy at the end of P2.

Table 4: The distribution of children's scores on literacy and numeracy at the end of P2 by mothers' qualifications.

	Literacy		Numeracy	
Mother's Qualifications	Mean	sd	Mean	sd
No qualifications	14.97	5.41	14.25	4.90
16 vocational	17.21	5.71	15.83	5.40
16 academic	16.69	5.63	16.88	4.77
18 vocational	17.16	4.77	16.71	4.35
18 academic	17.58	5.42	17.62	5.01
Degree and above	19.22	5.37	19.21	3.90

Generally, children whose mothers have higher qualifications attained higher mean scores on literacy and numeracy. For instance, children whose mothers have degree and above attained the highest mean score on both measures. For both literacy and numeracy, children whose mothers do not have any qualifications, attained the lowest mean score.

Regression Analyses

This section deals with separate types of regression models for literacy and numeracy outcomes at the end of the second year of primary school (P2). Ordinary least squares (OLS) regression procedures were used.

The first two models analyse the cognitive attainment of children at the end of P2. One regression model compares children with pre-school experience with Home children (those who did not attend any form of pre-school centre). No pre-school variables are included in this model. The second model compares children who have experienced different types of pre-school centre and includes pre-school type and process factors, and compositional variables.

The second two models analyse the children's progress on literacy and numeracy across the first two years of primary school. In addition to the variables included in the attainment models, the progress models include the children's start of P1 cognitive scores, so that the analysis becomes a measure of progress over the first two years of primary school. The first regression model compares children with pre-school experience and home children. The second model compares the progress of children who attended different types of pre-school provision.

Individual child, socio-economic, parent, family and home characteristics are analysed in successive stages. However in this report only the final model, which contains all significant predictor variables are presented. The intermediate steps of the analyses are omitted as they are not essential to the understanding of important findings and to make the presentation of results less confusing. Examples of each progressive stage of the analyses are presented in an earlier technical paper (Melhuish et al., 2002). In the tables showing the regression results the standardised beta values are an indication of the effect size associated with each variable having allowed for all other variables in the model.

This project has included a range of background variables related to the child's relative social and economic disadvantage. These include socio-economic status (SES) based upon parental occupation, mother's education, father's education, area deprivation and the home learning environment. These measures are interrelated to varying degrees. So that when they are used together, a significant effect of one variable may remove a significant effect for a related variable. For example, for literacy attainment, children with parents with professional SES do better than children in all other SES groups, when SES is considered alone. However when the other background factors are included the effects are significant for a reduced set of SES comparisons, reflecting the influence of the other background factors.

Regression Results

Literacy

Table 5: Literacy Attainment (Home Versus Pre-school)

$R^2 = .19$
Adjusted $R^2 = .16$
F (28, 790) 6.66, p <.0001

	Beta	Significance
Child Variables		
Gender	-.07	.036
Birth weight	.10	.002
Pre-school centre *(compared with Home Children)*		
Nursery Class/School	.20	.000
Playgroup	.10	.024
Private Day Nursery	.06	ns
Reception Class	.06	ns
Reception Group	.04	ns
Socio-Economic Status		
Parental SES (compared with Professional)		
Intermediate	-.13	.013
Skilled Non-Manual	-.11	.037
Skilled Manual	-.11	.036
Semi-Skilled	-.08	ns
Unskilled	.002	ns
Unemployed	-.08	ns
Area Child Poverty Mean	-.10	.007
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	.04	ns
16 Academic	.05	ns
18 Vocational	.05	ns
18 Academic	.07	ns
Degree and Above	.14	.006
Fathers' Quals (compared with none)		
16 Vocational	.09	.007
16 Academic	.08	ns
18 Vocational	.04	ns
18 Academic	.07	ns
Degree and Above	.11	.016
Father Not Resident	.03	ns
Fathers' Employment (compared with Full time)		
Part time	-.04	ns
Self employed	-.08	.016
Home Variables		
Home Learning Environment	.16	.000

Child variables, gender and birth weight were related to attainment on literacy at the end of P2. Girls and heavier birth weight children attained higher scores than boys and lower birth weight children respectively.

Children who have a professional background attained higher scores on literacy than children from an intermediate, skilled non-manual or skilled manual background. Children who live in areas that have greater child poverty attained lower scores on literacy compared with children from relatively more affluent areas.

Parental qualifications were related to children's attainment on literacy. Children whose mothers have degree and above qualifications scored higher on literacy than children whose mothers do not have qualifications. Children whose fathers have 16 vocational or degree and above qualifications attained higher scores on literacy than children whose fathers are unqualified.

Children whose fathers are employed full time obtained higher literacy scores than children whose fathers are self-employed.

The higher the quality of the home learning environment, the better children scored on literacy at the end of P2.

After considering a wide range of child, socio-economic status, parental, family, home, childcare and area variables, children's pre-school experience was related to their attainment on literacy. Children who attended nursery class/school or playgroup provision attained significantly higher scores on literacy than home children, while the differences between other pre-school groups and the home group were not statistically significant.

Literacy

Table 6: Literacy Attainment (Pre-school Type)

$R^2 = .24$
Adjusted $R^2 = .20$
F (31, 643) 6.37, $p < .0001$

	Beta	Significance
Child Variables		
Birth weight	.11	.002
Pre-school centre *(compared with Reception Group)*		
Nursery Class/School	.17	.007
Playgroup	.16	.027
Private Day Nursery	.11	ns
Reception Class	.02	ns
Socio-Economic Status		
Parental SES (compared with Professional)		
Intermediate	-.14	.014
Skilled Non-Manual	-.10	ns
Skilled Manual	-.07	ns
Semi-Skilled	-.08	ns
Unskilled	-.06	ns
Unemployed	-.09	.050
Area Child Poverty Mean	-.13	.002
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	-.02	ns
16 Academic	.01	ns
18 Vocational	.05	ns
18 Academic	.09	ns
Degree and Above	.15	.015
Fathers' Quals (compared with none)		
16 Vocational	.12	.002
16 Academic	.05	ns
18 Vocational	.05	ns
18 Academic	.09	.033
Degree and Above	.12	.020
Father Not Resident	.07	ns
Home Variables		
Home Learning Environment	.17	.000
Pre-school Characteristics		
ECERS-R Subscales		
Care	-.10	.009
Programme Structure	.14	.000
Pre-school Leader Qual's *(compared with none)*		
NIPPA	.000	ns
Montessori	.02	ns
BTEC/NNEB	.07	ns
Bachelor of Arts/Bachelor of Science	.04	ns
Bachelor of Education	.22	.011

Children who had a heavier birth weight attained better literacy scores at the end of P2 than lower birth weight children.

Parental socio-economic status affected children's attainment on literacy at the end of P2. Compared with children from a professional background, children from intermediate and unemployed backgrounds scored lower on literacy. There appeared to be no significant difference between children from the remaining socio-economic groups and children from a professional background on literacy attainment. Children who live in poorer areas attained lower scores on literacy than children from comparatively more affluent areas.

Parental qualifications had an effect on children's literacy scores at the end of P2. Compared with children whose mothers do not have qualifications, children whose mothers have degree and above qualifications attained higher scores on literacy. Children whose fathers have 16 vocational, 18 academic or degree and above qualifications scored higher on literacy than children whose fathers do not have any qualifications.

Children from homes that were rated higher on the home learning index attained better scores on literacy than children from homes that scored lower on the home learning index.

Various pre-school characteristics were related to children's attainment on literacy at the end of P2. Children who attended pre-schools that were rated higher on the ECERS-R care subscale scored lower on literacy at the end of P2. Children who attended pre-schools that scored higher on the quality of their provision for programme structure attained higher scores on literacy at the end of P2.

Compared with children who attended pre-school where the leader did not have any qualifications, children who attended pre-school where the leader had a Bachelor of Education qualification attained better scores on literacy at the end of P2.

Compared with children who attended reception groups, children who attended nursery classes/schools or playgroups appeared to attain higher scores on literacy at the end of P2. Children who attended private day nurseries or reception classes did not attain significantly different scores on literacy to children from reception groups, having allowed for background factors.

Literacy

Table 7: Literacy Progress (Home Versus Pre-school)

$R^2 = .38$
Adjusted $R^2 = .37$
F (20, 812) 25.17, $p < .0001$

	Beta	Significance
P1 Cognitive Outcome		
P1 General Cognitive Ability without Pre-reading	.27	.000
P1 Pre-reading	.38	.000
Pre-school centre *(compared with Home Children)*		
Nursery Class/School	.16	.000
Playgroup	.09	.011
Private Day Nursery	.06	ns
Reception Class	.03	ns
Reception Group	.01	ns
Socio-Economic Status		
Parental SES (compared with Professional)		
Intermediate	-.13	.002
Skilled Non-Manual	-.10	.017
Skilled Manual	-.09	.023
Semi-Skilled	-.07	.043
Unskilled	.02	ns
Unemployed	-.08	.023
Parental Variables		
Fathers' Employment (compared with Full time)		
Part time	-.05	ns
Self employed	-.07	.013
Father not resident	-.04	ns
ELB Area *(compared with Southern)*		
Belfast	.06	ns
Western	.12	.001
North Eastern	.12	.001
South Eastern	.01	ns

Children who had a higher general cognitive ability at the beginning of P1, attained higher scores on literacy at the end of P2. Additionally, children who scored higher on pre-reading at the beginning of P1 attained higher scores on literacy at the end of P2.

Compared with children from a professional background, children from intermediate, skilled non-manual, skilled manual, semi-skilled or unemployed backgrounds made less progress on literacy.

Children whose fathers are employed full time made more progress on literacy compared with children whose fathers are self-employed.

The ELB area in which children attended pre-school appeared to be related to children's progress on literacy. Children who attended pre-school in the Western and North Eastern ELB areas made more progress than children from the Southern ELB.

Children who attended nursery classes/schools or playgroups appeared to make more progress on literacy than home children. Home children and children who attended private day nurseries, reception classes and reception groups appeared to make similar progress on literacy.

Literacy

Table 8: Literacy Progress (Pre-school Type)

$R^2 = .41$
Adjusted $R^2 = .39$
F (21, 653) 21.67, $p < .0001$

	Beta	Significance
P1 Cognitive Outcome		
P1 General Cognitive Ability without Pre-reading	.26	.000
P1 Pre-reading	.36	.000
Pre-school Centre *(compared with Reception Group)*		
Nursery Class/School	.18	.001
Playgroup	.11	.044
Private Day Nursery	.11	.049
Reception Class	.08	ns
Socio-Economic Status		
Parental SES (compared with Professional)		
Intermediate	-.14	.003
Skilled Non-Manual	-.09	.047
Skilled Manual	-.07	ns
Semi-Skilled	-.09	.026
Unskilled	-.03	ns
Unemployed	-.06	ns
Area Child Poverty Mean	-.07	.047
ELB Area *(compared with Southern)*		
Belfast	.000	ns
Western	.16	.000
North Eastern	.13	.002
South Eastern	-.01	ns
Pre-school Characteristics		
ECERS-R Subscales		
Care	-.16	.000
Activity	.16	.000
Programme Structure	.08	.017
Composition of pre-school group		
Composition/Mothers' Qualifications	.09	.027

Children who had higher cognitive ability at the start of P1 attained higher scores on literacy at the end of P2. Children who attained a higher score on pre-reading at the beginning of P1 attained higher scores on literacy at the end of P2.

Compared with children from a professional background, children from an intermediate, skilled non-manual or semi-skilled background made less progress on literacy during P1 and P2. Children from the remaining socio-economic groups appeared to make equivalent progress on literacy to children from a professional background. Children from poorer areas made less progress on literacy during P1 and P2 than children from relatively more affluent areas.

Children who attended pre-school in the Western and North Eastern ELB areas appeared to make more progress on literacy than children from the Southern ELB area.

A number of pre-school characteristics affected children's progress on literacy over the first two years of primary school. Children who attended pre-schools that scored higher on the ECERS-R subscale, care, tended to make less progress on literacy. Children, who attended pre-schools that scored higher on the ECERS-R subscales, activity and programme structure, made more progress on literacy during the P1 and P2 period. Children who belonged to a pre-school peer group whose mothers have higher qualifications made more progress on literacy during P1 and P2.

Children who attended nursery classes/schools, playgroups or private day nurseries appeared to make more progress on literacy across the P1 and P2 period than children who attended reception groups. There appeared to be no difference between children who attended reception classes and reception groups in relation to literacy progress.

Numeracy

Table 9: Numeracy Attainment (Home versus Pre-school)

$R^2 = .19$
Adjusted $R^2 = .17$
F (21, 729) 8.04, $p < .0001$

	Beta	Significance
Child Variables		
Birth weight	.09	.008
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	.02	ns
16 Academic	.17	.001
18 Vocational	.11	.014
18 Academic	.15	.000
Degree and Above	.28	.000
Fathers' Quals (compared with none)		
16 Vocational	.08	.032
16 Academic	-.003	ns
18 Vocational	.01	ns
18 Academic	.05	ns
Degree and Above	.10	.036
Father Not Resident	-.01	ns
Home Variables		
Play with friends away from home (compared with none)		
Low	.08	.049
High	-.03	ns
Regular bedtime	.07	.036
Home Learning Environment	.15	.000
Childcare Characteristics		
Individual Care	-.08	.019
ELB Area *(compared with Southern)*		
Belfast	.10	.015
Western	-.02	ns
North Eastern	.08	ns
South Eastern	-.01	ns

Heavier birth weight children attained higher scores on numeracy at the end of P2 than lower birth weight children.

Parental qualifications were related to children's attainment on numeracy at the end of P2. Children whose mothers have 16 academic, 18 vocational, 18 academic or degree and above qualifications scored higher on numeracy than children whose mothers do not have any qualifications. In addition, children whose fathers have 16 vocational or degree and above qualifications attained better scores on numeracy than children whose fathers do not have qualifications.

Children, who had a moderate level of play with friends outside of the home, attained higher scores on numeracy than children who did not have any play with friends outside the home.

Children who had a regular bedtime attained higher scores on numeracy at the end of P2 than children who did not have a bedtime routine. Children who live in homes rated higher on the home learning index scored better on numeracy at the end of P2.

Children who experienced a greater amount of individual care, for example by a childminder, in their first three years, attained lower scores on numeracy.

ELB area appeared to be related to children's attainment on numeracy. Children in the Belfast ELB area appeared to attain higher scores on numeracy than children from the Southern ELB area.

There appeared to be no difference between home children and children who attended any type of pre-school centre on numeracy attainment at the end of P2.

Numeracy

Table 10: Numeracy Attainment (Pre-school type)

$R^2 = .25$
Adjusted $R^2 = .23$
F (22, 648) 9.93, $p < .0001$

	Beta	Significance
Child Variables		
Birth weight	.08	.025
Pre-school centre *(compared with Reception Group)*		
Nursery Class/School	.16	.011
Playgroup	.06	ns
Private Day Nursery	.13	.037
Reception Class	.14	.019
Socio-Economic Status *(compared with Professional)*		
Intermediate	-.05	ns
Skilled Non-Manual	-.07	ns
Skilled Manual	-.04	ns
Semi-Skilled	-.07	ns
Unskilled	-.11	.009
Unemployed	-.02	ns
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	-.02	ns
16 Academic	.11	.047
18 Vocational	.07	ns
18 Academic	.11	.015
Degree and Above	.24	.000
Home Variables		
Home Learning Environment	.13	.000
Pre-school Characteristics		
ECERS-R Subscale;		
Parent and staff facilities	-.16	.000
ECERS-E Subscale;		
Science	.20	.000
Pre-school staff-child interaction		
Positive Relations	-.17	.000
Punitiveness	-.14	.001
Composition of pre-school group		
Composition/Mothers' Qualifications	.10	.025

Children who had a heavier birth weight scored higher on numeracy than children who had a lower birth weight.

Compared with children from a professional background, children from an unskilled background attained lower scores on numeracy. There appeared to be no difference between children from a professional background and children from any other socio-economic backgrounds on numeracy attainment.

Compared with children whose mothers do not have any qualifications, children whose mothers have 16 academic, 18 academic or degree or above qualifications scored higher on numeracy at the end of P2.

Children who experienced a higher quality home learning environment attained better scores on numeracy at the end of P2.

Children who attended pre-schools that scored higher on the ECERS-R subscale, Parent and staff facilities scored lower on numeracy at the end of P2.

Children who attended pre-schools that were rated higher on the ECERS-E subscale, science, attained higher scores on numeracy.

Children who attended pre-schools where staff-child interactions were rated higher on the positive relations subscale, scored lower on numeracy at the end of P2. Children who attended pre-school centres where the interaction between the caregiver and children was rated as more punitive, attained lower scores on numeracy. These results indicate that high levels of positive or negative interactions are not associated with high numeracy attainment. Possibly where good numeracy experiences are provided the interactions are more moderate.

Children who belonged to a pre-school peer group whose mothers have higher qualifications scored better on numeracy.

Compared with children who attended reception groups, children who attended nursery classes/schools, private day nurseries or reception classes appeared to attain higher scores on numeracy. There appeared to be no difference between children who attended reception groups and children who attended playgroups, in terms of numeracy attainment.

Numeracy

Table 11: Numeracy Progress (Home Versus Pre-school)

$R^2 = .36$
Adjusted $R^2 = .34$
F (26, 799) 17.59, $p < .0001$

	Beta	Significance
P1 Cognitive Outcome		
P1 Early Number Concepts	.47	.000
Child Variables		
Age	-.19	.000
Birth weight	.06	.036
Health Problems *(compared to none)*		
Health problems without treatment	-.01	ns
Health problems with treatment	.07	.026
Pre-school Centre *(compared with Home Children)*		
Nursery Class/School	.18	.000
Playgroup	.10	.011
Private Day Nursery	.06	ns
Reception Class	.12	.004
Reception Group	-.03	ns
Socio-Economic Status *(compared with Professional)*		
Intermediate	-.03	ns
Skilled Non-Manual	-.01	ns
Skilled Manual	-.05	ns
Semi-Skilled	-.06	ns
Unskilled	-.07	.049
Unemployed	-.05	ns
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	.01	ns
16 Academic	.11	.006
18 Vocational	.06	ns
18 Academic	.09	.007
Degree and Above	.15	.001
Home Variables		
Regular bedtime	.08	.007
ELB Area (*compared with Southern)*		
Belfast	.17	.000
Western	.08	.036
North Eastern	.16	.000
South Eastern	.06	ns

Children who scored higher on early number concepts at the beginning of P1 made more progress on numeracy during the first two years of primary school.

A number of child variables were related to children's numeracy progress across the P1 and P2 period. Younger children made more progress on numeracy during P1 and P2 than older children. Heavier birth weight children made more progress on numeracy than lower birth

weight children. Compared with children who did not have any previous health problems, children who had early health problems and had treatment made more progress on numeracy across P1 and P2.

Children from a professional socio-economic background made more progress on numeracy across the P1 and P2 period than children from an unskilled background. Children from the remaining socio-economic groups appeared to make similar progress to children from a professional background.

Children whose mothers have 16 academic, 18 academic or degree and above qualifications made greater progress on numeracy than children whose mothers do not have any qualifications.

Children who had a regular bedtime in their first three years made more progress on numeracy during P1 and P2 than children who did not have a bedtime routine.

Children from the Belfast, Western or North-Eastern ELB areas appeared to make more progress on numeracy than children from the Southern ELB area.

In comparison with children who did not attend any form of pre-school, children who attended nursery classes/schools, playgroups or reception classes made more progress on numeracy during P1 and P2.

Numeracy

Table 12: Numeracy Progress (Pre-school type)

$R^2 = .39$
Adjusted $R^2 = .37$
$F (20, 650) = 20.89, p < .0001$

	Beta	Significance
P1 Cognitive Outcome		
P1 Early Number Concepts	.47	.000
Child Variables		
Age	-.21	.000
Pre-school centre *(compared with Reception Group)*		
Nursery Class/School	.16	.008
Playgroup	.10	ns
Private Day Nursery	.15	.005
Reception Class	.15	.005
Parental Variables		
Mothers' Quals (compared with none)		
16 Vocational	-.01	ns
16 Academic	.15	.001
18 Vocational	.07	ns
18 Academic	.10	.009
Degree and Above	.20	.000
Home Variables		
Regular Bedtime	.08	.011
ELB Area *(compared with Southern)*		
Belfast	.11	.004
Western	.15	.001
North-Eastern	.08	ns
South-Eastern	.04	ns
Pre-School Characteristics		
ECERS-R Subscales;		
Parents and Staff Facilities	-.18	.000
ECERS-E Subscales;		
Science	.20	.000
Pre-school staff-child interaction;		
Positive Relations	-.16	.000
Punitiveness	-.14	.000

Children who scored higher on early number concepts at the beginning of P1 made more progress on numeracy during the first two years of primary school.

Younger children made more progress on numeracy during P1 and P2 than older children.

Compared with children whose mothers do not have any qualifications, children whose mothers have 16 academic, 18 academic or degree and above qualifications made more progress on numeracy during P1 and P2.

Children who had a regular bedtime in their first three years made more progress on numeracy across the P1 and P2 years, than children who did not have a bedtime routine.

Children who attended pre-school in the Belfast or Western ELB areas appeared to make more progress on numeracy than children from the Southern ELB area.

Children who attended pre-schools that were rated higher on the ECERS-R subscale, Parent and staff facilities made less progress on numeracy across the P1 and P2 period. Children who attended pre-schools that were rated higher on their provision of science made more progress on numeracy across P1 and P2.

Children who attended pre-school where the interactions between the caregiver and children were rated as more positive, made less progress on numeracy during P1 and P2. Children who attended pre-school where the interaction between staff and children was rated as more punitive made less progress on numeracy during P1 and P2. Possibly where numeracy experiences are encouraged there are more moderate interactions.

Compared with children who attended reception groups, children who attended nursery classes/schools, private day nurseries or reception classes appeared to make more progress on numeracy across the P1 and P2 period. There appeared to be no difference between children who attended reception groups and children who attended playgroups in relation to numeracy progress.

Summary and Discussion

The summary deals with the overall pattern of results across all attainment and progress analyses. The results are grouped by category of predictor variable.

Child Variables

- Gender affected children's scores on literacy, with girls attaining better scores than boys at the end of P2.
- Heavier birth weight children attained higher scores on literacy and numeracy compared with lower birth weight children. Also heavier birth weight children made more progress on numeracy over the first two years of primary school.
- Compared with children who did not have any health problems in their first three years, children who had early health problems and received treatment made more progress on numeracy across the first two years of primary school.
- Younger children made more progress on numeracy than older children during P1 and P2.

Socio-Economic Status Variables

While the specific significant comparisons varied between analyses, the overall pattern below emerged.

Compared with children with parents from a Professional socio-economic status, children from;

- All other SES backgrounds either attained lower scores or made less progress on literacy, and usually both applied, over the first two years of primary school.
- Children from an unskilled background also attained lower scores on numeracy and made less progress in numeracy over the first two years of primary school.

- Children who live in areas where there is greater child poverty attained lower scores and made less progress in literacy than children from relatively more affluent areas over the first two years of primary school.

Parental Variables

Parental qualifications were important for literacy and numeracy attainment.

- Mothers' qualifications were significant for both literacy and numeracy. Compared with children whose mothers do not have any qualifications; children whose mothers had any type of qualification attained higher scores on numeracy; and children whose mothers have degree or above also scored better on literacy.
- In addition children whose mother's had 16 academic, 18 academic or Degree plus qualifications showed more progress in numeracy over the first two years of primary school.

- Fathers' qualifications were related to children's attainment on both literacy and numeracy. Compared with children whose fathers do not have any qualifications, children whose fathers have 16 vocational, 18 academic or degree and above qualifications scored better on literacy and numeracy. The effects for fathers' qualifications become greater if mothers' qualifications are not considered simultaneously.

Fathers' employment was associated with literacy attainment.

- Compared with children whose fathers are employed full time, children whose fathers are self employed attained lower scores on literacy and made less progress in literacy over the first two years of primary school.

Home Variables

- Play with friends was significant for numeracy; as compared with children who did not experience any play with friends outside of their own home, children who had a moderate level of such play attained better scores on numeracy.
- Children who had a regular bedtime attained higher scores on numeracy than children without a bedtime routine, and also made more progress in numeracy over the first two years of primary school, possibly indicating the influence of a structured home environment.
- The biggest effect for home background was for the Home Learning Environment where the higher the rating on the home learning index, the better children's scores were on both literacy and numeracy.

Childcare factors

- There was a small effect for one comparison only for children who experienced more individual care (e.g. child minder) in the first three years, in that they attained lower scores on numeracy at the end of the P2 year.

ELB Area

Compared with children from the Southern ELB area,

- Children in the Belfast ELB area attained higher scores on numeracy, and made more progress in numeracy over the first two years of primary school.
- Children in the Western and North Eastern ELB areas made more progress on both literacy and numeracy over the first two years of primary school, but did not show higher attainment.
- Children in the South Eastern ELB area appeared to make similar progress on literacy and numeracy.

Type of Pre-school

Compared with children who did not attend pre-school, children who attended;

- Nursery Class/School or Playgroup provision attained higher scores on literacy, and made more progress in literacy and numeracy over the first two years of primary school.
- Reception Class showed more progress in numeracy over the first two years of primary school.

Considering differences amongst those children who attended some type of pre-school and making comparisons against those who attended Reception Groups, children who attended;

- Nursery Class/School provision appeared to attain higher scores on literacy and numeracy, and also made more progress in literacy and numeracy over the first two years of primary school.
- Playgroups attained higher scores on literacy, and made more progress in literacy over the first two years of primary school.
- Private Day Nurseries attained better scores on numeracy, and made more progress in literacy and numeracy over the first two years of primary school.
- Reception Class attained higher scores on numeracy and made more progress in numeracy over the first two years of primary school.

Pre-school staff qualifications

Pre-school leaders' qualifications were significant for literacy.

- Compared with children who attended pre-school where the leader did not have any qualifications, children who attended pre-school where the leader has a Bachelor of Education qualification scored higher on literacy.

Pre-school Characteristics

Pre-school ratings on the ECERS-R and ECERS-E subscales were significant for literacy and numeracy.

- Children who attended pre-schools that were rated higher on the ECERS-R subscale, Care scored lower and made less progress in literacy.
- Children who attended pre-schools that were rated higher on the ECERS-R subscale, Parent and staff facilities, scored lower and made less progress in numeracy.
- Children who attended pre-schools that scored higher on the ECERS-R subscale, Programme structure, scored higher and made more progress in literacy.
- Children who attended pre-schools that were rated higher in their provision of Science attained better scores and made more progress in numeracy.
- Children who attended pre-schools that scored higher on the ECERS-R subscale, Activities, attained higher scores in literacy.

Pre-school staff-child interaction

- Children who attended pre-school where the interaction between staff and children was rated as either more positive or more punitive attained lower scores and made less progress in numeracy.

Pre-school peer group composition

- When children had attended a pre-school group where mothers were better qualified, they attained higher scores on numeracy and made more progress in literacy by the end of P2.

In considering these results it is clear that some variables influence attainment, some influence progress and some influence both attainment and progress.

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

When a variable shows a significant effect on progress but not on attainment, this indicates that the effect occurs over the first two years of primary school, but that the effect has been a 'catching up' effect whereby some children have reached a similar level as other children but from a lower starting point at the beginning of primary school.

Where both attainment and progress analyses reveal significant effects this indicates that the variable has had an effect over the first two years of school, and that the overall attainment at the end of P2 is affected either because;

a. the effect over the school period is more than a 'catching up' effect or
b. the variable exerted an influence in the pre-school period that affected the start of school performance and that the effect continues into the first two years of primary school.

With regard to the child variables considered, the better performance of girls on literacy is a continuation of their superior performance at entry to school, where they maintain their relative advantage over boys. The effects for birthweight show that birthweight differences have continued effects over those found in the pre-school period. The effects for children with early health problems indicate that these children are catching up with other children in numeracy over the first two years of school, as are younger children within their age group.

The effects for socio-economic and parental variables reflect the patterns found earlier in this study and this is a pattern also found in other studies, whereby the lower the socio-economic status and the lower the qualifications of parents, the less well children do in terms of cognitive development. These are general patterns and there are individual cases of children from disadvantaged circumstances doing very well.

One aspect of these results is new to this study and this is the poorer performance in attainment and progress on literacy where the father is self-employed. This suggests that self-employment for fathers may be related to patterns of family life that are not supportive of good literacy development. It is likely that self-employed parents work longer hours, and possibly the greater hours of work for self-employed fathers results in less opportunity for activities with young children that may help literacy, e.g. reading with the child. This issue would require further investigation to explain with confidence.

With regard to other home-related experience, the continued strong effect for the Home Learning Environment reflects earlier results. The absence for a progress effect for this variable suggests that its effects are primarily enacted within the pre-school period, but that these gains are maintained across the first two years of primary school. The positive effects on numeracy for the variable, play with friends, indicates that homes where this opportunity is provided also tend to foster numeracy but it is unclear how this might happen. Possibly the nature of some preschool peer play fosters some mathematical/numerical concepts e.g. comparison, counting and spatial skills. Also where children have a regular bedtime this is associated with improved attainment and progress in numeracy, which is possibly an indication of the benefits of a more structured home environment.

There was a small, isolated effect for early childcare, whereby those children with higher levels of individual childcare (i.e. cared for by an unrelated individual) in the first three years did less well in numeracy attainment. It is unclear how this might have happened and it would be appropriate to look for future supporting evidence before giving this finding further consideration.

The project is able to look at differences associated with the Education and Library Board (ELB) areas. In the earlier reports at entry to school the children from the Southern ELB were doing better on several measures than children in other areas. In this report the greater progress for literacy and numeracy shown by children from the Western and North Eastern ELB areas, but with no greater attainment, indicates that children from these areas are catching up with children from the Southern ELB over the first two years of primary school. However the superior attainment and progress of children from the Belfast ELB on numeracy was not to be anticipated from entry to school results. Thus it appears that the numeracy work in the first two years of primary school in Belfast offers advantages over that undertaken in the rest of Northern Ireland.

These results clearly indicate that the effects of pre-school experience found earlier in this study are being maintained after two years of primary school. In particular children who attended nursery schools and classes do better at literacy and numeracy than any other group of children in the study, with or without pre-school experience. Children from playgroups do well with regard to literacy doing better than home children or children from reception groups. Children from private day nurseries do better in attainment and progress for numeracy, and better for progress in literacy than reception group children. Reception class children show some improvement over their standing at entry to school and show more progress in numeracy than home or reception group children, while also showing higher attainment in numeracy than reception class children.

The results also reinforce the continuing importance of qualifications for leaders of pre-school centres in that where a pre-school centre leader has a Bachelor of Education degree the children attain higher literacy scores after two years of primary school.

In addition the results indicate some continuing effects related to the quality characteristics of pre-school centres. It appears that centres where there is relatively higher attention paid to aspects related to the routine care of children or to adult facilities then children will not make as much progress in numeracy in the first two years of primary school This indicates that such activities may not be conducive to good preparation for developing numeracy skills. On the other hand where science activities are given greater attention in pre-school this appears to improve the preparation for later numeracy learning. Similarly greater attention in the pre-school to programme structure and range of activities both appear to be associated with better preparation for literacy skills.

An unexpected finding related to pre-school staff interaction was that where there were high levels of either positive or punitive interactions, the children later did not do as well in numeracy in the first two years of primary school. There appears to be an association with poorer preparation for numeracy for reasons as yet unclear.

There was an effect of composition of pre-school group whereby if a pre-school peer group had mothers with higher qualifications the children attained higher scores on numeracy and made more literacy progress. This indicates continued peer group influence in learning in the early years of primary school.

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Appendices

Appendix 1

Pre-School Effects in Comparison with Home Children

	Literacy		Numeracy	
In comparison with Home Children;	Attainment	Progress	Attainment	Progress
Nursery Class/School	+	+		+
Playgroup	+	+		+
Private Day Nursery				
Reception Class				+
Reception Group				

The above table shows the impact of pre-school type compared with home children on cognitive attainment and progress.

In analysing attainment the child, socio-economic (area and parent), parent, family, home, childcare, and type of pre-school attended affecting the child's level of attainment at the end of P2 were considered. The child's earlier level of cognitive functioning is not taken into account.

In analysing progress, all possible predictor variables used in attainment were analysed, but, in addition, the child's level of functioning at the start of P1 is taken into account.

Key;

'+' = Children from this particular type of pre-school appeared to attain significantly higher scores at the end of P2 or make more progress across the P1and P2 period than home children, on the cognitive subscale concerned.

Where a cell remains blank, this means that there appeared to be no difference between children who attended pre-school and home children in their attainment and progress on the cognitive subscale concerned.

Appendix 2

Pre-School Type Effects

	Literacy		Numeracy	
In comparison with Reception Group;	Attainment	Progress	Attainment	Progress
Nursery Class/School	+	+	+	+
Playgroup	+	+		
Private Day Nursery		+	+	+
Reception Class			+	+

The above table shows the impact of each type of pre-school provision on children's cognitive attainment and progress across the P1 and P2 period by comparing the scores of children who attended reception group provision with children who attended the other main types of pre-school provision on literacy and numeracy at the end of P2.

Key;

'+' = Children from this particular type of pre-school appeared to attain significantly higher scores at the end of P2 or make more progress across the P1 and P2 period, than reception group children, on the cognitive subscale concerned

Where a cell remains blank, this means that there appeared to be no difference in the attainment or progress of children who attended reception group and other types of pre-school provision on the cognitive measure concerned.