GROWING UP IN SCOTLAND:
Changes in child cognitive ability in the pre-school years

GUS
GROWING UP IN SCOTLAND

smarter scotland
SCOTTISH GOVERNMENT

GROWING UP IN SCOTLAND:
Changes in child cognitive ability in the pre-school years

The Scottish Government, Edinburgh, 2011

This document is also available from our website at **www.scotland.gov.uk**.

ISBN: 978-1-78045-200-5 (web only)

The Scottish Government
St Andrew's House
Edinburgh
EH1 3DG

Produced for the Scottish Government by APS Group Scotland
DPPAS11601 (06/11)

Published by the Scottish Government, June 2011

GROWING UP IN SCOTLAND:
Changes in child cognitive ability in the pre-school years

Paul Bradshaw

Prepared for the Scottish Government: Children and Families Directorate by
the Scottish Centre for Social Research

Suggested citation: Bradshaw, P. (2011) *Growing Up in Scotland: Changes in child cognitive ability in the pre-school years,* Edinburgh: Scottish Government

ACKNOWLEDGEMENTS

First and foremost, the author would like to thank all the families who have given up their time to take part in the study and have supported it continuously sweep by sweep.

The Growing Up in Scotland study is very much a collaborative venture. We owe a huge debt of gratitude to our colleagues in NatCen's operations and computing departments and to our team of interviewers and supervisors for conducting the interviews with such dedication and professionalism.

I would also like to thank everyone involved in the preparation of this report – particularly John Curtice who provided advice on the analysis and Wendy van Rijswijk and colleagues at the Scottish Government who provided feedback on early drafts.

Responsibility for the opinions expressed in this report, and for all interpretation of the data, lies solely with the author.

Contents

This report examines changes in cognitive ability between the ages of 3 (34 months) and 5 (58 months) years amongst children with different social background characteristics and seeks to identify which circumstances and experiences contribute to the relative improvement of cognitive ability of children in lower (and higher) socio-economic groups in the pre-school period. In so doing, the report aims to identify factors which policy could usefully affect in order to maximise children's cognitive ability ahead of entering school and help to narrow the considerable difference in ability between children from more and less advantaged circumstances.

The report aims to answer a number of distinct research questions:

- Does the gap in cognitive ability between children with different social background characteristics change between ages 3 and 5?
- Which factors help or hinder improvement in cognitive ability between ages 3 and 5?
- Are the factors which influence improvements in cognitive ability during the pre-school period different for children whose parents have lower levels of educational qualifications and those whose parents have higher level qualifications?

Examining the gap in cognitive ability

- Children from higher income households, those whose parents have higher educational qualifications, and those with higher socio-economic classifications, have better vocabulary and problem solving scores, on average, at both ages than children whose parents have lower incomes, lower educational qualifications and are in lower socio-economic classifications.
- The largest differences in ability are between children whose parents have higher and lower educational qualifications. At age 5, compared with children whose parents have no qualifications, those with a degree-educated parent are around 18 months ahead on vocabulary and 13 months ahead on problem solving ability.
- The difference in vocabulary ability between children in the lowest and highest income groups reduced slightly between ages 3 and 5. The difference by social class did not change. The gap in vocabulary ability between those children in the lower and upper education groups widened in the pre-school period.
- The gap in problem solving ability by parental education and social class narrowed whilst differences in problem solving ability by income level widened.
- Of the three social background characteristics considered, parental level of education was most strongly associated with *change* in cognitive ability between ages 3 and 5. Children whose parents had higher qualifications were more likely to see their ability improve, relative to their peers, compared with those whose parents had no qualifications.

- A parent's lack of educational qualifications appears to have a continuing detrimental effect on children's vocabulary ability during the pre-school years. Children whose parents have lower qualifications have lower ability at age 3, and they are less likely to see an improvement in their ability during the pre-school period. This means that these children, who are already at a disadvantage, fall further behind their peers ahead of their entry to school. Other research suggests that those children who are developmentally behind at school entry will continue to stay behind.

Factors which help or hinder improvement

- Compared with children whose parents are degree-educated, those whose parents have no qualifications are more likely, amongst other things, to have younger mothers, live in lone parent families, experience lower levels of home learning activities and household rules, had a low birth weight, poorer general health, and a mother who smokes.
- Due to these characteristics also being associated with cognitive ability, some of these differences in circumstances and experiences of children from different educational backgrounds explain some of the education-related gaps in their cognitive ability.

Changes in vocabulary ability during the pre-school period were found to be more strongly related to aspects of the child's home environment and the choices and behaviours of parents (such as frequency of reading to the child, and level of infant-maternal attachment), than external influencing factors such as pre-school education.

- After controlling for parental education level, greater consistency of parenting, stronger parent-child attachment, attendance at ante-natal classes and breastfeeding were each independently associated with a relative improvement in vocabulary ability in the pre-school years.
- Early language development is also important – those children who display better communicative skills at an earlier stage are more likely to see their skills improve during the pre-school period. It would appear generally beneficial therefore, to seek to improve children's communication ability from the very earliest stages and establish better skills earlier in order to ensure continued positive language development.

Changes in problem solving ability during the pre-school period are related to parenting, the home environment and external factors like the type of pre-school the child attended.

- A higher frequency of home learning activities and being breastfed were each independently associated with a relative improvement in problem solving ability. External factors were also associated with changes in this ability.

- Attending a private nursery school for pre-school education and having some experience of primary school were both associated with positive development whereas not attending pre-school and living in an area in the most deprived quintile were associated with a relative decline in ability.

These factors present a complex picture of the numerous elements of children's lives which, taken together, can influence their cognitive development. Influencing just one factor is unlikely to generate any change in children's ability.

Were the effects different according to parental level of education?

Analysis was undertaken to examine whether the factors associated with change in ability identified above had different effects for children from lower educated households and those in higher educated households.

Vocabulary ability

- Lack of educational qualifications amongst younger mothers appears to be of less significance than a lack of qualifications amongst older mothers in respect of change in relative language ability. Rather than 'doubling' the negative effect, having a younger mother in the low qualifications group appeared to cancel out some of the negative impact of the lack of qualifications.
- The positive impact of infant-maternal attachment on improvement in relative language ability was specific to children whose parents have lower qualifications. This implies that the overall negative effect on cognitive development associated with a lack of parental qualifications can be limited somewhat by improving early infant-maternal attachment.
- The positive relationship between early communication skills and relative improvement in vocabulary between ages 3 and 5 was more pronounced for children whose parents had no or lower qualifications. Thus, children from less educated backgrounds whose relative vocabulary ability improves in the pre-school period are those who were already demonstrating more advanced communication skills at an earlier age. For children whose parents have no or lower qualifications, poor early communication skills will likely persist through the pre-school period with little or no relative improvement. In contrast, a lack of advanced early communication skills does not appear to necessarily prohibit later improvement in vocabulary for children in families where parents have higher qualifications.
- The positive effect of attendance at ante-natal classes on relative improvement of vocabulary applied equally to children in all educational groups. Thus ante-natal classes appear to have a 'universal' positive effect. However, it is possible that

attendance at ante-natal classes is measuring characteristics associated with a desire to be a good parent which are also beneficial to the improvement of vocabulary ability in the pre-school period. Thus, simply improving attendance at ante-natal classes alone is not likely to lead to improved cognitive ability.

Problem solving ability

- Experiencing a higher frequency of parent-child activities such as reading, drawing, and singing nursery rhymes at the ages of 2 and 3 has more benefit in respect of the relative improvement of problem solving ability for children whose parents have lower qualifications than for those who had higher qualifications. Increasing such activity for children from less educated backgrounds may therefore help to reduce the ability gap.
- None of the remaining factors associated with change in problem solving ability – attending a private pre-school, starting primary school, being breastfed and living in an area in the most deprived quintile – showed different effects for children in lower and higher educational groups.

Conclusion

The level of parents' educational qualifications is both a driver of overall changes in child cognitive ability at age 3 and age 5, and of change in cognitive ability for individual children in the pre-school period. However, some of these differences are accounted for by variations in other aspects of the lives of children from lower and higher educational groups. The findings suggest that by influencing some of these other factors, the education gaps in cognitive ability may be somewhat reduced.

The factors which showed some potential in this respect were associated with aspects of the child's home environment and the choices and behaviours of their parents – factors which are traditionally more difficult for policy to affect than more external, service-based influences such as pre-school and primary school education. However, external influences were not absent from the findings – both pre-school and early primary school experiences were shown to have some positive impact on problem solving ability. It is unclear which particular characteristics of privately-provided pre-school education generate this effect. The importance of good early development is also key with success in early communicative development proving important for later positive development. This confirms the importance of supporting and facilitating good development from the earliest possible stages of children's lives.

The factors that mattered for supporting child development were different for parents with lower and parents with higher educational qualifications. This suggests that universal policies which seek to improve children's cognitive ability and school readiness in the pre-school period will not benefit all children equally.

The mix of family and institution effects for lower and higher educated parents suggests that any strategies aimed at improving school readiness via the pre-school setting will require, for more disadvantaged children, a parallel strand which seeks to influence the child's home environment and parenting experiences. This confirms findings from Geddes et al (2010) who, in their review of interventions designed to improve school readiness, found that the most successful interventions utilised a mixed (centre and home-based), two generation (child and parents) approach. To ensure that children's cognitive ability is maximised in the pre-school period, our findings suggest that, in the home, such strategies should focus on the quality of the parent-child relationship and the frequency of home learning activities.

This report presents a complex picture of the numerous elements of children's lives which, taken together, can influence their cognitive development. Influencing just one factor is unlikely to generate any change in children's ability. Thus any policy must recognise the multi-faceted nature of factors which impact on children's development and seek to address improvements in each of those areas in order to close the ability gap. By improving children's cognitive ability ahead of their entry to primary school, there is a greater likelihood that they will achieve better educational and employment outcomes over the longer term.

chapter
1
INTRODUCTION

1.1 Background

Analysis in this report examines differences in cognitive ability at age 3 and 5 years amongst children with different social background characteristics and seeks to identify which circumstances and experiences contribute to change in the cognitive ability of children in lower (and higher) socio-economic groups in the pre-school period. In so doing, the report aims to identify factors which policy could usefully affect in order to maximise children's cognitive ability ahead of entering school and help narrow the considerable difference in ability between children from more and less advantaged circumstances.

To date, research from the Growing Up in Scotland (GUS) study has demonstrated stark variation in cognitive ability at age 3 amongst children from different backgrounds. Bromley (2009) found that children from less advantaged families were outperformed by their more affluent counterparts and noted worse ability in particular amongst boys, children with younger mothers, those from lone parent families, children with early developmental difficulties and those with a low birth weight. Bradshaw and Wasoff (2009) further revealed a relationship between early experience of childcare and cognitive ability, with children who experienced between 17 and 40 hours of non-parental childcare a week shown to have better vocabulary acquisition at age 3. Considerable other research has linked childcare and pre-school experiences to cognitive ability, indicating, for example, that as compared to no experience of centre-based care or pre-school education, children with any experience tend to have improved language and cognitive skills (Sylva, 2009; Butt et al, 2007; Magnuson et al, 2010). The quality of provision is the key element of the care and pre-school experience associated with making the greatest impact on on intellectual and cognitive development (Sylva et al, 2009). Experiences in the home are also important, as analysis from GUS has shown. Both Bromley (2009) and Melhuish (2010) have demonstrated a positive relationship between the amount of home learning activities a child experiences and their level of cognitive ability. In other analysis poor maternal mental health and experience of poverty have been linked to lower cognitive scores (Marryat and Martin, 2010; Barnes et al, 2010).

A range of other research has explored whether these gaps in ability persist as children age. Feinstein (2000) for example, found that children of educated or wealthy parents who scored poorly in early tests (at 22 or 42 months), had a tendency to catch up whereas children of disadvantaged parents who scored poorly were extremely unlikely to catch up and are a group at risk of poorer educational outcomes over the longer term. Recent research from the Millenium Cohort Study (Blanden and Michin, 2010) partially replicated this analysis with similar results; children from higher income households with poorer vocabulary at age 3 improved more quickly than their lower-income peers. The same research, whilst also identifying a gap in attainment at both ages 3 and 5 between

children in the lowest and highest income groups, did not demonstrate any significant widening of the ability gap between these groups of children in that specific period, contrary to Feinstein's earlier data, but neither did they show that the gap narrowed.

These, and other studies, demonstrate clearly that the relationship between social background and cognitive development is present at pre-school age (see also Denton, West and Walston, 2003) and even before (McCall 1981). Crucially, long-term analysis of cognitive development and attainment from birth, through pre-school into school and beyond suggests that children's movement between ability groups slows on entering school. Feinstein (2000) found that assessment scores at 60 months were more closely related to educational qualifications at age 26 than were earlier scores. Such evidence has led a number of authors to conclude that patterns of cognitive development and attainment are more difficult to change once children enter school (Heckman and Wax, 2004; see also evidence from CECD and Mustard in Haw, 2010). Other evidence demonstrates the potential long-term benefits of narrowing the early ability gap on, for example, reducing inequalities in final educational attainment or labour market participation (Feinstein, 2000; Heckman et al, 2006; Sinclair, 2007). Combined, these findings highlight the important role that experiences and development during the early years have on later educational achievement and suggest that more should be done to maximise the improvement of children's development before they enter school, including in the immediate pre-school period.

The theme of early intervention has been a prominent feature of much recent UK and Scottish Government policy. In Scotland, the National Performance Framework, which has underpinned and provided focus to all policy development since 2007, has as one of its national outcomes that "children should have the best start in life and are ready to succeed". To achieve this, each of the three policy frameworks – *Achieving Our Potential, Equally Well* and the *Early Years Framework* – acknowledge the importance of early intervention and the improvement of children's circumstances in the early years in order to benefit them in later life. The particular economic benefits of early intervention to Scotland's public spending have also recently been explored (Finance Committee of the Scottish Parliament, 2011; Scottish Government, 2010a). The preventative spending enquiry led by the Scottish Parliament's Finance Committee examined how public spending could be focussed more on preventing negative outcomes than dealing with them when they occur. In written evidence to the enquiry, the Scottish Government noted that preventative action was "integral to the approach to government in Scotland and delivering the outcomes set out in the National Performance Framework" (Scottish Government, 2010). Similar policy moves are also evident in the UK Government reflected, for example, through their concurrent commissioning of an independent review of early intervention (Allen, 2011) and the independent review on poverty and life chances (Field, 2010).

Data from the Growing Up in Scotland study (GUS) offers the potential to present a detailed exploration of changes in children's cognitive ability – more specifically their knowledge of vocabulary and skills in non-verbal reasoning – between the ages of 3 and 5 and to identify the factors associated with different directions and magnitudes of change for different groups of children, adding to the existing evidence referenced above. The existing analysis of GUS data on this topic has focused on cognitive ability at a single time point – age 3 (34 months) and the child's circumstances and experiences prior to that. The same cognitive assessments were more recently repeated at the fifth sweep of fieldwork, when the children were aged 5 (58 months). Using these two sets of data, this research will explore change in cognitive ability between the ages of 3 and 5 and examine, in particular, the extent to which early gaps in ability by children's social background remain, reduce or increase in this period.

A key aim of this report is to identify which circumstances and experiences contribute to the improvement of cognitive ability of children in lower (and higher) SES groups in the pre-school period. The results will allow policy to focus on improving those circumstances and experiences in order to maximise children's cognitive ability ahead of entering school in a period shown, in the longer-term research cited above, to be crucial to children's outcomes in adulthood. The pre-school period presents a unique opportunity for policy to make an impact on children's lives via statutory pre-school education. Evidence from GUS (Bradshaw et al, 2009) and from Scottish Government statistics (Scottish Government, 2010) suggests that over 95% of children eligible for a pre-school place take-up that place. Understanding better the factors which inhibit and which improve children's cognitive ability during this time will permit the provision of services and support to maximise children's ability ahead of school entry. In so doing, outcomes for children in these domains will not only improve throughout their school career but also beyond, in their transitions to further education and employment.

1.2 Adding to the evidence base

This report will go beyond the existing analysis of BCS 1970 and MCS data by investigating which factors, in addition to indicators of social background – such as child health, parenting behaviours and area deprivation - impact on *changes* in cognitive development between the ages of 3 and 5. The focus of much work in this area has been on differences observed by household income and social class[1] (Blanden and Machin, 2010; Feinstein, 2003; Waldfogel and Washbrook, 2010). For example, recent analysis of MCS data (Blanden and Machin, 2010) suggested that there was little change in the size of the ability gap between children in lower and higher income households between ages 3 and 5, and further that average scores amongst children in the lowest income groups had not declined during the period considered. This was cautiously

1 Although Cullis and Hansen (2008) consider other factors which influence cognitive ability at age 5, including maternal education, and also make use of value added models (which take account of earlier ability at age 3) in their analysis.

offered as a small, but positive improvement for that group. As this report will show, GUS data, whilst detecting only a small amount of change in the income ability gap, suggests that gap narrows during the pre-school period with children in all income groups showing a relative improvement in scores, but particularly those in the lowest income group. This contrasts with change across income groups in relation to problem solving ability, where a slight increase in the ability gap is evident. Whilst household income and social class will be considered initially, the analysis of ability gaps in this report will centre on differences by level of parental education.

In addition, whereas only data on vocabulary acquisition has been considered in the previous analyses, the GUS analysis will also examine changes in problem solving ability (non-verbal reasoning). The analyses in this report suggest that the variations in ability observed by level of parental education are quite different to those associated with income. Our findings suggest that lack of parental qualifications has a continuing detrimental effect on children's vocabulary ability during the pre-school years seeing those children fall further behind their peers ahead of their entry to school.

1.3 Research questions

This report aims to answer a number of distinct research questions:

- Does the gap in cognitive ability between children with different social background characteristics change between ages 3 and 5?
- Which factors help or hinder improvement in cognitive ability between ages 3 and 5?
- Are the factors which influence improvements in cognitive ability during the pre-school period different for children whose parents have lower levels of educational qualifications and those whose parents have higher level qualifications?

Initial analysis will look simply at the difference in cognitive ability at ages 3 and 5 between children with different social backgrounds. Social background characteristics considered will include parental education, annual household equivalised income and socio-economic classification. Comparison of average scores on each of the assessments for children in each of the groups is undertaken to demonstrate broad differences in ability, and to identify any changes in the magnitude of those differences at an overall level.

The next stage of the analysis draws on the existing literature to identify potential factors which may be associated with improving children's cognitive development in the pre-school period[2].

2 A description of the analysis is included in the Technical Appendix.

The final analytical stage examines whether the impact of key factors on pre-school cognitive development are stronger or weaker for children with degree educated parents compared with those whose parents have lower or no qualifications or whether there is no difference in effects at all between children in each group.

1.4 Methods

1.4.1 The Growing Up in Scotland study

The analysis in this report uses information from families in the **birth cohort** that took part in all of the first five sweeps of GUS (n = 3621)[3]. Some families who initially took part in GUS did not do so for all of the subsequent sweeps. There are a number of reasons why respondents drop out from longitudinal surveys and such attrition is not random. All of the statistics have been weighted by a specially constructed longitudinal weight to adjust for non-response and sample selection. Both weighted and unweighted sample sizes are given in each table. Standard errors have been adjusted to take account of the cluster sampling[4].

At each sweep/year of fieldwork, interviews took place around six weeks before the child's next birthday, therefore in the first year of the study, children were 10 months old, in the second year they were 22 months old and so on. For the purposes of this report, beyond the first interview, the child's age will be referred to in years. It is worth bearing in mind however that a 3-year-old child at sweep 3 for example, is actually 34 months old or just under 3, and a 5-year-old child at sweep 5 is actually 58 months old or just under 5.

1.4.2 Measuring cognitive ability

Cognitive ability was measured in the GUS birth cohort via two assessments: the naming vocabulary and picture similarities subtests of the *British Ability Scales Second Edition* (BASII). These two assessments measure, respectively, language development and problem solving skills. Each subtest is part of a cognitive assessment battery designed for children aged between 2 years and 6 months and 17 years and 11 months. The assessments are individually administered. Numerous tests of ability and intelligence exist but the BAS is particularly suitable for administration in a social survey like GUS.

The naming vocabulary assessment measures a child's language development. The test requires the child to name a series of pictures of everyday items and assesses the expressive language ability of children. The picture similarities assessment measures a child's problem solving ability (or non-verbal reasoning). In the assessment children are

3 Further information on the design, development and future of the project is available from the study website: www.growingupinscotland.org.uk

4 The GUS sample is generated in two stages. The first stage randomly selects geographic areas or clusters, the second stage selects individuals within those clusters. The standard errors are adjusted to take account of the geographic clustering of the sample at the first stage.

shown a row of four pictures on a page. They are asked to place a free-standing card with a fifth picture underneath the picture with which the card shares a similar element or concept. There are 36 items in total in the naming vocabulary assessment and 33 items in the picture similarities assessment. However, to reduce burden and to avoid children being upset by the experience of repeatedly failing items within the scale, the number of items administered to each child is dependent on their performance. For example, one of the criteria for terminating the naming vocabulary assessment is if five successive items are answered incorrectly.

Children in the birth cohort have been asked to complete the same two assessments at two different sweeps of data collection: sweep 3, when they were aged 3 years old (34 months) and sweep 5, when they were aged 5 years old (58 months). As such, the assessment scores offer a snapshot of children's ability in expressive vocabulary and problem solving, first a little ahead of their entry to pre-school education, and second around the time they start primary school.

As children age, their expected rate of development and their expected ability level also changes. As such, the assessments alter slightly with a different item range used at age 5 as compared with age 3. Furthermore, ability scores at age 5 tend to be higher across the board than scores at age 3. As a result, the basic, raw 'ability' score generated from the assessment cannot be compared across time as a child's ability will usually improve with age as a matter of course, and the rate of improvement will differ at different ages (being generally faster at younger ages). In order to examine whether a child's ability relative to his or her peers changes over time therefore, the ability score from each age point was standardised into a z-score. Z-scores are derived from the survey data, they count the number of standard deviations[5] from the score mean and have a mean of zero. Therefore a child with a z-score of zero at either age 3 or 5 has an average ability across all children in that age group. Those with a z-score greater than zero scored above average and those with a score of less than zero scored below average. By using the standardised scores it is possible to compare ability at age 3 and 5 and to consider whether children who scored above, below or about average at age 3 continued to do so at age 5.

1.5 Technical Appendix

Readers interested in the details of the analyses should consult the Technical Appendix published alongside this report.

5 The standard deviation provides a summary of the spread of data values around the mean.

chapter 2

EXAMINING THE GAP IN COGNITIVE ABILITY

2.1 Introduction

This section will consider the difference in cognitive ability between children in different social groups at age 3 and age 5. Differences in ability are considered according to parents' level of education[6], annual household equivalised income and parental socio-economic classification (NS-SEC[7]). The gap in average scores between children in different groups will be defined with the size of the gap compared at both time points. In so doing, it is possible to indicate whether known differences in cognitive ability at age 3 persist as children get older and whether the gap in ability increases, decreases or remains stable over time. The effect of other factors will be considered in chapter 3.

2.2 Key findings

- Children in higher income households, those whose parents have higher educational qualifications, and those with higher socio-economic classifications, on average, have better vocabulary and problem solving scores at both ages than children whose parents have lower incomes, lower educational qualifications and are in lower socio-economic classifications.
- The largest differences in ability are between children whose parents have higher and lower educational qualifications. At age 5, compared with children whose parents have no qualifications, those with a degree-educated parent are around 18 months ahead on vocabulary and 13 months ahead on problem solving ability.
- The gap in vocabulary ability between those children in the lower and upper education groups widened between ages 3 and 5 whereas the difference in vocabulary ability between children in the lowest and highest income groups reduced slightly and the difference by social class did not change.
- The gap in problem solving ability by parental education and social class narrowed whilst differences in problem solving ability by income level widened.
- Of the three social background characteristics considered, parental level of education was most strongly associated with change in cognitive ability between ages 3 and 5. The largest change in size of the ability gap for all children was in relation to differences in education and children whose parents had higher qualifications were more likely to see their relative ability improve in the period than those whose parents had no qualifications.

6 This is measured as the highest educational qualification achieved by any of the child's parents who are resident in the household.

7 Measured using the National Statistics Socio-Economic Classification (NS-SEC) and taken at household level – that is, the highest classification amongst all parents in the household. More information on NS-SEC is included in Appendix 1.

- Lack of parental qualifications appears to have a continuing detrimental effect on children's vocabulary ability during the pre-school years. Children whose parents have lower qualifications have lower ability at age 3 and are less likely to see a improvement in their ability, when compared to their peers, during the pre-school period meaning that they fall further behind other children ahead of their entry to school where, other research suggests, they will continue to do so.

2.3 Differences in expressive vocabulary at ages 3 and 5

Figure 2-A to Figure 2-C display the mean standardised vocabulary ability scores at 3 and 5 years by household equivalised income, parental level of education, and parental socio-economic classification. In each graph, the horizontal line with the value '0' represents the mean score for all children in Scotland at the respective age. The bar in the furthest right position illustrates the *difference* in mean scores between the top and bottom groups – that is, the size of the ability gap (measured in standard deviations). For example, in Figure 2-A, this bar indicates that the mean vocabulary score for children in the lowest income group is 0.77 standard deviations below the mean score for children in the highest income group. In addition, the bar for the lowest income group (at the very left-hand side of the graph) indicates that, on average, those children scored 0.5 standard deviations below the average score for all children.

Irrespective of the particular characteristic considered, the graphs clearly indicate the difference in knowledge of vocabulary by the child's social background. Children in higher income households, those whose parents have higher educational qualifications, and those with higher socio-economic classifications, on average, have better vocabulary scores at each age than children whose parents have lower incomes, lower educational qualifications and are in lower socio-economic classifications.

The differences in scores between the top and bottom groups range from 0.59 to 0.88 standard deviations. The largest differences observed are by parental education. At age 5, children with at least one parent who has a degree or equivalent qualification had an average score 0.88 standard deviations higher than children whose parent(s) had no qualifications. The smallest differences are in relation to NS-SEC.

Figure 2-A Mean standardised vocabulary ability score by equivalised household income

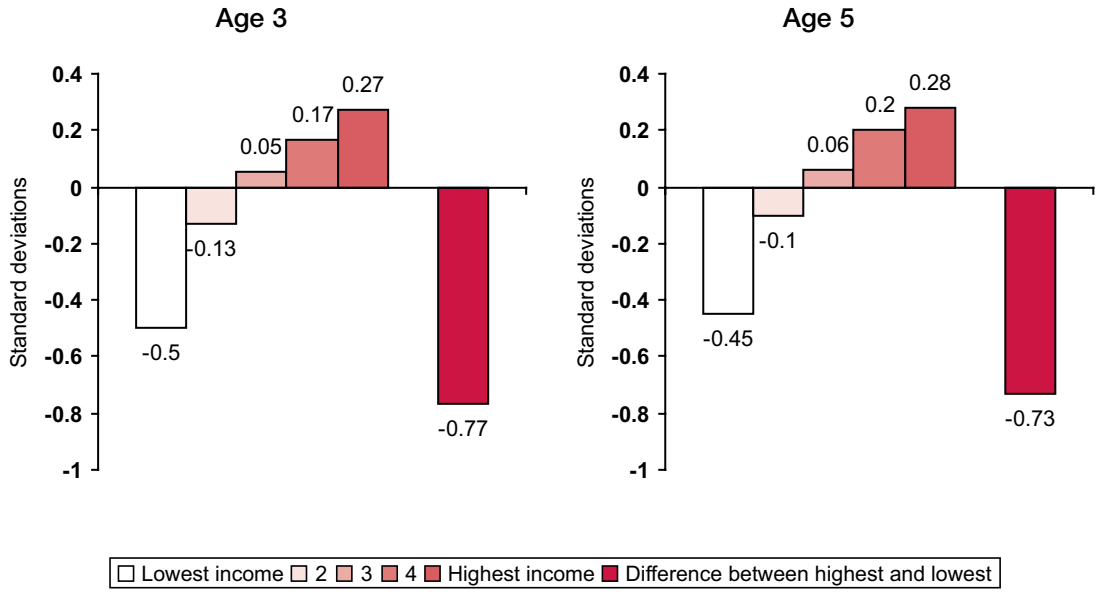


Figure 2-B Mean standardised vocabulary ability score by parents' level of education

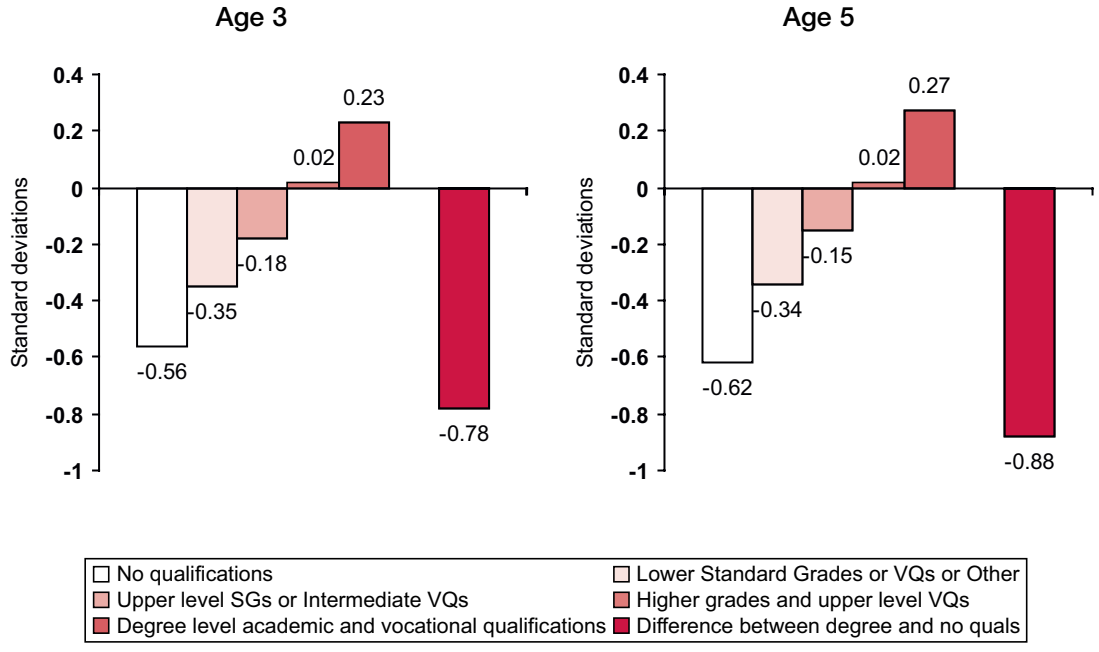
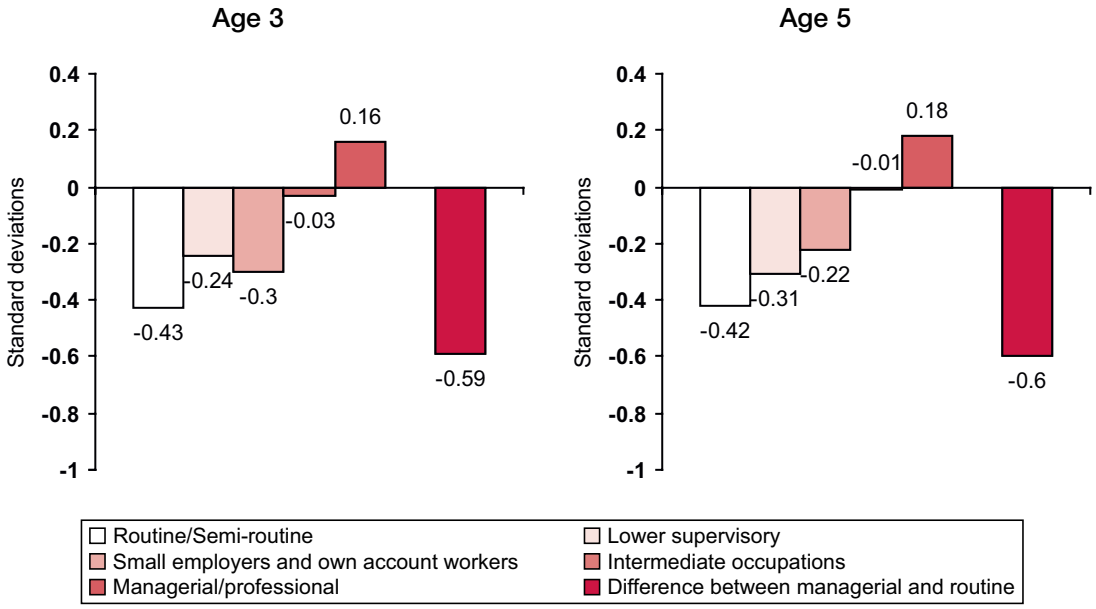


Figure 2-C Mean standardised vocabulary ability score by parental NS-SEC



2.3.1 Age equivalent differences

The use of standardised scores, whilst necessary to compare changes over time, makes it difficult to comprehend the actual size of these differences in developmental terms. To allow a better, although cautious, understanding of this it is possible to report the difference in average scores as an 'age equivalent' based on the progress which would be expected of a typical child at the respective age. Calculations undertaken and published by researchers on the Millennium Cohort Study (Hansen, 2008) provide such monthly estimates[8].

Based on these estimates, at age 5, children with a degree educated parent have a vocabulary ability around 6 months ahead of the average level obtained by GUS children at 5 years and around 18 months ahead of those whose parents have no qualifications, who are therefore around 12 months behind the average ability.

Compared with children in the lowest income group, those in the highest income group were around 13 months ahead in their knowledge of vocabulary. Finally, children from managerial and professional households were approximately 11 months ahead on vocabulary when compared with children whose parents had routine or semi-routine occupations. This again illustrates that the largest gaps occur according parental level of education.

8 The method used by MCS researchers uses differences at the median, averaged across a range of ages. The resulting 'differences in age equivalents' are therefore very rough estimates and should be treated with caution.

2.3.2 Changes in the ability gap

As noted above, the very right-hand bar in Figure 2-A to Figure 2-C displays the difference in mean scores between the top and bottom groups. In other words, this bar illustrates the size of the ability gap. By comparing this figure at both time points it is possible to infer whether the gap has decreased or increased over time.

The ability gap by parental level of education increases, there is a slight reduction in the gap between the lowest and highest income groups and there is virtually no change in the gap between children in routine or semi-routine households and those in managerial or professional households.

The gap between the lowest and highest education groups increases over time by 0.1 standard deviations. At age 3, children whose parents had no qualifications on average scored 0.78 standard deviations below children with a degree educated parent. By age 5, this difference had increased to 0.88 standard deviations. This overall increase in the gap is caused both by a drop in the average scores for the lowest education group (moving from -0.56 at age 3 to -0.62 at age 5) and an increase in scores for the highest education group (moving from 0.23 at age 3 to 0.27 at age 5).

Scores improve generally for children in all income groups. The reduction in the gap results predominantly from the scores of children in the lowest group increasing to a greater degree than those in the highest income group.

2.4 Differences in problem solving ability at ages 3 and 5

Figure 2-D to Figure 2-F display the mean standardised problem solving scores at age 3 and at age 5 by household equivalised income, parental level of education, and parental socio-economic classification. As before, the bar in the furthest right position in each graph displays the *difference* in mean scores between the top and bottom groups – the size of the ability gap.

The trends observed in relation to problem solving ability are similar to those seen for the vocabulary scores. Across each background measure, children in the most disadvantaged groups score lowest and those in the most advantaged groups score highest, with relative scores increasing as levels of income, education and socio-economic classification increase.

The difference between the various groups is considerably broader in relation to problem solving than it is for vocabulary. So far as NS-SEC is concerned, at age 5, the range stretches from a minimum of just 0.30 standard deviations between children in routine or semi-routine households and those in managerial or professional households, to a

maximum 0.73 standard deviations between those in the lowest and highest income households. The magnitude of differences observed by parental education and level of household income are quite similar at around 0.7 standard deviations between the top and bottom groups at both time points.

Figure 2-D Mean standardised problem solving score by equivalised household income

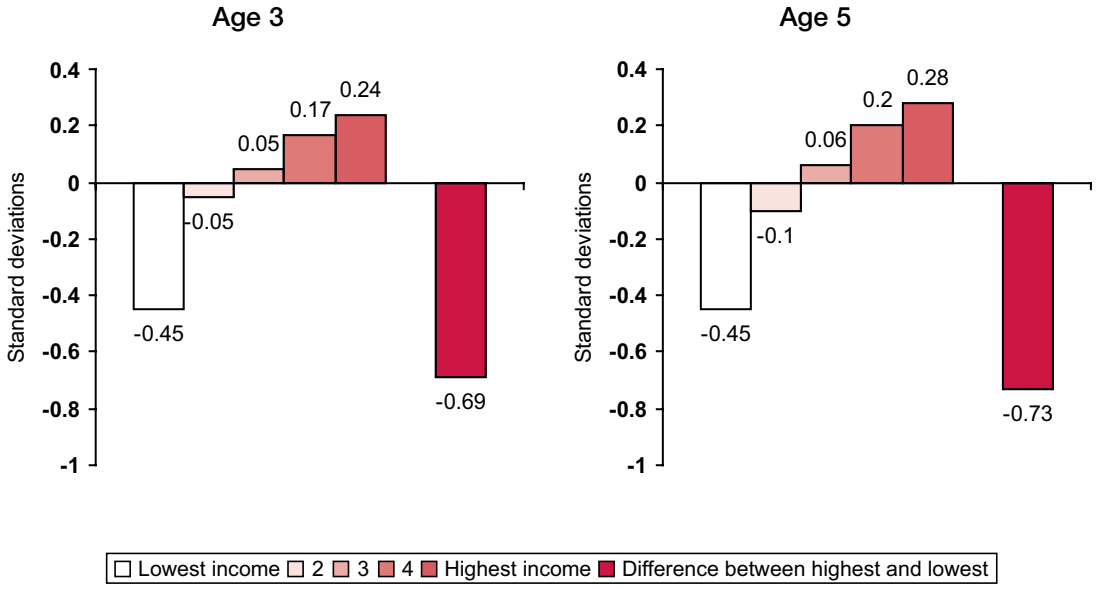


Figure 2-E Mean standardised problem solving score by parental level of education

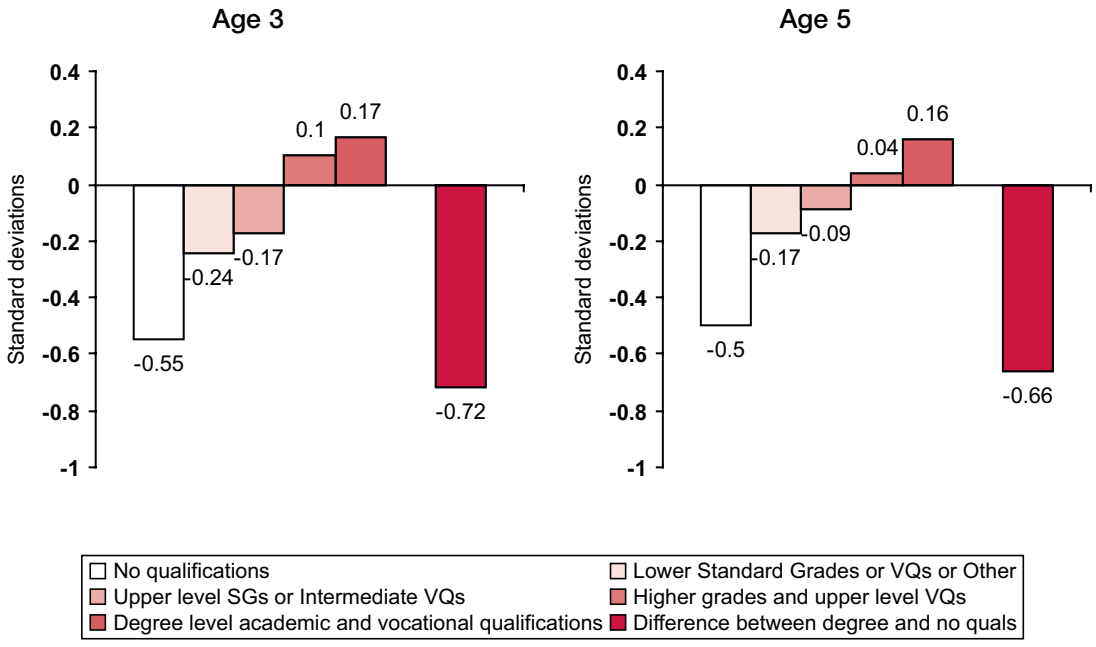
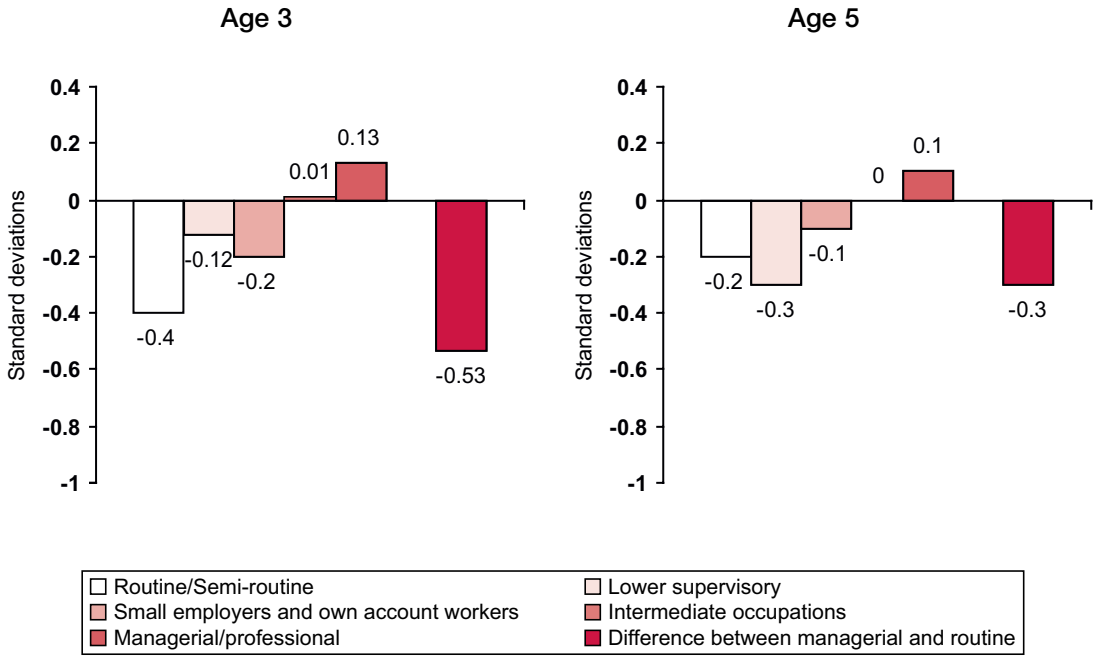


Figure 2-F Mean standardised problem solving score by household NS-SEC



2.4.1 Age equivalent differences

Again, estimates (based on MCS research) allow the consideration of age equivalent differences based on the expected progress of an average child around the respective assessment age.

These estimates suggest that, at age 5, age equivalent differences between children in the most and least advantaged groups are a little narrower for problem solving ability than for knowledge of vocabulary, although they are still considerable. Children whose parents have no qualifications had an average score which placed them around 10 months behind the average ability and 13 months behind those with a degree educated parent. Compared with children in the highest income group those in the lowest income group were around 10 months behind in their problem solving ability (compared with 13 months difference in vocabulary). Finally, children whose parents had routine or semi-routine occupations, when compared with children from managerial and professional households, were approximately 6 months behind on problem solving (compared with 11 months behind on vocabulary).

2.4.2 Changes in the ability gap

Again, using the very right-hand bar in Figure 2-D to Figure 2-F allows consideration of change in the size of the ability gap during the pre-school period. The direction and magnitude of change is quite different for each of the background characteristics.

The ability gap by parental level of education decreases, there is a slight increase in the gap between the lowest and highest income groups and there is a notable decrease in the gap between children in routine or semi-routine households and those in managerial or professional households.

The gap in ability by household income increases slightly from 0.69 to 0.73 standard deviations. This change results from an increase in average scores amongst children in the highest group – there is no change in scores amongst children from the lowest income group. Differences by parental level of education decrease from 0.72 to 0.66 standard deviations. This decrease occurs via an improvement in scores amongst children whose parents have no qualifications (from -0.55 to -0.50) and a slight downward movement in scores amongst the degree-educated group (from 0.17 to 0.16). The largest change is in relation to socio-economic classification where the gap reduces considerably from 0.53 to 0.30 standard deviations. The majority of this change is realised through a considerable improvement in scores amongst children in the routine/ semi-routine group where scores increase from 0.40 standard deviations below the mean to 0.20. There is also a slight decrease in scores at the top end from 0.13 to 0.10.

2.5 Income, education or social class?

There is some overlap between which people belong to the various social background categories considered thus far; families where parents are more highly educated are more likely to have higher incomes and to be in managerial or professional occupations. The analysis undertaken thus far does not identify whether each characteristic impacts on children's ability independently of the other characteristics. For example, it is unclear whether the changes observed by socio-economic classification have occurred simply due to the fact that managerial and professional parents are more likely to be degree-educated, or to have higher incomes.

Analysis was used to determine which characteristics are related to positive and negative individual level change[9] in relative ability on each assessment when holding the other, potentially confounding, characteristics constant.[10] The results of this analysis indicate, irrespective of the child's ability score at age 3 (thus whether or not they had a low, average or high score at that time), which factors are associated with a relative *improvement* or *decline* in ability during the pre-school period. The results are summarised in Table 2.1[11].

9 That is, change in ability at the level of an individual child rather than change at an overall group level.
10 The statistical analysis and approach used in this report represents one of many available techniques capable of exploring this data. Other analytical approaches may produce different results from those reported here. A description of the analysis is included in the technical appendix.
11 The regression output is included in Tables 1 and 2 in the Technical Appendix.

Parental level of education was the only characteristic which was associated with individual level change in relation to both assessments. When compared to children whose parents had no qualifications, those whose parents had passes at Standard Grade, Higher Grade, or a qualification at degree level, were more likely to improve on their relative ability during the pre-school period. Whilst significantly associated with relative improvements in both types of ability, the relationship between education and problem solving ability was weaker and only those children whose parents had Higher Grades or above were more likely to improve their relative score more so than those in the no qualifications group.

Household income was also significantly associated with change in vocabulary ability. Children in higher income households at the third quintile or above were more likely than those in the lowest income group to show improvement in vocabulary in the pre-school period.

Socio-economic classification was not significant in either model suggesting that the changes in the ability gap observed in relation to this variable in section 2.4.2 appear to be explained largely by differences in income and education.

The individual level results presented in Table 2.1 demonstrate some differences from the group level trends seen above in Figure 2-A to Figure 2-F. For example, for problem solving, whereas the broader level analysis indicated a narrowing of the ability gap between children from better and worse educational backgrounds between ages 3 and 5, the individual level data indicates that children whose parents have higher qualifications are, individually, more likely to see a relative improvement in their scores during that time.

Table 2.1 Statistical significance of independent associations between selected social background characteristics and change in cognitive ability between ages 3 and 5

Social background characteristic	Cognitive ability			
	Knowledge of vocabulary		Problem solving	
Household equivalised income *(ref: lowest income quintile)*	Sig.*	Direction of change**	Sig.*	Direction of change**
2nd Quintile (>=£11,875<£19,444)	NS		NS	
3rd Quintile (>=£19,444<£25,625)	<.05	+	NS	
4th Quintile (>=£25,625<£37,500)	<.01	+	NS	
Top Quintile (>=£37,500)	<.05	+	NS	
Parental level of education *(ref: no qualifications)*				
Lower SGs or VQs or 'Other' quals	NS		NS	
Upper level SGs or Intermediate VQs	<.01	+	NS	
Higher Grades or upper level VQs	<.05	+	<.05	+
Degree level academic or VQs	<.001	+	<.05	+
Household socio-economic classification *(ref: routine/semi-routine)*				
Lower supervisory	NS		NS	
Small Emps and Own Account	NS		NS	
Intermediate	NS		NS	
Managerial/professional	NS		NS	
Weighted base	*3133*		*3130*	

*Statistical significance is presented either as 'Not Significant' (NS) or at three levels of 'confidence' – 95% (<.05), 99% (<.01) or 99.9% (<.001). All figures quoted in this report have an associated margin of error, due to the fact that they are estimates based on only a sample of children, rather than all children. This margin can be estimated for each figure. For a figure which has a significance value (or p-value) of <.05 or 95%, this indicates that there is a 95% chance that the true value across all children in the subgroup (as opposed to just those in the sample) falls within the margin. Thus a lower significance value (of <0.1 or <0.01) indicates a lower margin of error and a greater chance that the figure or relationship presented in the report occurs within the population.

**A plus sign (+) indicates relative improvement in ability score and a minus sign (-) indicates relative decline in ability score for children in the various sub-groups as compared those in the reference sub-group. The reference sub-group is indicated in brackets. Where the variable is not significant, direction of change has not been included.

2.6 Summary

In relation to the first research question posed by this report – whether the gap in cognitive ability between children from different social backgrounds changes between ages 3 and 5 – the answer is yes. However, the size and direction of the change varies according to the particular background characteristic considered and the ability being assessed.

Much previous research on this issue has focused on ability gaps across children from different income groups (Blanden and Machin, 2010; Feinstein, 2003; Waldfogel and

Washbrook, 2010). Recent analysis of MCS data (Blanden and Machin, 2010) suggested that there was little change in the size of the gap in vocabulary ability between children in lower and higher income households between ages 3 and 5, and further that average scores amongst children in the lowest income groups had not declined during the period considered. This was interpreted as a small, but positive improvement for that group.

The analysis here did show change in the ability gap between children in different groups:

- For vocabulary, the ability gap by parental level of education increases, there is a slight reduction in the gap between the lowest and highest income groups and there is virtually no change in the gap between children in routine or semi-routine households and those in managerial or professional households.
- For problem solving, the ability gap by parental level of education decreases, there is a slight increase in the gap between the lowest and highest income groups and there is a notable decrease in the gap between children in routine or semi-routine households and those in managerial or professional households.

The GUS data shows a slight reduction in the ability gap by household income during the pre-school period. Whilst children in all income groups show a relative improvement in scores, there is a particular improvement in the average scores for children in the lowest income group. This contrasts with change across income groups in relation to problem solving ability, where a slight increase in the ability gap is evident.

The variations in ability observed by level of parental education are quite different. Our findings suggest that lack of parental qualifications has a continuing detrimental effect on children's vocabulary ability during the pre-school years; children from lower educated households, already likely to have poorer ability at age 3, fall further behind their peers ahead of their entry to school. Other research suggests (Feinstein, 2000; Heckman and Wax, 2004) they will continue to fall further behind after entering school. In contrast, those children with a degree educated parent improve on their position, moving further ahead than the average child, and considerably further from those whose parents have no qualifications. This effect is not observed in relation to problem solving ability. Indeed, the gap in problem solving ability between children in the lowest and highest educational groups reduces slightly in the pre-school period.

Whilst the preliminary analysis suggested some impact of socio-economic classification on ability, the additional analysis indicates that this effect is mostly explained by the education and income distribution of parents across the occupational classifications. Indeed, the analysis showed that parental level of education was most closely associated with change in vocabulary and problem solving ability in the pre-school period.

Earlier research using GUS data on children's cognitive ability at age 3 (Bromley, 2009) showed that other factors in a child's circumstances and environment can mediate the very strong effects of parental education on cognitive ability. These other factors contributed to the higher achievement of children whose parents had lower educational qualifications. What factors, then, can facilitate *change* in these abilities during the pre-school period? This issue is considered in the next chapter.

chapter 3

FACTORS WHICH HELP OR HINDER IMPROVEMENT

3.1 Introduction

Children who differ according to the level of their parents' education also differ in a range of other ways such as their family characteristics, living circumstances and their experience of parenting behaviours. Many of the dimensions along which these families differ are also known to impact on children's early cognitive ability (Washbrook and Waldfogel, 2010). It is not possible to assume, therefore, that improving educational qualifications amongst parents alone would close all or most of the education-related gaps in cognitive ability because some of those gaps are created by the different experiences of children whose parents have different levels of education. For example, better vocabulary ability amongst children with degree-educated parents is known to be, at least in part, a function of higher levels of parent-child reading amongst these parents. Thus, improving vocabulary ability could require increasing parent-child reading as well as improving parental educational qualifications.

This chapter examines the extent to which other factors that exist in children's lives contribute to improvement in cognitive ability and may help explain the developmental gap between those with poorly educated parents and those with highly educated parents. In so doing the analysis will permit some suggestion of where policy interventions designed to maximise children's cognitive ability during the pre-school period could be focused.

Existing research on child cognitive ability identifies a range of factors experienced by young children that impact upon their cognitive development. Given that these factors are related to level of cognitive ability at a single time point, we are anticipating that they may also be related to how children's cognitive ability *changes* over time – particularly during the pre-school period. The factors can be summarised across a range of 'domains':

- Demographic
- Family composition
- Parenting styles
- Experience of childcare and pre-school education
- Child health and development
- Parenting support
- Maternal physical and mental health
- Economic and material circumstances

These domains have been selected for three main reasons: first, other research has shown that the characteristics, circumstances and experiences they represent are associated, in different ways, with early cognitive ability; secondly, they cover a large part of the important experiences of children's early lives; and thirdly, GUS has collected data suitable for exploring them. In the following sections, the evidence which links measures within each of these domains to children's cognitive development in their early years will be cited.

A particular aim of this report is to identify factors which may lead to a narrowing of the gap in children's cognitive ability at age 3 during the pre-school period – factors which are associated with a relative improvement in ability from age 3 to age 5. Thus the analysis is not looking for factors necessarily associated with higher or lower cognitive ability – but those which are associated with change in ability, particularly a positive change from earlier scores. Whilst a certain characteristic may predict higher ability at age 3 or at age 5, it will not necessarily be associated with a *change* in scores in the pre-school period. However, we are assuming that the same factors are associated with both level of ability and change in ability to some degree.

The effect of factors in each domain was explored using multivariate analysis[12]. The results of this analysis allow us to determine which characteristics, circumstances and experiences of children's lives were independently associated with a relative improvement or decline in cognitive ability in the pre-school period after controlling for level of parental education. In addition, by looking at whether these factors weaken the strength of the relationship between parental level of education and cognitive ability at age 5, it is possible to measure whether variations in the additional factors are behind some of the education-related differences. That is, for example, to see whether some of the difference in ability by parents' education actually occurs because children whose parents have different levels of education have different experiences, circumstances or relationships.

3.2 Key findings

- Compared with children whose parents are degree-educated, those whose parents have no qualifications are more likely, amongst other things, to have younger mothers, live in lone parent families, experience lower levels of home learning activities and household rules, to have had a low birth weight, poorer general health, and a mother who smokes.
- Some of these differences in circumstances and experiences of children from different educational backgrounds explain part of the education-related gaps in their cognitive ability and there are a number of factors which appear to impact on change in cognitive ability over and above parental level of education. Indeed, only degree-level

12 A description of the analysis is included in the Technical Appendix.

education continues to have an independent positive effect on change in either ability after the full range of other factors is taken into account. This suggests that much of the difference in ability amongst children from lower educational backgrounds is explained by differences in the home and external environments, and parenting experiences of the children in these groups.

- Changes in vocabulary ability during the pre-school period are more strongly related to aspects of the child's home environment and the choices and behaviours of parents than external influencing factors such as pre-school education. After controlling for parental education, greater consistency of parenting, stronger parent-child attachment, attendance at ante-natal classes and breastfeeding were each independently associated with a relative improvement in vocabulary ability in the pre-school years.
- Early language development is also important – those children who display better communicative skills at an earlier stage are those who are more likely to see their skills improving during the pre-school period. It would appear generally beneficial therefore, to seek to improve children's communication ability from the very earliest stages and establish better skills earlier in order to ensure continued positive language development.
- Parenting and the home environment were also associated with change in problem solving ability; a higher frequency of home learning activities and being breastfed were each independently associated with a relative improvement in problem solving scores. External factors were also related to changes in this ability. Attending a private nursery school for pre-school education and some experience of primary school[13] were both associated with positive development whereas not attending pre-school and living in an area in the most deprived quintile were associated with a relative decline in ability.
- The significant variables present a complex picture of the numerous elements of children's lives which, taken together, can influence their cognitive development. Influencing just one factor is unlikely to generate any change in children's ability.

3.3 Domains of influence on cognitive development

First we examine how demographic characteristics vary by levels of education, then we will look at whether they are independently associated with change in cognitive ability and whether they explain any of the education-related differences.

3.3.1 Demographic characteristics

A range of evidence exists demonstrating the importance of demographic characteristics – including gender, parental ethnicity and maternal age – in predicting pre-school

13 Around one-third of the GUS children had started primary school by the time of their assessment at 58 months.

cognitive test scores. Previous analysis of GUS data, for example, has shown that at age 3, on average girls scored significantly higher than boys in both vocabulary and problem solving assessments (Bromley, 2009). In the same analysis, children with younger mothers – particularly mothers who are aged under 20 at the child's birth – are shown to have lower scores than are those with older mothers. Similar patterns are observed at age 3 in other comparable UK data from the Millenium Cohort Study which demonstrates that such demographic differences persist at age 5 and age 7 (Hansen, 2008; Hansen et al, 2010). The MCS data, and a considerable range of other research (Magnuson and Duncan, 2006; Keels, 2008) also show difference in early test scores between children of different ethnic backgrounds, particularly in the US.

Table 3.1 displays the demographic characteristics of children in each education group.

- There are few differences in the gender split of children from different educational backgrounds.
- There is a greater concentration of children with a non-white parent amongst the lower educational groups with fewer represented in the higher education groups. Eight per cent of families with no qualifications have at least one parent who is non-white compared with 3% of those with Higher Grades or upper level vocational qualifications.
- Maternal age at the child's birth shows the most stark differences by level of education. Younger mothers were considerably more likely than older mothers to be among those with lower qualifications. Just 6% of mothers with degree level qualifications were aged under 25 compared with 33% of those with no qualifications.

Table 3.1 Selected demographic characteristics by parental highest level of education

	Parental highest level of education					
Demographic characteristic	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
Child's gender						
Male	52%	51%	55%	49%	52%	**52%**
Female	48%	49%	45%	51%	48%	**48%**
Parental ethnicity						
Both parents white	92%	89%	97%	97%	94%	**95%**
At least one parent non-white	8%	11%	3%	3%	6%	**5%**
Maternal age at child's birth						
25 or older	67%	53%	57%	73%	94%	**75%**
Under 25	33%	47%	43%	27%	6%	**25%**
Bases						
Weighted	*222*	*201*	*769*	*1170*	*1222*	**3589**
Unweighted	*145*	*153*	*660*	*1202*	*1431*	**3596**

A summary of the demographic domain regression is included in Table 3.2[14]. The results suggest that demographic factors are more important for change in vocabulary ability than for problem solving. After accounting for parental education, having non-white parents and a younger mother at birth are both associated with a decrease in vocabulary ability during the pre-school period.

14 Full results from the regression are shown in Tables 3 and 4 in the Technical Appendix.

Table 3.2 Demographic domain linear regression – summary results

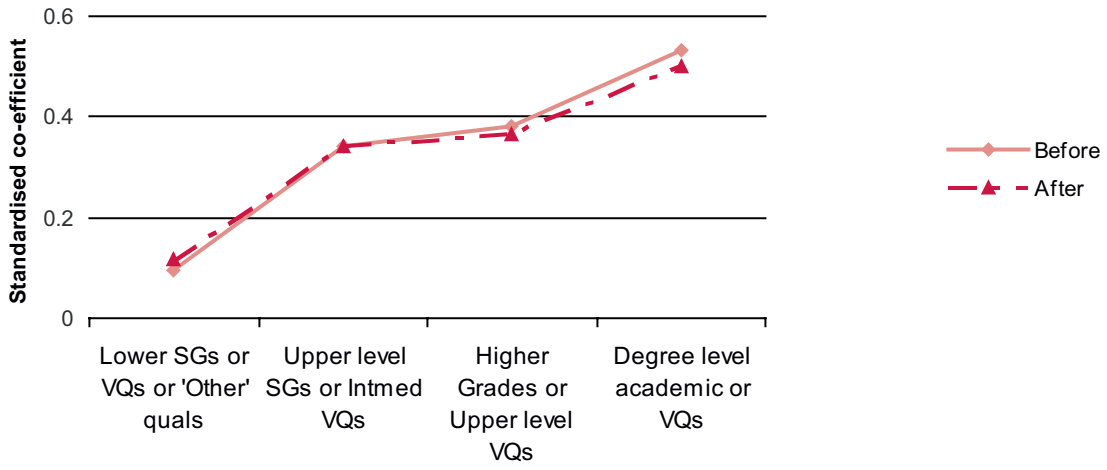
Demographic characteristic	Cognitive ability			
	Knowledge of vocabulary		Problem solving	
	Sig.	Direction of change*	Sig.	Direction of change*
Child's gender *(ref: male)*				
Female	NS		NS	
Parental ethnicity *(ref: both parents white)*				
At least one parent non-white	0.01	-	NS	
Maternal age at child's birth *(ref: 25 or older)*				
Under 25	0.03	-	NS	
Parental level of education *(ref: no qualifications)*				
Lower SGs or VQs or 'Other' quals	NS		NS	
Upper level SGs or intermediate VQs	<0.01	+	0.02	+
Higher Grades or upper level VQs	<0.01	+	<0.01	+
Degree level academic or VQs	<0.01	+	<0.01	+
Weighted base	*3324*		*3336*	

*A plus sign (+) indicates relative improvement in ability score and a minus sign (-) indicates relative decline in ability score for children in the various sub-groups as compared those in the reference sub-group. The reference sub-group is indicated in brackets. Where the variable is not significant, direction of change has not been included.

The effect of education persists after the domain variables have been added to the model – this is illustrated in Figure 3-A and Figure 3-B. The graphs display the values of the standardised regression co efficient (which measures the strength of the association) between parental level of education and cognitive ability at age 5. The solid line displays the values in a model with just education and ability score at age 3 as explanatory variables. The dotted line displays the values after the domain (in this case, demographic) measures have been added. If the dotted line falls below the solid line, this indicates a weakening of the association between education and change in ability after the domain measures have been added suggesting that differences in the domain measures by level of education help explain some of the association between education and change in ability. In contrast, if the dotted and solid lines show little separation, this indicates that the domain variables explain little or none of the association between education and change in ability.

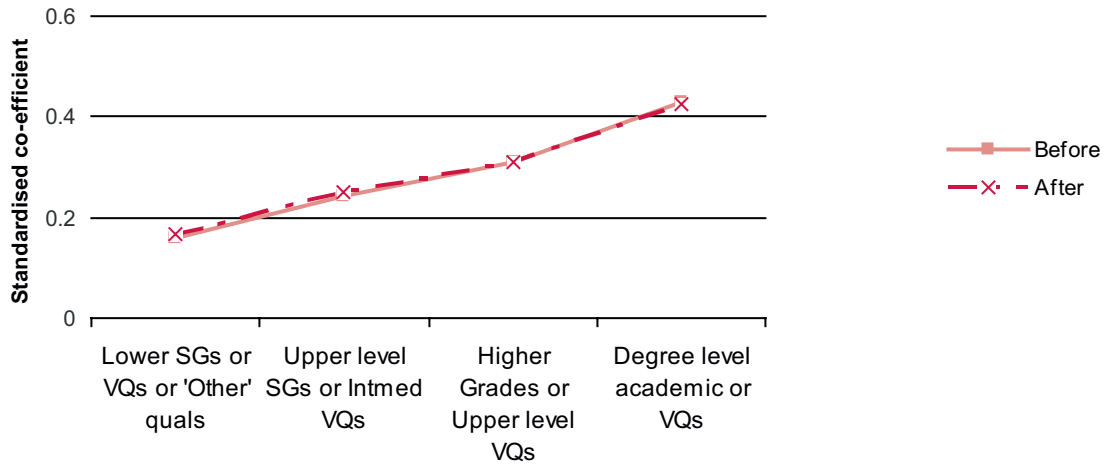
The results in Figure 3-A and Figure 3-B show that, for each ability, both the solid and dotted lines are very close together indicating that there is little change in the association between parental education and cognitive ability after the demographic characteristics have been added, and thus that these factors explain very little of the education differences.

Figure 3-A Associations between parental education and change in vocabulary ability before and after taking account of demographic characteristics



Note: reference category is 'no qualifications'.

Figure 3-B Associations between parental education and change in problem solving ability before and after taking account of demographic characteristics



Note: reference category is 'no qualifications'.

3.3.2 Family composition

The particular make-up of a family – for example, the number of parents and siblings a child lives with, and their birth order – is known to be related to children's performance on cognitive assessments. Analysis of GUS and MCS data shows that children in lone parent families, and those with two or more siblings tend to have a lower score than children in couple families and singleton children or those with just one sibling (Bromley 2009; Hansen 2008). Table 3.3 shows how these characteristics vary by parental education.

Table 3.3 Selected family composition characteristics by parental highest level of education

	Parental highest level of education					
Family composition characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or Intermediate VQs	Higher grades and upper level VQs	Degree level academic & vocational qualifications	**All**
Family type transitions, 10mths to 34mths[15]						
Stable couple	38%	57%	58%	78%	94%	**75%**
Couple who separated	6%	7%	7%	5%	3%	**5%**
Stable lone parent	47%	28%	26%	10%	2%	**14%**
Lone parent who re-partnered	9%	9%	8%	7%	1%	**6%**
Number of children in household at 10mths						
One	29%	32%	35%	36%	31%	**34%**
Two	30%	45%	39%	45%	50%	**44%**
Three or more	42%	23%	26%	18%	19%	**22%**
Cohort child's birth order						
First born in household	41%	44%	48%	51%	54%	**50%**
Not first born	59%	56%	52%	49%	46%	**50%**
Bases						
Weighted	*230*	*206*	*779*	*1172*	*1228*	**3621**
Unweighted	*150*	*157*	*668*	*1204*	*1437*	**3621**

- Almost all (94%) families with a degree-educated parent are headed by a stable couple, compared with around two-fifths (38%) of families where parents have no qualifications. Families in the lower educational groups are significantly more likely to be stable lone parents.
- The key variation in number of children by education is on the proportion of households with three or more children This is significantly higher in the no qualifications group than in all other groups and is lowest for the degree-educated group. There is very little difference in the proportion of singleton households by education.
- Among the lower qualified groups, the child was significantly more likely to be the oldest in the household – 59% were the first born in the no qualifications group compared with 46% in the degree group. This reflects, at least in part, the differences in maternal age amongst the two groups seen in Table 3.1 above.

15 Our measure of family type takes into account changes in family type over time. It incorporates data on parents/carers in the household from the first three waves of data collection to identify, for example, where a couple family have separated or remained, or a lone parent becomes re-partnered.

When entered into the multivariate model alongside score at age 3 and parental level of education, none of the family composition variables were found to be significantly associated with a change in cognitive ability – on either assessment[16]. Neither was there any notable change in the strength of the relationship between education and ability. Thus, these factors are neither independently related to change in cognitive ability during the pre-school years nor do they explain any of the difference in ability by education.

3.3.3 Parenting factors

Considerable attention has been focused in recent years on the relationship between parenting activities and children's development – including their cognitive development. In particular, numerous studies have shown a significant relationship between aspects of parenting – such as the nature of the parent-child relationship and the pursuit of home learning activities[17] – and children's early language skills (Bromley, 2009; Waldfogel and Washbrook, 2008; Waldfogel and Washbrook 2010; Foster et al, 2005; National Evaluation of Sure Start, 2008; Sylva et al, 2003).

Five aspects of parenting are considered in this section:

- Frequency of home learning activities.
- The existence of rules.
- Use of harsh discipline.
- Early infant-maternal attachment.
- Parental problems with reading or writing.

Table 3.4 provides information on how these factors vary according to parental level of education.

16 Full results of the regression analysis are shown in Tables 5 and 6 in the Technical Appendix.
17 Home learning activities include, for example, reading with the child, painting and drawing, and singing nursery rhymes – a full description of the measure as used in this analysis is included in Appendix 1.

Table 3.4 Selected parenting characteristics by parental highest level of education

	Parental highest level of education					
Parenting characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or Intermediate VQs	Higher grades and upper level VQs	Degree level academic & vocational qualifications	**All**
Mean score on home learning activities scale, age 2 and 3 years	38.6	40.9	42.6	45.9	47.6	**45.2**
Banded level of rules in household at 58 mths						
Low	61%	51%	41%	34%	27%	**36%**
Medium	35%	41%	51%	54%	63%	**55%**
High	4%	8%	8%	11%	10%	**10%**
Use of harsh discipline at 22 mths and/or 46 mths						
Never used smacking	52%	55%	48%	49%	54%	**51%**
Used smacking before age 4	48%	45%	52%	51%	46%	**49%**
Mean score on infant-maternal attachment scale at 10 mths	3.7	3.8	3.8	3.9	3.8	**3.8**
Parental problems with reading/ writing at 46 mths						
Does not have any problems	67%	80%	84%	90%	93%	**88%**
Does have some problems	33%	20%	16%	10%	7%	**12%**
Bases						
Weighted	*192*	*167*	*699*	*1096*	*1151*	**3309**
Unweighted	*127*	*130*	*603*	*1134*	*1354*	**3353**

- Children in higher educated households are more frequently involved in home learning activities such as reading, painting and games involving shapes and numbers than are children from lower educated households.
- In addition, parents with higher qualifications are more likely to set rules for the child than are parents with lower qualifications. Almost two-thirds (63%) of degree educated parents were categorised in the 'medium rules' group, around twice the proportion amongst parents with no qualifications.
- Figures on use of smacking are similar across the education groups – the differences which exist are not statistically significant.
- In contrast, whilst the differences in mean attachment scores are small, they are statistically significant ($p < 0.001$). Parents with no qualifications have slightly weaker attachment than parents in the other education groups.

- As may be expected, there is a close relationship between qualifications obtained and literacy problems. Parents with no and lower qualifications were considerably more likely to report having at least some difficulties with reading and/or writing.

Children who experienced a higher frequency of activities, those living in households with greater rule-setting and those with a stronger early parent-child attachment were each more likely to see their vocabulary scores improve in the pre-school period, irrespective of parental education level and age 3 score (Table 3.5)[18]. More frequent home learning activities were also associated with improved problem solving scores but other parenting measures were not significantly related to changes in that ability.

Table 3.5 Parenting domain linear regression – summary results

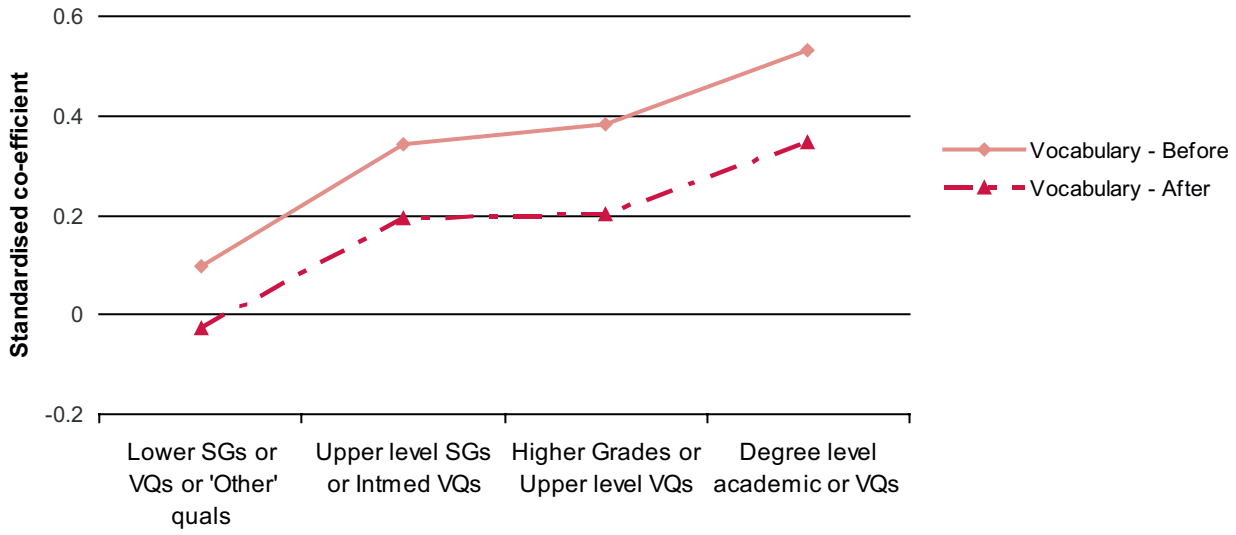
	Cognitive ability			
	Knowledge of vocabulary		Problem solving	
Parenting characteristic	Sig.	Direction of change*	Sig.	Direction of change*
Mean score on home learning activities scale	<0.001	+	<0.001	+
Banded level of rules in household *(ref: low rules)*				
Medium	NS		NS	
High	0.016	+	NS	
Harsh discipline *(ref: never smacked)*				
Used smacking before age 4	NS		NS	
Mean score on infant-maternal attachment scale at 10 mths	< .001	+	NS	
Parental problems with reading/writing when child aged 4 *(ref: does not have any problems)*				
Does have some problems	NS		NS	
Parental level of education *(ref: no qualifications)*				
Lower SGs or VQs or 'Other' quals	NS		NS	
Upper level SGs or Intmed VQs	0.004	+	NS	
Higher Grades or Upper level VQs	0.011	+	0.05	+
Degree level academic or VQs	< 0.001	+	< 0.001	+
Weighted base	*3098*		*3190*	

*A plus sign (+) indicates relative improvement in ability score and a minus sign (-) indicates relative decline in ability score for children in the various sub-groups as compared those in the reference sub-group. The reference sub-group is indicated in brackets. Where the variable is not significant, direction of change has not been included.

Figure 3-C and Figure 3-D show, the addition of parenting variables to the model weakened the relationship between education and ability on both assessments, suggesting that these approaches to parenting help to explain some of the differences observed by education.

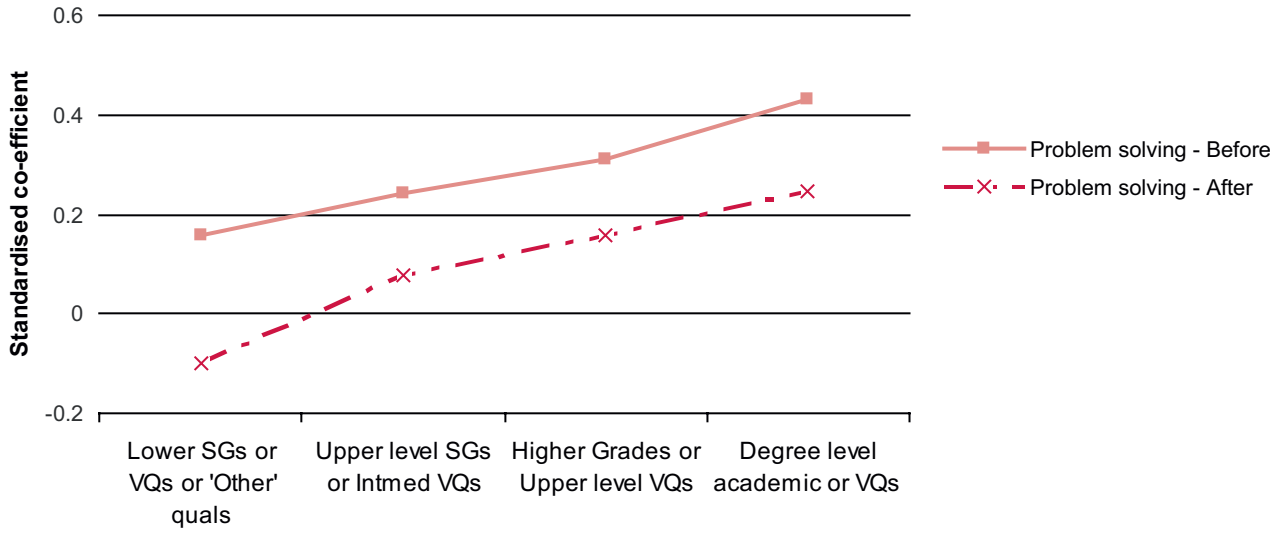
18 Full regression results are shown in Tables 7 and 8 in the Technical Appendix.

Figure 3-C Associations between education and change in vocabulary ability before and after taking account of parenting characteristics



Note: reference category is 'no qualifications'.

Figure 3-D Associations between education and change in problem solving ability before and after taking account of parenting characteristics



Note: reference category is 'no qualifications'.

3.3.4 Experience of childcare and pre-school

Improvement of child outcomes via the provision of childcare and pre-school based interventions and programmes have been a focus of much recent early years policy. This follows a range of research and evaluations demonstrating the significant impact

such experiences and intervention can have on a broad range of child outcomes (see Burger, 2010 for a review). Evidence shows that as compared to no experience of centre-based care or pre-school education, children with any experience tend to have improved language and cognitive skills (Sylva, 2009; Butt et al, 2007; Magnuson et al, 2010). In terms of the statutory pre-school provision, to which all children in the UK are entitled at ages 3 and 4, the EPPE study (Sylva et al, 2009) found that quality of provision is the key factor associated with making the greatest impact on on intellectual and cognitive development – a finding echoed in US-based research (Butt et al, 2007). However other factors such as duration of attendance (in months and years rather than the number of hours per day) have also been shown to be important (Butt et al, 2007).

In this section we consider a range of factors which seek to capture children's experience of childcare, pre-school and primary school in the period between birth and the assessment at age 5. They include: any experience of formal childcare before age 3, any attendance at pre-school and type of provision attended, weekly duration of pre-school, months of pre-school attended, child's perceived readiness for pre-school, and whether the child had started primary school. Differences across these measures are shown in Table 3.6.

- Children from higher educated backgrounds were considerably more likely than those in all other groups to have experienced some formal childcare before the age of 3; 72% had done so compared with 35% of children whose parents had no qualifications.
- Data from age 3 onwards shows that the type of pre-school varied slightly amongst the different groups. Whilst children in all groups were most likely to have attended a nursery class attached to a state or independent school, reflecting the dominant type of provision offered in Scotland, those in the higher education groups were more likely than those in the lower groups to have attended a private nursery school and those with no qualifications a local authority nursery school.
- There were no significant differences in the number of hours attended per week nor in the duration of attendance prior to the assessment at age 5 (note that this measure was approximately derived – further details in appendix 1), neither were there any significant differences in primary school attendance – as may be expected given that eligibility is driven by date of birth.
- Differences are evident in perceived school readiness. Parents with higher qualifications were significantly more likely to consider the child 'ready' for pre-school than were parents with lower qualifications which appears justified given the higher ability scores amongst children in the former group.

Table 3.6 Selected childcare and pre-school characteristics by parental highest level of education

	Parental highest level of education					
Childcare and pre-school characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
Experience of formal childcare before age 3						
No	65%	61%	54%	43%	28%	**42%**
Yes	35%	39%	46%	57%	72%	**58%**
Type of pre-school attended						
No pre-school	2%	4%	2%	2%	2%	**2%**
Nursery class attached to state or independent primary school	63%	74%	70%	63%	63%	**65%**
Local authority nursery school	25%	15%	17%	15%	11%	**14%**
Private nursery school	7%	5%	9%	16%	20%	**15%**
Other	3%	2%	2%	4%	4%	**4%**
Weekly duration of pre-school						
No pre-school	2%	4%	2%	2%	2%	**2%**
Less than 12 hours	7%	6%	7%	8%	9%	**8%**
Between 12 and 12.5 hours	62%	68%	66%	62%	55%	**61%**
Between 12.5 and 15 hours	17%	11%	11%	11%	13%	**12%**
15 hours or more	12%	11%	13%	18%	21%	**17%**
Mean duration of pre-school experienced (months)	18.0	17.1	17.4	17.9	18.0	**17.8**
Parent's perception of child's readiness for pre-school at age 3						
Average or above readiness score	42%	52%	49%	57%	60%	**55%**
Below average readiness score	58%	48%	51%	43%	40%	**45%**
Whether child started school at 58 mths						
No	72%	73%	67%	67%	67%	**68%**
Yes	28%	27%	33%	33%	33%	**32%**
Bases						
Weighted	*185*	*151*	*639*	*1015*	*1072*	**3066**
Unweighted	*123*	*118*	*559*	*1053*	*1262*	**3119**

Few of the childcare and pre-school factors remained significant in the regression model. Those which did were slightly different for each type of ability[19]. For naming vocabulary, only perceived readiness was significant – children with above average perceived readiness were more likely to improve their relative scores during the pre-school period. For problem solving pre-school type was significant. The results suggest that, as compared to children attending a pre-school class attached to a primary school, those who attended a private nursery school were more likely to see their relative problem solving ability improve. Attending primary school (P1) was also associated with a relative improvement in problem solving ability despite those children who had started school having only spent a small amount of time there.[20]

3.3.5 Child health and early development

For children who suffer poorer health and early developmental difficulties the effects on outcomes can be persistent. A range of evidence indicates that early health problems and developmental delays continue to impact on developmental outcomes, including cognitive outcomes, in later life. For example, Bradshaw (2010) found that children who were reported by their parents to have delays in motor development and language development at age 3 were more likely to display difficulties with their social, emotional and behavioural development at school entry.

This section examines the association between a number of indicators of child health and early development and change in cognitive ability. The indicators considered include: child's general health from 10 months to age 3, low birth weight, total score on the Infant/Toddler Checklist of the Communication and Symbolic Behaviour Scales at age 2 (22 months)[21], and child's level of physical activity at age 3. Descriptive information on how these characteristics vary by parental level of education is included in Table 3.7.

19 The full results of the regression are shown in Tables 9 and 10 in the Technical Appendix.
20 Due to the spread of birth dates amongst the sample and the timing of fieldwork, around one-third of children had started P1 by the time of the 58 month interview.
21 Difficulties with early language and communicative development was assessed at 22 months using the infant/toddler checklist of the Communication and Symbolic Behaviour scales. A lower score suggests less advanced development. Further details are included in Appendix 1.

Table 3.7 Selected child health and early development characteristics by parental highest level of education

	Parental highest level of education					
Child health and early development characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
General health from 10 mths to 34 mths						
Always good or very good	84%	78%	82%	87%	90%	**86%**
Temporarily or always fair, bad or very bad	16%	22%	18%	13%	10%	**14%**
Low birth weight						
Not low	88%	93%	91%	95%	95%	**94%**
Low	12%	7%	9%	5%	5%	**6%**
Mean total score on CSBS infant/toddler checklist at age 2 (22 mths)	48.2	48.2	48.6	49.9	50.0	**49.5**
Level of physical activity at age 3 (34 mths)						
Low	56%	41%	41%	29%	26%	**32%**
Medium	27%	30%	31%	36%	37%	**35%**
High	17%	30%	28%	35%	37%	**33%**
Bases						
Weighted	*191*	*167*	*699*	*1096*	*1151*	**3308**
Unweighted	*126*	*130*	*603*	*1134*	*1354*	**3352**

- Those children with better educated parents tended to have persistently better general health than those with lower educated parents. Nine in ten (90%) children with degree-educated parents were reported to have consistently good or very good health between the ages of 10 months and 3 years compared with around eight in ten children from the lowest education groups.
- 12% of children whose parents had no qualifications were born with a low birth weight, a proportion twice as high as that amongst children whose parents are degree educated (5%).
- Whilst the differences are small, children from lower educational backgrounds scored statistically significantly lower on average on their assessment of communication and and language development at age 22 months.
- Variations in levels of child physical activity are quite stark; children in the lowest education group were around twice as likely as those in upper two groups to be classed in the 'low activity' category.

Few of the variables considered remain significant in the regression model, as summarised in Table 3.8[22]. For vocabulary, early indications of good progress in language and communicative development are associated with improvement in vocabulary ability in the pre-school years. In other words, children given a good start in language development show better improvement in these skills in the later pre-school period. Early communication issues do not have the same association with change in problem solving ability although this factor is only just non-significant. General health appears to be more important for problem solving ability. Those children who report even temporarily poorer general health are more likely than those with consistently good general health to see their relative problem solving ability decline between age 3 and 5.

Table 3.8 Child health and early development domain linear regression – summary results

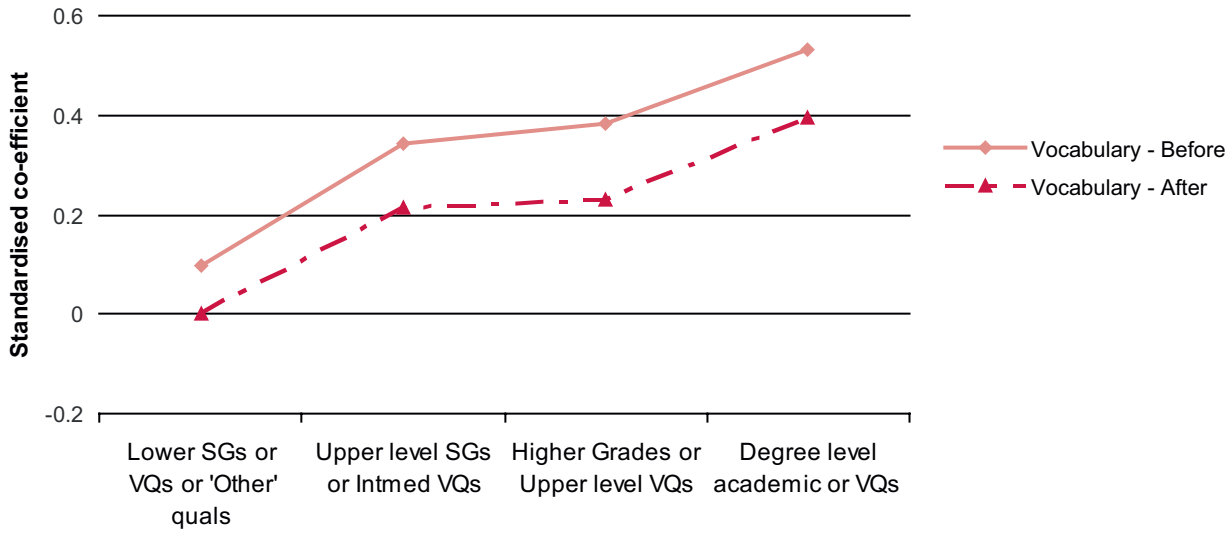
Child health or early development characteristic	Cognitive ability			
	Knowledge of vocabulary		Problem solving	
	Sig.	Direction of change	Sig.	Direction of change
General health from birth to age 3 *(ref: always good or very good)*				
Temporarily or always fair, bad or very bad	NS		<.05	-
Birth weight *(ref: not low)*				
Low	NS		NS	
Total score on CSBS Infant/Toddler checklist	<.001	+	NS (.06)	+
Level of physical activity	NS		NS	
Parental level of education *(ref: no qualifications)*				
Lower SGs or VQs or 'Other' quals	NS		NS	
Upper level SGs or Intmed VQs	<.01	+	NS	
Higher Grades or Upper level VQs	<.01	+	NS	
Degree level academic or VQs	<.001	+	<.01	+
Weighted base	*2998*		*3006*	

*A plus sign (+) indicates relative improvement in ability score and a minus sign (-) indicates relative decline in ability score for children in the various sub-groups as compared those in the reference sub-group. The reference sub-group is indicated in brackets. Where the variable is not significant, direction of change has not been included.

Aspects of a child's health and early development do appear to offer some part of the explanation of differences in ability by parental education. As shown in Figure 3-E and Figure 3-F, there is a noticeable drop in the association between education and ability when the health variables are added to the regression model. This effect is slightly larger for vocabulary than for problem solving.

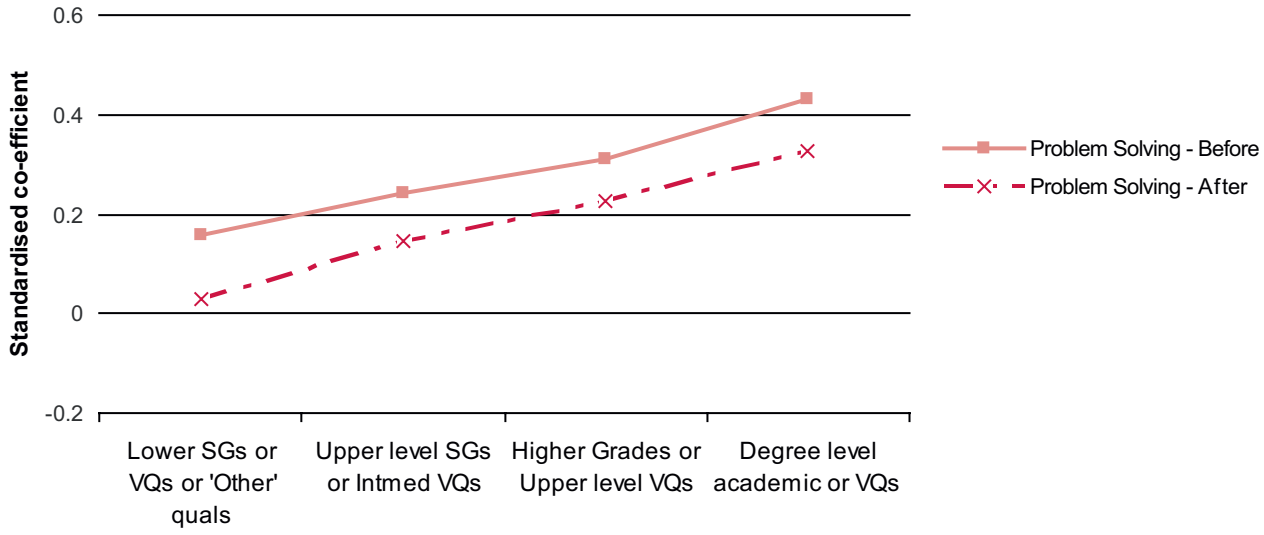
22 Full regression results are shown in Tables 11 and 12 in the Technical Appendix.

Figure 3-E Associations between education and change in vocabulary ability before and after taking account of child health and early development characteristics



Note: reference category is 'no qualifications'.

Figure 3-F Associations between education and change in problem solving ability before and after taking account of child health and early development characteristics



Note: The reference category is 'no qualifications'.

3.3.6 Parenting support

This section examines the impact of aspects of support for parents on change in cognitive ability. Indicators of this domain included levels of service use at 10 months, access to informal support networks (family and friendship groups), and attendance at ante-natal and other parenting classes.

For parents of young children, having access to the services and support necessary to assist them in their parenting role can be important for improving child outcomes across a range of developmental domains. Evidence from the Sure Start Impact evaluation (National Evaluation of Sure Start, 2008) indicated that the improvement of services in areas of high deprivation through the Sure Start programme led to better social development amongst children in those areas, along with beneficial effects on parenting, higher rates of child immunisation and lower rates of accidental injury (although caution was advised on interpreting this finding due to issues related to the timing of measurement). Evaluations of a range of early childhood interventions demonstrate the significant improvements which can be gained in cognitive and academic achievement via engaging at-risk parents and providing the necessary support and services they, and their children, require (Geddes et al, 2010). Although getting those parents engaged with such services can be particularly challenging (Mabelis and Marryat, 2011).

The data in Table 3.9 illustrate how aspects of service use and support vary by parental education.[23]

- More highly educated parents were significantly more likely to draw on a wider range of services when the child was aged 10 months. Degree-educated parents reported accessing an average of around five different health, care and parenting services compared with an average of around three for parents with no qualifications.
- More highly educated parents also reported higher levels of informal social support. A little over 60% of parents in the two upper education groups had both a satisfactory friendship and family network compared with 48% of those in the lowest group.
- Attendance at ante-natal classes was much higher among the higher educated groups. Sixty-one percent of degree-educated parents attended some ante-natal classes, around three times the proportion of those in lower educated groups who attended.
- Attendance at other parenting classes was generally low and there were no significant differences in attendance by education level.

23 More detail on differences in parental service use and support amongst families with young children is provided in an accompanying GUS report: Mabelis, J. and Marryat, L. (2011) Growing Up in Scotland: Parental service use and informal networks in the early years.

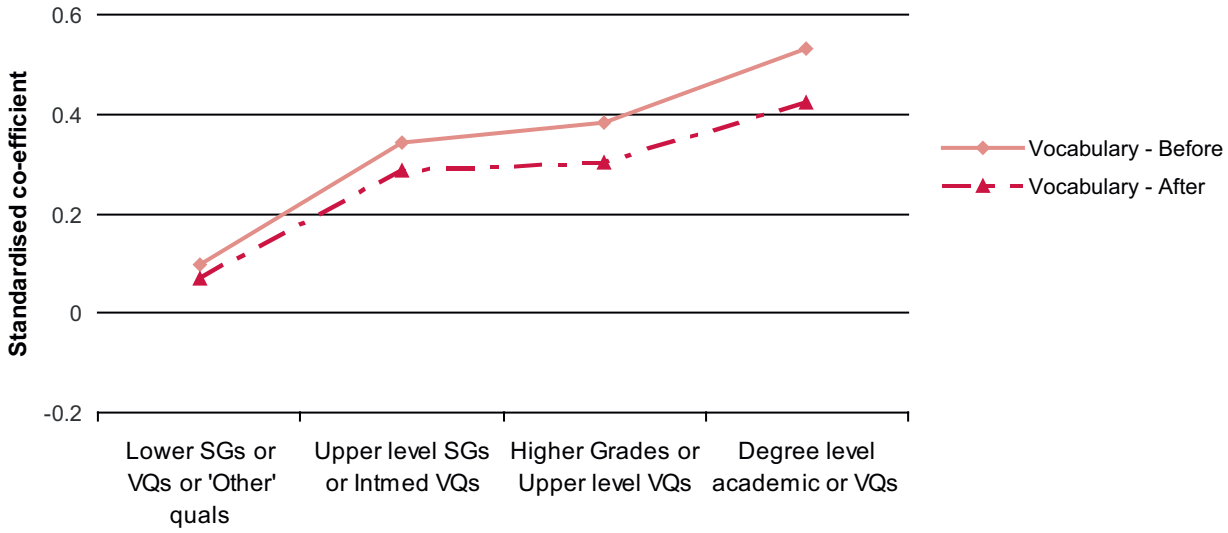
Table 3.9 Selected parenting support characteristics by parental highest level of education

	Parental highest level of education					
Parenting support characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
Mean score on service use scale at 10 months	3.3	4.0	4.3	4.7	5.4	**4.8**
Existence of social networks at 22 mths						
Has both satisfactory family and friendship networks	48%	55%	58%	65%	62%	**61%**
Only has satisfactory friendship network	8%	9%	12%	12%	19%	**14%**
Only has satisfactory family network	26%	19%	21%	16%	12%	**16%**
Has neither satisfactory social network	18%	17%	9%	7%	7%	**8%**
Attended any parenting classes from birth to age 3						
No	91%	93%	92%	93%	91%	**92%**
Yes	9%	7%	8%	7%	9%	**8%**
Ante-natal classes						
Went to all or most	12%	16%	25%	39%	50%	**37%**
Went to some	4%	10%	9%	13%	11%	**11%**
Did not go to any	84%	73%	66%	49%	39%	**52%**
Bases						
Weighted	*192*	*167*	*699*	*1095*	*1150*	**3309**
Unweighted	*127*	*130*	*603*	*1134*	*1354*	**3353**

None of the parenting support factors remained associated with change in vocabulary ability and only attendance at all ante-natal classes remained associated with problem solving ability, having a positive effect on ability during the pre-school period[24]. Parenting support factors do slightly affect the relationship between education and ability as shown in Figure 3-H and Figure 3-H. The coefficients for education are weakened more in relation to vocabulary than problem solving ability. This suggests that variations in parenting support contribute more to explaining education differences in vocabulary ability than explaining education differences in problem solving. This overall effect, without the individual variables being significant, suggests there may be some correlation between the various explanatory variable measures.

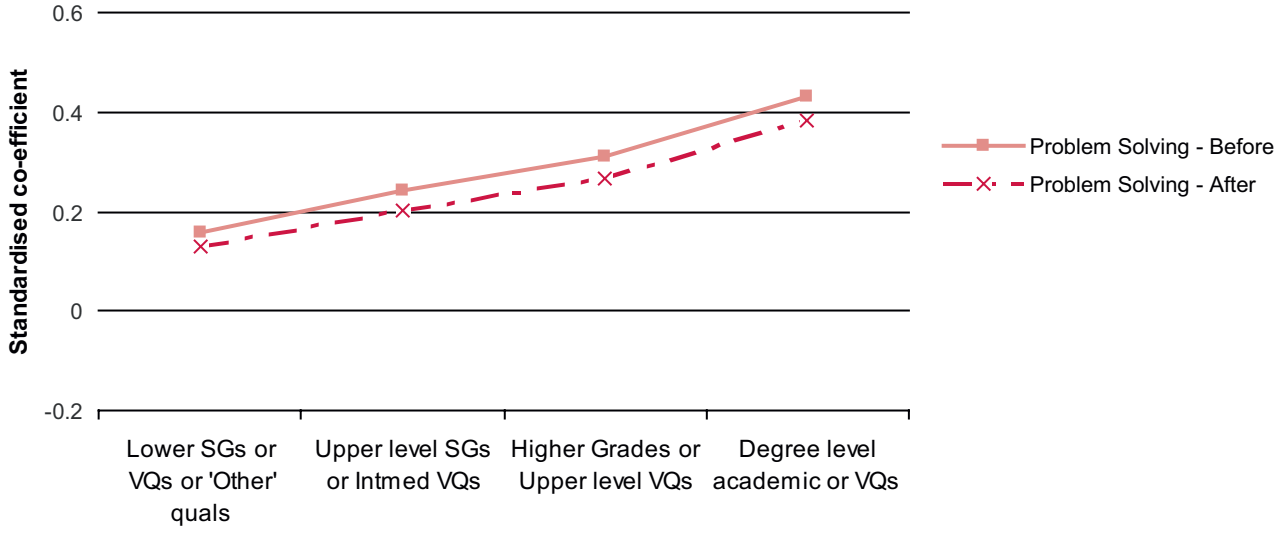
24 Full regression results are shown in Tables 13 and 14 in Appendix 2.

Figure 3-G Associations between education and change in vocabulary ability before and after taking account of parenting support characteristics



Note: reference category is 'no qualifications'.

Figure 3-H Associations between education and change in problem solving ability before and after taking account of parenting support characteristics



Note: The reference category is 'no qualifications'.

3.3.7 Maternal health and health behaviours

The next domain considered the impact of a number of indicators of maternal health and health behaviours on change in cognitive ability. Good maternal health and wellbeing promotes better development and outcomes for children whereas poorer physical and mental health can be detrimental to child development.

Marryat and Martin's analysis of GUS data (2010) showed that, at age 4, children whose mother's had reported poor mental health had, on average, lower cognitive ability and higher social, emotional and behavioural difficulties. In addition, Bromley (2010) illustrated the strong associations between maternal health and health behaviours (such as smoking) and a range of child outcomes including cognitive ability. Bromley's findings indicated, for example, that children whose mothers did not smoke had far fewer negative health outcomes than children whose mothers did smoke.

A range of studies have demonstrated higher average cognitive ability, at several ages, amongst children who were ever breastfed compared with those who were formula fed (Quigley et al, 2009; Iacovou and Sevilla-Sanz, 2010; see also Anderson et al (1999) for a meta-analysis). One interpretation of this association is that breastmilk has nutritional value of benefit to child cognitive development. However, the decision to breastfeed may also reflect a desire to adopt a particular parenting approach and positive health behaviours which may involve other parenting and childcare practices associated with better cognitive ability. Thus the effect of breastfeeding on cognitive ability may be transmitted via these additional parenting behaviours rather than solely linked to the nutritional content of breastmilk itself.

The indicators selected for inclusion were: maternal smoking between the child's birth and age 3, whether the child was ever breastfed and whether the mother had reported poor mental or poor general health between the child's birth and age 3. These factors all showed significant differences by parental level of education as shown in Table 3.10. Some of the largest differences relate to smoking and breastfeeding.

- In more highly educated households, the child was significantly more likely to have been breastfed and the mother less likely to smoke than in lower educated households.
- Mothers in the two lower education groups were around 6 times more likely to have smoked during the child's first three years than were mothers in the highest group.
- Those in the lower groups were also more likely to have reported poorer mental and general health. A little over two-fifths (44%) of mothers in households where parents had no qualifications reported poor mental health compared with around one-fifth (19%) in households where a parent was degree-educated.

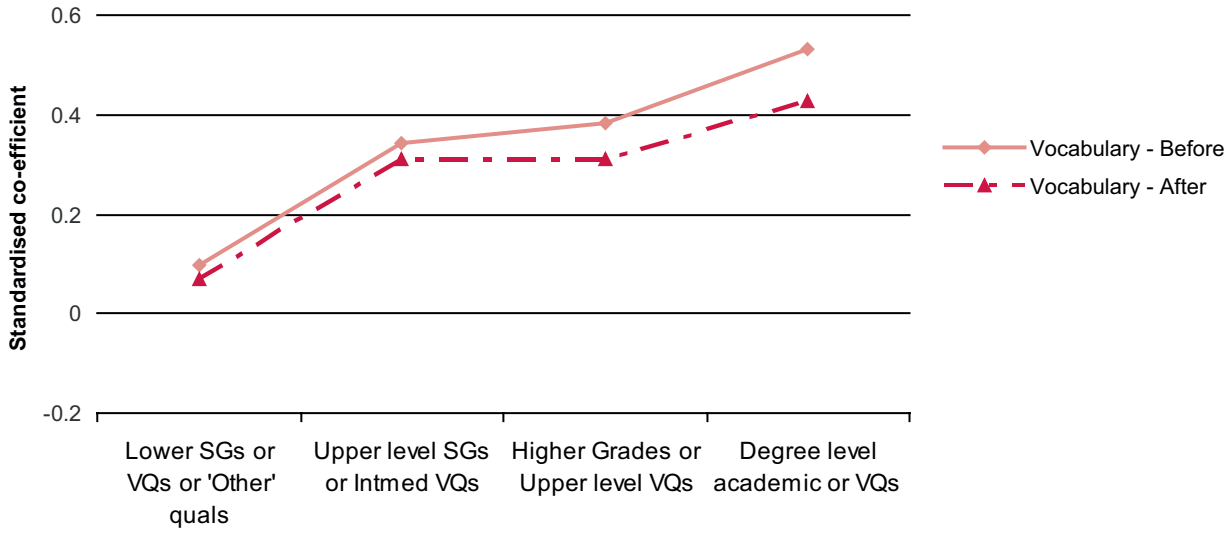
Table 3.10 Selected maternal health characteristics by parental highest level of education

	Parental highest level of education					
Maternal health characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
Ever smoked between child's birth and age 3						
No	34%	43%	47%	72%	89%	**69%**
Yes	66%	57%	53%	28%	11%	**31%**
Was child ever breastfed?						
No	76%	67%	57%	42%	16%	**39%**
Yes	24%	33%	43%	58%	84%	**61%**
Reported poor mental health between child's birth and age 3						
No	56%	71%	71%	79%	81%	**76%**
Yes	44%	29%	29%	21%	19%	**24%**
Reported less than 'good' health between child's birth and age 3						
No	61%	77%	76%	82%	87%	**81%**
Yes	39%	23%	24%	18%	13%	**19%**
Bases						
Weighted	*192*	*167*	*698*	*1096*	*1151*	**3308**
Unweighted	*127*	*130*	*602*	*1134*	*1354*	**3352**

Breastfeeding emerged as significant in both multivariate models[25]. Children who were breastfed were more likely than those who were not to show a relative improvement in their cognitive ability. For problem solving ability, maternal mental health was also significant. The results indicate that children whose mothers suffered poorer mental health saw a relative deterioration in their abilities during the pre-school period. The maternal health variables made only a small reduction to the education co efficients, as shown in Figure 3-I and Figure 3-J. This means they explain only a small amount of the education-related difference in cognitive ability. The effect was of a similar magnitude for both vocabulary and problem solving.

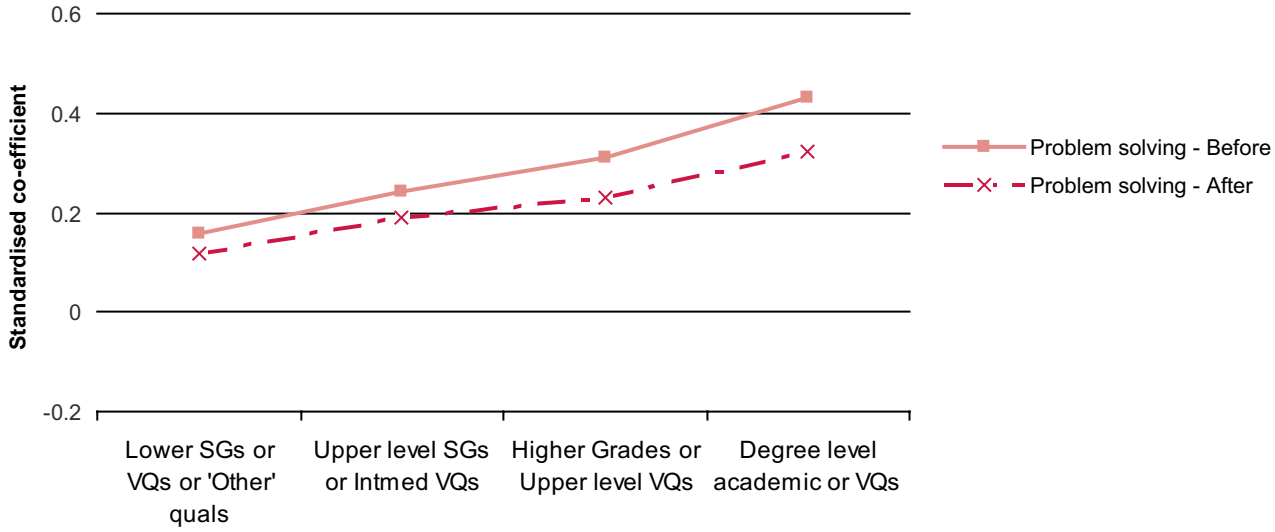
25 The results of the full models are shown in Tables 15 and 16 in the Technical Appendix.

Figure 3-I Associations between education and change in vocabulary ability before and after taking account of maternal health characteristics



Note: reference category is 'no qualifications'.

Figure 3-J Associations between education and change in problem solving ability before and after taking account of maternal health characteristics



Note: the reference category is 'no qualifications'

3.3.8 Material and economic circumstances

A considerable amount of evidence, including that discussed in Chapter 2 of this report, illustrates the differences in child cognitive ability by level of household income. However, other research has also demonstrated that additional, related, material and economic circumstances – such as maternal employment and area deprivation – can impact on child outcomes above and beyond the effect of income itself. For example, McCulloch and Joshi (2001), in analysis of data from the British National Child Development Study, found a small but statistically significant relationship between neighbourhood poverty and lower test scores in children aged 4-5. Barnes et al (2010) found associations between indicators of poverty such as car ownership and housing tenure and a range of child health and development outcomes.

The association between several measures of family material and economic circumstances and change in cognitive ability was explored. The measures included housing tenure, level of material deprivation, maternal employment, area deprivation, and the extent to which the parent reported the family to be coping on their current income. Given these measures are associated with income, and that there is a close relationship between income and education it is unsurprising to also find considerable variations in these measures by parental education (Table 3.12).

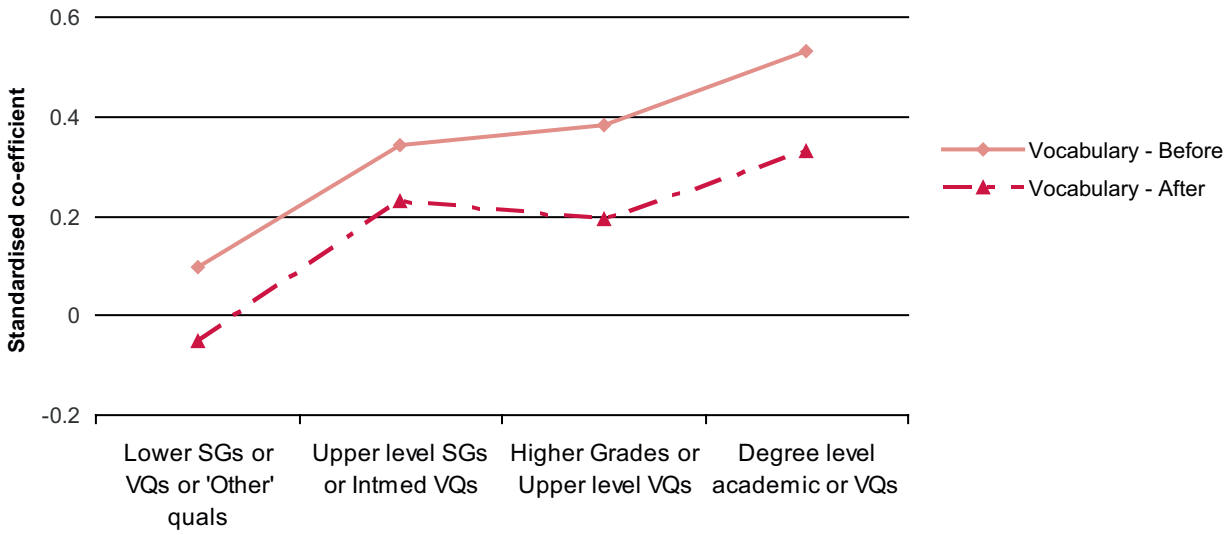
- Children with degree educated parents were significantly more likely than those whose parents had lower qualifications to live in an owner-occupied home, experience lower material deprivation, have higher rates of maternal employment and to live in an area in the lowest two deprivation quintiles.
- In contrast, children whose parents had lower qualifications, and particularly those in the lowest education group, were more likely to live in social rented housing, experience higher material deprivation than children whose parents had higher qualifications and live in an area with higher deprivation.

Table 3.11 Selected material and economic characteristics by parental highest level of education

	Parental highest level of education					
Material and economic characteristics	No qualifications	Lower Standard Grades or VQs or Other	Upper level SGs or intermediate VQs	Higher Grades & upper level VQs	Degree level academic & vocational qualifications	**All**
Housing tenure at age 3 (34 mths)						
Owner occupied	17%	30%	39%	69%	89%	**65%**
Social rented	74%	61%	47%	23%	6%	**27%**
Private rented	8%	7%	10%	5%	3%	**6%**
Other	1%	3%	4%	3%	2%	**3%**
Mean score on material deprivation index at age 4 (46 mths)	22.1	11.0	12.6	7.1	4.0	**7.9**
Did mother work between child's birth and age 3						
No	65%	51%	40%	21%	16%	**28%**
Yes	35%	49%	60%	79%	84%	**72%**
Area deprivation – quintiles – age 3 (34 mths)						
Least deprived	2%	8%	8%	17%	33%	**19%**
2	6%	7%	14%	20%	28%	**20%**
3	10%	20%	20%	22%	19%	**20%**
4	26%	25%	22%	19%	11%	**18%**
Most deprived	56%	40%	35%	22%	9%	**23%**
Reported difficulty coping on present income between birth and age 3						
No	39%	63%	62%	73%	81%	**71%**
Yes	61%	37%	38%	27%	19%	**29%**
Bases						
Weighted	*192*	*167*	*698*	*1096*	*1151*	**3308**
Unweighted	*127*	*130*	*602*	*1134*	*1354*	**3352**

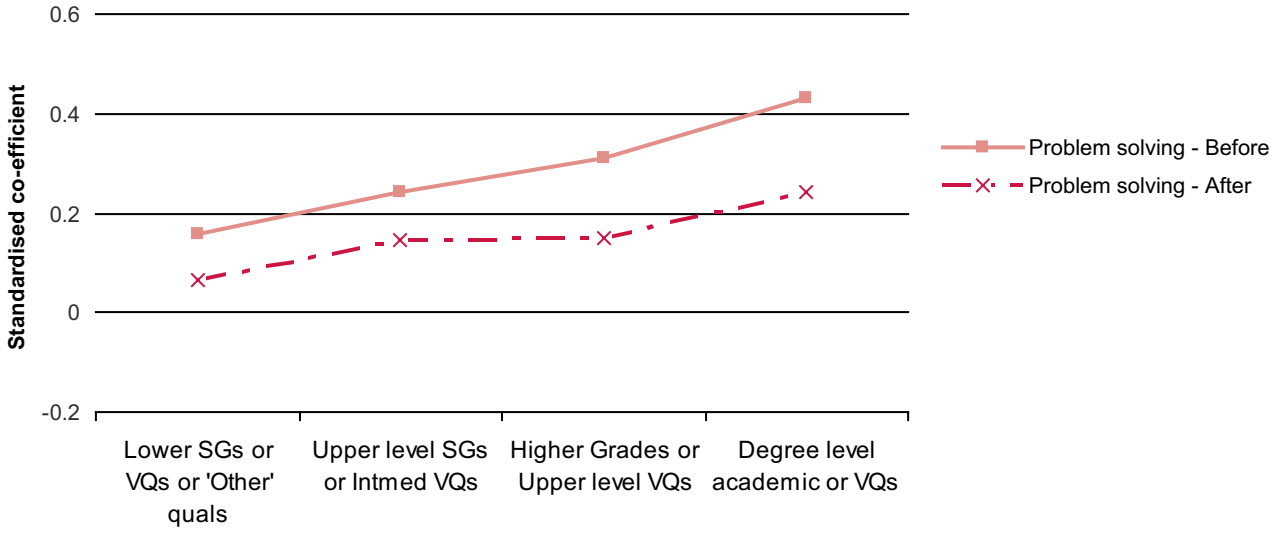
The relative ability of children who experienced higher levels of material deprivation tended to deteriorate in the pre-school period. In addition, living in an area in the highest deprivation quintile was detrimental for problem solving ability. No other factors were significant in the regression models. Despite this, the addition of material and economic circumstances to the models did make a noticeable reduction to the education coefficients (Figures 3-K and 3-L) with slightly larger effects in relation to vocabulary, meaning that these factors explained some of the variation in cognitive ability by parental education.

Figure 3-K Associations between education and change in vocabulary ability before and after taking account of material and economic characteristics



Note: reference category is 'no qualifications'.

Figure 3-L Associations between education and change in problem solving ability before and after taking account of material and economic characteristics



Note: reference category is 'no qualifications'.

3.4 Summary of single domain effects

Thus far the analysis has considered each of the various domains of influence in isolation. This analysis has demonstrated that a range of factors, measuring different aspects of children's circumstances and experiences, are associated with their change in cognitive ability during the pre-school period. However, across all the domain analysis, parental level of education has remained significantly associated with change in cognitive ability although some factors have weakened this association. The factors which have emerged from the various domains as being important differ according to each ability and are summarised in Table 3.12.

Table 3.12 Factors significantly associated with change in cognitive ability from the single domain analysis

Cognitive ability	
Knowledge of vocabulary	**Problem solving**
• Mother aged under 25 at child's birth • Having a non-white parent • Frequency of home learning activities at age 2-3 years • Level of rule-setting in household at age 5 • Level of infant-maternal attachment at 10 months • Parent's perception of child's readiness for pre-school at age 3 • Language and communicative development at age 1 • Attendance at ante-natal classes • Breastfeeding • Maternal mental health • Experience of material deprivation	• Frequency of home learning activities at 2-3 years • Type of pre-school attended • Whether child had started primary school • Child's general health between 10 months and 2 years • Breastfeeding • Area deprivation

Only two factors are shared across the two types of ability at this stage – frequency of home learning activities and breastfeeding. The variation across the remaining factors indicates that progress in each ability is influenced by quite different characteristics, circumstances, environments and experiences. This is perhaps unsurprising; whilst both abilities form part of the core assessment in the British Ability Scales Early Years Battery and contribute to the measurement of General Conceptual Ability via that battery, they are clearly measuring quite different cognitive concepts and thus are likely to be affected in different ways by different factors present in the child's life. Indeed, although scores on both assessments are statistically significantly correlated (so that children who score better on one assessment also tend to score better on the other), the strength of the association is only moderate (at around 0.4 at each time point) indicating that consistently high or low scores on *both* measures for any single child are not inevitable.

3.5 Combined domain effects

To what extent do the various factors in each domain, when taken together, explain differences in change in ability by education level? The next stage of analysis involved entering the significant domain factors together into a single regression model for each ability alongside parental level of education. In so doing, this analysis explores the extent to which each factor remains independently associated with change in ability and an examination of the combined effect of all factors on the relationship between education and change in ability.

The results of the regression analysis are summarised in Table 3.13 for vocabulary and in Table 3.14 for problem solving with the remaining significant variables for both models included in Table 3.15[26].

In each model, factors across a range of domains remain independently associated with change in the respective skill. However, the particular pattern of variables and domains is different.

Changes in vocabulary (Table 3.13) are more related to aspects of the child's home environment and the choices and behaviours of parents. After controlling for education, greater consistency of parenting, stronger parent-child attachment, attendance at ante-natal classes and breastfeeding were each independently associated with an improvement in vocabulary ability in the pre-school years.

Alongside these home experiences and parenting behaviours, early language development is also key. A higher score on the CSBS infant/toddler checklist at 22 months remained significantly associated with improvement in expressive language skills in the pre-school period. This indicates that those children who display better communication and language skills at an earlier stage are those who are more likely to see those skills improving during the pre-school period. It would appear generally beneficial therefore, to seek to improve children's communication ability from the very earliest stages in order to ensure their continued positive language development. Indeed, it is possible, and perhaps likely, that those factors associated with relative improvement in language ability during the pre-school period are also associated with very early communicative development such as that measured by the CSBS scale.

26 The full results are shown in Tables 19 and 20 in the Technical Appendix.

Table 3.13 Knowledge of vocabulary cross-domain linear regression – summary results

	Sig.	Direction of change
Standardised ability score at age 3	0.001	+
Maternal age at child's birth *(ref: 25 or older)* Under 25	 NS	
Parental ethnicity *(ref: both parents white)* At least one parent non-white	 NS	
Mean score on home learning activities scale	NS	
Banded level of rules in household (ref: low rules) Medium High	 NS 0.01	 +
Infant-maternal attachment score	0.001	+
Perceived readiness for school scale	NS	
Total score on CSBS Infant/Toddler checklist	0.02	+
Attendance at ante-natal classes *(ref: did not attend)* Went to some classes Went to all classes	 NS <0.001	 +
Was child ever breastfed? *(ref: no)* Yes	 0.03	 +
Poor mental health since child's birth *(ref: no)* Yes Score on material deprivation index	 NS NS	 -
Parental level of education *(ref: no qualifications)* Lower SGs or VQs or 'Other' quals Upper level SGs or Intmed VQs Higher Grades or Upper level VQs Degree level academic or VQs	 NS NS NS 0.015	 +
Weighted base	*2689*	

Table 3.14 Problem solving cross-domain linear regression – summary results

	Sig.	Direction of change
Standardised ability score at age 3	<0.001	+
Mean score on home learning activities scale	0.002	+
Pre-school type *(ref: nursery class attached to school)*		
No pre-school	0.03	-
Local Authority nursery school	NS	
Private nursery school	<0.001	+
Other provider	NS	
Has child started primary school? *(ref: no)*		
Yes	0.03	+
General health from birth to age 3 *(ref: always good or very good)*		
Temporarily or always fair, bad or very bad	NS	
Was child ever breastfed? *(ref: no)*		
Yes	0.04	+
Area deprivation *(ref: least deprived)*		
2	NS	
3	NS	
4	NS	
5 Most deprived	0.02	-
Parental level of education *(ref: no qualifications)*		
Lower SGs or VQs or 'Other' quals	NS	
Upper level SGs or Intmed VQs	NS	
Higher Grades or Upper level VQs	NS	
Degree level academic or VQs	0.04	+
Weighted base	*3344*	

Change in problem solving ability appears much more susceptible and responsive to external influences, although the home environment and parenting behaviours – through home learning activities and breastfeeding – continue to have an impact.

The experience of pre-school education itself had an impact. Those children who did not attend any pre-school education were more likely to show a deterioration in problem solving ability. In contrast, when delivered via a private nursery school, the pre-school experience itself remained independently associated with an improvement in problem solving skills. Early primary school experience, of just a few months, also had a positive impact with those children showing an improvement in problem solving ability although we may expect this effect to disappear when all children enter school at this stage. That is, all children will mutually benefit in terms of their problem solving ability from their early experience at primary school when they come to attend and it cannot be presumed that sending children to primary school early will necessarily additionally benefit their cognitive development.

Area deprivation was a further external influence, but a negative one. Compared to those living in the least deprived areas, the relative problem solving ability of children living in the most disadvantaged areas declined.

3.5.1 Summary of combined domain effects

The factors which have emerged as being statistically significantly associated with change in each ability in the combined domain analysis are summarised in Table 3.15.

Table 3.15 Factors significantly associated with change in cognitive ability from the cross-domain analysis

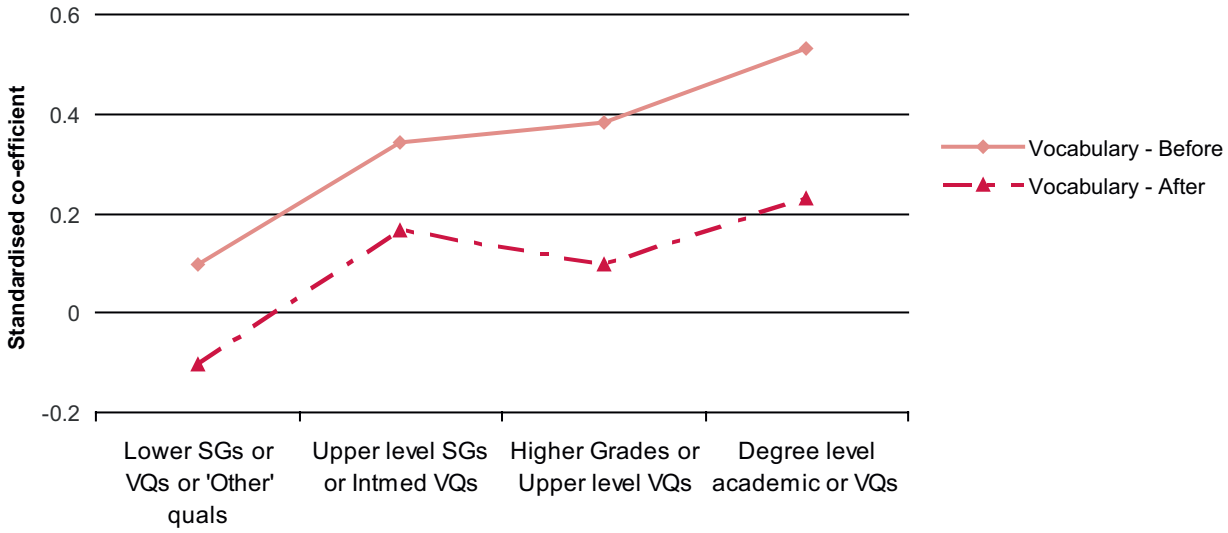
Cognitive ability	
Knowledge of vocabulary	**Problem solving**
• Level of rule-setting in household at age 5 • Level of infant-maternal attachment at 10 months • Language and communicative development at 22 months • Attendance at ante-natal classes • Breastfeeding	• Frequency of home learning activities at 2-3 years • Type of pre-school attended • Whether child had started primary school • Breastfeeding • Area deprivation

Only a single factor, breastfeeding, is shared across the two types of ability in this analysis. The variation across the remaining factors further confirms that progress in each ability is influenced by different characteristics, circumstances, environments and experiences.

3.5.2 Explaining the effect of education on gaps in ability

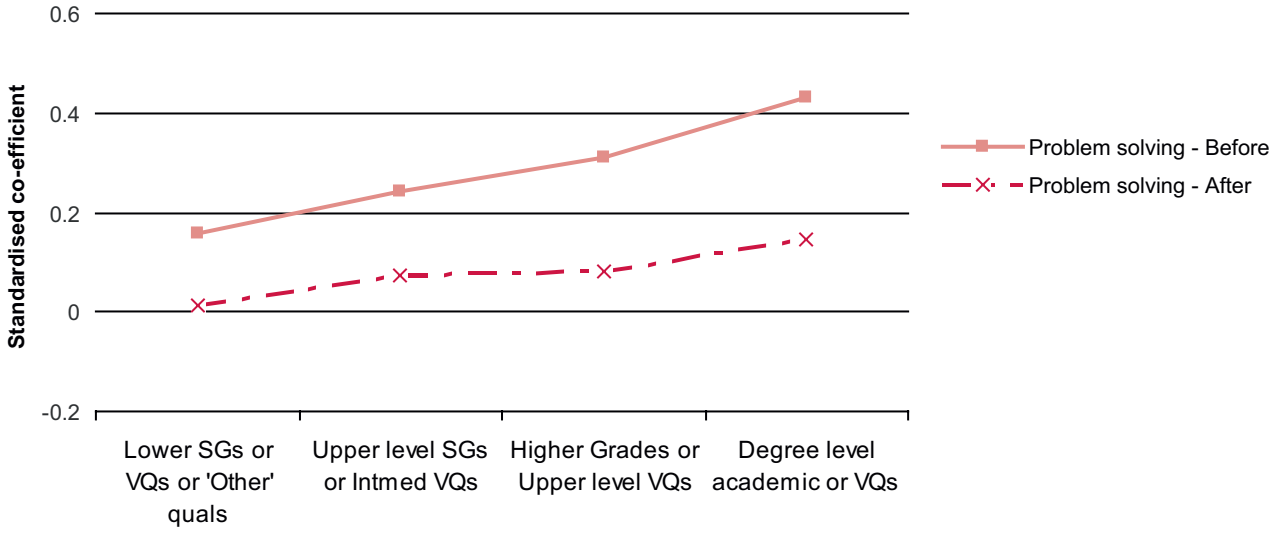
Throughout this section we have been considering how much of the difference (or variance) in ability scores at age 5 between children from the various educational groups can be explained by differences in measures in each of the domains. When differences in ability at age 5 are considered across all children, the analysis shows that level of parental education and score at age 3 explain 30% of those differences in relation to vocabulary and 11% in relation to problem solving. When the additional significant measures are added, no further variance is explained in relation to vocabulary, and only an additional 2% is explained in relation to problem solving indicating that the domain measures largely form part of the differences already seen and measured by parental education. It is therefore unsurprising to see that the strength of the association between parental level of education and change in ability is visibly reduced in these final models as shown in Figure 3-M and Figure 3-N. As indicated by the position of the dotted lines in the graph, the association between level of parental education and ability at age 5 is weaker (that is, the coefficient has a lower value) for both models *after* the additional explanatory measures have been added.

Figure 3-M Associations between education and change in vocabulary ability before and after taking account of combined domain characteristics



Note: reference category is 'no qualifications'.

Figure 3-N Associations between education and change in problem solving ability before and after taking account of combined domain characteristics



Note: reference category is 'no qualifications'.

In addition, it is notable that of the various levels of qualifications included in the education measure, only degree-level education continues to have an independent positive effect on change in either ability. This suggests that much of the difference seen earlier across the lower qualifications is explained by differences in the home and external environments, and parenting experiences of the children in these lower groups.

The evidence in this chapter has shown that there are a number of factors which appear to impact on change in cognitive ability over and above parental level of education. Moreover, the direct effect of education level on change in ability is reduced by the addition of these factors. Thus, whilst these additional factors do not explain any more of the variance in ability than education itself, we have confirmed some of the processes through which the effects of parental education are transferred to children's cognitive development. As such, these findings indicate that improving educational qualifications amongst parents alone would not close all or most of the education-related gaps in cognitive ability because some of those gaps are created by the different experiences of children whose parents have different levels of education. Raising education levels would require accompanying change in the circumstances outlined here in order to move towards a more narrow cognitive ability gap.

chapter

4

DIFFERENT EFFECTS BY PARENTAL LEVEL OF EDUCATION

4.1 Introduction

The analysis in the previous chapter has identified those factors, across various domains of children's lives, which impact, in both positive and negative ways, on the continuing development of their vocabulary and problem solving skills during the pre-school period. It is possible though, given the difference in circumstances and experiences of children from different educational backgrounds, that the factors which are associated with change for children with higher educated parents may differ from those associated with change for children with lower educated parents.

The final analytical stage, addressed in this section, will examine in more detail whether the effect of any of these factors varies according to parental level of education. For example, the analysis will show whether a richer home learning environment is more beneficial to children whose parents have a lower level of education, or those whose parents are more highly educated or whether there is no difference in the effect.

In this way, it is possible to identify whether the development of cognitive ability among children from the various educational groups is affected in different ways by different characteristics, circumstances and experiences and thus assess the extent to which universal or targeted policy interventions are required.

4.2 Key findings

Knowledge of vocabulary

- Lack of educational qualifications amongst younger mothers appears to be of less importance than a lack of qualifications amongst older mothers in respect of change in relative language ability. Rather than 'doubling' the negative effect, having a younger mother in the low qualifications group appeared to cancel out some of the negative impact of the lack of qualifications.
- The positive impact of infant-maternal attachment on improvement in relative language ability was specific to children whose parents have lower qualifications, implying that the overall negative effect on cognitive development associated with a lack of parental qualifications can be mediated somewhat by improving early infant-maternal attachment.
- The positive relationship between early communication skills and relative improvement in vocabulary between ages 3 and 5 was more pronounced for children whose parents had no or lower qualifications. Thus children from less educated backgrounds whose relative vocabulary ability improves in the pre-school period are those who were already demonstrating more advanced communication skills at an earlier age. For children whose parents have no or lower qualifications, poor early communication skills will likely persist through the pre-school period with little or no relative

improvement. In contrast, a lack of advanced early communication skills does not appear to necessarily prohibit later improvement in vocabulary for children in families where parents have higher qualifications.

- The positive effect of attendance at ante-natal classes on relative improvement of vocabulary applied equally to children in all educational groups. Thus ante-natal classes appear to have a 'universal' positive effect. However, it is feasible that attendance at ante-natal classes is measuring characteristics associated with a desire to be a good parent which are also beneficial to the improvement of vocabulary ability in the pre-school period. Thus simply improving attendance at ante-natal classes alone is not likely to lead to improved cognitive ability.

Problem solving

- Experiencing a higher frequency of parent-child activities such as reading, drawing, and singing nursery rhymes etc at the ages of 2 and 3 has more benefit in respect of the relative improvement of problem solving ability for children whose parents have lower qualifications than for those who had higher qualifications. Increasing such activity for children from less educated backgrounds may therefore help to reduce the ability gap.
- None of the remaining factors associated with change in problem solving ability – attending a private pre-school, starting primary school, being breastfed and living in an area in the most deprived quintile – showed different effects for children in lower and higher educational groups.
- Whilst it may be taken as encouraging that private pre-school attendance and early primary school experience appear to lead to a general improvement in problem solving ability, these factors do not appear to offer a policy solution for narrowing the cognitive gap and improving, in particular, the ability of those children whose parents have lower qualifications.

4.3 Education independent effects – to what degree?

In the previous chapter, Table 3.16 summarises the factors from the combined domain analysis which were associated with a change in ability in the pre-school period. Looking again at the cross-sectional analysis discussed in section 3.2, it is clear that there are stark differences in the pattern of some of the domain factors amongst the different education groups. Breastfeeding, for example, is highly socially patterned in this respect – 84% of children from households with a degree-educated parent were ever breastfed, compared with 39% of children across the two lowest educational groups. Whilst the regression analysis controls for these social patterns, it is possible that the close relationship between education and some of the explanatory variables may still be confounding the statistical process to some extent[27].

4.3.1 Differences amongst those with higher qualifications

To explore the extent to which the various factors are associated with change in cognitive skills, beyond the effect of education, each of the final models were first run on a sub-sample of the data restricted to those parents with a degree-level qualification – this being the only education category which was shown to remain statistically significant in those final models – and then on a sub-sample restricted to those with lower level qualifications (reported in section 4.3.2). If any of the factors remain statistically significant in these degree-only models, this suggests that despite having similar level qualifications, the experience or behaviours described by the factors have an independent effect on the change in children's cognitive skills and are not simply a function of the parent's education level. The results of each model are summarised in Table 4.1[28].

27 This issue is known as 'multicollinearity'. It occurs when two or more of the independent variables in a regression model are highly correlated. Multicollinearity can mean that the correlated variables may not be reporting unique or independent values. This can cause potentially misleading results for example indicating that an association is significant when it is not (because it is reporting the association with the correlated variable).

28 Full results of the regression are shown in Tables 21 and 22 in the technical appendix.

Table 4.1 Factors associated with change in cognitive ability: degree-educated parents only

Cognitive ability	
Knowledge of vocabulary	**Problem solving**
Significant factors: • Language and communicative development at 22 months • Attendance at ante-natal classes • Breastfeeding **Non-significant factors:** • Level of rule-setting in household at age 5 • Level of infant-maternal attachment at 10 months	**Significant factors:** • Type of pre-school attended • Area deprivation **Non-significant factors:** • Frequency of home-learning activities at 2-3 years • Whether child had started primary school • Breastfeeding

Of the factors which were associated with change in vocabulary for the full sample, early language development, attendance at ante-natal classes and breastfeeding remain. Thus, amongst children who each have a degree-educated parent, those who were breastfed, with better early language skills, and whose parent(s) attended ante-natal classes, were more likely to show a relative improvement in vocabulary skills in the pre-school period. For problem-solving, receiving pre-school education from a private nursery school continues to have a positive effect and area deprivation a negative effect.

4.3.2 Differences amongst those with lower qualifications

If policy is to narrow the gap in cognitive ability, then the focus needs to be on improving the performance of children from lower educational backgrounds in order that they 'catch-up' with those from higher educated households. The analysis in the previous section demonstrated that certain factors, beyond parental education, are associated with change in ability amongst children who all have a degree-level educated parent. It is possible though, given the difference in circumstances and experiences of children from different educational backgrounds, that the factors which are associated with change for children with higher educated parents may differ from those associated with change for children with lower educated parents.

To examine this, both final models were again run on a sub-sample of the full data, this time including only those cases in the lower three educational groups[29] – where parents had either no qualifications, lower-level Standard Grades (or equivalent) or upper-level Standard Grades (or equivalent). The factors which remain significant on the lower qualification group models can then be compared to those on the degree-level models allowing an appraisal of whether the effects of various factors are similar or different across the different education groups. The results of each of the lower qualification models are summarised in Table 4.2[30].

29 Combining the groups was necessary to maintain a large enough number of cases for consideration.
30 Full results are shown in Tables 23 and 24 in the Technical Appendix.

Table 4.2 Factors associated with change in cognitive ability: lower educated parents only

Cognitive ability	
Knowledge of vocabulary	**Problem solving**
Significant factors: • Level of infant-maternal attachment at 10 months **Non-significant factors:** • Level of rule-setting in household at age 5 • Language and communicative development at 22 months • Attendance at ante-natal classes • Breastfeeding	**Significant factors:** • Frequency of home-learning activities at 2-3 years **Non-significant factors:** • Type of pre-school attended • Whether child had started primary school • Breastfeeding • Area deprivation

The results are quite different from those for the degree-level sub-sample:

- In relation to change in vocabulary, only infant-maternal attachment remained significant; those children with higher levels of attachment were more likely to see their relative scores improve.
- For problem-solving, the frequency of home learning activities was the only factor to return a statistically significant association. Children who experienced higher levels of these activities at ages 2 and 3 were more likely to see their problem solving skills improve in the pre-school period.

Thus, for both types of ability, amongst children from lower educated backgrounds, the importance of the home environment and parent-child relationship appears to be key. The external influences (pre-school and area deprivation) shown to have a positive relationship with change in problem solving ability in the full model, and for the degree-level sub-sample, are not evident amongst this group.

4.4 Reducing the gap – are different factors important for children with lower educated and higher educated parents?

Whilst the above analysis indicates that some factors appear to have different effects on children whose parents have different levels of education, it does not allow us to determine whether these differential effects are statistically significant. In order to do this, interaction terms between selected explanatory variables and those defining the sub-groups of parental level of education (degree or equivalent and no qualifications, lower or upper level Standard Grades) were entered into each of the main final multivariate models. Where the interaction term is statistically significant in the analysis, this indicates that the corresponding explanatory factor has a statistically significantly different effect for children in each sub-group. Table 4.3 summarises which measures were selected for inclusion in the interaction analysis and which interactions were significant. A full description of the analysis and the results is included in the Technical Appendix.

Table 4.3 Factors where an interaction with parental level of education was explored

Cognitive ability	
Knowledge of vocabulary	**Problem solving**
Significant interactions: • Maternal age at child's birth: whether under 25 or not • Level of infant-maternal attachment at 10 months • Language and communicative development at 22 months • Whether ever breastfed or not **Non-significant interactions:** • Attendance at all ante-natal classes	**Significant interactions:** • Frequency of home-learning activities at 2-3 years • Did not attend pre-school **Non-significant interactions:** • Attended private pre-school • Whether child had started primary school • Whether ever breastfeed or not • Lives in an area in the most deprived quintile

In terms of circumstances and experiences which could be influenced in order to help improve the development of cognitive ability amongst children from poorer educational backgrounds, the following interaction results are notable:

- The association between infant-maternal attachment and improvement in relative language ability was specific to children whose parents have lower qualifications implying that the overall negative effect on cognitive development associated with a lack of parental qualifications can be limited somewhat by improving early infant-maternal attachment.
- Children from worse educational backgrounds whose relative vocabulary ability improves in the pre-school period are those who were already demonstrating more advanced communication skills at an earlier age. For children whose parents have no or lower qualifications, poor early communication skills will likely persist through the pre-school period with little or no relative improvement. In contrast, a lack of advanced early communication skills does not appear to necessarily prohibit later improvement in vocabulary for children in families where parents have higher qualifications.
- Children whose parents have lower qualifications appear to benefit more – in terms of the improvement of their problem solving ability – from experiencing a higher frequency of parent-child activities such as reading, drawing, and singing nursery rhymes etc at the ages of 2 and 3 than those whose parents have higher qualifications.

Children vary in their cognitive ability from a very early age. At just age 3, there are stark differences in expressive vocabulary and problem solving ability according to a child's social background – household income, parental level of education and parental social class.

Longitudinal research following children from childhood into adulthood indicates that early ability is closely associated with longer-term academic outcomes and economic activity in adulthood. Research also indicates that on entering school, it becomes more difficult for under-performing children from more disadvantaged backgrounds to catch-up with their more advanced peers than is the case in the pre-school and early years period (Feinstein, 2000; Heckman et al, 2006; Sinclair, 2007). This suggests that policy efforts should be focused on maximising children's cognitive ability ahead of their school entry. The pre-school period presents a good opportunity to do so. Whilst trajectories for children with developmental vulnerabilities can be changed, the major effort is better made in the early years when the brain is most susceptible to change. Later interventions are more difficult and less effective. Maximising children's ability ahead of school entry permits them a better chance of more positive longer-term outcomes and can be done economically more efficiently than providing a 'crisis intervention' at a later stage (Scottish Government 2010b, Sinclair, 2007; Heckman et al, 2006). Thus efforts to improve cognitive ability ahead of entering school offer an opportunity for greater returns to investment and to improve outcomes over the life course.

This paper has considered two separate abilities – knowledge of vocabulary and problem solving. Whilst the existing long-term research cited above relates early ability to later educational and employment outcomes, the ability measures used are combined and development is considered more generally. Future research on the different or similar relationships that early vocabulary ability and early problem solving ability have with later outcomes would be useful in determining their relative importance in the early years.

The importance of measuring and influencing children's early development is increasingly being recognised by Scottish Government as reflected in the many recent related reports, research, policy frameworks and parliamentary debates. For example, a pilot project is currently underway to assess the usefulness of the 'Early Development Instrument' (EDI) – a teacher-completed checklist that assesses children's readiness to learn when they enter school (Geddes and Frank, 2010). The EDI permits an assessment, at a broad population level, of how children's pre-school experiences at school entry will affect their readiness to learn at school. It can be used to influence the delivery of services and support designed to maximise children's development in the 0-5 period.

chapter
5
CONCLUSION

5.1 Differences in cognitive ability by social background characteristics

GUS data shows that the gaps in cognitive ability by social background which exist at age 3 persist at age 5. Estimates from the data suggest that, at age 5, children in more advantaged circumstances are between 11-18 months ahead in their expressive vocabulary skills and between 6-13 months ahead in their problem solving ability. The largest gaps are according to parental level of education. In terms of vocabulary, children with degree (or equivalent) educated parents are around 18 months ahead of children whose parents have no qualifications. For problem solving the equivalent gap is 13 months.

In the pre-school period, gaps in vocabulary ability by level of household income – for all children combined – decrease very slightly, and gaps by social class remain stable. In contrast, gaps between children from the lowest and highest education groups widen significantly. In relation to problem solving, the pattern is different; income gaps increase slightly, whereas gaps by education and social class decrease, quite substantially for social class. On the whole, social background factors were found to be more closely associated with, and to explain more of the variance in, vocabulary ability than problem solving ablity which may explain the different patterns of change at this broader level. Nevertheless, at this broader level, the considerable differences in cognitive ability by social background found at age 3 still remain at age 5.

Parental educational qualifications are not only a driver of the gaps in cognitive ability seen at age 5, the findings of this report suggest that parental level of education is the key social background factor which influences individual level *change* in cognitive ability in the pre-school period. Influences on change in ability is something that has not been much considered in other research. Children whose parents are more highly educated were significantly more likely than those whose parents had lower qualifications to see their relative performance on both assessments improve during the pre-school period. Notably, parental education was much more closely associated with the development of vocabulary skills than problem solving ability.

5.2 Other factors affecting change in cognitive ability

Many of the factors shown, through existing research, to influence early child cognitive ability – such as home learning activities and early child development – vary significantly by parental level of education. Analysis, which controlled for the effect of the level of education, showed that many of these factors continued to have an effect on *change* in children's cognitive ability in the pre-school years, over and above the effect of educational levels.

This analysis showed that changes in vocabulary are more related to aspects of the child's home environment and the choices and behaviours of parents. After controlling for education, greater consistency of parenting, stronger parent-child bonds, attendance at ante-natal classes and breastfeeding were each independently associated with an improvement in vocabulary ability in the pre-school years. Alongside these home experiences and parenting behaviours, early language development was also important – children who were reported to have better communication skills at 22 months were more likely to show improvement in the vocabulary ability in the pre-school period.

Change in problem solving ability appears to be more influenced by external factors such as pre-school education, although the family environment and parenting behaviours – through home learning activities and breastfeeding – were still associated with positive change. Pre-school education itself was associated with change in problem solving ability. Those children who did not attend any pre-school education were more likely to show a deterioration in problem solving ability. Interestingly, those who attended a private nursery school saw an improvement in this ability. The benefits of pre-school education to children's cognitive skills have been widely investigated and reported (Butt et al, 2007; Sylva et al, 2003). It is unclear from the analysis in this report what aspects of a private pre-school environment may cause it to be more strongly associated with a relative improvement of problem solving skills than other pre-school settings. Existing research into the effects of pre-school generally conclude that the quality of the pre-school environment – for example, measured through the warmth and responsiveness of staff towards children – is the key driver of its influence on improving outcomes. Pre-school 'practices' – such as the extent to which pre-schools particularly promote literacy or maths, or focus on positive social interactions – can also play a part. Therefore, one interpretation may be that private pre-school settings provide a better quality of environment or a different set of practices compared with other settings, and that these environments and practices are better suited to the improvement of problem solving skills than other settings. Other research has explored peer influence on individual development in the pre-school environment (Mashburn et al, 2009). The cross-sectional analysis in section 3.3.4 showed that private pre-schools were more likely to be attended by children from better educated households. Thus a further interpretation may be that the particular social mix of children in private pre-school settings contributes to its impact on problem solving ability. Further research would be useful to examine this relationship in more detail.

The proportion of children who had started attending primary school ahead of their age 5 assessment of problem solving ability appeared to benefit from that early, although brief experience. As these children do not differ in age from those who had not started school (other than in their month of birth) it is reasonable to assume this early beneficial impact will be universal – applying to all children on entry to Primary 1. Indeed, we showed no

difference in effect between children from different maternal educational backgrounds. As such, this finding does not support earlier entry to school for those children at risk of poorer problem solving ability.

In the case of each ability considered, differences in prevalence of the additional explanatory factors amongst parents with different levels of qualifications explained at least some of the differences in change in ability seen by parental education rather than the qualifications *per se*. In other words, some of the greater change in ability shown amongst children whose parents have higher qualifications is because those children have different experiences and circumstances than children with lower educated parents. It is not simply due to parental education level itself.

5.3 Factors and associated policy responses which may help narrow the gap in cognitive ability

When the explanatory factors themselves are so closely associated with level of education, isolating their independent effect is difficult. Furthermore, it is unclear whether each factor has a similar effect on change in ability across all educational groups. If policy is to narrow the gap in cognitive ability, then the focus needs to be on improving the performance of children from lower educational backgrounds in order that they 'catch-up' with those from higher educated households. It is possible, given the differences in circumstances and experiences of children from different educational backgrounds, that the factors which are associated with change for children with higher educated parents may differ from those associated with change for children with lower educated parents. Thus we undertook analysis to look for any such differential effects.

We found differences for those cases where the parent was educated to degree-level and those with no or lower level qualifications showing that, in fact, the factors which matter are different for each group and in relation to each type of ability. This suggests that, at least in relation to some areas of family life and education, universal policies which seek to improve children's cognitive ability and school readiness in the pre-school period will not benefit all children equally. In fact, there are some notable findings in terms of identifying practices which may be influenced in order to improve the cognitive ability of children from lower educated backgrounds, and to reduce the cognitive gap during the pre-school period.

Having a good, early infant-maternal bond appeared to protect children in the lower education group from following the general trend of a drop-off in relative vocabulary ability amongst this group. We may assume that a good early bond will reflect, in most cases, a good continuing bond through the child's early life including in the pre-school period. This bond, and the parenting behaviours it represents, appears to compensate, at least in part, for the lack of parental qualifications and assists children from lower

educational backgrounds in continuing to improve their relative vocabulary ability during the pre-school period.

Good early communication ability was also more important for children whose parents had no or lower educational qualifications. The data suggested that amongst the lower education group, those children who were reported to have better communication and language skills at 22 months were more likely to show an improvement in vocabulary over the pre-school period. This finding suggests that by assisting children from at risk groups with their communication development from the earliest possible stage would continue to have benefits to their language development throughout the pre-school years, and possibly beyond. It is imperative, however, that this intervention occurs as early as possible in order to influence emerging language skills at 22 months and is undertaken as a preventative rather than reactive measure as our findings suggest that it is particularly difficult to address existing language problems for children in this group in the pre-school period. Preventative policy is necessary because other research has indicated that disadvantaged parents are less likely to have the knowledge and skills necessary to detect early developmental delay. Furthermore, research on GUS data (Mabelis and Marryat, 2011) also shows that parents in more disadvantaged circumstances tend to have a more negative attitude to formal advice and intervention and lower formal service contact. Thus, even if some delay was suspected, parents in these circumstances may be less likely to seek help or advice. Children from these groups are also considerably less likely to attend formal childcare settings or any sort of organised parent-child group in their early years (Mabelis and Marryat, 2011). This combination of circumstances suggests that language delay amongst children from lower educated backgrounds may be less likely to be detected by a health or childcare professional than such a delay amongst children from better educated households.

For improving problem solving ability, the parent-child activities represented by the home learning environment were shown to be more important for children in the lower educational group. Experiencing – at the ages of 2 and 3 – a higher frequency of activities involving, amongst other things, reading, drawing and singing with their parents protected children in this group from the dominant trend of a decrease in problem solving ability relative to their peers. The importance of the home learning environment for the development of children's cognitive ability is not a new finding – including for analysis of GUS data (Bromley, 2009; Melhuish, 2010). However, the suggestion here is that such parent-child activities can be of particular benefit to children whose parents have lower educational qualifications. As such, current general policies aimed at encouraging parents to undertake such activities with their children – including the Play, Talk, Read campaign and the Bookbug initiative – may benefit further by providing an additional targeted element aimed at those children most likely to benefit, in terms of an improvement in problem solving ability, in the pre-school period.

As can be seen, for the most part, the factors which did suggest some variation by educational background were associated with aspects of the child's home environment and the choices and behaviours of parents – factors which are traditionally more difficult for policy to effect than more external, service-based influences such as pre-school and primary school education. However, both pre-school and early primary school experiences were shown to have some positive impact on problem solving ability. It is unclear at this point which particular characteristics of privately-provided pre-school education generate this effect. Further research is recommended to explore this so that the factors which bring about this positive change may be delivered via other pre-school settings.

The mix of family and institution effects suggests that any strategies aimed at improving school readiness via the pre-school setting will require, for more disadvantaged children, a parallel strand which seeks to influence the child's home environment and parenting experiences. This is not a surprising finding, Geddes et al (2010), in their review of interventions which are designed to improve school readiness, found that the most successful interventions utilised a mixed (centre and home-based), two generation (child and parents) approach. To ensure that children's cognitive ability is maximised in the pre-school period, our findings suggest that, in the home, such strategies should focus on the quality of the parent-child relationship and frequency of home learning activities. Delivering a support service to parents in this manner can be challenging. As Mabelis and Marryat acknowledge (2011), parents who would benefit most from such support are often those most wary of formal services, and who tend to use services less. It is important therefore, that any such support is delivered in a manner likely to engage and ensure the co-operation of those families who would benefit most from receiving it.

This report presents a complex picture of the numerous elements of children's lives which, taken together, can influence their cognitive development. Influencing just one factor is unlikely to generate any change in children's ability. Thus any policy response must recognise the multi-faceted nature of factors which impact on children's development and seek to address improvements in each of those areas in order to close the ability gap.

REFERENCES

Allen, G. (2011) *Early Intervention: The Next Steps – An Independent Report to Her Majesty's Government,* London: HM Government http://offlinehbpl.hbpl.co.uk/NewsAttachments/PYC/early-intervention-7th1.pdf

Anderson, J.W., Johnstone, B.M., and Remley, D.T. (1999) "Breastfeeding and cognitive development: a meta-analysis"*, American Journal of Clinical Nutrition*, 70(4), pp525-35

Barnes, M., Chanfreau, J. and Tomaszewski, W. (2010) *Growing Up in Scotland: The circumstances of persistently poor children*, Edinburgh: Scottish Government

Blanden, J. and Machin, S. (2010) *Millenium Cohort Study Briefing 13:Intergenerational inequality in early years assessments*, London: Institute for Education

Bradshaw, P. (2010) *Growing Up in Scotland: Children's social, emotional and behavioural development at entry to primary school,* Edinburgh: Scottish Government

Bradshaw, P. and Wasoff, F. (2009) *Growing Up in Scotland: Multiple childcare provision and its effect on child outcomes,* Edinburgh: Scottish Government

Bromley, C. (2009) *Growing Up in Scotland: The impact of children's early activities on cognitive development,* Edinburgh: Scottish Government

Burger, K. (2010) "How does early childhood care and education affect cognitive development? An international review of the effects of early interventions for children from different social backgrounds", *Early Childhood Research Quarterly,* 25, pp140-165

Butt, S., Goddard, K. and La Valle, I. with Hill, M. (2007) *Childcare nation? Progress on the childcare strategy and priorities for the future*, London: Daycare Trust Summary available at: http://www.daycaretrust.org.uk/data/files/Research/childcare_nation_summary__october_2007.pdf

Cullis, A. and Hansen, K. (2008) *Child Development in the first three sweeps of the Millennium Cohort Study*, London: Department for Children, Schools and Families

Denton, K., West, J., & Walston, J. (2003). Reading - Young children's achievement and classroom experiences. Washington, DC: U.S. Dept. of Education, NCES 2003-070

Feinstein, L. (2000) *Inequality in the early cognitive development of British children in the 1970 Cohort*, Paper presented at the launch of the LSE Research Lab, July 2001. Available here: http://www.rlab.lse.ac.uk/opening/papers/feinstein.pdf

Field, F. (2010) *The Foundation Years: preventing poor children becoming poor adults – the report of the Independent Review on Poverty and Life Chances,* London: HM Government http://povertyreview.independent.gov.uk/media/20254/poverty-report.pdf

Finance Committee of the Scottish Parliament (2011) *Report on prevantative spending*, Edinburgh: Scottish Parliament http://www.scottish.parliament.uk/s3/committees/finance/reports-11/fir11-01.htm#2

Foster, M.A., Lambert, R., Abbott-Shim, M., McCarty, F. and Franze, S. (2005) "A model of home learning environment and social risk factors in relation to children's emergent literacy and social outcomes"*, Early Childhood Research Quarterly,* 20, pp13-36

Geddes, R. and Frank, J. (2010) *Measuring Early Child Development in Scotland: Introducing the Early Development Instrument,* Presentation delivered to the Support from the Start Planning Board, July 2010 http://edubuzz.org/blogs/equallywell/files/2010/08/Early-Child-Development-in-Scotland_July7_97-2000.ppt

Geddes, R., Haw, S. and Frank, J. (2010) *Interventions for Promoting Early Child Development for Health: An environmental scan with special reference to Scotland*, Edinburgh: MRC Scottish Collaboration for Public Health Research and Policy

Hansen, K. (Ed.) (2008) *Millenium Cohort Study: Third Survey: A User's Guide to Initial Findings*, London: Centre for Longitudinal Studies

Hansen, K., Jones, E., Joshi, H. and Budge, D. (Eds) (2010) *Millenium Cohort Study: Fourth Survey: A User's Guide to Initial Findings*, London: Centre for Longitudinal Studies

Haw, S. (2010) *Reflections from a Health Perspective,* paper given at the 4th Annual GUS conference, Edinburgh, April 2010. http://www.crfr.ac.uk/gus/GUS%20events/Year%204/Sally%20Haw.pdf

Heckman, J., Stixrud, J. and Urzua, S. (2006) "The effects of cognitive and noncognitive abilities on labor market outcomes and social behaviour"*, Journal of Labor Economics,* 24: 411-482

Heckman J. and Wax, A. (2004). Home Alone. Wall Street Journal, January 23, 2004, 14

Iacovou, M. and Sevilla-Sanz, A. (2010) *The Effect of Breastfeeding on Children's Cognitive Development*, ISER Working Paper No.2010-40, London: Institute for Economic and Social Research

Keels, M. (2008) "Ethnic group differences in early head start parents' parenting beliefs and practices and links to children's early cognitive development", *Early Childhood Research Quarterly,* 24, pp381-397

Mabelis, J. and Marryat, L. (2011) *Growing Up in Scotland: Parental service use and informal networks in the early years*, Edinburgh: Scottish Government

Magnuson, K. and Duncan, G.J. (2006) "The role of family socioeconomic resources in the black-white test score gap among young children", *Developmental Review,* 26, pp365-399

Marryat, L. and Martin, C. (2010) *Growing Up in Scotland: Maternal mental health and its impact on child behaviour and development*, Edinburgh: Scottish Government

McCall R.B (1981). Nature-nurture and the two realms of development: a proposed integration with respect to mental development. Child Development, 52, 1-12

McCulloch, A. and Joshi, H. (2001) "Neighbourhood and family influences on the cognitive ability of children in the British National Child Development Study", *Social Science and Medicine,* 52, pp579-591

Melhuish, E. (2010) *Impact of the Home Learning Environment on Child Cognitive Development: Secondary Analysis of data from Growing Up in Scotland,* Edinburgh: Scottish Government

National Evaluation of Sure Start (2008) *The impact of Sure Start Local Programmes on Three Year Olds and Their Families*, London: DCSF

Quigley, M.A., Hockley, C., Carson, C., Kelly, Y., Renfrew, M. and Sacker, A. (2009) "Breastfeeding is associated with improved child cognitive development: evidence from the UK Millenium Cohort Study", Paper presented at the Society for Social Medicine 53rd Annual Scientific Meeting, University of Newcastle

Scottish Government (2009) *The Early Years Framework,* Edinburgh: Scottish Government

Scottish Government (2010b) *The Financial Impact of Early Years Interventions in Scotland*, Edinburgh: Scottish Government

Scottish Government (2010a) *Written submission to the Finance Committee Preventative Spending Enquiry, available at:* http://www.scottish.parliament.uk/s3/committees/finance/inquiries/preventative/ScottishGovernment2.pdf

Sinclair, A. (2007) *0-5: How small children make a big difference*, London: The Work Foundation

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., Taggart, B. and Elliot, K. (2003) *The effective provision of pre-school education (EPPE) project: Findings from the pre-school period,* London: Institute of Education http://eppe.ioe.ac.uk/eppe/eppepdfs/RB%20summary%20findings%20from%20Preschool.pdf

Waldfogel, J. and Washbrook, E. (2010) *Low income and early cognitive development in the UK,* London: Sutton Trust http://www.suttontrust.com/research/low-income-and-early-cognitive-development-in-the-uk/

Waldfogel, J. and Washbrook, E. (2008) *Early Years Policy,* Bristol: University of Bristol http://www.bristol.ac.uk/ifssoca/outputs/waldfogeleyp.pdf

appendix 1
FURTHER DETAILS OF EXPLANATORY AND OUTCOME VARIABLES

Social background variables

Equivalised annual household income

The income that a household needs to attain a given standard of living will depend on its size and composition. For example, a couple with dependent children will need a higher income than a single person with no children to attain the same material living standards. 'Equivalisation' means adjusting a household's income for size and composition so that we can look at the incomes of all households on a comparable basis.

Socio-economic classification (NS-SEC)

The National Statistics Socio-economic Classification (NS-SEC) is a social classification system that attempts to classify groups on the basis of employment relations, based on characteristics such as career prospects, autonomy, mode of payment and period of notice. There are fourteen operational categories representing different groups of occupations (for example higher and lower managerial, higher and lower professional) and a further three 'residual' categories for full-time students, occupations that cannot be classified due to a lack of information or other reasons. The operational categories may be collapsed to form a nine-, eight-, five- or three-category system.

This report uses a five-category system in which respondents and their partner, where applicable, are classified as managerial and professional, intermediate, small employers and own account workers, lower supervisory and technical, and semi-routine and routine occupations. The variable is measured at household level. In couple families this corresponds to the highest classification amongst the respondent and his/her partner.

Parental level of education

At the first wave of data collection, each parent was asked to provide information on the nature and level of any school and post-school qualifications they had obtained. The information is updated at each subsequent contact. Qualifications are grouped according to their equivalent position on the Scottish Credit and Qualifications Framework which ranges from Access 1 to Doctorate. These are further banded to create the following categories: Degree-level academic or vocational qualifications, Higher Grades or equivalent vocational qualification (e.g. SVQ 3), Upper-level Standard Grades (grades 1 to 4) or equivalent vocational qualification (e.g. SVQ 1 or 2), Lower-level Standard grades (grades 5 to 7) or equivalent vocational qualifications (e.g. Access 1 or 2, National Certificates). The highest qualification is defined for each parent and a household level variable is calculated. In In couple families this corresponds to the highest classification amongst the respondent and his/her partner.

Other variables

Family type transitions

Using information on family type (couple family or lone parent household) collected at every sweep, a variable was constructed which measured stability or changes in family type between the ages of 10 months and 3 years (sweeps 1 to 3). Four classifications were derived: stable couple family, couple who separate, stable lone parent and lone parent who repartnered.

Home learning environment

The index of the children's home learning environment was originally developed to assess the association between children's activities at 22 and 34 months and their cognitive development at 34 months (Melhuish, 2010). The index covers aspects such as: how often the children have been read to; done activities such as painting, singing rhymes, or playing educational games; and the number of books in the home. Higher scores on the index indicate children who have experienced a higher number of these items.

Rules and routines

Rules and routines were measured at sweeps 2 and 5. A count of the number of 'rules' or routines was derived from the following: 'always' responses to question on regular meals at sweep 2, a question on regular bedtime at sweep 5 and four questions at sweep 5 on whether the child had to tidy up toys, brush teeth, stay in room, and turn off TV or music in room (using 4-point scale - always/usually/sometimes/never or almost never). The number of rules was banded into low (0-3 rules), medium (4-5 rules) or high (all 6 rules).

Harsh discipline

At age 2 (22 months, sweep 2) and age 4 (46 months, sweep 4), parents were asked the extent to which they had *ever* used a range of discipline approaches with the cohort child. The approaches included were:

- Time out
- Reward system/sticker chart
- Ignoring bad behaviour
- Smacking
- Naughty step/room/corner
- Raising your voice or shouting
- Removing treats or privileges

Responses to the items on smacking were combined to create a single variable indicating whether smacking had ever been used.

Infant-maternal attachment

Early mother-infant attachment was measured at sweep 1 using an abbreviated six-item version of the Condon mother-infant attachment scale (Condon and Corkindale 1998). Mothers were asked about their feelings for their child, with four different possible responses for each item. Items in the scale had low reliability[31] (Cronbach alpha=0.52), but the measure was retained in this study because of the likely policy interest in associations between early indicators of the mother-child relationship and health. The scale used in this report was created by taking the responses to four of the six items – those answers which showed an absence of feelings of annoyance and resentment and feeling patient and confident all the time or most of the time. Each response was divided into positive and negative categories. The revised scale counted the number of responses in the 'positive' category. A score of four, that is a positive relation to the child on all four items, was taken as showing good maternal attachment.

Parent's problems with reading or writing

At sweep 4, respondents were asked two questions designed to measure difficulties with reading and writing. At each question respondent's were asked to indicate whether they had any difficulties with specific tasks. For example, in relation to reading these included understanding what is written in a newspaper and reading aloud from a children's storybook, for writing they included spelling words correctly and making handwriting easy to read. Responses across all items were combined into a single binary variable indicating whether the respondent mentioned any difficulty with reading or writing.

Experience of formal childcare before age 3

Information on use of regular non-parental care collected in GUS includes whether that care is provided through a formal or informal setting. Formal providers include private, workplace and local authority nurseries, childminders and playgroups. Data from sweeps 1 to 3 was combined to generate a binary variable indicating whether or not the child had been cared for on a regular basis by any of these formal providers at any time between the ages of 10 months and 34 months.

31 'Reliability' is used here to denote the internal consistency of items making up a parenting measure. Consistency is estimated using Cronbach's alpha, which is based on the average correlation between items. The value of Cronbach's alpha depends in part on the number of items in the scale, with a greater number of items resulting in higher alphas. While there is no firm consensus, a commonly accepted 'cut-off' of an alpha of 0.7 or more for items to be included in a scale is often lowered to 0.6, particularly for exploratory studies.

Pre-school type

Pre-school education is delivered through a range of settings. Respondents were asked to indicate which type of setting the child was attending for pre-school education or if the child was not attending pre-school. A choice of nine pre-school settings was available. These responses were collapsed to represent five main categories: no pre-school, nursery class attached to an independent or local authority primary school, local authority nursery school, private day nursery or nursery school, or another type of provider. Note that private day nurseries or nursery schools include only commercially operating daycare providers rather than independent schools (which are captured via the nursery class attached to a primary school category).

Perceived readiness for pre-school

A series of six items were included at sweep 4 in order to measure the respondent's perception of the child's 'readiness' for pre-school. These items took the form of statements suggesting various skills or behaviours considered necessary for a comfortable transition into the pre-school environment. They included issues with separation from parent, child's reluctance to attend, ability to mix with other children, ability to take turns and share, whether the child was sufficiently toilet trained, and whether the child was independent enough to cope. Respondents were asked the extent to which they agreed or disagreed on each scale. Responses were then summed into a scale with a higher score indicating a perceived higher readiness. Children were then classified into one of two groups according to whether they had an average or above average score, or a below average score on the scale.

Duration of pre-school attended prior to assessment

This is calculated as the number of months between the date the child started pre-school and the date at which their cognitive assessment was administered during the sweep 5 fieldwork. The figure does not allow for school holidays or child absences so is not a precise measure of the duration of pre-school which the child has experienced, however it is considered to provide a proxy for that information.

Children's general health

At each sweep of fieldwork, parents are asked to rate their child's general health on a five-point scale ranging from very good through to very bad. The measure used in this report captures changes in child's health status between the ages of 10 and 34 months (sweeps 1 to 3). Children who were reported to have fair, bad or very bad health at any or all time points were categorised as temporarily or always having fair, bad or very bad health.

Low birth weight

Any child with a birth weight of less than 2500 grammes at full term was classified as having a low birth weight. The measure includes full-term (born at or after 37 weeks gestation) babies only.

Infant/toddler checklist of the Communication and Symbolic Behaviour Scales

The Infant/Toddler checklist of the Communication and Symbolic Behaviour (CSBS) (Wetherby and Prizant, 2001) assesses children's communicative development at 6-24 months. This instrument was included in the self-completion section of the sweep 3 survey when the cohort children were aged 22 months (just under 2 years old). Three principle domains are assessed in the checklist – social communication, expressive speech/language and symbolic functioning – with a composite score provided for each element. A total score can also be calculated by summing the three composite scores. This report uses the total score. A higher score indicates better communicative development and language skills.

Level of physical activity

Data from questions on sedentary and physical activities asked at sweep 3, when the child was aged 3 (34 months) were used to form a combined physical activity score. More specifically, the questions used were:

- The number of days the child had played outside in the previous week
- The number of days the child had played on the computer in the previous week
- The number of hours of TV the child watched on the average weekday
- The amount of time in the previous week spent: riding a bike, throwing or kicking a ball, dancing or gymnastics, running and/or jumping, playing on a trampoline, swimming, playing at a soft play area or ball swamp, playing at a swing/play park, or doing another physical activity

The scale had a range of 0 to 66, with 0 being no physical activity and a large amount of sedentary activity, and 66 being the reverse. The scale was banded to create three similarly sized groups indicating low, medium and high levels of activity.

Social networks

To explore variations in social networks three summary indicators were created using data collected at sweeps 2 and 3 – one focused on satisfactory friendship networks, one focused on satisfactory family networks and the final one identified those people who had neither a satisfactory friendship nor family network.

Respondents were considered to have a satisfactory friendship network if they agreed with the statement "My friends take notice of my opinions", and they reported one of the

following: visited by friends with children once a fortnight or more often; visits friends with children once a fortnight or more often; attends a parent and toddler group; uses friends for childcare support in the first instance. Respondents were considered to have a satisfactory family network if they agreed with the statement: "I feel close to my family" and they reported any one of the following: any set of the child's grandparents see the child at least once a week; uses a relative for childcare support in the first instance.

Parenting classes

At sweeps 1 to 3, respondents were asked whether they had attended any parenting classes or groups "where parents have the chance to improve their parenting skills and knowledge". Responses across the three sweeps were combined to create a single binary variable indicating any attendance at such at parenting classes over that period.

Maternal mental health

GUS has measured maternal mental health using two different scales: at sweeps 1 and 3 (ages 10 months and 34 months respectively), the SF12 Mental Health Component Score (MCS) was used, whereas at sweeps 2 and 4 (ages 22 months and 46 months respectively) selected items from the Depression, Anxiety and Stress Scale (DASS10) were used. 11 Both scales are widely used and well validated.

In this report, a respondent is defined as having 'poor' mental health if she has a score on SF12 (MCS) at sweep 1 or sweep 3 which fell more than one standard deviation below the mean population score for that sweep. A binary variable was created to indicate if the poor maternal mental health was reported at either sweep 1 *or* sweep 3.

Maternal general health

General health is measured at every sweep by asking respondents to indicate whether they think their health is excellent, very good, good, fair or poor. Responses from sweeps 1 to 3 were combined into a single binary variable which indicated whether the respondent had reported 'fair' or 'poor' health at any of those contacts.

Material deprivation

This measure is used to provide an alternative, direct, assessment of family deprivation to that offered by indirect income-based measures. Items assessing material deprivation were first developed for use in the Family Resources Survey in 2004/05 and now form part of UK government's measure of child poverty. The data used in this report was collected at sweep 4 and consists of a series of 21 questions assessing the extent to which the family are unable to afford various household, child or adult goods or unable to participate in various activities due to lack of money. The index measure used here counts the number of items where the respondent indicates that they 'cannot afford this at the moment'. A weight is then applied to those items that more people have. A higher score indicates a higher level of material deprivation.

Area deprivation (SIMD)

Area deprivation is measured using the Scottish Index of Multiple Deprivation (SIMD) which identifies small area concentrations of multiple deprivation across Scotland. It is based on 37 indicators in the seven individual domains of Current Income, Employment, Health, Education Skills and Training, Geographic Access to Services (including public transport travel times for the first time), Housing and a new Crime Domain. SIMD is presented at data zone level, enabling small pockets of deprivation to be identified. The data zones, which have a median population size of 769, are ranked from most deprived (1) to least deprived (6,505) on the overall SIMD and on each of the individual domains. The result is a comprehensive picture of relative area deprivation across Scotland.

In this report, the data zones are grouped into quintiles. Quintiles are percentiles which divide a distribution into fifths, i.e., the 20th, 40th, 60th, and 80th percentiles. Those respondents whose postcode falls into the first quintile are said to live in one of the 20% least deprived areas in Scotland. Those whose postcode falls into the fifth quintile are said to live in one of the 20% most deprived areas in Scotland.

Further details on SIMD can be found on the Scottish Government website http://www.scotland.gov.uk/Topics/Statistics/SIMD/Overview(Footnotes)

ISBN 978-1-78045-200-5 (web only)

APS Group Scotland
DPPAS11601 (06/11)