

Centre for Research on the  
Wider Benefits of Learning  
Research Report

28

The influence of context on attainment in primary  
school: interactions between children, family and  
school contexts

Kathryn Duckworth



Centre for Research on the  
Wider Benefits of Learning

WBL is a research centre at the Institute of Education

# **THE INFLUENCE OF CONTEXT ON ATTAINMENT IN PRIMARY SCHOOL**

**INTERACTIONS BETWEEN CHILDREN, FAMILY  
AND SCHOOL CONTEXTS**

**Kathryn Duckworth**

**July 2008**

Published by: Centre for Research on the Wider Benefits of Learning  
Institute of Education, 20 Bedford Way, London WC1H 0AL  
[www.learningbenefits.net](http://www.learningbenefits.net)

© Kathryn Duckworth  
ISBN: 978-0-9552810-8-2

Individual copy price: £10.00

The Centre for Research on the Wider Benefits of Learning (WBL) is core funded by the Department for Children, Schools and Families (DCSF). It investigates the benefits that learning brings to the individual and to society as a whole. WBL's main objectives are to clarify, model and quantify the outcomes of all forms of intentional learning so as to inform the funding, implementation and practice of educational provision through the lifecourse. The views that are expressed in this work are those of the author and do not necessarily reflect the views of the DCSF. All errors and omissions are those of the author.

## **The Wider Benefits of Learning Research Report Series**

The reports in this series are published by the Centre for Research on the Wider Benefits of Learning, Institute of Education, London. Reports published to date are listed below and are available online at [www.learningbenefits.net](http://www.learningbenefits.net).

### **2008**

27. Determinants of aspirations
26. Educational inequality and juvenile crime: An area-based analysis
25. Children's well-being in primary school: pupil and school effects

### **2007**

24. The development and impact of young people's social capital in secondary schools
23. What role for the three Rs? Progress and attainment through primary school
22. Parenting behaviours and children's development from infancy to early childhood: changes, continuities and contributions
21. Determinants and pathways of progression to level 2 qualifications: evidence from the NCDS and BHPS

### **2006**

20. Development in the early years: its importance for school performance and adult outcomes
19. Are there effects of mothers' post-16 education on the next generation? Effects on children's development and mothers' parenting
18. What is the relationship between child nutrition and school outcomes?
17. Are those who flourished at school healthier adults? What role for adult education?
16. Does education have an impact on mothers' educational attitudes and behaviours?

### **2005**

15. Leisure contexts in adolescence and their effects on adult outcomes (online only)
14. Education and youth crime: effects of introducing the Education Maintenance Allowance programme

### **2004**

13. Identity, learning and engagement: a qualitative inquiry using the NCDS
12. Education, training and the take-up of preventative health care
11. Adult education and attitude change
10. A model of the inter-generational transmission of educational success

### **2003**

9. The macro-social benefits of education, training and skills in comparative perspective
8. The contribution of adult learning to health and social capital
7. Education, equity and social cohesion: a distributional model

### **2002**

6. Quantitative estimates of the social benefits of learning, 2: health (depression and obesity)
5. Quantitative estimates of the social benefits of learning, 1: crime
4. Learning, family formation and dissolution
3. Learning, continuity and change in adult life
2. Parental perspectives of family learning
1. The wider benefits of further education: practitioner views



## Executive summary

### Background

Recent years have seen a growing concern about the quality of the lives of children and young people in the UK and elsewhere. Concern focuses both on well-being itself and also on the consequences of poor quality childhood for later outcomes. Growing awareness of the importance of parents and the home environment in shaping children's achievement, coupled with the recognition of the school as a site for engagement in broader aspects of social and personal development, has raised interest in the interactions between these different influences as a way of addressing issues of educational attainment and inequality. This more holistic approach is reflected in the creation of the Department for Children, Schools and Families (DCSF) in June 2007 and the launch of *The Children's Plan* in December 2007 (DCSF, 2007).

This study explores the nature of these links and considers the relative contribution of different aspects of four different 'contexts' or likely spheres of influence on pupil achievement in England at Key Stage 2 (age 10/11), as well as their associations with one another. In doing so, we hope to clarify some of the ways in which these contexts influence and interact with each other to shape the lives of individuals and operate to support, sustain or hinder positive development. The four contexts we consider are:

- the distal context – background socio-demographic features, such as income, parental education, etc.
- the proximal context – parental support and parent-child relationships
- the school-peer context – the nature of the school and its population
- the child context – individual child ability, measured primarily in terms of prior attainment.

### Key findings

#### *The importance of good quality 'contexts'*

- **Pupils with better contexts – i.e. better individual, school and family background and experience – have higher scores** in Key Stage 2 assessments in English, maths and science.
- **Child capabilities are most important in predicting Key Stage 2 attainment** across all three subjects. Social and economic family background (distal) factors carry the second-largest influence. Much weaker in predicting attainment are proximal features of the family (family relationships and behaviours), with the school-peer context having the weakest influence.

#### *Contexts are related*

- **Individuals who have a good quality experience in one sphere of their life are also more likely to have good experiences in other contexts.** This relationship between different areas of life is strongest between distal (socio-demographic features, such as income and parental education) and proximal (family relationships and behaviours) contexts.

- **The effect of each context on attainment is affected by its relationships with other contexts** (interaction effects). Thus the importance of one context for attainment can vary, depending on how good (or bad) other contexts are.

#### *Interactions between contexts*

- For those whose contexts are poor, improvements in other areas of their lives make much more difference to their Key Stage 2 attainment.

#### *Differences by gender*

- For girls, the social and economic family background is more important for both Key Stage 2 English and maths attainment, whereas for boys, family relationships and behaviours have a greater influence on attainment across all three Key Stage 2 subjects.

## **Methodology**

Data are from the Avon Longitudinal Study of Parents and Children (ALSPAC), a longitudinal study of children born in the former Avon Health Authority with an expected date of delivery between 1 April 1991 and 31 December 1992.

The study contains data on family background, family process, the cognitive development of children, and key features of the school environment and peer intake. Administrative data from the National Pupil Database (NPD) have been merged with the ALSPAC data, providing records of individual achievement in the National Curriculum Key Stage 1 (KS1) and Key Stage 2 (KS2) assessments. These data cover all relevant state schools in the four local education authorities covering the former Avon area: Bristol, South Gloucestershire, North Somerset and Bath, and North East Somerset.

For this study, academic attainment is measured when the children were in Year 6 (aged between 10 and 11 years old) in terms of KS2 scores in English, maths and science. The study children fall into three separate school cohorts, and took the tests in 2002, 2003 and 2004.

#### *Analysis*

We use a number of descriptive features and key characteristics, as identified by existing theory and evidence, to create a composite index of the quality of each context in terms of its capacity to promote positive development, measured here by achievement. Each index therefore provides a single dimension of ‘context’ quality, weighted according to KS1 attainment. In this way we are able to simplify many different aspects of children’s lives that are known to influence attainment. This methodology allows the findings to be presented in simple terms and enables a focus on the interactions between the different contexts. Measures used in each of the four indices in the analysis include:

- **distal index:** aspects of poverty, socio-economic status and income; family education; housing tenure
- **proximal index:** aspects of maternal mental health; parent–child interactions;

parental teaching behaviours

- **school-peer index:** school characteristics, including school value-added measures; proportion of children eligible for free school meals; proportion of children with special educational needs
- **child index:** school entry assessment scores; birth order.

The first stage in the analysis explores how these indices relate to each other and to KS2 attainment, drawing on correlations and quartile matrices. The second stage of the analysis uses Ordinary Least Squares (OLS) multiple regression to investigate the relative contribution of each context in predicting KS2 attainment.

For more detail on the data and methods used, please see the full research report, available at: [www.learningbenefits.net/Publications/ResearchReports.htm](http://www.learningbenefits.net/Publications/ResearchReports.htm).

## Findings

### *Good quality 'contexts' matter*

Pupils with better quality child, family and school contexts – i.e. those who have better experiences in those spheres of life – have higher scores in all three KS2 assessments. For instance, for those whose contexts are all in the poorest 1%, the average KS2 score in English is 26.7 points; for those whose contexts are all in the best 1%, the average KS2 English score is 82.9 points; and for those whose contexts are halfway between best and worst, the average score is 57.3 points. The average KS2 maths score for pupils in the bottom 1% of all four contexts is 27.4 points; and for pupils in the very top percentile it is 94.7 points. Table ES1 shows the average KS2 score at low, medium and high positions in the distribution of each context's 'quality'.

**Table ES1: Low, medium and high quality contexts: average KS2 scores**

<i>All contexts level at:</i>	1%	10%	25%	50%	75%	90%	99%
English	26.7	39.8	48.2	57.3	65.0	73.7	82.9
Maths	27.4	43.0	53.0	63.9	73.2	83.6	94.7
Science	37.5	46.3	52.0	58.5	64.1	70.3	76.7

Table ES2 shows the estimated regression coefficients for each of the indices on attainment in KS2 English; a higher coefficient indicates a greater degree of influence. Column 1 summarises the estimates when each context is considered separately; column 2 shows the results when all four contexts are considered simultaneously in the regression model.



**Table ES2: Influence of the four context indices on Key Stage 2 English attainment: regression coefficients**

Key Stage 2 English		
<i>Regression coefficient when contexts are considered:</i>		
	<i>separately</i>	<i>together</i>
Distal index	7.23	3.31
Proximal index	6.73	1.85
School index	3.82	0.71
Child index	8.69	6.47

All significant at  $p < .001$

Consonant with other research, this shows that it is the child's own capabilities which have the greatest effect on KS2 attainment in English. Distal features of the family context (for example parental education and socio-economic status) are the next most important group of factors in predicting attainment. Again reflecting the literature, the influence of the proximal environment (family relationships and behaviours) is much weaker, with school quality having the smallest effect. This ranking pattern is consistent across each of the KS2 subjects. However, we need to bear in mind that the child's capabilities are measured chiefly by assessment on entry to school. This effectively summarises not just innate (genetic) ability, but also the child's early experiences and consequent development. The child's own capabilities may thus overlap with other contexts. We consider some such possible overlaps later in this report.

It is important to note too that although the child's own capabilities have the greatest association with KS2 attainment, this does not totally overshadow the influence of the other three contexts, even the proximal family and school effects, despite the fact that these are much smaller. The fact that the regression coefficients are statistically significant, even when the contexts are considered together, shows that all four contexts matter independently.

The implication of better attainment being related to better quality contexts is that, **if** this is a causal relationship, improving the quality of a child's contexts should improve their attainment. Table ES3 shows what this would potentially look like in terms of KS2 maths scores. To illustrate, moving from the 1st to the 10th percentile of the family (proximal) quality index would increase KS2 maths scores by an average of 1.0 points. The same boost in the school index would result in an additional 1.3 points.

**Table ES3: Effect on Key Stage 2 maths score of boosting the quality of different contexts**

<b>Maths</b>					
<b>All contexts level at:</b>	<b>1%</b>	<b>11%</b>	<b>51%</b>	<b>81%</b>	<b>91%</b>
Additional KS2 points with boost in a given index to:					
	<b>10%</b>	<b>20%</b>	<b>60%</b>	<b>90%</b>	<b>100%</b>
Boost in <b>distal</b> index	3.1	0.9	1.3	2.0	4.0
Boost in <b>proximal</b> index	1.0	0.6	0.4	0.5	1.6
Boost in <b>school</b> index	1.3	0.7	0.2	0.2	0.9
Boost in <b>child</b> index	10.1	4.2	1.3	4.4	9.5

It is noticeable that the gains to be made in attainment by increasing context quality are generally greater for those with the best and worst quality contexts. Thus, for example, Table ES3 shows that having a higher score on the distal index (socio-economic background) increases average maths attainment by 3.1 KS2 points when comparing the 1st to 10th percentile, by 4.0 points comparing the 91st to the 100th percentile, but by only 1.3 points between the 51st to the 60th percentile. This pattern of greater gains for those at either end of each context's distribution also holds for English and science.

*One good quality context is related to another*

The four different contexts are also all related to one another: those with one type of good quality context are more likely to have other good quality contexts. This is demonstrated by the correlation in Table ES4 below, where all the values are positive and statistically significant. In particular, pupils with good social and economic backgrounds (distal contexts) also tend to have good quality family relationships and educational behaviours (proximal family environments), demonstrated by the high correlation coefficient ( $r = 0.70$ ) between these two contexts.

**Table ES4: Correlations between the four contexts**

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>
<b>Context measures</b>				
1 Distal index	1			
2 Proximal index	0.70	1		
3 School index	0.36	0.29	1	
4 Child index	0.36	0.36	0.21	1

All significant at  $p < .001$

However, there is variation in the relationships between the contexts. Table ES5, for example, shows the relationship between socio-economic (distal) background and family relationships/behaviours (proximal indices) in terms of a quartile matrix. This shows the likelihood of a pupil being in a certain quartile of an index's distribution, given their position in another quartile. Nearly two-thirds, 64.6% (16.2% of the total

sample), of those in the bottom quartile of the distal index are also in the bottom quartile of the proximal index. Conversely, only just over 1% (0.3% of the total sample) of those at the bottom of the distal index are at the top end of the proximal index. Similarly, 59.5% (14.9% of the total sample) of pupils with the highest quality distal contexts are also in the top quartile of the proximal index. However, if we look at those in the second and third quartiles of the distal index, only 38.5% and 36.4% of these groups respectively are in the same quartile of the proximal index.

Thus, while Table ES5 shows the strong relationship between these two aspects of family background, it also emphasises that it is strongest for those with the best and worst quality contexts: if you are greatly advantaged or disadvantaged in one aspect of life, it is much more likely that you will be similarly advantaged or disadvantaged in others than if you have an ‘average’ experience. Exploring the notion of context in this way highlights that ‘who people are and what they do’ (Desforges and Abouchar, 2003) are closely related and suggests that the quality of any one context limits the quality of others.

**Table ES5: Quartile matrix: distal and proximal index quartiles**

<i>Distal index</i>	<i>Proximal index</i>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>64.6</b>	<b>26.4</b>	<b>7.9</b>	<b>1.1</b>
<i>(% of whole sample)</i>	<i>(16.2)</i>	<i>(6.6)</i>	<i>(2.0)</i>	<i>(0.3)</i>
<b>2nd quartile</b>	<b>25.4</b>	<b>38.5</b>	<b>26.3</b>	<b>9.8</b>
<i>(% of whole sample)</i>	<i>(6.4)</i>	<i>(9.6)</i>	<i>(6.6)</i>	<i>(2.4)</i>
<b>3rd quartile</b>	<b>8.2</b>	<b>25.8</b>	<b>36.4</b>	<b>29.6</b>
<i>(% of whole sample)</i>	<i>(2.0)</i>	<i>(6.5)</i>	<i>(9.1)</i>	<i>(7.4)</i>
<b>Top quartile</b>	<b>1.8</b>	<b>9.3</b>	<b>29.4</b>	<b>59.5</b>
<i>(% of whole sample)</i>	<i>(0.4)</i>	<i>(2.3)</i>	<i>(7.3)</i>	<i>(14.9)</i>

N = 8,164

*The law of diminishing returns: interactions between contexts*

Not only are the contexts related, but the effect of each context on attainment is affected by their relationship with other contexts, i.e. they show interaction effects. Thus, looking back to Table ES2, we see that the effect sizes of the individual contexts on attainment decrease when they are considered together (column 2) rather than singly (column 1).

Looking at these pair-wise interactions<sup>1</sup> in more detail (Table ES6) reveals a number of relationships where interaction effects are statistically significant. These interactions are also negative, indicating that the effects of changes in other areas of their lives are greatest for those with the worst contexts. Thus, for example in the interaction between proximal and school indices, schools have more influence on the KS2 performance of pupils from families with poor quality family relationships and

<sup>1</sup> Interactions between three contexts were also examined initially, but the effect sizes were close to zero.

parental teaching behaviours. Similarly, an improvement in the quality of family relationships and behaviours has a greater effect on attainment for pupils whose school context is poor than for those who attend higher-scoring schools on the schools index.

**Table ES6: Interaction between contexts and their effect on Key Stage 2 English attainment: regression coefficients**

	Key Stage 2 English		
	<i>Proximal index</i>	<i>School index</i>	<i>Child index</i>
<i>Distal index</i>	-0.06	-0.35 *	-0.34 *
<i>Proximal index</i>		-0.52 **	-0.62 ***
<i>School index</i>			-0.65 ***
<i>Child index</i>			

\*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

Conversely, the attainment of pupils with better quality contexts is less affected by improvements in other areas of their lives and requires a far greater boost in quality to achieve comparable increases in attainment. Borrowing from the language of economics, we can express this as being a ‘diminishing returns’ relationship.

#### *Difference by gender*

These results also suggest that the influences of context differ by gender. For girls, the influence of the distal family context (i.e. the socio-economic and educational standing of their parents) has a greater effect on KS2 English and maths attainment, whereas for boys the proximal family context (i.e. parental behaviour and family relationships) has a greater influence on later attainment across all three KS2 subjects.

### **Caveats and limitations**

While we show that relationships exist between contexts and with attainment, despite using terms like ‘effect’ and ‘influence’, we cannot prove here that one causes another. This study also reports only average effects for the sample population – there are individuals who will not fit the patterns we have described here: children at risk who do not experience harmful outcomes and children with low apparent or observable risk who do.

### **Conclusions and implications**

The quality of different aspects of their lives is important for children’s attainment in primary school – better contexts are associated with better attainment. However, these contexts do not act in isolation, but are closely related to one another, and their influence on attainment is affected by these interrelationships. This suggests that where, for example, families are socially and economically disadvantaged, attainment may be affected not only by a boost in their socio-economic circumstances, but by

improvements in other contexts, for example in the quality of schooling or of parent–child relationships.

These interaction effects are greater for those with poor quality contexts. This suggests not only that there is scope to narrow the gaps in educational opportunity, but also that, where influence is possible, the greatest likely returns are for those whose background and experience are poor. This is the central premise of progressive universalist approaches, i.e. the objective of providing support and intervention on the basis of need within a universal system recognising the entitlement of all to such support.

The dynamic and interdependent nature of different areas of children’s lives that we show here indicates that there is no one thing that is likely to radically transform young lives for the better. Changes (for better or worse) in one area of a child’s life may not only affect their attainment, but may also place lesser or greater importance on other contexts as a means of supporting their continued development. Further, different groups of children will need different types and levels of support if greater equality in attainment is to be achieved, as the gender differences highlighted in this study indicate. Rather, these findings offer support to the flexible and integrated models of child support implied by the Government’s focus on personalised learning and the Every Child Matters legislation, most recently drawn together in *The Children’s Plan* (DCSF, 2007).

## **Acknowledgements**

I am very grateful to advice and inputs from Leon Feinstein, Anna Vignoles, Ingrid Schoon and Richard D. Wiggins as well as to staff at the Centre for Research on the Wider Benefits of Learning for their useful comments on this report. I would also like to thank Rachel Barker and colleagues at the Department for Children, Schools and Families (DCSF) for helpful suggestions.

I would like to thank the DCSF for their financial support on this project.

Finally, I am grateful to all the mothers who took part in the study and to the midwives for their cooperation and help in recruitment. The whole ALSPAC Study Team comprises interviewers, computer technicians, laboratory technicians, clerical workers, research scientists, volunteers and managers who continue to make the study possible. The ALSPAC study has been supported by funding from the Medical Research Council, the Wellcome Trust, UK government departments, medical charities and others and is part of the WHO-initiated European Longitudinal Study of Pregnancy and Childhood.

## Table of contents

<b>1. Introduction</b>	1
1.1 The importance of different contexts	2
1.1.1 <i>Families</i>	2
1.1.2 <i>Schools: composition and peer intake</i>	4
1.1.3 <i>Individual prior attainment</i>	6
1.2 Interactions between contexts	6
1.3 The current study	9
<b>2. Method</b>	11
2.1 Data	11
2.2 Measures	11
2.2.1 <i>Outcome measures</i>	11
2.2.2 <i>Index composites</i>	14
2.3 Analysis plan	19
<b>3. Results</b>	20
3.1 Who has high/low quality contexts? The descriptive characteristics of pupils	20
3.2 How tightly do different contexts overlap?	21
3.3 How do different contexts relate to Key Stage 2 attainment?	24
3.4 What contexts are most important in predicting Key Stage 2 attainment?	26
3.4.1 <i>Sub-group analysis: moderation by gender</i>	31
3.5 How do these contexts interact to influence Key Stage 2 attainment?	32
<b>4. Discussion</b>	36
4.1 Contexts matter	36
4.2 The law of diminishing returns: interactions between contexts	37
4.3 Mummy's boy? Moderation by gender	38
4.4 Limitations and future directions	38
4.5 Conclusions and implications	40
<b>References</b>	42
<b>Appendix</b>	49

## Tables

Table 1	Key Stage 2 level boundaries	13
Table 2	Key Stage 2 summary statistics	13
Table 3	Key Stage 2 summary statistics, by gender	13
Table 4	Average Key Stage 2 score by top and bottom quartile of the four contexts (standardised indices)	20
Table 5	Proportions of pupils in each quartile of the four context distributions, by gender	20
Table 6	Pair-wise correlations between four contexts	21
Table 7	Quartile matrix: Distal and proximal index quartiles	22
Table 8	Quartile matrix: Distal and school index quartiles	23
Table 9	Quartile matrix: Child and school index quartiles	23
Table 10	Pair-wise correlations between Key Stage 2 attainment outcomes and four contexts	24
Table 11	Quartile matrix: Child index and Key Stage 2 English attainment	25
Table 12	Quartile matrix: School index and Key Stage 2 maths attainment	26
Table 13	Coefficients and standard errors from regression models of Key Stage 2 English on four context indices	28
Table 14	Coefficients and standard errors from regression models of Key Stage 2 maths on four context indices	29
Table 15	Coefficients and standard errors from regression models of Key Stage 2 science on four context indices	29
Table 16	Simulated effects of boosts in the quality of individual context indices on Key Stage 2 attainment	31
Table 17	Coefficients and standard errors from regression models of Key Stage 2 attainment on four context indices, by gender	32
Table 18	Coefficients and standard errors from regression models of Key Stage 2 English on four context indices and their pair-wise interactions	33
Table 19	Summary of pair-wise interaction estimates	34
Appendix Table 1	Summary statistics for variables used in context indices	48

## Figures

Figure 1	Interaction plot for Key Stage 2 English: Quartile of school context index plotted against proximal context index	35
Figure 2	Interaction plot for Key Stage 2 English: Four quartile of proximal context index plotted against school context index	35



# 1. Introduction

Throughout social science and related policy arenas, the influences on attainment continue to be one of the most researched and hotly debated topics. Recent years have seen a growing concern about the quality of the lives of children and young people in the UK and elsewhere. Concern focuses both on well-being itself and also on the consequences of poor quality childhood for later outcomes. Few would argue against the view that parents, families and the relationships therein are among the most important and direct influences on children's development and their subsequent life chances. However, the family is not the only context in which individual competence and character are developed and nor is it independent of other important social settings. Rather, human character and competence are a product of an individual and of his or her experience.

Throughout childhood, children's worlds expand to include pre-school and childcare settings, and then schooling, neighbourhoods, the wider community, as well as larger social structures. Existing theory and evidence point to the importance of the strength of the connections between the family and the various other principal settings in which children live and learn for positive child development. These wider environments, and the resources available in them, interact with the family context and so shape the phenomenological world of the child, influencing their experiences as they move through the education system. Thus at any one time the connections, or disconnections, between these contexts raise important questions for the study of individual development and the persistent inequalities in the education system.

Despite improvements in educational attainment at all Key Stages since new Labour came to power in 1997, 25% of children are still making the transition to secondary school with levels of literacy and numeracy skills that prevent them from making the most of their secondary education. Consequently, improving the standards of reading, writing and maths in primary schools and ensuring progression at each stage of the children's education remains a top priority in order that all children are able to achieve their full potential.

Increasingly, the links between families and schools are being seen as key in tackling such problems. Growing awareness of the importance of parents and the home environment in shaping children's well-being and achievement, coupled with the recognition of the school as a site for engagement in broader aspects of social and personal development, has raised interest in the interactions between home and school as a way of addressing issues of educational attainment and inequality. This more holistic approach is reflected in the creation of the new Department for Children, Schools and Families (June 2007) and its strategy document, *The Children's Plan* (DCSF, 2007).

This study explores the nature of these links and considers the contribution of earlier contexts to attainment. We explore the relative importance of four contexts, defined in terms of their capacity to predict attainment at Key Stage 1 (KS1), their relationships with one another and their association with subsequent academic success. By using rich longitudinal data, this study attempts to tease apart how distal and proximal features of the family, the composition of school-peer context and individual child-

level capabilities predict, separately and together, attainment at the end of primary school, assessed in terms of Key Stage 2 (KS2) attainment. In doing so, we hope to clarify some of the ways in which different contexts interact with each other to shape the lives of individuals and operate to support, sustain or hinder positive development.

## **1.1 The importance of different contexts**

Within our society, the environment still places major restrictions on individual development above and beyond individual ability or talent. Bronfenbrenner's ecological model of development (1979) attempts to capture the complexity of human development at any point in time by viewing individual development and behaviour as processes that are inextricably linked to the multiple, interrelated contexts within which they live. He defines context as the location and/or institutional locale within which sets of processes occur. These different contexts and their features are conceptualised as fostering or interfering with the development of processes and so being developmentally appropriate (i.e. constructive) or inappropriate (destructive), depending on whether they are positively or negatively associated with patterns of achievement, behaviour, motivation and well-being. Bronfenbrenner highlights the family, childcare arrangements, schools, peer groups, and neighbourhoods as particularly salient settings. We focus here on the family and school and peer-group composition and individual ability.

There is also growing interest in understanding genetic contributions to individual development and the joint influence of biology and the environment. While this study is not able to assess genetic factors or heredity in individual differences, it is nevertheless important to recognise that biology also plays a role in shaping and constraining the individual and their environment. For example, research from behavioural genetics suggests that parents' education can moderate the heritability of IQ and that genetic influences are generally higher in more favourable environments (Rowe, Jacobson and van den Oord, 1999). (For further discussion of gene x environment interactions, see: Moffitt, 2005; Rutter, 2002; Turkheimer *et al.*, 2003; Vineis and Kriebel, 2006.)

### **1.1.1 Families**

In the pre-school years particularly, the family is at the core of children's expanding social worlds. Bronfenbrenner's ecological model makes a critical distinction between the concepts of 'process', i.e. the day-to-day reciprocal interactions between individuals, and the 'environment' in which these processes occur. This dichotomy is reflected in the two aspects of the family context outlined below.

#### *Distal family factors*

Despite average overall improvement, large, unconditional differences in educational achievement according to family socio-economic background persist. The Department for Education and Skills (DfES) (2005a) reported that 77% of pupils with fathers in higher professional occupations achieved five or more GCSEs at grades A\*–C or equivalent in 2004, compared to 53% with fathers in intermediate occupations, and

only 33% with fathers in routine occupations. By Key Stage 4 (ages 14 to 16), the social class attainment gap is three times as large as the gender gap.<sup>2</sup>

Social inequalities in educational attainment are the product of complex relations between different features of family background,<sup>3</sup> such as education (Feinstein, 2003; Smith, Brooks-Gunn and Klebanov, 1997; Wolfe and Haveman, 2002), income and experiences of poverty or financial hardship (Duncan and Brooks-Gunn, 1997; Gregg and Machin, 2000), occupation and employment status, as well as pervasive wider, social and educational difficulties (for reviews, see Feinstein, Duckworth and Sabates, 2004; Feinstein, Duckworth and Sabates, 2008; Haveman and Wolfe, 1995). Teenage parenthood is also a potential risk factor for child development. On average, children of young mothers score more poorly on cognitive measures and are at higher risk of poor school attainments than children of older mothers (Feinstein, Robertson and Symons, 1999; Furstenburg, Brooks-Gunn and Morgan, 1987).

Distal factors may impact on educational and other developmental outcomes but their effect may well depend on children's characteristics, such as age and gender, and other factors, such as birth order and number of children. It is also the case that it is often cumulative disadvantage and compounding risk that matters more than any one risk associated with a single distal factor: a child raised in poverty, in a large family headed by a single parent who has low educational qualifications is likely to experience a higher risk of low or underachievement than one raised in a one-parent household out of poverty. Cumulative disadvantage and the interactions between different aspects of individuals' lives are discussed further in section 1.2, below.

#### *The proximal family environment*

A range of other features of families are also important in influencing developmental and educational outcomes. For example, an extensive literature has consistently shown the importance of positive, consistent and engaged parenting styles for children's positive development. In particular, the importance of parental warmth and secure attachment for the development of children's cognitive and behavioural competence is widely acknowledged (see Baumrind, 1967; Bowlby, 1969, 1973; Maccoby and Martin, 1983; Masten and Coatsworth, 1998). Quality family relationships and secure attachment in childhood have also been found to act as sources of resilience in the face of social or economic disadvantage in adulthood (Bartley, Head and Stansfeld, 2007). Other studies have highlighted the value of breastfeeding on motor and cognitive development in early childhood (Vestergaard *et al.*, 1999; Paine, Makrides and Gibson, 1999) and highlighted that these associations are not simply a product of social position or parental education (Sacker, Quigley and Kelly, 2006).

Educational behaviours in the home include reading to children, actively teaching letters, numbers and nursery rhymes, engaging infants and toddlers in drawing and painting activities in early childhood and later helping with homework and being actively involved in schooling, as well as going on visits to places of educational value and interest, such as libraries and museums. These features of the day-to-day

---

<sup>2</sup> As in much of educational research, social class is proxied for by those eligible/not eligible for free school meals.

<sup>3</sup> As noted above, social inequalities are also constrained by genetic factors and gene x environment interactions, as well as by personal attributes.

family environment have, in particular, been found to have real and considerable effects on children's development, particularly in the domains of cognitive ability and academic achievement.

Parenting itself is also influenced by many features of parents, their own upbringing and childhood experiences, and their relationships together and in wider social settings. For example, Tietjen and Bradley (1982) found that mothers who had access to stronger social networks during their pregnancy reported lower levels of stress, anxiety and depression, a better marital adjustment and a more positive attitude towards pregnancy. Parents' ability to cope with emotional stress, financial and economic pressures and additional social stressors are also known to influence the performance and attainments of children, both directly through living in a more stressful environment and indirectly through negative impacts on parenting and diminished parent-child relations (Makosky, 1982; McLoyd, 1990; McLoyd and Wilson, 1991).

### **1.1.2 Schools: composition and peer intake**

After the family, schools are one of the most salient social contexts for children aged over 4 years. Beginning with the early work of Coleman (Coleman *et al.*, 1966), research in the area of school effectiveness, i.e. whether schools make a difference to individual attainment, has been a central concern of social scientists for the last four decades. Using national probability samples of elementary and secondary school students in the US, Coleman was the first to study the association between academic performance and school and family input measures. He found that when individual socio-economic background characteristics are held constant, the differences among schools only accounted for a small proportion of the differences in achievement. This work led to a series of studies examining the impact of schools on attainment that has produced mixed findings, ranging from little or no associations between school inputs and pupil achievement (Hanushek, 1986, 1989) to substantial ones (Greenwald, Hedge and Lain, 1996).

Advances in statistical methods, however, have enabled researchers to more accurately assess the impact of school factors in predicting academic achievement, and the school effectiveness research conducted in the 1980s and 1990s has consistently pointed to the existence of significant differences **between** schools in their impact on pupils. That is to say, some schools are more effective than others in facilitating pupil progress (Mortimore *et al.*, 1988, in junior schools; Tizard *et al.*, 1988, in infant schools; Thomas and Mortimore, 1996, and Willms, 1985, in secondary schools).

The social composition or peer intake of schools measured by the proportion of pupils from disadvantaged family backgrounds has been shown to influence pupil attainment (Feinstein and Symons, 1999; Mortimore, Mortimore and Thomas, 1994; Robertson and Symons, 2003). For example, at the end of infant school, children from schools with a high proportion of families with low incomes and those not fully fluent in English attained less highly than other pupils (Tizard *et al.*, 1988; Mortimore *et al.*, 1988) and, in general, the differences between these groups tend to increase, rather than decrease, over time (Strand, 1999). Such differences in the social composition of schools account for a considerable amount of the variation observed between schools

(for example, see Goldstein and Sammons, 1997, for the UK; Bryk and Raudenbush, 1988, Lee and Bryk, 1989, for the US).

Following a sample of more than 1,600 pupils over KS1, the period from when children enter reception year at primary school (age 4/5) to the end of Year 2 (age 6/7), Strand (1997) shows that the social composition of a school's intake has a strong relationship with child outcomes over and above effects associated with individual prior attainment or family background. Pupils entitled to free school meals (FSM), start school with lower attainment and fall further behind peers during this period. However, while the differences between schools in KS1 results were reduced substantially when account was taken of their pupil intakes, significant school differences remained: Strand's results suggest that there is a difference of 0.6 of a National Curriculum level (over a year's progress) between the most effective and least effective schools (see also Robertson and Symons, 2003; Sammons, West and Hind, 1997).

Value-added analysis<sup>4</sup> of primary school data suggests that, on average, pupils make more progress in schools with a high proportion of girls, and less progress in schools with a high proportion of pupils entitled to FSM, a high proportion of pupils with English as a second language and where the school average baseline was high. Interestingly, pupils with English as an additional language make more progress, catching up with their monolingual peers by the end of KS1 (Strand, 1997, 1999). Note, however, that Strand (1999) finds no evidence of significant differential school effectiveness in relation to socioeconomic disadvantage, ethnic group or gender.

Sammons and Smees (1998) use multilevel modelling techniques<sup>5</sup> to measure pupil progress at KS1. Like those of Strand (*op cit*), their results similarly indicate that while background factors and prior attainment at reception are better predictors of later performance, particularly for reading, a 'statistically and educationally significant' (p.400) proportion of the variation in KS1 results remains attributable to the school attended. Longitudinal studies of performance across primary and secondary phases also reveal the strong and persistent links between pupils' attainment in primary school and GCSE results nine years later. Goldstein and Sammons (1997), for example, estimate that the impact of primary schools on pupils' attainment at age 16+ is substantially larger than the impact of their secondary schooling (see also Sammons, 1995; Sammons *et al.*, 1995).

In the Avon Longitudinal Study of Parents and Children (ALSPAC) data used in this study, Hobbs (2007) has estimated that, on average, 7–8% of social class differences in KS2 achievement are accounted for by social differences in school effectiveness during the KS2 period. Similarly, Gutman and Feinstein (2008) suggest that 10% of the variation in KS2 English and 7% of the variation in KS2 maths can be explained by school factors, such as social composition and school ethos.

---

<sup>4</sup> Value-added analysis uses longitudinal data to control for prior attainment.

<sup>5</sup> Multilevel analyses give estimates of the impact of prior attainment measures and pupils' background characteristics on later attainment, while allowing identification of any systematic differences at the level of the school, taking into account the clustering and number of pupils in the individual school attended: for example, children are nested in classrooms, within schools (see Goldstein, 1995 for further discussion).

### **1.1.3 Child factors: Individual prior attainment**

The prior attainment of pupils is the most important predictor of later academic performance (Melhuish *et al.*, 2006) and continuity in cognitive achievement is a well-established feature of development (Kowaleski-Jones and Duncan, 1999; McCall, Applebaum and Hogarty, 1973; Sameroff *et al.*, 1993; Wilson, 1983). Although middle childhood, roughly the period between ages 5 and 12, is distinct from other periods in the lives of children and young people as one marked by considerable developmental changes in many dimensions, previous work from the Centre for Research on the Wider Benefits of Learning emphasises a good degree of stability in average attainment over the primary school period (Duckworth, 2007).

Examining the importance of earlier literacy and numeracy skills for attainment at KS2, Duckworth also suggests that stability observed in these assessments is fairly independent of wider developmental contexts. The four KS1 tests in reading, writing, spelling and maths alone account for 49%, 52% and 40% of the variance in KS2 English, maths and science assessments respectively. When comprehensive controls for family background, parenting, earlier child-level skills and capabilities, and school fixed-effects are controlled for, the proportion of variance explained does not substantially increase. That is not to say that features of the child and their family background do not matter for attainment in primary school, but that the prior attainment of pupils measured by KS1 tests contributes the most in explaining the variance in their performance at KS2 (see also Feinstein, 2004).

Furthermore, because children's academic and problem behaviour trajectories vary by gender, the contexts they experience may differ for girls and boys (Kowaleski-Jones and Duncan, 1999; Pungello *et al.*, 1996). For example, girls are approximately 10 percentage points more likely than boys to achieve five or more A\*–C grades in GCSE, a figure that has shown little variation since 1995 (DfES, 2005b; see also Melhuish *et al.*, 2006). This imbalance, however, is not confined to achievement at GCSE and is evident at most stages in the educational system, typically emerging during primary school and widening as children move to secondary school. National statistics indicate that there is a persistent gender gap in English in favour of girls that is evident from the Foundation Stage through to GCSE. The equivalent gap in maths is smaller, but girls are performing slightly better than boys at Foundation Stage, and at Key Stages 1, 3 and 4 (DfES, 2007).

## **1.2 Interactions between contexts**

The literature reviewed above considers the separate importance of each of the four development contexts considered in this study in influencing educational and developmental outcomes. However, as was mooted throughout this discussion, these contexts do not exist in isolation. As such, the relative importance of different contexts in influencing attainment can be better understood by adopting a more holistic perspective of development.

Anastasi (1958) is widely credited with the important interactionist conceptual breakthrough in pointing out that individual development could not occur without an environment. More recently, ecological perspectives of the lifecourse have conceptualised human development as the dynamic interactions between individuals

and contexts (Baltes, 1987; Bronfenbrenner, 1979; Elder, 1998; Lerner, 1984, 1998; Magnusson and Stattin, 1998; Sameroff, 1983) and argued that a more sophisticated analysis of the environment is therefore necessary.

Ecological models are based on the premise that human lives are embedded in, and shaped by, multiple contexts that are causally interdependent in complex ways (Bronfenbrenner, 1979, 1986; Bronfenbrenner and Ceci, 1994; Brown, 1999). For example, effective parents influence the selection of a child's school, who their child's friends are, and the types and number of out-of-school activities in which their child participates (e.g. Furstenburg *et al.*, 1999; Silbereisen, 1995). More affluent families are able to choose better-resourced and more desirable schools. Gibbons and Machin (2003), for example, find a positive association between school quality, measured by national league tables, and property prices. In addition, more educated parents may be better equipped to assess quality and so choose the more successful, higher-achieving schools. Schools also contribute to the selection processes that can operate to reinforce social patterns in attainment, as league tables may give schools an incentive to select children in order to maximise their results.

The contribution that different environments make to individual development may also vary with particular characteristics of the developing child. Robertson and Symons (2003), for example, examine the effect of ability streaming on children's outcomes and show that children placed in the top streams within a school show gains, whilst being placed in the bottom has a negative effect on improvement, in maths and reading between the ages of 7 and 11. Summers and Wolfe (1977) show similar interactions in the individual ability and the mix of the peer group, finding positive effects for lower-ability pupils mixed with more able peers, but finding no effect for those already doing well.

The influence of multiple contexts and interactions between them, however, has rarely been the primary focus of research. There are some notable exceptions to this. For example, Cook *et al.* (2002) investigated the interconnectivity between different social contexts and explored the ways in which they jointly contribute to positive change during early adolescence. The authors considered the influence of four developmental contexts – the family, neighbourhood, school and peer group – paying particular attention to the interactions between these contexts. Owing to the lack of existing theoretical and conceptual work specifying in detail **how**, a priori, different contexts are related to one another or to children's development, the authors adopt a simple, additive approach to develop a multi-attribute index that should promote successful development.

Their results showed that the effects of different contexts were generally cumulative across the nine broad educational achievement and engagement outcomes studied, so that each 'good' context promoted healthier development and thus may have provided some buffering effects against 'bad' contexts. However, no constellation of contexts was identified whose total effect was significantly greater than the additive sum of the individual settings examined. Rather, each context was associated with particular outcomes, some having stronger or unique links. The features of the family context, for example, tended to show the greatest contribution to changes in participation in conventional out-of-school activities, lack of misbehaviour and positive self-image; neighbourhoods were most often associated with school attendance and participation

in social activities; peer-group settings were more strongly linked to negative social behaviour, such as more acting up and drug use; and positive school contexts led to increases in attendance, academic performance and participation in conventional out-of-school activities. However, there was no single context that could be considered as the ‘silver bullet’ in promoting positive youth development.

Burgess, Gardiner and Propper (2001) consider school, family and area influences on adolescents’ later life chances. When considered separately, they find that family factors, including measures of mothers’ and fathers’ education, employment status, and lone parent status, have the strongest explanatory power in terms of adult economic outcomes, followed by school variables, including school size, social composition and pupil–teacher ratio, with area-level factors having the smallest effect. This ranking remains when all three contexts are entered simultaneously in multivariate analysis.

Like those of Cook *et al.*, these results similarly highlight the strong degree of correlation between these different aspects of adolescents’ lives. However, while Burgess *et al.* argue that their results demonstrate that the advantage or disadvantage associated with family background is compounded by young people’s experiences of school and area, they do not explicitly test the statistical interactions between the different contexts. Furthermore, the key features of families, schools and area are considered separately, rather than combined in any way, but the individual coefficients are not reported. As such, it may be that one variable drives the apparent importance of any one context and the significance of the separate contexts cannot be compared in the same way as in the Cook study. Nevertheless, both papers highlight that individual development takes place in many complicated, overlapping settings and that any given context can increase the risk of, or provide protection against, the likelihood of poor performance or underachievement depending on its characteristics, those of the child and the dynamic relations between them.

Several other studies demonstrate important interactions between different contexts and developmental settings, even though they may not be the primary focus of the research. Findings from the Effective Pre-school and Primary and Secondary Education Project (Sammons *et al.*, 2007) consistently indicate that pre-schools can play an important part in combating social exclusion and promoting inclusion by offering disadvantaged children a better start to primary school. Some of their most recent investigations demonstrate the particular influences of combined pre-school and primary school effects in shaping children’s educational outcomes. These results indicate that attending a better pre-school and a more academically effective primary school, as rated by independent national assessments, improves cognitive outcomes substantially. Children attending higher quality or more effective pre-school settings showed better educational outcomes in maths and reading at the end of Year 5 (age 10), controlling for the possibly confounding influences of family background.<sup>6</sup> Conversely, children who attended low quality pre-school settings did not show the same continued gains and, in contrast to earlier research suggesting benefits of all pre-school experience, did not differ from those who did not attend pre-school at all.

---

<sup>6</sup> The effect is similar in size to the impact of having a high rather than a low Home Learning Environment (HLE) or a mother with the highest level of educational qualifications (a degree or above).



Sameroff *et al.* (1993) examined the influence of family and social risk factors on the stability of intelligence from pre-school to adolescence. Using a single composite multiple risk score, which included both distal and proximal features of the family, the authors show that it is the **number** of risks and not the **kind** of risk factors that is more important in influencing child IQ at both 4 and 13 years of age. Their results also demonstrate the longitudinal stability of environmental risk: controlling for prior levels of attainment, stability in contextual risk was of the same magnitude as stability of child IQ. Feinstein (2006) also finds that being at risk in childhood is very strongly associated with the likelihood of experiencing risk or elements of social exclusion later on in adolescence and in adulthood in both the 1958 and the 1970 British birth cohorts (see also Schoon, 2006). However, Feinstein also notes considerable mobility in risk throughout childhood and adolescence. That is, while the chances of being at risk at any age are much higher for those who were at risk at previous ages, most of those at risk at one age are often not at risk at subsequent ages, i.e. people move in and out of risk. Thus, although risk is not randomly distributed in a population, it is not immutable nor set in stone.

The presence of multiple risks, in turn, makes the tasks of day-to-day family management that much more complex. Eccles *et al.* (1992) and Furstenburg (1992) show that families living in high-risk, low-resource neighbourhoods have to rely more on in-home strategies to help their children develop and to protect them from the dangers of the neighbourhood. Conversely, families from low-risk neighbourhoods are better able to use resources from their community, such as organised youth programmes, to help their children develop the same talents and skills. Taken together, these studies demonstrate the kinds of strains and stresses that can accumulate for children and their families and further emphasise the value of the ecological approach to development.

### 1.3 The current study

This study considers the relationships between different contexts and attainment in primary school. We use rich longitudinal data to explore the importance of family and school contexts alongside child capability at entry to school, the associations between these contexts and their relative contribution to later academic success. We use a number of key descriptive features and characteristics of each context to attempt to quantify and scale their impact on attainment, rather than attempting to model the processes and mechanisms through which they may influence attainment (see Feinstein, Duckworth and Sabates, 2008 for further discussion of theory here).

Healthy, positive development results from several important features of these contexts. However, as has been described above, no theories specify in detail how particular attributes of each context are related to one another, to other contexts, or to positive development. Therefore, based on a consideration of existing theory and evidence, we attempt to quantify what constitutes a ‘good’, i.e. developmentally superior, context in terms of its capacity to predict attainment at KS1 and assess the relative contribution of these contexts on attainment in KS2 tests.

The analytic approach uses a small set of measures to create a single dimension of ‘context’ quality as it relates to KS1 attainment. Similar to a propensity score, each

index predicts an average, individual measure of attainment at KS1. The components of each index are weighted according to the degree to which they predict average KS1 attainment. In this way we are able to simplify many different aspects of children's lives that are known to influence attainment into a simpler or more parsimonious construct of children's different environments. This methodology allows the findings to be presented in simple terms and enables a focus on the relationships and interactions between the different contexts.

We then use these four indices to explore the extent to which the variation in KS2 attainment is explained, singly and together, by each sphere of influence. On the basis of the prior discussion, our research questions are as follows:

1. What are the descriptive characteristics of pupils with high/low quality contexts?
2. How tightly do different contexts overlap?
3. How do different contexts relate to KS2 attainment?
4. What contexts are most important in predicting KS2 attainment?
5. How do these contexts interact to influence KS2 attainment?

## **2. Method**

### **2.1 Data**

Avon Longitudinal Study of Parents and Children (ALSPAC) is an ongoing and extremely rich longitudinal study of children born in the former Avon Health Authority in the early 1990s. To be eligible for the study, mothers had to be resident in Avon while pregnant, with an expected date of delivery between 1 April 1991 and 31 December 1992. Mothers who were resident in the area but left shortly after enrolment were omitted from further follow-up. However, those who had completed the questionnaire scheduled for the third trimester of pregnancy before leaving the study area have been kept in the study, even if they had not delivered at the time of moving. More than 80% of the known births from the geographically defined catchment area were included, resulting in a total cohort of 14,062 live births. The resulting sample design puts children in three adjacent academic cohorts: those born 1 April–31 August 1991, those born 1 September 1991–31 August 1992, and those born 1 September–31 December 1992. Therefore, children in the sample would have started years 12 (or equivalent), 11 and 10 respectively in September 2007.

These data are unique among large sample, longitudinal birth cohort studies in the UK in surveying children, their mothers and her partner at short, regular intervals prenatally and after birth. Later, data from schools, including local education authority (LEA) entry assessment scores, were also obtained. Consequently the study contains a wealth of data on: family background; family process; the cognitive, social and behavioural development of children; and key features of the school environment. In addition to these rich data, administrative data from the National Pupil Database (NPD) have been merged with the ALSPAC data, providing records of individual achievement in the National Curriculum KS1 and KS2 assessments. These data include all relevant state schools in the four LEAs covering the Avon area: Bristol, South Gloucestershire, North Somerset and Bath, and North East Somerset.

### **2.2 Measures**

#### **2.2.1 Outcome measures**

For this study, academic attainment is measured when the children are in year 6 of primary school, aged between 10 and 11 years old, in terms of Key Stage scores in English, maths and science. Children in this sample will thus have taken their KS2 tests in the period 2001/02 to 2003/04. KS2 tests are designed to assess pupils' knowledge and understanding of the KS2 programmes of study and provide a snapshot of pupils' attainment at the end of primary school. As in other research from the Centre for Research on the Wider Benefits of Learning (Duckworth, 2007; Gutman and Feinstein, 2008), we focus on the raw KS2 test scores.

#### *Key Stage 2 English*

The English assessment is marked out of 100 and consists of three tests: a reading test, a writing test (made up of a longer task and a shorter task), and a spelling test. The spelling test is aggregated with the writing test. In the reading test, questions cover descriptive criteria as well as more open-ended responses. The test includes

different texts, such as stories, poems, explanations and interviews. The writing test is designed to assess pupils' individual independent work, and marks are awarded for sentence structure, punctuation and text organisation, and for composition and effect. Marks are also awarded for handwriting.

Additional marks gained through a small number of pupils sitting the English extension paper (N = 46) were added onto their individual result to minimise any possible ceiling effects. The number of additional marks gained ranged from 2 to 23, with an average of 12.5.

#### *Key Stage 2 maths*

The maths test is marked out of 100 and consists of three separate tests: a calculator paper, a non-calculator paper and a mental arithmetic test. Most of the questions are worth one mark, although some are worth two and carry one mark for showing appropriate working.

Again, some pupils scored more than the 100 maximum through sitting the extension paper (N = 71), gaining between 0 and 29 extra marks, with an average of 12.8.

#### *Key Stage 2 science*

The science test is made up of two papers. Pupils may be asked to describe how an investigation could be carried out, what factors need to be controlled and measured, whether an outcome can be predicted and how the results could be presented, as well as to explain the outcome and whether the evidence collected is significant, reliable and valid.

Only 12 pupils sat the extension paper for the science assessment, gaining between 9 and 18 additional marks, with an average of 12.6.

The standard marks and corresponding level boundaries are shown in Table 1. Extension papers cover Level 6 material for English, maths and science. For further details on the assessment and reporting arrangements for these tests, see: [www.qca.org.uk/eara/documents/KS2\\_ARA.pdf](http://www.qca.org.uk/eara/documents/KS2_ARA.pdf)

**Table 1: Key Stage 2 level boundaries<sup>7</sup>**

	English	Maths	Science
<i>Level</i>	<i>Mark range</i>		
N	0–20	0–15	0–16
2	21–23	16–18	17–19
3	24–43	19–44	20–39
4	44–68	45–75	40–62
5	69–100	76–100	63–80

Summary statistics used in these analyses are shown for the full sample in Table 2 and by gender in Table 3.

**Table 2: Key Stage 2 summary statistics**

Variable	N	Mean	Std. Dev.	Min	Max
<b>Key Stage 2 outcome:</b>					
English	8164	56.7	(17.3)	0	107
Maths	8164	63.3	(22.5)	0	122
Science	8164	58.2	(13.0)	0	96

**Table 3: Key Stage 2 summary statistics, by gender**

	N		Mean		Std. Dev.	
	Male	Female	Male	Female	Male	Female
<b>Key Stage 2 outcome:</b>						
English	4143	4021	53.6	60.0	(17.8)	(16.2)
Maths	4143	4021	64.4	62.1	(23.0)	(21.9)
Science	4143	4021	58.3	58.1	(13.1)	(13.0)

#### *Key Stage 1 average points score*

The metric of the KS1 scores are available only in the basic levels awarded and consist of levels 1, 2, 3 and 4+ with grades A, B and C within Level 2. Level 4+ is assessed by means of KS2 materials. However, there were so few children achieving Level 4+ (N=10) that it has been combined with Level 3. In addition, code W ('working towards Level 1') means the child was assessed but did not achieve Level 1.

<sup>7</sup> These level boundaries are based on the level thresholds in the academic year 2002/03, the middle and largest cohort in the ALSPAC data, 60% of the sample. The Qualifications and Curriculum Authority assessment and reporting information states that: 'Due to the changes to the tests in 2003, the final level thresholds this year may vary considerably from the 2002 [2004] level thresholds. This is to ensure that standards are maintained and that a child who would have achieved a certain level in last year's tests, will achieve the same level in the new tests' ([www.qca.org.uk](http://www.qca.org.uk)).

Earlier sensitivity analysis of the KS1 tests in these data highlighted considerable linearity across the different levels awarded. Therefore, to try to maximise this information and in line with others researchers (Strand, 1997; Tymms, 2000; Hobbs, 2007), a KS1 points score is constructed by combining the reading task and reading comprehension test, the writing and spelling test, and the maths task and test.<sup>8</sup> For example, if the level categories were not subdivided (W, L1, L3) the numbers were left unchanged, i.e. these levels score 0, 1 and 3 points respectively. However, if the level categories were divided, i.e. 2C, 2B and 2A, pupils were assigned the marks 2 1/6, 2 3/6, and 2 5/6 respectively. These scores were then aggregated into a single measure of individual KS1 attainment.

### **2.2.2 Index composites**

The aim of this study is to explore the relative contributions of, and interactions between, four different contexts as they relate to each other and to KS2 attainment. We are not concerned with the specific, individual elements of family background or proximal environment, nor with the individual interactions between, for example, mother's education and the frequency of reading to children at home. Rather, our interest lies in estimating, alone and in combination, the associations between broad conceptions of the different contexts in which children live and their KS2 attainment.

To provide a measure of the quality of each of the four contexts, we construct four indices which use a number of descriptive features and key characteristics for each sample member to provide a single dimension of context quality of each context in terms of how it predicts KS1 performance. Similar to a propensity score, a small set of measures known to be important in predicting individual attainment and which describe each context, are combined into a single dimension of context quality which predicts attainment at KS1. This is done by regressing a single measure of average KS1 attainment on each set of measures for a given context and constructing a score using the coefficients from the regression as weights. This estimation results in an index in which the components of all four indices are weighted and linearly scaled to predict an individual average measure of KS1 attainment.

In this way, we are able to simplify many different aspects of children's lives which are known to influence attainment into a more parsimonious composite of children's different environments. This methodology allows the findings to be presented in simple terms that enable a focus on the relative contributions of each context, as well as the interactions between them.

Given the structure and availability of the ALSPAC data and to create comparable indices, we use distal, proximal and child-level information covering approximately the same time period, typically from between 32 weeks antenatal and 5 years. For the school-peer index, we use administrative data from the NPD to create a measure of the school-level peer composition or intake. See below for more detail on the variables included in each index.

---

<sup>8</sup> Moreover, previous work using these data highlighted the particular importance of the four KS1 assessments for KS2 performance (Duckworth, 2007). These four tests assessed at the end of year 2 in reading, writing, spelling and maths accounted for 49%, 52% and 40% of the variance in KS2 English, maths and science respectively. Therefore, our analytic strategy makes use of information to predict a single average measure of KS1 attainment so as to explore the relative contributions of each earlier context to later performance.

Measures to be included in the individual index composites were based on existing theory and evidence as well as the most salient and statistically significant features of each context in predicting later attainment based on previous analyses of these data (see Duckworth, 2007, for further detail). This necessarily places restrictions on the estimation and the interpretation of results. However, by using earlier measures of distal and proximal features of the family, school composition measures based on estimates averaged across pupils, and entry assessment, our indices attempt to remove potential confounding bias and unobserved age-invariant features of the child, family and school. To the extent that we are able to do this, these results provide a guide as to the importance for KS2 attainment of contexts experienced up to the KS1 assessments.

All indices are standardised to provide a comparable metric. The variables contributing to each index are described below. Summary statistics for each individual variable are presented in Appendix Table A1. Missing data were imputed and missing dummy variables were used.

#### *Distal index*

***Mother has a partner at 32 weeks antenatal:*** This dichotomous variable was coded as 0 = no partner, 1 = partner.

***Parents' education:*** This was based on mother-reported mother and father/partner highest level of educational qualifications coded on a scale from 0 to 4: CSE/lower; less than Level 2 academic and vocational qualifications; O-level/GCSE/Level 2 vocational qualifications; A-levels/Level 3 vocational qualifications; university degree and higher.

Parents' education is the combination of both parents' highest level of qualification and is defined as high/medium/low – broadly corresponding with DCSF qualification distinctions (see also Duckworth, 2007). 'Low education' is broadly defined as both parents not being at Level 2 (five O-levels/GCSEs or vocational equivalent) and 'high education' as both parents having at least Level 3 (two A-level passes or equivalent) qualifications. 'Medium education' is defined as every other combination between low and high. Where father's/partner's education is not available, we use mother's education, defined using the same cut-offs.

***Family social class:*** The ALSPAC data only contain the derived 1991 OPCS Standard Occupational Classification (Registrar General's Social Class based on Occupation). In line with the 'household dominance approach' (e.g. Goldthorpe, Llewellyn and Payne, 1987), family social class is coded as the higher of the mother or father/partner.<sup>9</sup> This variable is coded: 1 = I: Professional; 2 = II: Managerial or technical; 3 = III<sub>nm</sub>: Skilled non-manual; 4 = III<sub>m</sub>: Skilled manual; 5 = IV: Partly skilled; 6 = V: Unskilled.

***Mothers' employment category:*** This variable was created by combining mother responses from the 21 and 33 months questionnaires and is coded: 1 = Employed full-time by 18 months; 2 = Employed part-time by 18 months; 3 = Employed by 18

---

<sup>9</sup> If mother's class is missing, then it is coded to the father's class, and vice versa. If the mother has 'no partner', then it is coded to the mother's class.

months, but hours not known; 4 = Employed between 19 and 33 months; 5 = Not employed by 33 months; 6 = Not employed by 21 months.

**Household tenure:** Household tenure was reported by the mother at 47 months and coded as: 1 = owned/mortgaged; 2 = private rental; 3 = being bought from the council; 4 = rented council; 5 = rented housing association; 6 = other.

**Income:** Weekly family income was reported by the mother at 47 months and coded as: 1 = less than £100 per week; 2 = £100–£199; 3 = £200–£299; 4 = £300–£399; 5 = greater than £400.

**Mother's age at birth of study child:** Age of mothers at the birth of the study child ranged from 15 to 44.

**Household crowding:** This continuous variable was constructed by dividing the number of people living in the household by the number of rooms in the home, both reported by the mother at 33 months.

**Experience of financial difficulties:** The financial difficulties score is averaged across mother reports (at 32 weeks antenatal, 8, 21 and 33 months) of experiencing difficulties affording food, clothing, heating, rent or mortgage, things needed for the study child. Zero represents 'no financial difficulties' and 15 represents 'maximum financial difficulties'.

#### *Proximal index*

**Mother breastfed:** This variable was reported by mothers at 6 months and is coded as: 1 = Not at all; 2 = Less than 1 month; 3 = 1 to less than 3 months; 4 = 3 to less than 6 months; 5 = 6 months and over.

**Mother smoked during pregnancy:** This variable was measured by mothers at 32 weeks antenatal and reports the number of cigarettes smoked per day during pregnancy. It is coded: 0 = None; 1 = 1–9 per day; 2 = 10–19 per day; 3 = More than 20 per day.

**Partner–child interaction score:** Partner–child interactions were measured using the summed responses to questions about how frequently they sing and read to/with their children, and play with them, etc. The partner–child interaction score reports the average of these scores measured at 6, 18, 30 and 42 months. A higher score indicates more frequent interactions.

**Number of books in the home score:** Mother-reported number of books in the home (none, 1–2, 3–9, 10 or more) was measured at 6, 18, 30 and 42 months and averaged to create a continuous score.

**Teaching activities score:** At 18, 30 and 42 months, mothers were asked whether they try to teach their child skills and activities such as colours, numbers, nursery rhymes and songs, shapes, sizes, the alphabet, politeness, clapping games, and parts of the body. Responses were summed at each age and averaged to create a continuous score.



***Mother's social networks score:*** The social network scale comprises ten items which ascertain the extent of her social networks and is assessed at 12 weeks antenatal. Mothers report on items such as the number of people in their lives they can go to in order to discuss personal problems, get advice on important decisions or borrow money, as well as the number of times in the last month they have got together with friends and/or relatives. This score ranges from 2 to 14.5, with a higher score indicating better, more positive social networks.

***Mother's own school experiences score:*** At 12 weeks antenatal, mothers were asked a number of questions about their own experiences at school, such as whether they liked school, thought it was valuable, thought good marks were important or whether it was useless to try, and ever played truant, suspended or expelled. These items were summed to create a score of school experiences which ranges from 0 to 12, wherein a high score indicates a more negative school experience.

***Mother's locus of control score:*** Locus of control assesses perceived control in individuals' lives. People who believe that an outcome is largely contingent on their own actions are seen as having a more **internal** locus of control. Those who feel that their lives are determined more by luck, fate, chance and other people are considered to have an **external** locus of control. Measures of internality and externality have been shown to be associated with a number of different factors, including academic achievement, psychological well-being and beliefs (e.g. Lefcourt, 1982).

It is measured at 12 weeks antenatal using a shortened version of the ANSIE, the adult version of the Nowicki-Strickland Internal-External locus of control scales (Nowicki and Duke, 1974). The shortened version of the ANSIE comprises 12 of the original 40 items in a yes/no format which assess perceived control (e.g. 'Do you believe that whether or not people like you depends on how you act?' and 'Do you believe that when bad things are going to happen they are just going to happen no matter what you try to do to stop them?'). A high score indicates a more external locus of control.

#### *Child index*

The entry assessment data come from teacher-administered tests, developed by Reception teachers in partnership with head teachers, advisers and an educational psychologist. They are not the same as the national Foundation Stage assessments. There is no exact date in the documentation for when these tests were administered. However, according to the test booklet, teachers should set the tests once the children are generally settled in school and in the class (South Gloucestershire Professional and Curriculum Support Service, 1996). This has been broadly interpreted by ALSPAC administrators as 1 October of that academic year.

The primary purposes of the entry assessment were to establish an entry assessment of strengths and needs for pupils from which to plan and against which progress can be measured to the end of KS1. The entry assessment is made up of four required areas (see below), each marked on a scale of 2–7.

***Entry language:*** The language assessment focuses on the use and understanding of language and assesses, for example, whether the child can carry out instructions, answer questions about himself or herself and ask questions to satisfy needs and

establish information, contribute to discussions, maintain dialogue with an adult and re-tell a story.

**Entry reading:** The reading assessment covers whether the child can attentively listen to a story, look at books alone, talk about the pictures in a book, recognise names and words, as well as notice and remark on visual details in words, draw inferences from stories and suggest more than one possible ending for a story.

**Entry writing:** The writing assessment recognises that children come into the classroom with different levels of writing experience, with some pupils being able to write full sentences and others not able to hold a pencil. With this in mind, the assessment covers a wide range of skills – from whether the child can use pencils/crayons/paint to make patterns on paper, and make letter-like shapes without adult direction, to writing their own names, explaining what the writing says, beginning to use invented spellings and writing a story.

**Entry maths:** Like the writing assessment, the maths assessment covers a wide range of skills, which include understanding pairs, matching colours, arranging items in specific orders, counting, recognising written numerals, and pointing to the first, middle and last items in a row of five objects.

#### *School composition index*

As noted above, the ALSPAC data have been supplemented with administrative information from the NPD. In addition to the KS1 and KS2 data, we also have information pertaining to study children's free school meal (FSM) eligibility, special educational needs (SEN) status and whether English is the predominant language spoken at home.

Unfortunately, we do not have this information for children not in the ALSPAC core sample, so we are limited in our ability to obtain true school-level measures of the school quality environment.<sup>10</sup> We attempt to overcome this by creating average measures for schools in which we limit the data used to (i) pupils who did not move over the KS2 period, i.e. the four-year period from the start of year 3 to the end of year 6; and (ii) where there are more than 20 ALSPAC pupils per school. The other data are dropped from these analyses. For each variable we also control for the academic cohort.

**School KS1 to KS2 value-added average:** This score is created by first subtracting a pupil's standardised average KS1 points score (see above) from their standardised average KS2 score, taken as the first factor of the three separate KS2 assessments. This creates an individual pupil value-added score. The school average is then taken as the mean of this score for schools with at least 20 ALSPAC children who stayed in the same school for the whole of the KS2 period and is calculated per academic cohort.

---

<sup>10</sup> The ALSPAC school information is subject to considerable missing data, so we use the NPD administrative data, which lack information on individual school-level processes and mechanisms but are less biased by attrition and other issues resulting from non-response.

***School average proportion of pupils claiming FSM:*** Pupils are coded: 0 = not eligible for free school meals; 1 = eligible for free school meals in the academic year they take their KS2 assessments.

***School average proportion of pupils with SEN:*** Pupils are coded as: 1 = No special provision; 2 = School action; 3 = School action plus; 4 = Statement of SEN.

***School average proportion of pupils with English as a foreign language:*** Pupils are coded: 0 = English as first language at home; 1 = other than English as first language at home.

***Type of school in KS2 period:*** This variable classifies school according to the following categories: community school; voluntary aided school; voluntary controlled school. Independent schools were not included, as too few students had complete Key Stage data to be included in the analyses.

### **2.3 Analysis plan**

The first stage in the analysis explores how the four indices relate to each other and to KS2 attainment, using correlations and quartile matrices. Quartile matrices report the conditional probabilities of being in a certain quartile in one index or KS2 assessment, given relative position in another index. They provide a more detailed assessment of how tightly different contexts are related than the correlation matrix, which reports average associations between two measures. They also provide a broad indication of how different contexts relate to later attainment.

The second stage of the analysis uses OLS multiple regression analysis to investigate what contexts are most important in predicting KS2 attainment. We want to estimate the contribution that each index has, alone and when all four are considered simultaneously, for attainment in English, maths and science at KS2. In addition, we want to explore the proportion of variance accounted for and so the relative importance of each context in contributing to overall variation. Each regression model controls for age in weeks at the time of the KS1 assessments, for academic cohort and for gender.

This estimation approach does not attempt to model the mechanisms or processes through which these different contexts influence attainment at KS2. Nor does it imply any causal relationship between the quality of a context and later attainment. Rather, the regression approach adopted here is essentially an advance on a simple, factorial model (for example SES type x school ANOVA), as it utilises broader conceptions of each context.

### 3. Results

#### 3.1 Who has high/low quality contexts? The descriptive characteristics of pupils

We begin our analyses by describing some of the characteristics of pupils with high and low quality developmental contexts. Table 4 shows the average score for the three KS2 assessments for the top and bottom quartiles of each of the four context indices considered in this study. These summary statistics set out the general pattern of results in that there are positive relations between context quality and subsequent attainment; pupils with better contexts are doing better, i.e. they have higher scores, in all three KS2 assessments.

**Table 4: Average Key Stage 2 score by top and bottom quartile of the four contexts (standardised indices)**

	Distal index		Proximal index		School index		Child index	
	<i>Bottom Quartile</i>	<i>Top Quartile</i>	<i>Bottom Quartile</i>	<i>Top Quartile</i>	<i>Bottom Quartile</i>	<i>Top Quartile</i>	<i>Bottom Quartile</i>	<i>Top Quartile</i>
<b>Key Stage 2 outcomes:</b>								
English	47.5	66.2	47.7	65.3	51.0	60.5	45.3	66.6
Maths	52.0	75.3	53.1	73.5	55.9	67.8	48.3	76.8
Science	51.3	65.3	51.4	64.7	54.5	60.5	49.6	65.4
<b>N</b>	2041	2041	2041	2041	2045	2019	2058	2031

The gender split across the standardised distributions of the four different contexts is roughly equal, with the exception of the child index. Table 5 shows that boys are more likely than girls to be in the bottom half of the child index, particularly the bottom 25%. Nearly 60% of those in the lowest quartile of the child index are boys; conversely 56% of the top quartile of this index is made up of girls.

**Table 5: Proportions of pupils in each quartile of the four context distributions, by gender**

	Distal index		Proximal index		School index		Child index	
	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>	<i>Boys</i>	<i>Girls</i>
<b>Position in the index distribution:</b>								
Bottom quartile	49.2	50.8	51.9	48.1	51.0	49.1	59.2	40.8
2nd quartile	50.5	49.5	49.7	50.3	51.4	48.6	51.3	48.7
3rd quartile	52.9	47.1	51.2	48.9	50.1	50.0	47.5	52.5
Top quartile	50.4	49.6	50.2	49.8	50.5	49.5	43.9	56.1

That girls are, on average, doing better at entry to school is consistent with other research and national statistics. It is also the case that by the time pupils reach the end of primary school, girls continue to outperform boys in English and literacy-related

subjects, but, on average, boys tend to do better in maths. As noted above, we therefore control for pupil gender in all subsequent analyses, as well as running some sub-group sensitivity analyses to see whether these four contexts operate differently for boys and girls.

### 3.2 How tightly do different contexts overlap?

The next step in these analyses explores the relationships between our four contexts to gain an insight into how these contexts are related. Bivariate correlations showing the cross-sectional associations between the four indices are presented in Table 6. They are all positive and statistically significant at  $p < .001$ .

**Table 6: Pair-wise correlations between the four contexts**

	1	2	3	4
<b>Context measures</b>				
1 Distal index	1			
2 Proximal index	0.70	1		
3 School index	0.36	0.29	1	
4 Child index	0.36	0.36	0.21	1

All significant at  $p < .001$

N = 8,164

The association between the two family-level indices, distal and proximal, is the strongest,  $r = .70$ . Thus, on average, the greater the level of the distal index, the greater the level of the proximal index, and vice versa. Both family-level indices correlate equally with the child index ( $r = .36$ ). Of these two measures of family context, the distal index correlates most strongly with the school index.

These correlations report average associations across all pupils in this sample. Examining quartile matrices between the different context indices highlights the variation, i.e. the heterogeneity, in this average estimate.<sup>11</sup> For example, Table 7 shows that nearly two-thirds, 64.6% (16.2% of the total sample), of those in the bottom quartile of the distal index are also in the bottom quartile of the proximal index. Conversely, only 1% (0.3% of the total sample) of those at the bottom of the distal index are at the top end of the proximal index distribution. A similar pattern is apparent at the top end of the distal index; 59.5% (14.9% of the total sample) of pupils in the highest quarter of the distal distribution are also in the top quartile of the proximal index, with less than 2% (0.4% of the total sample) in the bottom quarter of the proximal index.

These ‘on-diagonal’ relationships, i.e. being in the same quartile position in both standardised distributions, are far greater at the two extreme ends of the distal and proximal relationships than in the middle. Taken together with the greater fluidity in

<sup>11</sup> Note, however, that these quartile matrices are not developmental in the sense that they do not show relationships over time. Rather, they report the cross-sectional associations of the different context indices considered here in order to better understand how high and low quality contexts are related.

the centre of each distribution, the entrenchment observed at the extreme ends of the distal and proximal indices in Table 7 highlights the utility of this ‘single context’ methodological approach. It neatly demonstrates the heterogeneity present in these different aspects of the family environment and how assumptions of homogeneity and a focus on mean estimates may be misleading. Furthermore, these inter-quartile relationships suggest that the quality of one context constrains the quality of others. This finding and its methodological and conceptual implications are discussed further below.

**Table 7: Quartile matrix: distal and proximal index quartiles**

<i>Distal index</i>	<i>Proximal index</i>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>64.6</b>	<b>26.4</b>	<b>7.9</b>	<b>1.1</b>
<i>(% of whole sample)</i>	<i>(16.2)</i>	<i>(6.6)</i>	<i>(2.0)</i>	<i>(0.3)</i>
<b>2nd quartile</b>	<b>25.4</b>	<b>38.5</b>	<b>26.3</b>	<b>9.8</b>
<i>(% of whole sample)</i>	<i>(6.4)</i>	<i>(9.6)</i>	<i>(6.6)</i>	<i>(2.4)</i>
<b>3rd quartile</b>	<b>8.2</b>	<b>25.8</b>	<b>36.4</b>	<b>29.6</b>
<i>(% of whole sample)</i>	<i>(2.0)</i>	<i>(6.5)</i>	<i>(9.1)</i>	<i>(7.4)</i>
<b>Top quartile</b>	<b>1.8</b>	<b>9.3</b>	<b>29.4</b>	<b>59.5</b>
<i>(% of whole sample)</i>	<i>(0.4)</i>	<i>(2.3)</i>	<i>(7.3)</i>	<i>(14.9)</i>

N = 8,164

Table 8, for example, shows the inter-quartile relationship between the distal and school contexts, which are correlated at  $r = .36$ . In comparison with Table 7, the off-diagonal relationships are slightly greater: while the greatest proportion of pupils are in the same quartile in the distal index as in the school index, the probability of ‘accelerating’ or ‘decelerating’ from these diagonal positions is higher than for the distal/proximal transitions. Nearly half, 46% (11.5% of the total sample), of those in the bottom quartile of the distal index are also in the bottom quartile of the school index. As in Table 7 above, there is entrenchment at the very bottom of the two contexts: those from the most disadvantaged families are also in schools with the poorest school-peer composition. The diagonal probability is smaller at the top end of the distribution, with just over a third, 35.4% (8.9% of the total sample), of those in the top quarter of the distal index also being in the top quarter of the school context index. Again, movement in the inter-quartile relationships is greatest in the centre of the distribution: pupils in the second quartile of the distal index, for example, are almost as likely to be in the bottom quartile of the school index as in the top one.

**Table 8: Quartile matrix: distal and school index quartiles**

<i>Distal index</i>	<i>School index</i>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>46.0</b>	<b>26.1</b>	<b>15.5</b>	<b>12.4</b>
<i>(% of whole sample)</i>	<i>(11.5)</i>	<i>(6.5)</i>	<i>(3.9)</i>	<i>(3.1)</i>
<b>2nd quartile</b>	<b>27.3</b>	<b>29.0</b>	<b>21.6</b>	<b>22.1</b>
<i>(% of whole sample)</i>	<i>(6.8)</i>	<i>(7.3)</i>	<i>(5.4)</i>	<i>(5.5)</i>
<b>3rd quartile</b>	<b>15.0</b>	<b>27.4</b>	<b>28.5</b>	<b>29.1</b>
<i>(% of whole sample)</i>	<i>(3.8)</i>	<i>(6.8)</i>	<i>(7.1)</i>	<i>(7.3)</i>
<b>Top quartile</b>	<b>11.8</b>	<b>19.6</b>	<b>33.2</b>	<b>35.4</b>
<i>(% of whole sample)</i>	<i>(3.0)</i>	<i>(4.9)</i>	<i>(8.3)</i>	<i>(8.9)</i>

N = 8,164

The quartile matrix between child and school contexts (Table 9) shows slightly lower levels of diagonal consistency and, correspondingly, even greater off-diagonality. This is reflected in the lowest correlation between any of the four contexts,  $r = .21$ . It is interesting to note the extent of the heterogeneity between these two indices throughout the distribution: the proportions of the whole sample are very similar across the 16 possible cells, much more so than between the distal and school indices. In line with the wider literature on social inequalities in educational attainment, Table 9 further suggests that features of families are particularly important in driving educational inequalities and that these are not simply the product of more able children going to better schools.<sup>12</sup>

**Table 9: Transition matrix: child and school index quartiles**

<i>Child index</i>	<i>School index</i>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>34.6</b>	<b>28.5</b>	<b>20.9</b>	<b>16.1</b>
<i>(% of whole sample)</i>	<i>(8.7)</i>	<i>(7.1)</i>	<i>(5.2)</i>	<i>(4.0)</i>
<b>2nd quartile</b>	<b>26.7</b>	<b>25.0</b>	<b>22.8</b>	<b>25.5</b>
<i>(% of whole sample)</i>	<i>(6.7)</i>	<i>(6.2)</i>	<i>(5.7)</i>	<i>(6.4)</i>
<b>3rd quartile</b>	<b>21.8</b>	<b>25.7</b>	<b>24.0</b>	<b>28.6</b>
<i>(% of whole sample)</i>	<i>(5.5)</i>	<i>(6.4)</i>	<i>(6.0)</i>	<i>(7.2)</i>
<b>Top quartile</b>	<b>17.1</b>	<b>23.0</b>	<b>31.2</b>	<b>28.8</b>
<i>(% of whole sample)</i>	<i>(4.3)</i>	<i>(5.7)</i>	<i>(7.8)</i>	<i>(7.2)</i>

N = 8,164

<sup>12</sup> Note, however, that these are data for pupils in the state sector and exclude pupils in independent schools.

### 3.3 How do different contexts relate to Key Stage 2 attainment?

Having observed the associations between the four contexts, we next consider how they each relate to KS2 attainment. Table 10 shows the bivariate associations between the three KS2 outcome measures and the different context indices: all are positive and statistically significant at  $p < .001$  (columns 4–7 duplicate the correlations reported in Table 6 above).

The strengths of these relationships are greatest between the three outcome measures considered, indicating a high degree of correlation between the attainment measures across domains of cognitive assessment at the end of primary school. The correlations between KS2 and the four context indices are slightly smaller and vary in magnitude, but are nevertheless highly statistically significant.

**Table 10: Pair-wise correlations between Key Stage 2 attainment outcomes and the four contexts**

	1	2	3	4	5	6	7
<b>Key Stage 2 outcomes</b>							
1 English	1						
2 Maths	0.73	1					
3 Science	0.74	0.79	1				
<b>Context measures</b>							
4 Distal index	0.41	0.40	0.42	1			
5 Proximal index	0.39	0.35	0.39	0.70	1		
6 School index	0.22	0.21	0.19	0.36	0.29	1	
7 Child index	0.50	0.48	0.47	0.36	0.36	0.21	1

All significant at  $p < .001$   
N = 8,164

Consistent with previous work from the Centre for Research on the Wider Benefits of Learning (Duckworth, 2007) and other authors looking at predictors of primary school attainment (Melhuish *et al.*, 2006; Sammons *et al.*, 2007), earlier attainment shows the strongest relationships with performance in KS2 assessments. This can be seen in the high correlations between the child index and all three measures of later academic success considered here (English,  $r = 0.50$ ; maths,  $r = 0.48$ ; science,  $r = 0.47$ ). Of the two measures of family context considered here, the distal index shows slightly stronger associations with KS2 performance. For example, the correlation between KS2 English and the distal index is 0.41 and for the proximal index is 0.39; for maths these correlations are 0.40 and 0.35 for the distal and proximal indices respectively. Associations between the index of school composition and all three KS2 outcomes are weakest.

The stability in attainment over the course of primary school is also demonstrated in Table 11. For example, over half (51.1%, i.e. 12.8% as a percentage of all 8,164 pupils) of those who were in the bottom 25% on the child index at entry to school remain at the bottom of the distribution in KS2 English. At the top end of the child



index distribution, 42% of pupils entering school in the top quartile remain in the top 25% of KS2 performance in English.

However, there is also evidence of discontinuity during this period, with pupils accelerating and decelerating from earlier anticipated trajectories (see also Duckworth, 2007). For example, the percentage of those who make it out of the bottom quartile by the time of or during the KS2 assessment, given their position in the bottom 25% of the child index (i.e. accelerating), is 48.9% (12.3% of the total sample). The corresponding deceleration rate from the top end of the distribution is 58% (14.5% of the total sample of 8,164 pupils). Again, there is greater mobility in the middle of the distribution, but pupils of mid-level ability at entry to school are more likely to remain towards the centre of the KS2 distribution.

**Table 11: Quartile matrix: child index and Key Stage 2 English attainment**

<i>Child index</i>	<i>Key Stage 2 English</i>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>51.1</b>	<b>28.3</b>	<b>13.8</b>	<b>6.9</b>
<i>(% of whole sample)</i>	<i>(12.8)</i>	<i>(7.1)</i>	<i>(3.5)</i>	<i>(1.7)</i>
<b>2nd quartile</b>	<b>28.6</b>	<b>30.3</b>	<b>24.5</b>	<b>16.6</b>
<i>(% of whole sample)</i>	<i>(7.1)</i>	<i>(7.6)</i>	<i>(6.1)</i>	<i>(4.2)</i>
<b>3rd quartile</b>	<b>19.3</b>	<b>24.1</b>	<b>26.9</b>	<b>29.7</b>
<i>(% of whole sample)</i>	<i>(4.8)</i>	<i>(6.0)</i>	<i>(6.7)</i>	<i>(7.4)</i>
<b>Top quartile</b>	<b>5.9</b>	<b>21.4</b>	<b>30.7</b>	<b>42.0</b>
<i>(% of whole sample)</i>	<i>(1.5)</i>	<i>(5.3)</i>	<i>(7.7)</i>	<i>(10.5)</i>

N = 8,164

While there is a positive relationship between the school composition index and attainment at KS2, there is also sizeable variation throughout these distributions. Consistent with the literature reviewed in the Introduction, comparison of Tables 11 and 12 shows that prior attainment of the child is more closely related to later attainment than is school-peer composition. It is interesting to compare these two tables with Table 9 above, which explores the relations between the child and school indices.

**Table 12: Transition matrix: school index and Key Stage 2 maths attainment**

<b>School index</b>	<b>Key Stage 2 Maths</b>			
	<i>Bottom 25%</i>	<i>2nd Q</i>	<i>3rd Q</i>	<i>Top 25%</i>
<b>Bottom quartile</b>	<b>37.9</b>	<b>25.5</b>	<b>20.0</b>	<b>16.7</b>
<i>(% of whole sample)</i>	<i>(9.5)</i>	<i>(6.4)</i>	<i>(5.0)</i>	<i>(4.2)</i>
<b>2nd quartile</b>	<b>25.2</b>	<b>27.2</b>	<b>24.7</b>	<b>22.9</b>
<i>(% of whole sample)</i>	<i>(6.4)</i>	<i>(6.9)</i>	<i>(6.3)</i>	<i>(5.9)</i>
<b>3rd quartile</b>	<b>22.1</b>	<b>23.0</b>	<b>25.6</b>	<b>29.4</b>
<i>(% of whole sample)</i>	<i>(5.5)</i>	<i>(5.7)</i>	<i>(6.3)</i>	<i>(7.3)</i>
<b>Top quartile</b>	<b>17.9</b>	<b>25.1</b>	<b>30.0</b>	<b>26.9</b>
<i>(% of whole sample)</i>	<i>(4.4)</i>	<i>(6.2)</i>	<i>(7.4)</i>	<i>(6.7)</i>

N = 8,164

These quartile matrices indicate that there are complex relationships between children’s own capabilities, different features of their families, the peer composition of the schools they attend and their own educational attainment at the end of primary school. Thus, while the correlations between these different contexts and measures of attainment provide a useful gauge for exploring the relationships between these different features of development, they can only offer a summary measure of how closely these contexts may interact to support (or hinder) academic achievement.

### 3.4 What contexts are most important in predicting Key Stage 2 attainment?

The results discussed above explore how different contexts experienced earlier in life relate to later academic attainment. This section presents the results of regression analysis and considers the relative contribution of different contexts in predicting KS2 attainment. Tables 13–15 report the explanatory power for each of the four context composites, separately and together, one table for each of the KS2 subjects. The  $R^2$  summarises the proportion of variance accounted for in each regression model, which also always includes age (in weeks) at testing and a dummy variable for child gender (girl) as controls. These standardised coefficients are shown in the natural metric of the Key Stage tests as outlined above in section 2.2.1 and Tables 1 and 2, such that a one standard deviation increase in a given context index leads to a corresponding increase in KS2 points.

In Tables 13–15, the first four columns of each table show the association between measures of KS2 attainment (English, maths and science) and each of the four individual context indices. In each case there is a positive and statistically significant relationship between each context and the outcome. In other words, composite measures of distal, proximal, school and child factors all positively predict KS2 attainment. Thus, on average and as indicated in the analyses above, the higher the quality of the context, the better an individual’s attainment in each of the three KS2 tests is likely to be. When the index composites are entered into the regression model separately, a very consistent ranking pattern emerges: the child index is most

important in predicting KS2 attainment across all three subjects and explains the largest proportion of variance in the regression model. Distal characteristics of the family carry the second largest influence, followed by proximal features of the family, with the school composition index explaining the least.

Column 5 in Tables 13–15 reports the regression coefficients for each of the four indices when they are entered into the model simultaneously. This enables an assessment of the relative contribution of each context's association with KS2 attainment, independent of the other three contexts. For each outcome, the same ranking pattern of influence is apparent, but the estimates for the distal, proximal and school indices fall substantially. This attenuation in the size of these coefficients further illustrates the extent to which these different contexts are correlated.

In this model, 34% of the variance in KS2 attainment is explained, indicating relatively smaller contributions of family and school contexts.<sup>13</sup> Importantly, however, with the exception of the school index for KS2 science, each context continues to predict positively to attainment – even with the other contexts in the model all remaining statistically significant. Thus, experience of all four areas of influence matters independently. The explanatory power of the child index is also reduced when the influence of all four contexts is considered jointly, but by a much smaller magnitude, reflecting the particular importance of this context.

For English, for example (Table 13), when entered alone, the coefficient for the distal index indicates that a one standard deviation increase results in 7.23 additional points in the KS2 test. However, when entered in combination with the other three indices, this coefficient falls by more than half to 3.31. The change for the coefficient on the proximal index is even greater: when entered into the model on its own, a one standard deviation increase in the quality of the proximal composite results in a 6.73 rise in the KS2 English score. However, in combination with measures of family background, school composition and the prior attainment of the child, this coefficient is reduced to 1.85. The size of the school quality index is reduced by more than 80%, falling from 3.82 to 0.71. Its explanation of variance in KS2 attainment, however, remains highly significant. The coefficient on the child index is reduced by approximately 25% to 6.47, roughly twice the size of the distal index coefficient. Table 13 also highlights differences in attainment by gender: girls, on average, are doing better in KS2 English than boys.

---

<sup>13</sup> This is a relatively small proportion of the variance in KS2 performance, but reflects the fact that the actual KS1 tests are not included in the estimation model which have been shown in earlier work from the Centre for Research on the Wider Benefits of Learning to be the most important predictors of KS2 success (Duckworth, 2007). Rather, the measures of context quality used here are scaled to predict an average measure of KS1 attainment and demonstrate the relative contributions of these contexts experienced up to the point of the KS1 assessments. Including the individual KS1 tests in the estimation would alter the focus of the research questions addressed here and change this interpretation.

**Table 13: Coefficients and standard errors from regression models of Key Stage 2 English on the four context indices**

	Key Stage 2 English				
	(1)	(2)	(3)	(4)	(5)
<b>Index main effects</b>					
Distal index	7.23 *** (.17)				3.31 *** (.23)
Proximal index		6.73 *** (.17)			1.85 *** (.22)
School index			3.82 *** (.18)		0.71 *** (.17)
Child index				8.69 *** (.17)	6.47 *** (.18)
<b>Child covariates</b>					
Girl	6.60 *** (.34)	6.27 *** (.35)	6.41 *** (.37)	4.28 *** (.33)	4.86 *** (.32)
N	8164	8164	8164	8164	8164
R <sup>2</sup>	0.21	0.19	0.08	0.27	0.34

\*\*\* p < .001

Column 1 gives the  $\beta$  coefficient for the estimate of the distal index for KS2 English, Column 2 the proximal index, column 3 the school index etc. Column 5 gives the  $\beta$  coefficients for each of the four indices when entered into the regression model simultaneously.

This general pattern of results observed for KS2 English is comparable for both the maths and science outcomes (see Tables 14 and 15). For maths, the coefficients for each of the indices considered, both separately and together, are larger than for English and science outcomes. However, the proportion of variance accounted for is slightly lower. The influence of all four contexts on KS2 science, however, is smaller.

The degree of attenuation in coefficients when all four indices are considered together is also of approximately the same magnitude: the coefficient on the distal index is reduced by roughly half, the proximal and school index coefficients fall by over three-quarters and, in the case of KS2 science, the coefficient on the school index is reduced by over 95%, becoming non-significant. The coefficient on the child index is reduced by less than a quarter. Consistent with other research, boys are again, on average, outperforming girls in maths. There is also a smaller, but significant, relationship between boys and science, wherein, on average, boys are scoring 1.36 points higher than girls.

**Table 14: Coefficients and standard errors from regression models of Key Stage 2 maths on the four context indices**

Key Stage 2 maths					
	(1)	(2)	(3)	(4)	(5)
<b>Index main effects</b>					
Distal index	8.94 *** (.23)				4.38 *** (.30)
Proximal index		7.97 *** (.23)			1.38 *** (.29)
School index			4.71 *** (.24)		0.80 *** (.22)
Child index				11.52 *** (.22)	9.05 *** (.24)
<b>Child covariates</b>					
Girl	-2.01 *** (.45)	-2.42 *** (.46)	-2.24 *** (.48)	-5.07 *** (.43)	-4.39 *** (.42)
N	8164	8164	8164	8164	8164
R <sup>2</sup>	0.17	0.14	0.06	0.26	0.31

\*\*\* p < .001

**Table 15: Coefficients and standard errors from regression models of Key Stage 2 science on the four context indices**

Key Stage 2 science					
	(1)	(2)	(3)	(4)	(5)
<b>Index main effects</b>					
Distal index	5.42 *** (.13)				2.59 *** (.17)
Proximal index		5.04 *** (.13)			1.36 *** (.17)
School index			2.52 *** (.14)		0.11 (.13)
Child index				6.62 *** (.13)	5.02 *** (.14)
<b>Child covariates</b>					
Girl	-0.02 (.26)	-0.27 (.27)	-0.16 (.28)	-1.79 *** (.25)	-1.36 *** (.24)
N	8164	8164	8164	8164	8164
R <sup>2</sup>	0.18	0.15	0.04	0.24	0.31

\*\*\* p < .001

So what do these results mean in real terms? One way of considering the influence of the different contexts is to look at the simulated effect of increasing the quality of one context while holding the others constant. For example, if a pupil is at the very bottom, i.e. the 1st percentile, of the distribution in four indices, what impact does moving to the 10th percentile on any one index have and how do these differ from boosts at the very top end of the distribution? What is the advantage of moving up from the bottom of the distribution versus moving from the middle or towards the top end?

Using the estimated coefficients from the regression models above, this calibration-type exercise shows the implied KS2 test score at different points in each context's distribution. Table 16 shows, for example, that boosting the quality of the distal family context from the 1st to the 10th percentile results, on average, in an increase of 2.1 KS2 points in English, 3.1 points in maths and 1.8 points in science – holding the other contexts constant. Similarly, boosting the quality of the child context from the 1st to the 10th percentile implies an increase of 8.7 points in KS2 English attainment, 10.1 in maths and 5.8 points in science.

Slightly further up the distribution, a boost in the distal index from the 11th percentile to the 20th, however, results, on average, in an increase of just 0.6 points in English, 0.9 points in maths and just 0.5 points in science. For the child index, this boost implies an additional 3.6 points in KS2 English, 4.2 points in maths and 2.4 points in science.

The four indices are linearly scaled, so simulated increments at the other end of the distribution carry similar boosts in terms of KS2 attainment.

**Table 16: Simulated effects of boosts in the quality of individual context indices on Key Stage 2 attainment**

<b>English</b>							
<b>All level at:</b>		<b>1%</b>	<b>11%</b>	<b>51%</b>	<b>61%</b>	<b>81%</b>	<b>91%</b>
<i>KS2 score:</i>		26.7	40.3	57.6	60.5	67.8	74.3
Additional KS2 points with boost in 'x' index to:							
		<b>10%</b>	<b>20%</b>	<b>60%</b>	<b>70%</b>	<b>90%</b>	<b>100%</b>
Boost in <b>distal</b> index	+	2.1	0.6	0.9	0.8	1.3	2.7
Boost in <b>proximal</b> index	+	1.3	0.7	0.5	0.5	0.6	2.0
Boost in <b>school</b> index	+	1.0	0.5	0.2	0.1	0.1	0.7
Boost in <b>child</b> index	+	8.7	3.6	1.1	1.2	3.8	8.1
<b>Maths</b>							
<b>All level at:</b>		<b>1%</b>	<b>11%</b>	<b>51%</b>	<b>61%</b>	<b>81%</b>	<b>91%</b>
<i>KS2 score:</i>		27.4	43.7	64.3	67.9	76.6	84.3
Additional KS2 points with boost in 'x' index to:							
		<b>10%</b>	<b>20%</b>	<b>60%</b>	<b>70%</b>	<b>90%</b>	<b>100%</b>
Boost in <b>distal</b> index	+	3.1	0.9	1.3	1.2	2.0	4.0
Boost in <b>proximal</b> index	+	1.0	0.6	0.4	0.4	0.5	1.6
Boost in <b>school</b> index	+	1.3	0.7	0.2	0.1	0.2	0.9
Boost in <b>child</b> index	+	10.1	4.2	1.3	1.5	4.4	9.5
<b>Science</b>							
<b>All level at:</b>		<b>1%</b>	<b>11%</b>	<b>51%</b>	<b>61%</b>	<b>81%</b>	<b>91%</b>
<i>KS2 score:</i>		37.5	46.7	58.8	60.9	66.1	70.7
Additional KS2 points with boost in 'x' index to:							
		<b>10%</b>	<b>20%</b>	<b>60%</b>	<b>70%</b>	<b>90%</b>	<b>100%</b>
Boost in <b>distal</b> index	+	1.8	0.5	0.8	0.7	1.2	2.3
Boost in <b>proximal</b> index	+	1.0	0.5	0.4	0.4	0.5	1.5
Boost in <b>school</b> index	+	0.2	0.1	0.0	0.0	0.0	0.1
Boost in <b>child</b> index	+	5.8	2.4	0.8	0.8	2.5	5.5

The general pattern of results observed in Table 16 indicates that improvements in the quality of individual contexts are not the same at all points throughout that distribution: although differences are not generally large, more seems to be happening at the top and bottom ends of the distribution.

### 3.4.1 Sub-group analysis: moderation by gender

Another important question concerns whether the influence of multiple contexts operates differently by gender. The analyses presented above control for gender and show that, on average, girls are doing better in KS2 English and boys are doing better in KS2 maths and science.

Table 17 presents the results of sub-group analyses and indicates that there is some moderation by gender in the predictive importance of these four contexts. For girls, a higher quality distal family environment is more important for both maths and science at KS2. For boys, a better proximal context carries greater gains than for girls across all three KS2 outcomes, particularly for maths. These findings are discussed below.

**Table 17: Coefficients and standard errors from regression models of Key Stage 2 attainment on the four context indices, by gender**

	English		Maths		Science	
	Girls	Boys	Girls	Boys	Girls	Boys
<i>Index main effects</i>						
Distal index <sup>a b</sup>	3.47 *** (.31)	3.18 *** (.33)	5.06 *** (.41)	3.72 *** (.43)	3.02 *** (.25)	2.16 *** (.25)
Proximal index <sup>c d e</sup>	1.22 *** (.30)	2.45 *** (.33)	0.64 (.40)	2.07 *** (.42)	0.99 *** (.24)	1.73 *** (.24)
School index	0.58 * (.23)	0.84 *** (.25)	1.02 *** (.30)	0.56 † (.32)	0.23 (.18)	-0.01 (.19)
Child index	6.42 *** (.25)	6.49 *** (.26)	8.91 *** (.34)	9.15 *** (.33)	5.11 *** (.20)	4.93 *** (.19)
N	4021	4143	4021	4143	4021	4143
R <sup>2</sup>	0.31	0.32	0.32	0.30	0.32	0.30

†  $p < .1$ ; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

<sup>a</sup> Girls' coefficient is significantly higher than boys' coefficient for Key Stage 2 maths at  $p < .05$ .

<sup>b</sup> Girls' coefficient is significantly higher than boys' coefficient for Key Stage 2 science at  $p < .05$ .

<sup>c</sup> Girls' coefficient is significantly lower than boys' coefficient for Key Stage 2 English at  $p < .01$ .

<sup>d</sup> Girls' coefficient is significantly lower than boys' coefficient for Key Stage 2 maths at  $p < .05$ .

<sup>e</sup> Girls' coefficient is significantly lower than boys' coefficient for Key Stage 2 science at  $p < .05$ .

### 3.5 How do these contexts interact to influence Key Stage 2 attainment?

The discussion thus far has focused on the relative importance of single contexts in relation to academic attainment at the end of primary school and has shown that, with one exception (the influence of school context on KS2 science attainment, see Table 15, column 5), these associations, while reduced, continue to positively predict KS2 attainment when other contexts are included in the model. We now turn the focus of our analyses to our final research question and explore the interactions between these four contexts in promoting academic success.

Examination of the pair-wise interactions between the four different contexts reveals relatively modest, but interesting, differences in the way that contexts operate together in relation to KS2 attainment. These results suggest that the influence of context is not simply just linear or additive. This reflects the variation in different contexts observed in the quartile matrices above, and again makes the point that complex interactions at the sample level can mask the ways in which different contexts relate to outcomes for different sub-groups of people. Taking, for example, the interaction between the proximal index and school quality index, the way the school environment affects KS2 attainment varies according to the quality of the proximal family environment (and vice versa).



Table 18 shows each pair-wise<sup>14</sup> interaction between the four contexts as they relate to KS2 English attainment. These estimates include the main effects discussed in section 3.4 above, which stay largely the same, but for ease of presentation only the interaction coefficients are reported.

Where these interactions are statistically significant, they are negative – indicating that the interaction effects are stronger for those at the lower end of the distribution, i.e. those with poorer quality contexts.<sup>15</sup> Conversely, for pupils whose contexts are good, improvements in other areas of their lives make much less difference to their KS2 attainment, requiring a far greater boost in quality to achieve comparable increases in attainment. In economics, this would be described in terms of a ‘diminishing returns’ relationship. These relationships are discussed in more detail in Section 4.

**Table 18: Coefficients and standard errors from regression models of Key Stage 2 English on the four context indices and their pair-wise interactions<sup>16</sup>**

	Key Stage 2 English					
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Index interaction effects</b>						
Distal x proximal	-0.06 (.17)					
Distal x school		-0.35 *				
		(.16)				
Distal x child			-0.34 *			
			(.16)			
Proximal x school				-0.52 **		
				(.16)		
Proximal x child					-0.62 ***	
					(.16)	
School x child						-0.65 ***
						(.15)
N	8164	8164	8164	8164	8164	8164
R <sup>2</sup>	0.34	0.34	0.34	0.34	0.34	0.34

These coefficient estimates include the main effects of each context as in column 5 in Tables 13–15 above.

\* p < .05; \*\* p < .01; \*\*\* p < .001

<sup>14</sup> Interactions between three contexts were also examined initially, but the effect sizes were close to zero.

<sup>15</sup> The term ‘effect’ here does not infer any causal relationship, but reflects statistical terminology.

<sup>16</sup> Table 19 shows the coefficients for each of the pair-wise interactions between the four contexts. Main effects for each context are included in this model, but for presentation purposes only the interactions are reported.

Table 19 summarises all the pair-wise interactions for each of the KS2 measures of attainment. For each of the three outcomes, the interactions between proximal and school contexts, proximal and child contexts, and school and child contexts are significant. The interactions between distal and school and distal and child contexts are also significant for KS2 English and science. Each of these significant relationships can be interpreted in the same way as the example of the proximal/school interaction. Thus, for example, families with more enriched or higher quality proximal contexts – i.e. parents who engage in more teaching behaviours at home, have more books, go on more outings and include mothers with greater social networks and a more external locus of control – benefit children with poorer school entry assessments more than those who do particularly well in these assessments. Similarly, children with poorer ability on entry to school gain more in their KS2 tests from improvements in school quality than those who performed well.

**Table 19: Summary of pair-wise interaction estimates**

	English	Maths	Science
<b>Index interaction effects</b>			
Distal x proximal	<i>ns</i>	<i>ns</i>	<i>ns</i>
Distal x school	- *	<i>ns</i>	- *
Distal x child	- *	<i>ns</i>	- ***
Proximal x school	- **	- *	- ***
Proximal x child	- ***	- *	- ***
School x child	- ***	- †	- **

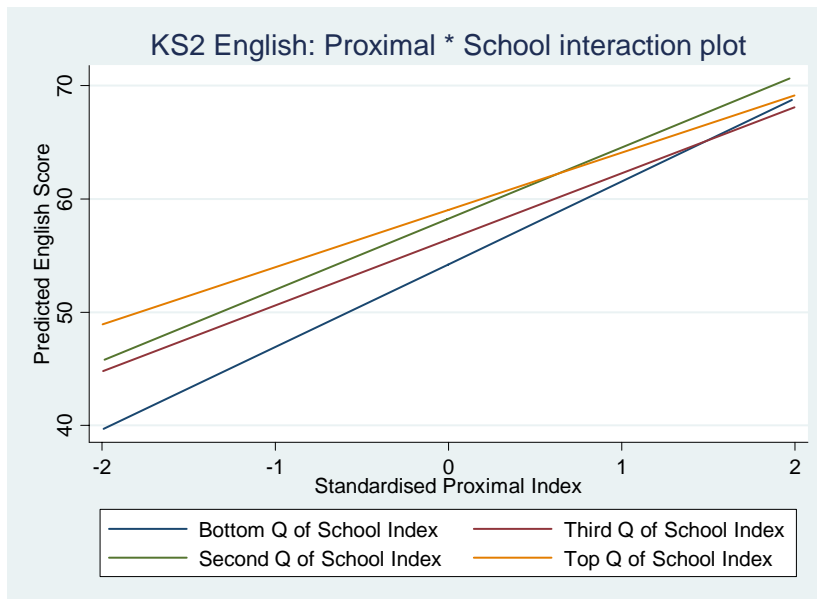
- = negative; *ns* = non-significant

†  $p < .10$ ; \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

The diminishing returns of these interactions can also be understood by looking at graphs that plot predicted Key Stage scores against one index and the four quartiles of another. Staying with the example of KS2 English and the interaction between proximal and school contexts, Figure 1 plots the interaction between proximal and school contexts. The school composition index is split into quartiles and each quartile is then graphed against the standardised proximal index to show its relationship with the predicted KS2 English score.

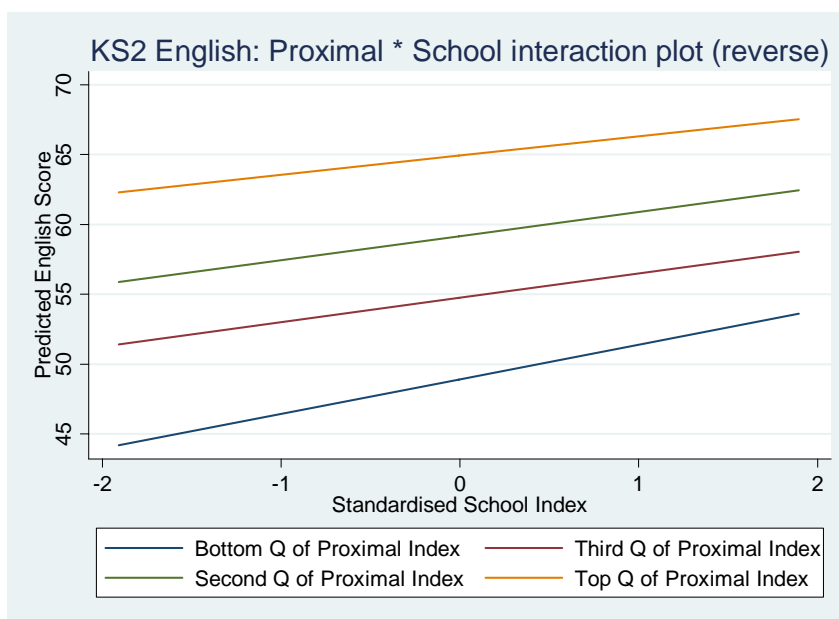
Figure 1 illustrates how attainment increases as the quality of both proximal and school contexts improves. Splitting the school index into quartiles further highlights that this is the case throughout the distribution. Pupils in the bottom quartile of the school index are shown, on average, to be doing worse in KS2 English and their intercept is almost 10 points below those in the top quartile of the distribution. However, their slope is far steeper, indicating that the bottom 25% are making larger gains in KS2 English attainment as these two contexts improve: the returns to improving the quality of a context are greater for those with lower quality contexts.

**Figure 1: Interaction plot for Key Stage 2 English: quartile of school context index plotted against proximal context index**



However, since the estimation strategy used here precludes causal assumptions between these interactions, it is important to consider these graphs from both sides of the interaction. In other words, we are not suggesting that it is improvements in the proximal context that drive increased attainment for those within the poorest quality schools or vice versa. Figure 2 therefore shows this interaction in reverse, to highlight that this association is an interaction between the two contexts and not one necessarily driving the other.

**Figure 2: Interaction plot for Key Stage 2 English: four quartiles of proximal context index plotted against school context index (reverse of Figure 1)**



## 4. Discussion

This study considers the contribution of different contexts to children's attainment at the end of primary school. We explore the relative importance of child, family and school contexts for KS2 attainment in an attempt to tease apart some of the ways in which different developmental settings interact with each other to shape the lives of individuals and operate to support, sustain or hinder positive development.

In this final section, we discuss in more detail the three themes that emerge from these results and put forward possible interpretations for what they might mean in terms of policy and practice. We also raise some of the issues and limitations that come to light from these findings which pose further questions and require additional analyses.

### 4.1 Contexts matter

Contexts matter for children's attainment. The results of the current study clearly demonstrate that early experience in family and school contexts, as well as individual prior attainment at entry to school, each exhibit significant, positive associations with KS2 attainment. Pupils with better quality contexts are doing better, i.e. they have higher scores, in all three KS2 assessments.

First and foremost, as in previous work from the Centre for Research on the Wider Benefits of Learning and elsewhere in the literature, the individual prior attainment is the strongest predictor of KS2 attainment across all three subjects assessed. Distal features of the family context are the next most important context in predicting attainment, followed by the proximal environment, with school quality accounting for the smallest proportion of the variance. This ranking pattern is consistent across each of the KS2 subjects.

The dominant influence of the child context is in line with other literature exploring influences on attainment and continuities in achievement. It is measured by the predictive capacity for four local area entry assessments to promote KS1 attainment and is therefore primarily summarising elements of earlier child development that are likely to be similarly captured by later measures of school attainment. It does not take into account wider features of child ability developed during the important pre-school years. These earlier capabilities have been shown to be powerful predictors of both school readiness and later educational success, and they can be scaffolded and influenced by features of the home environment in the pre-school years (Duncan *et al.*, 2007; Feinstein and Duckworth, 2006). As such, it is not being argued here that the child context reflects inherent or innate ability and is thus not amenable to policy makers. Rather, we suggest that the strength of the child context here arises from child capability–family interactions already in place or operating by the time of the entry and KS1 assessments (see also Feinstein, 2003). It is also likely to reflect the substantive continuity in school assessments (see Duckworth, 2007, for further discussion here).

Importantly though, the strength of the child context does not totally overshadow the influence of the other three contexts and, while restrictions on the available data limit

the extent to which these indices can be considered as heterogeneous with respect to developmental quality, all four contexts are found to matter independently. Thus, although some contexts are more amenable to policy intervention than others, these results provide evidence suggesting that there is scope for policy instruments to level out the playing field for educational opportunity across the different contexts within which children and young people live and learn.

#### **4.2 The law of diminishing returns: interactions between contexts**

Ecological models of human development are based on the premise that individual lives are shaped by many multi-layered and interacting environments. The contexts investigated here are correlated such that individuals with one good context are more likely to have other good contexts. But this is not necessarily so; children from advantaged homes can and do experience poor parenting and those in better schools do not necessarily come from high-achieving or advantaged backgrounds. The second main element of this study explored possible interactions between the quality of individual contexts, and examined whether different combinations of contexts operate in different ways to promote (or hinder) positive attainment.

The off-diagonal relationships in the quartile matrices highlight the importance of considering how different contexts are related. For example, many children in families with impoverished socio-economic circumstances are also experiencing poor proximal environments and are in schools with low quality peer intakes. This ‘double whammy’ negative experience indicates that the quality of one context constrains the quality of others. It also suggests that interactions may be different at different points in the distribution of contexts and, as such, are unlikely to operate in simple additive ways. This is consistent with the conclusions of Aitken and Zuzovsky (1994), who review many of the large-scale, school effectiveness studies and argue that: ‘achievement is dependent in a very sensitive, non-additive way, on the particular combinations of pupil’s home background, his or her general ability, teaching style and other teaching characteristics, the class and the school context’ (p.45).

Examination of the pair-wise interactions between the four contexts reveals modest, but nevertheless interesting, differences in the relationships between interacting contexts and attainment, further demonstrating that the influence of context is not simply linear. Where these interactions are significant they are negative, indicating that the interaction effects are stronger for those with the poorest contexts. At the same time, the attainment of pupils with better quality contexts is less affected by improvements in other areas of their lives and requires a far greater boost in quality to achieve comparable increases in attainment. Thus the statistically significant pair-wise interactions between different contexts observed here result in ‘diminishing return’ relationships. Thus, for example, in the interaction between proximal and school indices, schools matter more for the KS2 performance of pupils from families with low levels of proximal resources. Similarly, an improvement in the quality of proximal family context has a greater effect on attainment for pupils whose context is poor than for those who attend good quality schools.

We do not attempt to untangle the causality and directionality of this relationship here. Rather, our aim is to highlight the value of adopting approaches that enable a

focus on interactions and non-linearities in exploring children's development and influences on attainment. Together with other research from the Centre for Research on the Wider Benefits of Learning that highlights the moderating influence of social background on children's development in middle childhood (Feinstein and Duckworth, 2006; Duckworth, 2007) and the importance of children's different and varied experiences within schools (Gutman and Feinstein, 2008; Stevens *et al.*, 2007), these findings further highlight the complexity of individual development across the lifecourse. Moreover, they demonstrate the need for educational research to use paradigms and analysis that enable real person-in-context methodologies in order to capture the dynamic processes of interaction and transaction and deliver appropriate policies that can best support the positive development of pupils from all circumstances and across the full spectrum of ability levels.

### **4.3 Mummy's boy? Moderation by gender**

The third interesting finding emerging from this report follows on from the value of adopting a more person-in-context focus in highlighting that the influences of context differ by gender. For girls, the distal family context has a stronger association with both KS2 English and maths, whereas for boys the proximal family is more predictive of later attainment across all three KS2 subjects.

This apparent gender moderation is particularly noteworthy, given the well-documented gender gap in educational attainment evident at most stages in the educational system, typically emerging during primary school and widening as children move through secondary school (DfES, 2005b, 2007; Melhuish *et al.*, 2006). Duckworth (2007) reports that while there is a greater tendency for girls to be 'upwardly mobile' in English and boys to be so in maths over the KS1 period, there is no significant difference in the predictability of KS2 results based on earlier KS1 attainment. The results presented in this report suggest that there may be different processes through which features of the family influence children's attainments (see also Feinstein and Duckworth, 2006). Future research therefore needs to model the more micro-level processes and mechanisms operating over time within the family in order to understand the ways in which they may differentially influence girls and boys.

### **4.4 Limitations and future directions**

A number of limitations need to be noted in interpreting these findings. First, what is a 'good' context? The approach adopted here, of constructing composite index measures to provide a simplified description of children's different environments – their own capabilities, their schools and families – is just one way of examining the relative influence of different contexts on KS2 attainment, and using it carries certain assumptions. We have attempted to interpret these findings to make sense in real terms, by simulating what differences or boosts in these indices would look like. However, future work needs to consider in more detail what constitutes a developmentally superior family or school, what the operationalisation of a 'good' context means in practice and, in turn, how those contexts might be improved. This

may be particularly relevant to the measure of school quality used here, which was limited by available data.

Second, social structures are not fixed or deterministic. The approach adopted here considers the cross-sectional influence of context on later attainment and focuses primarily on descriptive features of each context without modelling the micro-level processes operating within those settings that may be responsible for individual change in that context. It may also be false to assume that key characteristics of a given context are causally related to its process attributes.

Furthermore, while the models consider the joint contribution of all four contexts, it is possible to argue for different theories of causal precedence. The statistical dominance of the child context may be an example of this; important interactions between children's own ability, their wider skills and capabilities and families are likely to have already taken place by the time of the entry and KS1 assessments. The model used here assumes fairly static, unidirectional relationships between the different contexts and KS2 attainment. As such, it does not recognise bi-directional relations and feedback loops that operate to promote, sustain or hinder positive development and may therefore mask or underestimate important and dynamic complexities involved in individual educational pathways.

Finally, we are limited by the data currently available for analysis, both in terms of the features of families and school contexts and in terms of child outcomes. As more information becomes available, we will be able to examine the longitudinal developments of the different contexts, attainment and the interactions therein. This will also enable additional contexts to be considered. For example, as children mature and make the transition to secondary school and into adolescence, the peer group becomes increasingly influential. In addition, features of the neighbourhood and local area also need to be considered: for instance the availability and prevalence of social housing is known to interact with family and school contexts in important ways to impact on cycles of disadvantage and to influence life chances (Feinstein *et al.*, 2007).

Future work will also be better placed to model the processes and mechanisms operating within families and schools as well as between them which may be differentially supporting positive development. For example, while these results show a positive association between features of the family and school quality, they do not enable a detailed consideration of choices about where children go to school, how different families operationalise these choices or the practices that are adopted to influence attainment during the course of primary school.

#### **4.5 Conclusions and implications**

Contexts matter. The results presented here demonstrate the multiple levels of social influence and the dynamic interactions and transactions operating in the lives of children and young people. The complexities observed highlight the challenge that emerges from concentrating on any single context and suggest that the simple correlations between the impact of any individual context and attainment may represent a poor gauge to the different contributions of the various features of the child's phenomenological world.

Taken together with other findings from the Centre for Research on the Wider Benefits of Learning and elsewhere, there is an increasing body of evidence emphasising the need to understand how different contexts interact and work to promote positive development for all pupils. This is further demonstrated by the small, but statistical, interactions which suggest that there is no one thing that is likely to radically transform young lives for the better. Developmentally sensitive contexts matter more, and the more of these which are of ‘good quality’, the better. But there are children at risk who do not experience harmful outcomes and there are children with low apparent or observable risk who do (see Luthar, 2003, and Schoon, 2006, for further discussion on risk and resiliency frameworks). Similarly, different processes work differently for different groups of children and young people. Thus there are unlikely to be one-size-fits-all quick fixes or a single policy ‘silver bullet’.

While it is a substantial ask of social and educational policy to simultaneously improve multiple contexts of children and young people, these results suggest that, where leverage in attainment is possible, the best place to start is at the bottom end of the distributions. This is the central premise of progressive universalist approaches, i.e. the objective of providing support and intervention on the basis of need within a universal system, recognising the entitlement of all to such support.

The ecological framework underpinning this report would therefore be usefully extended to integrated models of education and social policy. Education policy that wants to truly adopt a holistic approach to development needs to recognise and consider all the contexts in which children live and learn, and to integrate service provision and delivery accordingly. This is an important element of the Government’s focus on personalised learning and teaching (DfES, 2006), which involves both structured and responsive approaches to curriculum, pedagogy and assessment.

Finally, that services need to be shaped by and responsive to children, young people and their families is one of the core principles of *The Children’s Plan* (DCSF, 2007), recently launched by the DCSF and the Every Child Matters legislation. The connections between the many different and varied settings in which children and their families live, learn and work need to be strengthened and further integrated through extended schools and learning communities. Policy responses need to continue to allow for flexibility and change in order to sustain, enhance and, where necessary, create environments that are conducive to healthy human growth, such that every child has the resources to be the best that they can be.



## References

- Aitken, M., and Zuzovsky, R. (1994). 'Multilevel interaction models and their use in the analysis of large-scale school effectiveness studies'. *School Effectiveness and School Improvement*, 5(1), 45-74.
- Anastasi, A. (1958). 'Heredity, environment, and the question "How?"' *Psychological Review*, 65, 197-208.
- Baltes, P. B. (1987). 'Theoretical propositions of life-span developmental psychology: On the dynamics between growth and decline'. *Developmental Psychology*, 23, 611-626.
- Bartley, M., Head, J. and Stansfeld, S. (2007). 'Is attachment style a source of resilience against health inequalities at work?' *Social Science and Medicine*, 64, 765–75.
- Baumrind, D. (1967). 'Child care practices anteceding three patterns of preschool behavior'. *Genetic Psychology Monographs*, 75, 43–88.
- Bowlby, J. (1969). *Attachment and Loss*. (Vol. 1 Attachment). New York: Basic Books.
- Bowlby, J. (1973). *Attachment and Loss*. (Vol. 2 Separation). New York: Basic Books.
- Bronfenbrenner, U. (1979). *The Ecology of Human Development*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. and Ceci, S. J. (1994). 'Nature/nurture reconceptualized in developmental perspective: A bio-ecological model'. *Psychological Review*, 101, 568–86.
- Brown, B. B. (1999). 'Measuring the peer environment of American adolescents'. In S. L. Friedman and T. D. Wachs (eds), *Measuring Environment across the Life Span: Emerging methods concepts* (pp. 59–90). Washington, DC: American Psychological Association.
- Bryk, A. S. and Raudenbush, S. W. (1988). 'Toward a more appropriate conceptualization of research on school effects: A three-level hierarchical linear model'. *American Journal of Education*, 97, 65–108.
- Burgess, S., Gardiner, K. and Propper, C. (2001). *Growing Up: School, family and area influences on adolescents' later life chances* (CASE paper 49). London: Centre for Analysis of Social Exclusion, London School of Economics.
- Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D. and York, R.L. (1966). *Equality of Educational Opportunity*. Washington: United States Office of Education.

Cook, T. D., Herman, M. R., Phillips, M. and Settersten, R. A. Jnr (2002). 'Some ways in which neighbourhoods, nuclear families, friendship groups, and school jointly affect changes in early adolescent development'. *Child Development*, 73(4), 1283–1309.

Department for Children, Schools and Families (2007). *The Children's Plan – Building brighter futures*. London: The Stationery Office.

Department for Education and Skills (2005a). *Youth Cohort Study: The activities and experiences of 16 year olds: England and Wales 2004*. The Stationery Office: London.

Department for Education and Skills (2005b). *National Curriculum Assessment, GCSE and Equivalent Attainment and Post-16 Attainment by Pupil Characteristics in England 2004*: [www.dfes.gov.uk/rsgateway/DB/SFR/s000564/SFR08-2005v2.pdf](http://www.dfes.gov.uk/rsgateway/DB/SFR/s000564/SFR08-2005v2.pdf).

Department for Education and Skills (2006). *2020 Vision. Report of the Teaching and Learning in 2020 Review Group*: [www.teachernet.gov.uk/docbank/index.cfm?id=10783](http://www.teachernet.gov.uk/docbank/index.cfm?id=10783).

Department for Education and Skills (2007). *Gender and Education: The evidence on pupils in England*. The Stationery Office: London

Desforges, C. and Abouchar, A. (2003). *The impact of parental involvement, parental support and family education on pupil achievement and adjustment: A literature review*. Research Report 43. London: Department for Education and Skills.

Duckworth, K. (2007). *What Role for the Three Rs? Progress and attainment during primary school* (Research Report 23). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.

Duncan, G. J. and Brooks-Gunn, J. (1997). *Consequences of Growing Up Poor*. New York: Russell Sage Foundation.

Duncan, G. J., Dowsett, C. J., Classens, A., Magnuson, K., Huston, A., Klebanov, P. K., Pagani, L.S., Feinstein, L., Engel, M., Brooks-Gunn, J., Sexton, H., Duckworth, K., and Japel, C. (2007). 'School readiness and later achievement'. *Developmental Psychology*, 43(6), 1428–46.

Eccles, J. S., Furstenberg, F., McCarthy, K. A. and Lord, S. E. (1992). *How Parents Respond to Risk and Opportunity*. Paper presented at the Biennial Meeting of the Society for Research on Adolescence, Washington, DC.

Elder, G. H. (1998). The Life Course and Human Development. In W. Damon and R. M. Lerner (Eds.), *Handbook of Child Psychology: Theoretical models of human development* (5th Edition ed., Vol. 1, pp. 939-992). New York: John Wiley and Sons, Inc.

Feinstein, L. (2003). 'Inequality in the early cognitive development of British children in the 1970 cohort'. *Economica*, 73–98.

- Feinstein, L. (2004). 'Mobility in pupils' cognitive attainment during school life'. *Oxford Review of Economic Policy*, 20(2), 213–29.
- Feinstein, L. (2006). Predicting adult life outcomes from earlier signals: modelling pathways through childhood (WBL Discussion Paper 07-02). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.
- Feinstein, L. and Duckworth, K. (2006). *Ready for School? The components of school readiness and their importance for school performance and adult outcomes* (Research Report 20). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.
- Feinstein, L. and Symons, J. (1999). *Attainment in Secondary School*. Oxford Economic Papers, 51, 300–21.
- Feinstein, L., Duckworth, K. and Sabates, R. (2004). *A Model of the Inter-Generational Transmission of Educational Success* (Research Report 10). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.
- Feinstein, L., Duckworth, K. and Sabates, R. (2008). *Education and the Family: Passing success across the generations*. London: Routledge.
- Feinstein, L., Lupton, R., Hammond, C., Mujtaba, T., Salter, E. and Sorhaindo, A. (2007). *The Public Value of Social Housing: A longitudinal analysis of the relationship of housing and life chances* (Discussion Paper 08-01). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.
- Feinstein, L., Robertson, D. and Symons, J. (1999). 'Pre-school education and attainment in the NCDS and the BCS'. *Education Economics*, 7(3), 209–34.
- Furstenberg, F. (1992). *Adapting to Difficult Environments: Neighbourhood characteristics and family strategies*. Paper presented at the Biennial Meeting of the Society for Research on Adolescence, Washington, DC.
- Furstenburg, F. F. J., Brooks-Gunn, J. and Morgan, S. P. (1987). 'Adolescent mothers and their children in later life'. *Family Planning Perspectives*, 19(4), 142–51.
- Furstenburg, F. F., Cook, T. D., Eccles, J. S., Elder, G. H. and Sameroff, A. (1999). *Managing To Make It: Urban families and adolescent success*. Chicago, IL: University of Chicago Press.
- Gibbons, S. A. and Machin, S. (2003). 'Valuing English primary schools'. *Journal of Urban Economics*, 53(2), 197–219.
- Goldstein, H., and Sammons, P. (1997). 'The influence of secondary and junior school on sixteen year examination performance: A cross-classified multilevel analysis'. *School Effectiveness and School Improvement*, 8(2), 219-230.
- Goldthorpe, J. H., Llewellyn, C. and Payne, C. (1987). *Social Mobility and Class Structure in Modern Britain* (2nd edn). Gloucestershire: Clarendon Press.

- Greenwald, R., Hedges, L., and Laine, R. (1996). The effect of school resources on student achievement. *Review of Educational Research*, 66(3), 361-396.
- Gregg, P. and Machin, S. (2000). 'The relationship between childhood experiences, subsequent educational attainment and adult labour market performance'. In K. Vleminckx and T. Smeeding (eds), *Child Well Being in Modern Nations: What do we know?* Bristol: The Policy Press.
- Gutman, L. M. and Feinstein, L. (2008). *Children's Well-being in Primary School: Pupil and school effects* (Research Report 25). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.
- Hanushek, E. A. (1986). 'The Economics of Schooling: Production and Efficiency in Public Schools'. *Journal of Economic Literature*, 24, 1141-1177.
- Hanushek, E. A. (1989). 'The impact of differential expenditures on school performance'. *Educational Researcher*, 18, 45-51.
- Haveman, R. and Wolfe, B. (1995). 'The determinants of children's attainments: A review of methods and findings'. *Journal of Economic Literature*, 23, 1829-78.
- Hobbs, G. T. (2007). *Investigating Social Class Inequalities in Educational Attainment: The effects of schools and the validity of Free School Meal status as a proxy for socio-economic status*. Unpublished PhD thesis. Institute of Education, University of London.
- Konstantopoulos, S. (2005). 'Trends of school effects on student achievement: Evidence from NLS: 72, HSB: 82, and NELS: 92'. IZA Discussion Paper 1749. Bonn, Germany: Institute for the Study of Labor
- Kowaleski-Jones, L. and Duncan, G. J. (1999). 'The structure of achievement and behavior across middle childhood'. *Child Development*, 70(4), 930-43.
- Lee, V. E. and Bryk, A. S. (1989). 'A multilevel model of the distribution of high school achievement'. *Sociology of Education*, 62, 172-92.
- Lefcourt, H. (1982). *Locus of Control: Current trends in theory and research* (2nd edn). Hillsdale, NJ: Lawrence Erlbaum.
- Lerner, R. M. (1984). *On the nature of human plasticity*. New York: Cambridge University Press.
- Lerner, R. M. (1998). Theories of human development: Contemporary perspectives. In *Handbook of Child Psychology. Vol 1. Theoretical models of human development* (Vol. 1). New York: John Wiley and Sons, Inc.
- Luthar, S. S. (ed.) (2003). *Resilience and Vulnerability: Adaptation in the context of childhood adversities*. Cambridge: Cambridge University Press.

- Maccoby, E. E. and Martin, J. A. (1983). 'Socialization in the context of the family: Parent-child interaction'. In P. H. Mussen (ed.), *Handbook of Child Psychology* (pp. 1–101). New York: Wiley.
- Magnusson, D., and Stattin, H. (1998). Person-context interaction theories. In W. Damon and R. M. Lerner (Eds.), *Handbook of child psychology: Vol.1. Theoretical models of human development* (5th ed., pp. 685-759). New York, NY: Wiley.
- Makosky, V. P. (1982). 'Sources of stress: events or conditions?' In D. Belle (ed.), *Lives in stress: Women and depression*. Beverly Hills, CA: Sage.
- Masten, A. S. and Coatsworth, J. D. (1998). 'The development of competence in favorable and unfavorable environments: Lessons from research on successful children'. *American Psychologist*, 53(2), 205–20.
- McCall, R. B., Appelbaum, M. and Hogarty, P. S. (1973). 'Developmental changes in mental performance'. *Monographs for the Society for Research in Child Development*, 38(3, Serial No. 150).
- McLoyd, V. (1990). 'The impact of economic hardship on black families and development: Psychological distress, parenting, and socioemotional development'. *Child Development*, 61(2), 311–46.
- McLoyd, V. and Wilson, L. (1991). 'The strain of living poor: parenting, social support, and child mental health'. In A. C. Huston (ed.), *Children in poverty* (pp. 105–35). Canada: Cambridge University Press.
- Melhuish, E., Romaniuk, H., Sammons, P., Sylva, K., Siraj-Blatchford, I. and Taggart, B. (2006). *The effectiveness of primary schools in England in Key Stage 2 for 2002, 2003 and 2004*. London: DfES/Institute of Education.
- Moffitt, T. E. (2005). 'The New Look of Behavioral Genetics in Developmental Psychopathology: Gene–Environment Interplay in Antisocial Behaviors'. *Psychological Bulletin* 131(4), 533-554.
- Mortimore, J., Mortimore, P. and Thomas, H. (1994). *Managing Associate Staff: Innovation in primary and secondary schools*. London: Paul Chapman Associates.
- Mortimore, P., Sammons, P., Jacob, R., Stoll, L. and Lewis, D. (1988). *School Matters: The junior years*. Salisbury: Open Books.
- Nowicki, S. D. and Duke, M. P. (1974). 'A locus of control scale for non-college as well as college adults'. *Journal of Personality Assessment*, 38(2), 136–7.
- Paine, B. J., Makrides, M. and Gibson, R. A. (1999). 'Duration of breast-feeding and Bayley's Mental Developmental Index at 1 year of age'. *Journal of Paediatric Child Health*, 35, 82–5.

- Pungello, E. P., Kupersmidt, J. B., Burchinal, M. R., and Patterson, C. J. (1996). 'Environmental Risk Factors and Children's Achievement from Middle Childhood to Early Adolescence'. *Developmental Psychology*, 32(4), 755-767.
- Robertson, D. and Symons, J. (2003). 'Do peer groups matter? Peer group versus schooling effects on academic attainment'. *Economica*, 70, 31-53.
- Rowe, D. C., Jacobson, K. C., and van den Oord, E. (1999). 'Genetic and environmental influences on vocabulary IQ: Parental education level as moderator'. *Child Development*, 70(5), 1151-1162.
- Rutter, M. (2002). Nature, nurture, and development: From evangelism through science toward policy and practice. *Child Development*, 73, 1-21
- Sacker, A., Quigley, M. A. and Kelly, Y. J. (2006). 'Breastfeeding and developmental delay: Findings from the Millennium Cohort Study'. *Pediatrics*, 118(3), 682-89.
- Sameroff, A. J. (1983). Developmental systems: Contexts and evolution. In W. Kessen (Ed.), *Handbook of Child Psychology: Volume 1. History, theory, and methods* (4th ed., pp. 237-294). New York: Wiley.
- Sameroff, A. J., Seifer, R., Baldwin, A. and Baldwin, C. (1993). 'Stability of intelligence from preschool to adolescence: The influence of social and family risk factors'. *Child Development*, 64, 80-97.
- Sammons, P. (1995). 'Gender, ethnic and socio-economic differences in attainment and progress: a longitudinal analysis of student achievement over 9 years'. *British Educational Research Journal*, 21, 465-485.
- Sammons, P., Nuttall, D., Cuttance, P., and Thomas, S. (1995). 'Continuity of school effects: a longitudinal analysis of primary and secondary school effects on GCSE performance'. *School Effectiveness and School Improvement*, 6, 285-307.
- Sammons, P., and Smees, R. (1998). 'Measuring Pupil Progress at Key Stage 1: using baseline assessment to investigate value added'. *School Leadership and Management*, 18(3), 389-407.
- Sammons, P., Sylva, K., Melhuish, E., Siraj-Blatchford, I., Taggart, B., Grabbe, Y. and Barreau, S. (2007). *Summary Report. Influences on children's attainment and progress in Key Stage 2: Cognitive outcomes in Year 5*. London: Department for Education and Skills, Research Report 828.
- Sammons, P., West, A., and Hind, A. (1997). 'Accounting for Variations in Pupil Attainment at the End of Key Stage 1'. *British Educational Research Journal*, 23(4), 489-511.
- Schoon, I. (2006). *Risk and Resilience: Adaptations in changing times*. Cambridge: Cambridge University Press.

Silbereisen, R. K. (1995). 'How parenting styles and crown contexts interact in actualizing potentials for development: commentary'. In L. J. Crockett and A. C. Crouter (eds), *Pathways Through Adolescence: Individual development in relation to social contexts* (pp. 197–207). Mahwah, NJ: Erlbaum.

Smith, J. R., Brooks-Gunn, J. and Klebanov, P. K. (1997). 'The consequences of living in poverty for young children's cognitive and verbal ability and early school achievement'. In G. J. Duncan and J. Brooks-Gunn (eds), *Consequences of growing up poor* (pp. 132–89). New York: Russell Sage Foundation.

South Gloucestershire Professional and Curriculum Support Service (1996). *Entry Assessment in South Gloucestershire*. Weston-super-Mare: Woodspring Educational Resource Centre.

Stevens, P., Lupton, R., Mujtaba, T. and Feinstein, L. (2007). *The Development and Impact of Young People's Social Capital in Secondary Schools* (Research Report 24). London: Centre for Research on the Wider Benefits of Learning, Institute of Education.

Strand, S. (1997). 'Pupil progress during Key Stage 1: A value added analysis of school effects'. *British Educational Research Journal*, 23(4), 471–88.

Strand, S. (1999). 'Ethnic group, sex and economic disadvantage: Associations with pupils' educational progress from Baseline to the end of Key Stage 1'. *British Educational Research Journal*, 25(2), 179-202.

Summers, A. A., and Wolfe, B. L. (1977). 'Do schools make a difference?' *American Economic Review*, 67, 639-652.

Thomas, S., and Mortimore, P. (1996). 'Comparison of value added models for secondary school effectiveness'. *Research Papers in Education*, 11, 5-33.

Tietjen, A. M. and Bradley, C. F. (1982). *Social Networks, Social Support and Transition to Parenthood*. University of British Columbia, Vancouver, Division of Family Studies.

Tizard, B., Blatchford, P., Burke, J., Farquhar, C., and Plewis, I. (1988). *Young Children at School in the Inner City* Hove: Lawrence Erlbaum.

Turkheimer, E., Haley, A., Waldron, M., D'Onofrio, B., and Gottesman, I. I. (2003). 'Socioeconomic status modifies heritability of IQ in young children'. *Psychological Science*, 14(6), 623-628.

Tymms, P. (2000). 'Baseline Assessment and Progress During the First Three Years at School'. *Educational Research and Evaluation*, 6, 105-129.

Vestergaard, M., Obel, C., Sorensen, H. T., Skajaa, E. and Ostergaard, J. (1999). 'Duration of breastfeeding and developmental outcomes during the latter half of infancy'. *Acta Paediatrica*, 88, 1327–32.

Vineis, P., and Kriebel, D. (2006). 'Causal models in epidemiology: past inheritance and genetic future'. *Environmental Health: A Global Access Science Source*, 5(21), 1-10.

Willms, D. (1985). 'The balance thesis - contextual effects of ability on pupils' 'O' grade examination results'. *Oxford Review of Education*, 11, 33-41.

Wilson, R. S. (1983). 'The Louisville Twin Study: Developmental synchronies in behaviour'. *Child Development*, 54, 298-316.

Wolfe, B. and Haveman, R. (2002). *Social and Non-market Benefits from Education in an Advanced Economy*. Paper presented at the Education in the 21st Century: Meeting the Challenges of a Changing World. Federal Reserve Bank of Boston (Conference Series 47), Boston, MA, 2002.



## Appendix

**Table A1: Summary statistics for variables used in context indices**

Variable	N	Mean	Std. Dev.	Min	Max
<b>Variables contributing to the distal index</b>					
Mother has a partner at 32 weeks antenatal	8164	0.87	(.34)	0	1
Mother has a partner (missing)	8164	0.12	(.32)	0	1
Combined household education	8164	0.77	(.77)	0	2
Combined household education (missing)	8164	0.10	(.31)	0	1
Family social class at 47months	6525	2.74	(1.09)	1	6
Family social class (missing category)	1639	99.00	(.00)	99	99
Mother's employment category by 18 months	6598	3.45	(1.61)	1	6
Mother's employment category (missing category)	1566	99.00	(.00)	99	99
Household tenure at 47months	5900	1.55	(1.21)	1	6
Household tenure (missing category)	2264	99.00	(.00)	99	99
Weekly income at 47months	5291	3.38	(1.21)	1	5
Weekly income (missing category)	2873	99.00	(.00)	99	99
Mother's age at birth of study child	8164	28.00	(4.79)	15	44
Household crowding at 33 months	8164	0.85	(.24)	0.2	2.5
Household crowding (missing)	8164	0.29	(.46)	0	1
Experience of financial difficulties	8164	3.09	(2.55)	0	14.5
Experience of financial difficulties (missing)	8164	0.02	(.15)	0	1
<b>Variables contributing to the proximal index</b>					
Mother breastfed child	6631	2.96	(1.57)	1	5
Mother breastfed (missing category)child	1533	99.00	(.00)	99	99
Mother smoked during pregnancy	7167	0.35	(.78)	0	3
Mother smoked during pregnancy (missing category)	997	99.00	(.00)	99	99
Partner-child interaction score: Averaged across 6, 18, 30 & 42 months	8164	18.43	(4.23)	0	28.5
Partner-child interaction score (missing)	8164	0.37	(.48)	0	1
No. books in the home: Averaged across 6, 18, 30 & 42 months	8164	3.50	(.35)	1.5	4
No. books in the home (missing)	8164	0.35	(.48)	0	1
Teaching activities: Averaged across 18, 30 & 42 months	8164	7.03	(.67)	2.33	8
Teaching activities (missing)	8164	0.34	(.47)	0	1
Mother's social networks score at 12 wks antenatal	8164	11.71	(1.52)	2	14.5
Mother's social networks score (missing)	8164	0.26	(.44)	0	1
Mother's own negative school experiences score	8164	3.03	(1.80)	0	12
Mother's own negative school experiences score (missing)	8164	0.29	(.45)	0	1
Mother's locus of control score at 12 wks antenatal	8164	4.38	(2.02)	0	12
Mother's locus of control score at 12 wks antenatal (missing)	8164	0.11	(.31)	0	1
<b>Variables contributing to the child index</b>					
Entry Assessment: Language	8164	3.58	(.96)	0	5
Entry Assessment: Language (missing)	8164	0.20	(.40)	0	1
Entry Assessment: Reading	8164	3.08	(.77)	0	5
Entry Assessment: Reading (missing)	8164	0.20	(.40)	0	1
Entry Assessment: Writing	8164	2.92	(.77)	0	5
Entry Assessment: Writing (missing)	8164	0.20	(.40)	0	1
Entry Assessment: Maths	8164	3.30	(.96)	0	5
Entry Assessment: Maths (missing)	8164	0.20	(.40)	0	1
<b>Variables contributing to the school quality index</b>					
School Key Stage 1 to Key Stage 2 valued-added average	8164	-0.03	(.24)	-0.60	0.69
School average proportion of pupils claiming FSM	8164	0.10	(.29)	0	1
School average proportion of pupils with SEN	8164	1.24	(.60)	1	4
School average proportion of pupils with English as a foreign language	8164	0.01	(.09)	0	1
KS2 school type	8164	1.51	(.81)	1	3

## Centre for Research on the Wider Benefits of Learning Research Report No.28

# The influence of context on attainment in primary school: interactions between children, family and school contexts

**Kathryn Duckworth**

➔ Recent years have seen a growing concern about the quality of the lives of children and young people in the UK and elsewhere. Concern focuses both on well-being itself and also on the consequences of poor quality childhood for later outcomes. Growing awareness of the importance of parents and the home environment in shaping children's achievement, coupled with the recognition of the school as a site for engagement in broader aspects of social and personal development, has raised interest in the interactions between these different influences as a way of addressing issues of educational attainment and inequality.

This study explores the nature of these links and considers the relative contribution of different aspects of four different 'contexts' or likely spheres of influence on pupil achievement in England at Key Stage 2 (age 10/11), as well as their associations with one another. In doing so, we hope to clarify some of the ways in which different contexts influence and interact with each other to shape the lives of individuals. We use a single dimension of context quality to simplify many

different aspects of children's lives that are known to influence attainment. This methodology allows the findings to be presented in simple terms and enables a focus on the interactions between the different contexts.

The results highlight that the quality of each of the different aspects of their lives is important for children's attainment in primary school: pupils with better contexts – i.e. better individual, school and family background and experience – have higher scores in Key Stage 2 assessments in English, maths and science. However, these contexts do not act in isolation, but are closely related to one another, and their influence on children's attainment is affected by these interrelationships. In line with other research, these findings suggest that where, for example, families are socially and economically disadvantaged, attainment may be affected not only by a boost in their socio-economic circumstances, but by improvements in other contexts, for example in the quality of schooling or of parent-child relationships. Furthermore, these results indicate that the

interaction effects are greater for those with poor quality contexts. This suggests not only that there is scope to narrow the gaps in educational opportunity, but also that, where influence is possible, the greatest likely returns are for those whose background and experience are poor.

The different areas of children's lives explored in this report indicates that there is no one thing that is likely to radically transform young lives for the better. Changes (for better or worse) in one area of a child's life may not only affect their attainment, but may also place lesser or greater importance on other contexts as a means of supporting their continued development. Further, different groups of children will need different types and levels of support if greater equality in attainment is to be achieved.

**Kathryn Duckworth** is a Research Officer at the Centre for Research on the Wider Benefits of Learning, Institute of Education.

ISBN: 978-0-9552810-8-2

Centre for Research on the Wider Benefits of Learning, Institute of Education, 20 Bedford Way, London, WC1H 0AL  
tel: +44 (0)20 7612 6291 | fax: +44 (0)20 7612 6880 | email: [info@learningbenefits.net](mailto:info@learningbenefits.net) | web: [www.learningbenefits.net](http://www.learningbenefits.net)

The contents of this report do not necessarily reflect the views of the Department for Children, Schools and Families (DCSF), or other funders of the Centre.