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Children's educational attainment and the aspirations, attitudes and behaviours of parents and children through childhood in the UK

Alissa Goodman

Institute for Fiscal Studies

Paul Gregg P.Gregg@bristol.ac.uk

Centre for Market and Public Organisation, University of Bristol

Elizabeth Washbrook

Centre for Market and Public Organisation, University of Bristol

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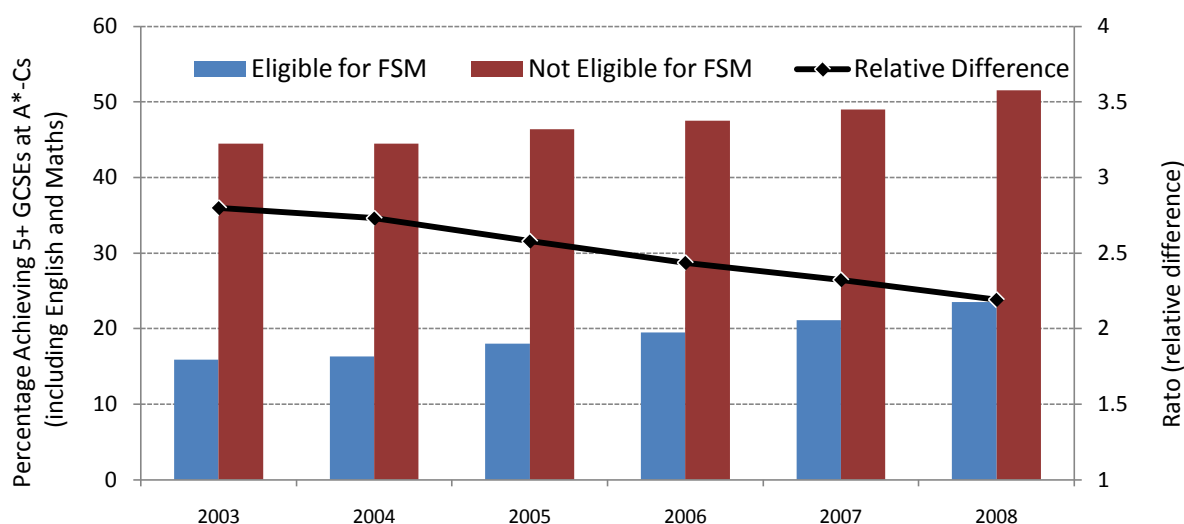
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1. Introduction to this Special Issue of Longitudinal and Life Course Studies (LLCS)

It is well known that children growing up in poor families emerge from our schools with substantially lower levels of educational attainment. The only regularly published government statistics are for attainment gaps between those on free school meals (FSM), broadly an indicator of receipt of major workless benefits, and the rest of the population. As of 2008, less than a quarter of children from families eligible for free school meals obtained the widely used UK benchmark of sufficient achievement at the secondary school level for continuing in academic education to age 18 and potentially going on to university (defined as five General Certificates of Secondary Education – GCSEs – at grades C or above including English and

maths). This compares with just over a half of their richer peers, not eligible for free school meals. As Figure 1 shows, the proportion of both groups achieving this benchmark has risen in recent years. This growth has been slightly faster amongst the FSM-eligible group, such that the relative gap between these groups has fallen over this period (as indicated by the black line). Whilst gaps in achievement at age 16 by family income have started to close over the last decade (Gregg and Macmillan 2010) these gaps remain large, and since educational qualifications are such a strong determinant of later life income and opportunities, such achievement gaps create a major obstacle to social mobility, which is of strong public concern.

Figure 1. Percentage of children achieving 5+ GCSEs at A*-C (including English and maths) by FSM eligibility, 2003-2008.



Sources: 2003-2007, Department for Children, Schools and Families (2009), *Deprivation and Education: the evidence on pupils in England, Foundation Stage to Key Stage 4*, <http://www.dcsf.gov.uk/research/data/uploadfiles/DCSF-RTP-09-01.pdf>; 2008, DCSF Departmental Report 2009, <http://publications.dcsf.gov.uk/eOrderingDownload/DCSF-Annual%20Report%202009-BKMK.PDF>

Policymakers and commentators on policy thinking have long struggled to understand precisely what the sources of these educational inequalities are, and in turn to find policies that will reduce them. The influential work of Feinstein (2003, 2004) has shown how attainment gaps appear early in childhood but then continue to widen through childhood. The large magnitude of the gaps early in life have led many to argue for an increased focus on the early years (for example, Esping-Andersen 2005; Carneiro and Heckman 2003). However, a number of studies have highlighted how increasing the school leaving age results in substantial earnings gains for those forced to continue education, who are largely drawn from lower social backgrounds (e.g. Meghir and Palme 2005 or Harman and Walker 1995). This highlights the potential for policy development before and during the school years and the support for post-compulsory learning in addressing socio-economic attainment gaps.

Our aim in this LLCS Special Issue (which comprises this overview paper and 4 studies) is to assess the empirical relevance of a particular set of factors for explaining the socio-economic gradient in cognitive and educational

achievement over the course of childhood. The factors in which we are interested can be grouped together under the broad umbrella term 'transmission mechanisms'. This diverse set of influences ranges, for example, from parenting styles during the very earliest stages of life and parental cognitive and social abilities in general, through to parental aspirations for educational success in the primary school years, and teenage engagement in risky and positive behaviours during adolescence. What unites them is they are all factors that have been proposed as 'proximal' influences on children's developmental outcomes, in the language of ecological models of child development (e.g. Bronfenbrenner and Morris 1998), as distinct from 'distal' influences such as socio-economic and demographic characteristics. Loosely speaking, proximal factors are those that drive the observed association between a distal factor and an outcome. Children from disadvantaged backgrounds perform worse on achievement tests because the contexts, environments and interactions experienced by such children differ from those experienced by better-off children. If all such contexts and environments are observed and accounted for by

the researcher, then socio-economic background by definition will have no 'direct' association with the outcome.

As a set of observational studies, the research documents the strength of a wide variety of mechanisms that potentially generate the observed pattern of outcome differences between disadvantaged and more affluent children. It is well-known that work of this kind cannot establish the causal nature of the relationship between mechanisms and outcomes, as the possibility of correlated unmeasured factors is always present. We address this as far as possible, through the use of rich conditional models that proxy unmeasured influences with indicators of distal family characteristics, school performance and prior test scores. Evaluations of existing policy initiatives reviewed in this paper provide additional evidence on the likelihood that the mechanisms we identify are amenable to policy intervention.

Section 2 introduces the four data sources used in the chapters, and charts the observed relationship between parental socio-economic background and educational outcomes at different ages. Section 3 provides details of the common measure of socio-economic position used in the four following studies. Section 4 discusses the conceptual framework and gives an overview of how it is operationalized, while Section 5 gives a general formulation of the empirical models estimated in each paper. Section 6 gives a summary of the key findings and considers their implications for policy formation. Section 7 investigates whether evidence from recent policy initiatives supports a causal interpretation of the associations we identify, and Section 8 offers a brief conclusion.

2. The four studies

In order to study these factors, we are fortunate enough to be able to make use of four new and rich sources of data, capturing groups of children growing up in the UK today (described in Table 1). These studies surveyed children and their families at various points in time from early childhood through to mid-adolescence, and all contain high quality information on children's cognitive achievement at different ages, and the processes, environments and contexts experienced by family members. The developmental stage covered by each survey is different, meaning that different types of transmission mechanisms will be relevant in each case, but to facilitate comparability, we impose common definitions on some of the key concepts of interest and employ a common modelling framework. In terms of definitions, we derive an index of socio-economic position (SEP) using a common methodology in all four studies, and divide children in each survey into quintiles (fifths) on the basis of this measure. Hence the relative position of the most- and least-disadvantaged fifth of children can be compared in a systematic way across studies. Second, all outcomes measures are converted to the common metric of percentile scores or ranks. As is shown in Table 1, the outcomes measured differ across childhood stages, and this technique provides a way to assess the relative size of the SEP gap as children age. The table also provides a brief introduction to the datasets used in each of the four studies, the ages over which children are followed in our analysis and the key outcome variables. Further details of the specific studies and definitions of other variables are provided in each article.

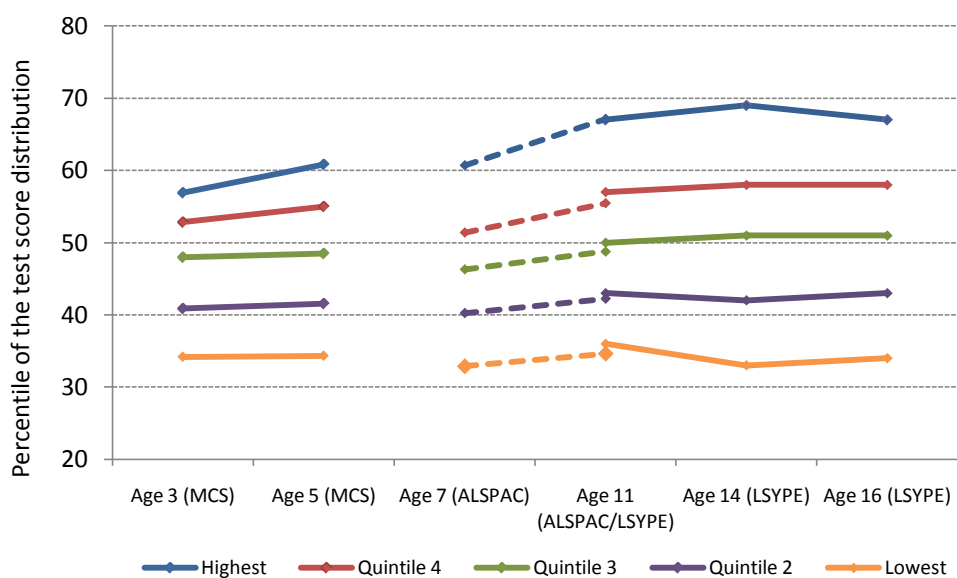
Table 1. Overview of the datasets

	Study 1: Pre-school	Study 2: Primary school	Study 3: Secondary school	Study 4: Across the ages
Data source	Millennium Cohort Study (MCS)	Avon Longitudinal Study of Parents and Children (ALSPAC)	Longitudinal Study of Young People in England (LSYPE)	Children of the British Cohort Study (BCS)
Coverage	Nationally representative sample of children born in the United Kingdom	Census of all children born in the old Avon area of England (a region in the southwest of England located around the cities of Bristol and Bath)	Nationally representative sample of 14-year olds in England	Children in 2004 of a nationally representative sample of adults born in one week in 1970
Dates of birth of cohort members	September 2000 to January 2002	April 1991 to December 1992	September 1989 to August 1990	June 1987 to April 2005
Total cohort members	19,517	13,988 children alive at 1 year	15,770	11,083
Sample size used in analysis	11,054	7,972	13,343	3,416
Focal outcome measure	British Ability Scales (BAS) Naming Vocabulary score, age 5	Average of standardized Key Stage 2 (KS2) scores in English, maths and science, age 11	Average of point scores in eight best GCSE (or vocational equivalent) exam results (KS4), age 16	British Ability Scales (BAS) Vocabulary and Early number concepts, age 3-5 BAS Word reading, Spelling and Number skills, age 6-16
Prior outcome measures	(BAS) Naming Vocabulary score, age 3	Average of standardized Key Stage 1 (KS1) scores in reading, writing and maths, age 7	Average of standardized Key Stage 2 (KS2) scores in English, maths and science, age 11 Average of standardized Key Stage 3 (KS3) scores in English, maths and science, age 14	

Figure 2, drawn from the three longitudinal cohorts, summarizes the average percentile achievement score of children in each SEP quintile group (to be defined more fully below) across ages and cohorts. The picture is that educational deficits emerge early in children's lives, even before entry into school, and widen throughout childhood. Even by the age of 3, there is a considerable gap in cognitive test scores between children in the

poorest fifth of the population, compared to those from better off backgrounds. The poorest children average at the 34th percentile of overall attainment, whilst the richest are at the 57th percentile on average, a gap of 23 percentile points. This gap gets wider as children enter and move through the schooling system, especially in the primary school years. At age 14 this gap is 36 percentile points, before narrowing a little by age 16.

Figure 2. Cognitive achievement outcomes by socio-economic position quintile, across surveys and ages.



Notes: Children in each survey are divided into fifths, ranked according to a constructed measure of socio-economic position based on their parents' income, social class, housing tenure, and a self-reported measure of financial difficulties. The chart plots the average cognitive achievement measures for each group from the ages of 3 through to 16.

Figure 2 conveniently summarizes the patterns we wish to explain in three of the papers, but it is important to not to interpret it in terms of changes in a common outcome for a single group of individuals as they age. Cohorts vary over those born in 1989/90, 1991/2, and 2000/1, and over children born in the Avon region, England or the whole United Kingdom. Further, the outcomes vary from a test of purely verbal ability for children age 3 and 5, to "Key Stage" results in the core subjects of English, maths and (sometimes) science for children age 7 through 14, to GCSE results in eight different subjects (including vocational courses) at age 16. Nevertheless is notable that magnitudes of the SEP gaps at age 5 in the Millennium Cohort Study (MCS) cohort line up closely with those at age 7 in the Avon Longitudinal Study of Parents And Children

(ALSPAC) cohort, and similarly for the gaps in age 11 outcomes in the ALSPAC and Longitudinal Study of Young People in England (LSYPE) cohorts. The Children of the British Cohort Study (BCS) dataset differs from the three longitudinal cohorts, in that it surveys a group of children at a single point in time when they are all different ages. The appropriate methods for dealing with data in this format are discussed fully in the paper, but it is clear that the BCS study can only estimate an 'average' SEP gradient in the cognitive outcome that is invariant to the child's age. The unique addition for the BCS study is that both the mother and her children have undertaken similar cognitive tests in their childhood and hence offer an inter-generational perspective.

3. Definition of socio-economic position

For each of our project strands we have constructed an index of socio-economic position (SEP) that is designed to be as common as possible across strands. Its definition is described in detail here in order to avoid repetition in the substantive articles. The index seeks to capture the longer-term material resources of the household, and is constructed from the following variables:

- Log equivalised household income (averaged across as many points in time as possible, depending on the survey used)
- Reported experience of financial difficulties
- Mother's and father's occupational class
- Housing tenure

The index is constructed using principal-components analysis, and individuals are then placed into quintiles (fifths) of the population ranked by this measure. This approach is likely to give a more accurate classification of the family's long-term social position than measures taken at a single point in time (which will exhibit greater fluctuation), or that capture only one aspect of the family's material resources (such as paternal occupation). This is particularly important in a comparative study of this kind because the individual SEP indicators are measured at different stages of the life course in different studies. It is an approach that recognises that the resources or 'capitals' that convey advantage or disadvantage are multi-dimensional, and that the best and least well-off families exhibit clusters of a number of different kinds of characteristic (Galobardes, Lynch and Davey Smith 2007). The benefits of an approach that recognizes cumulative risk are illustrated by the fact that the outcome differentials between different SEP groups are larger than the differentials between groups defined by income or occupational class alone. Hence the combined measure discriminates those children likely to perform well or poorly, better than any single component indicator. An important exclusion from the combined measure, however, is parental educational qualifications. These are retained as separate control variables, enabling us to explore the distinction between education as an indicator of non-material parental resources – such as knowledge and cognitive ability – and material resources like earnings capacity.

In order to document SEP differentials that are comparable across studies, it is important to classify children according to their position in the underlying population rather than the (possibly non-

representative) estimation sample. Survey attrition and item non-response mean that disadvantaged children are likely to be under-represented in the final samples. Defining SEP groups on the basis of these samples, then, risks drawing the quintile boundaries too "high" relative to the population (and perhaps misclassifying differently across studies). For this reason, we conduct an imputation procedure that includes all children in the definition of the SEP quintile groups, even if they are subsequently dropped from the analysis due to missing data on outcomes or mechanisms. The imputation is conducted only on the SEP component variables and with the single aim of defining more representative quintile groups and consistency across the four studies in this regard.

The imputation procedure (the 'ice' command in Stata10) uses switching regression, an iterative multivariable regression technique, that predicts the likely values of missing items on the basis of the non-missing data (for details see van Buuren, Boshuizen and Knook 1999). Typically multiple imputation (MI) is used as an integral part of the analysis of interest and involves the creation of multiple datasets, each of which is analyzed separately before the averaging of the resulting series of parameter estimates. Since our aim is only to approximate the 'true' population quintile boundaries, we use only a single round of imputation that fills in likely values of missing SEP components on the basis of those observed. Maternal and paternal education are used in the imputation procedure to improve the prediction of missing values. The MI procedure, as we use it, gives us a single complete set of SEP indicators for every individual sampled. We then conduct polychoric principal components analysis (PCA) to combine the indicators into a summary index. This data reduction technique adapts standard principle components analysis in a manner that is appropriate for dealing with discrete variables such as parental occupation and housing tenure (see Kolenikov and Angeles 2004). It extracts a single component or index from the data, such that the index accounts for the maximum variation possible in the underlying indicators.

Although we investigate outcome differences over the full range of the SEP quintile groups, we focus our results on one key statistic: the difference in mean outcomes between the poorest 20% and the richest 20% of children according to the SEP index. We also explore results comparing the lowest and middle SEP quintiles and although the gaps in outcomes are

smaller, as we would expect, our conclusions regarding the explanatory power over different mechanisms are virtually identical.

4. Conceptual framework

The finding that family income and poverty have strong consequences for child development, though to varying degrees and across different contexts, is well established (Blow et al 2006; Brooks-Gunn and Duncan 1997; Duncan and Brooks-Gunn 1997; Duncan and Brooks-Gunn 2000; Gregg and Machin 1998; Haverman and Wolfe 1995; Mayer 1997; Sylva et al 2008). This set of studies focuses on the mechanisms by which social and economic disadvantage may translate into child outcomes. As such, our quantitative analysis is related to a number of theoretical literatures, that hypothesise different routes through which advantage and disadvantage may be transmitted from parents to children.

The developmental psychology literature provides our primary conceptual framework for studying the effects of parental beliefs, attitudes and practices on children's cognitive and socio-emotional development. Bronfenbrenner and Morris (1998, 996) state that, "Throughout the life course, human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving bio-psychological human organism and the persons, objects, and symbols in its immediate external environment. To be effective, the interaction must occur on a fairly regular basis over extended periods of *time*. Such enduring forms of interaction in the immediate environment are referred to as *proximal processes*." They further state that these proximal processes vary systemically with individual characteristics and contexts.

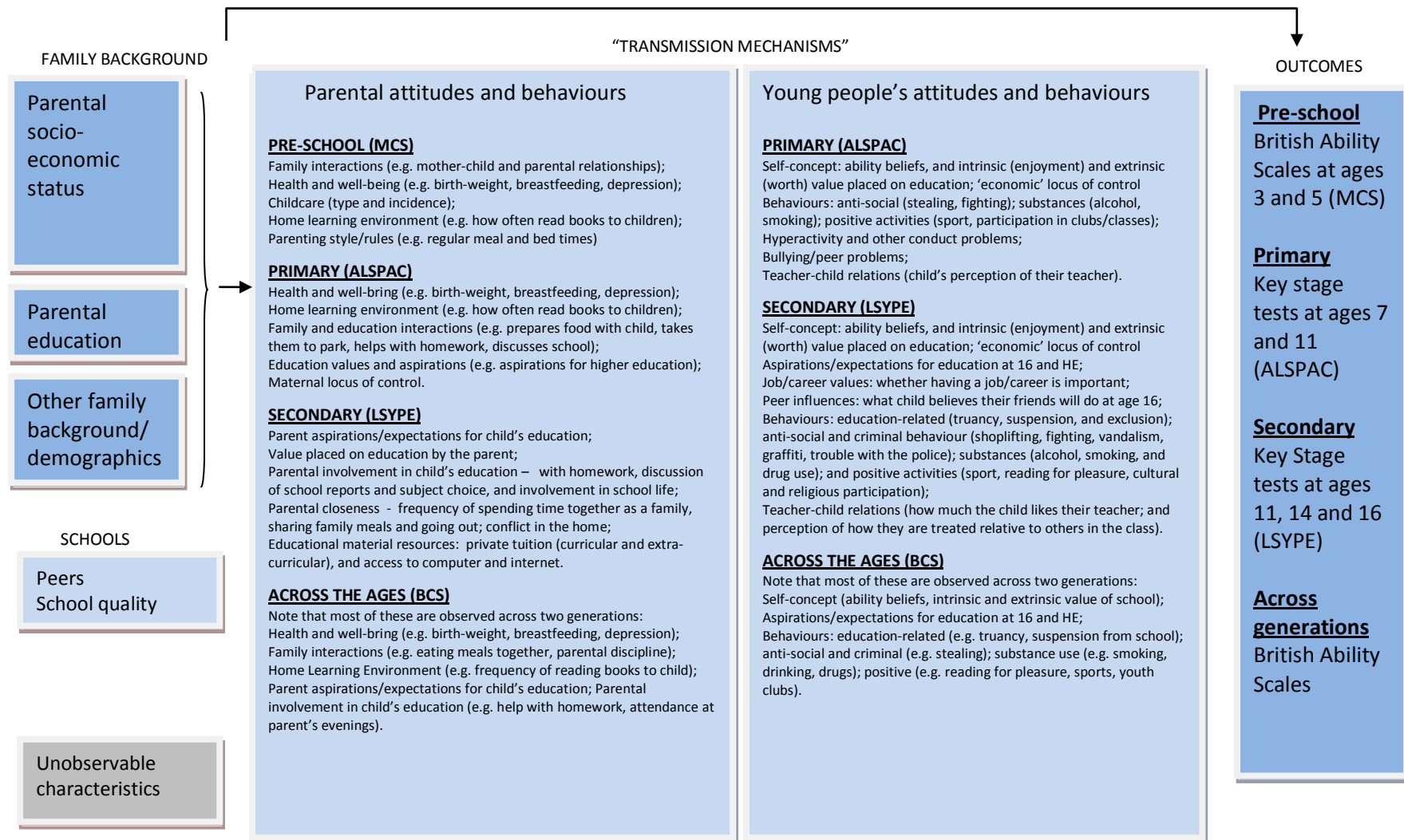
The sociological literature examines how family beliefs, attitudes and practices can be construed as social and cultural capital. For example, Bourdieu's work examines the role played by social and cultural capital in reproducing patterns of social and economic advantage and disadvantage (Bourdieu 1977a, 1977b; Bourdieu and Passeron 1977). Under the social capital theory, social relationships and networks create a resource which families can draw upon (Croll 2004). Cultural capital reflects the idea that "cultural experiences in the home facilitate children's adjustment to school and academic achievement, thereby transforming cultural resources into what [Bourdieu] calls cultural capital" (Lareau 1987, 74).

The economics literature has generally focused on theories of parental investment. For instance, in the Becker-Tomes model, parents invest in their children's education because they care about their children's future well-being, investing up until the point that marginal benefit equals marginal cost (Becker and Tomes 1986). Under this simple optimising theory, parental income should not influence child outcomes under the assumption that there are no credit constraints. Given that it seems unlikely that all families will be able to borrow against future earnings, poorer families may well not be able to invest optimal amounts (for more information on credit constraints see Carneiro and Heckman 2002). Beyond credit constraints, other economic models suggest that a lack of income may place significant strains on poorer families, preventing them from providing a rich home-learning environment, or reducing the quality of parenting (for a review of such models see Mayer 1997).

In the past, the developmental psychological literature has relied on observation, questionnaire and interview methods. It usually relies on research with small samples of about 100 families, and rich datasets. The sociological and economic literatures have usually relied on secondary analysis of existing datasets, many of which contain information on a limited number of variables. The current study attempts to use four datasets, that are both large in terms of sample sizes and rich in terms of variables, to bridge these three theoretical approaches/literatures.

The potential transmission mechanisms between socio-economic background and educational achievement identified by the literature are vast in scope, a scope mirrored by the range of explanatory variables available in our datasets. This presents the researcher with a trade-off between a framework that considers as many influences as possible in a simple and even-handed way, and one in which the inter-relationships between a smaller subset of variables are modelled explicitly, using theoretical insights from a specific branch of the literature. The latter is the approach most commonly used to address the question of socio-economic differentials, and it is vital for understanding the complex inter-relationships between parental and child characteristics and their evolution over time. Our analysis takes the former approach, which can be seen as complementary to the wealth of more narrowly-focused studies.

Figure 3. Transmission mechanisms between distal characteristics and cognitive achievement outcomes



The central panels in Figure 3 give some indication of the breadth of factors covered by the term 'transmission mechanisms' across the four studies. Many different typologies for organizing influences on children's development are possible, but it is extremely difficult to find a scheme that applies naturally to all the mechanisms in which we are interested, over the different stages of childhood. We choose the single broad-brush distinction between parental attitudes and behaviours and young people's attitudes and behaviours, as one that can be applied consistently across studies. Within each study, the mechanisms considered are then grouped into specific sub-categories, such as the 'home learning environment' experienced in the pre-school period or the 'anti-social behaviours' engaged in by adolescents.

Figure 3 also shows that we make a clear conceptual distinction in our analysis, between the transmission mechanisms listed in the central panels, and a set of other 'distal' characteristics listed beneath parental socio-economic status on the left. We do not consider factors such as parental education, family composition and the school attended by a child to be proximal in the same sense as the transmission mechanisms of interest. Instead, like socio-economic status, they are structural features of children's environments that are associated with disparities in child outcomes which can, in theory, be fully explained by differences in intermediary processes. Measures of other distal factors besides SEP are useful, because their inclusion provides a check on how far all the relevant transmission mechanisms are captured by our data, and can be used to proxy for unobserved proximal factors. If all the relevant proximal processes for children's development are measured and controlled in our analysis, then distal factors

such as single parenthood and parental education should have no remaining association with the child outcome. In fact we find that many such distal factors remain strong and significant predictors of outcomes even in the fully controlled models, implying that they are systematically related to unmeasured factors that are consequential for children's development. Their inclusion in the models, therefore, helps to 'mop up' the residual unexplained variation in child outcomes. The interpretation of their contribution to outcomes, however, is crucially different from that of the proposed transmission mechanisms, as their 'direct' effects via any of the observed mechanisms have been controlled away. Their remaining association with outcomes, then, is only a partial one and reflects an 'indirect' association via residual unknown mechanisms that ideally would be observed and controlled.

5. Empirical strategy

In order to avoid repetition within articles, this section formally sets out the model used in the three longitudinal studies and that forms that baseline in the inter-generational study. Whatever the stage of childhood, it is clear that the inter-relationships between different groups of mechanisms will be many and complex. Parental attitudes and behaviours early in life will influence the attitudes and behaviours adopted by the child, which will then in turn affect parents' attitudes and behaviours later in life, and so on. We make no attempt to unpick this type of intermediate relationship. Every transmission mechanism in the analysis is considered simultaneously, so the associations identified are conditional or net associations only. Specifically, our analysis makes use of the coefficients from the (within-study) least squares regression:

$$Outcome_{it} = \alpha Mechanisms_i + \beta Distal_chars_i + \gamma SEP_i + \varepsilon_{it} \quad (1a)$$

The dependent variable is the outcome score of child i at age t , the age of the child at the end of the observation period in each dataset. (This is age 5 in the pre-school years study, 11 in the primary years study and age 16 in the secondary years study. The pre-school years study also estimates some versions in which age 3 scores are treated as the final outcome.) The outcome is regressed

simultaneously on all the mechanism variables listed in Figure 3 (which may be measured at different points in the child's life), a set of distal characteristics such as parental education and family composition and a set of dummy variables for the five SEP quintile groups, omitting the lowest quintile group from the regression as the reference case. The ε_{it} term is an individual-specific error that

is uncorrelated with any observed child characteristics.

The α coefficients therefore capture the correlation between a factor of interest and the outcome holding all other observable factors constant. An insignificant estimate of a particular α should not be taken to imply that the factor is necessarily inconsequential for children's development. It is possible that the factor operates entirely through its 'knock-on' impact on other influences that are controlled in the model. The 'all else constant' assumption means that care is needed in interpreting the contribution of a single variable when other highly correlated variables are also present in the model. The joint contribution of a group of variables, that together measure a common concept, can be thought of providing a more 'realistic' measure of association than any single marginal effect.

The concept of 'a correlation holding all other observable factors constant' also highlights that the

α coefficient will pick up the influence of any unobservable factors that are correlated with both the factor of interest and the outcome. This classic problem of omitted variables bias is essentially unavoidable in a regression-based study of this kind, and reminds us that the α 's cannot be considered estimates of causal effects. We note however, that the inclusion of a rich set of distal family characteristics and the SEP dummies in equation (1a), means that the source of any bias must be uncorrelated not only with any of the included transmission mechanisms, but also with the structural features of families and schools captured by these proxies.

In three of our studies, longitudinal data on the same children at different ages allow us to explore the timing of the developmental process and its association with different transmission mechanisms in more detail. In these studies we also estimate 'value-added' regressions in which a lagged outcome score is added to equation (1a).

$$Outcome_{it} = \alpha^V Mechanisms_i + \beta^V Distal_chars_i + \gamma^V SEP_i + \delta^V Outcome_{it-1} + \varepsilon_{it}^V \quad (1b)$$

Here the $t-1$ subscript does not indicate a lag of a fixed period of time, but rather indexes the child's age at start of the observation period in the dataset in question. In comparison with the α 's from equation 1a, the α^V 's capture the association of the mechanism with the child's trajectory between age $t-1$ and age t , rather than the level of the outcome at age t . These estimates help to disentangle how far the influence of each mechanism is specific to the developmental stage in question, and how far it has already been 'embedded' in attainment at the start of the period. These estimates provide a stringent test of the predictive power of the mechanisms because they net out the part of the causal effect of the mechanism that has manifested itself in the outcome at $t-1$, as well as its correlation with any later unobserved confounders that are associated with prior achievement.

The estimates from equations 1a and 1b provide estimates of the independent association of every mechanism variable with the outcome, but this does not tell us their empirical importance in explaining the raw socio-economic gap. For this, a second step is required that captures the association between each mechanism and SEP. A factor can only be important in predicting the socio-

economic gap if it both differs systematically between socio-economic groups and is associated with the child outcome. Its total "contribution" as an explanatory factor is the product of these two associations, and so may differ from the impression given by the coefficients in the outcome regressions alone. One way to interpret this contribution is as the predicted difference in the outcome if average differences in the mechanism in question between SEP groups were eliminated.

In this second step, we quantify the SEP-mechanism association using coefficients from the following regression:

$$Mechanism_{ij} = \theta_j SEP_i + \mu_{ij} \quad (2)$$

The θ_j coefficients capture the mean differences in the j th mechanism variable between the omitted lowest SEP quintile group and the other four groups. Large and significant estimates of the θ_j 's, therefore, indicate strong social grading in the factor of interest. The term μ_{ij} is the within-group residual of child i – the deviation from the mean value of the j th mechanism variable in the SEP quintile to which the child belongs – and as such is uncorrelated with SEP.

To provide a complete set of estimates between the observed variables in the model, we require a further regression for the relationships between SEP and the k distal characteristics, identical in format to equation 2:

$$Distal_char_{ik} = \pi_k SEP_i + \omega_{ik} \quad (3)$$

$$Outcome_{it} = \left\{ \gamma + \sum_j \alpha_j \theta_j + \sum_k \beta_k \pi_k \right\} SEP_i + \left\{ \sum_j \alpha_j \mu_{ij} + \sum_k \beta_k \omega_{ik} + \varepsilon_{it} \right\} \\ \equiv BSEP_i + \eta_{it} \quad (4)$$

The idiosyncratic error terms – the μ_{ij} 's, ω_{ik} 's and ε_{it} 's – are uncorrelated with SEP by construction, so the unconditional regression coefficients on SEP – the B vector – can be decomposed into the sum of terms shown in the first set of brackets. The product term $\alpha_j \theta_j$ measures the contribution of the j th mechanism to this raw gap. To illustrate, the analysis in Gregg and Washbrook (this issue, pp 41-58) estimates that a 1 kg difference in birth weight is associated with a 2.0 percentile rank difference in the Key Stage 2 outcome score at age 11, holding all observable variables constant (Table 3). This is the α_j . Children in the highest SEP quintile group are, on average, 0.11 kg heavier at birth than children in the lowest quintile (Table 2). This is the θ_j . The product of the two terms gives the contribution of birth weight differences to the socio-economic gradient: 2.0 multiplied by 0.11, or 0.22 percentile points, less than 1 percent of the overall 31.3 point gradient

The vectors of coefficients estimated from the three sets of equations can be brought together in a simple decomposition that summarizes the hundreds of associations between SEP, the intermediary variables and the outcome in a single set of figures. To see this, we can substitute 2 and 3 into 1a:

(Table 4). This example also serves to illustrate why large significant coefficients from the outcome equation 1a may be misleading as to the importance of a particular mechanism for the socio-economic gap. Although birth weight is significantly associated with positive outcomes, disadvantaged children weigh only slightly less on average than the most advantaged children, so eliminating the socio-economic gap in birth weight predicts only a minor change in the socio-economic gradient.

In order to construct the value-added equivalent of the decomposition, we must estimate one further regression:

$$Outcome_{it-1} = \rho^V SEP_i + \varphi_{it-1} \quad (5)$$

The value-added equivalent of 4 can then be derived by substituting 2, 3 and 5 into 1b to get:

$$Outcome_{it} = \left\{ \gamma^V + \sum_j \alpha_j^V \theta_j + \sum_k \beta_k^V \pi_k + \rho^V \delta^V \right\} SEP_i + \left\{ \sum_j \alpha_j^V \mu_{ij} + \sum_k \beta_k^V \omega_{ik} + \delta^V \varphi_i + \varepsilon_{it}^V \right\} \\ \equiv BSEP_i + \eta_{it} \quad (6)$$

Here, B again represents the unconditional difference in the mean outcomes of children in different SEP groups. The term $\rho^V \delta^V$ captures the extent to which differences in prior outcomes can explain differences in current outcomes. In the value-added model the product terms $\alpha_j^V \theta_j$ now capture the contribution of the j th mechanism to

the SEP gap conditional on outcomes at $t-1$. To return to the birth weight example given above, a 1 kg difference in birth weight is associated with a 0.5 percentile point difference in the age 11 outcome in the value-added model, compared with a 2 point difference in the levels model. This estimate of α_j^V is multiplied by the same 0.11 kg estimate of θ_j to

give a contribution of 0.055 percentile points to the overall socio-economic gradient when age 7 outcomes are held constant.

The difficulties involved in interpreting a single α coefficient discussed above, also affect the interpretation of a single product term $\alpha_j\theta_j$. For this reason we sum over the contribution of a group of related variables when presenting the results of the decomposition. Overall, the decomposition technique gives us a parsimonious impression of the relative importance of different types of measured factors in explaining the socio-economic gradient. Note that the importance of a set of factors in the framework depends entirely on the magnitudes of the underlying associations, rather than on the precision with which they are estimated.

An alternative approach (and one that we employed in preliminary analyses) is to observe how the coefficients on the SEP quintile dummies change (or are mediated) as variables are progressively added to equation 1a. A drawback of this approach is that the results depend crucially on the order in which variables are added to the model, as earlier additions will pick up some of the effects of later ones to the extent they are correlated. Without a strong "time-ordering" of variables the sequence is arbitrary, and only multiple replications with different combinations can determine the sensitivity of the findings to a particular ordering of the introduction of controls. Since our aim is provide parsimonious estimates that are comparable across studies and life course stages, the decomposition method outlined above, which draws conclusions from a single conditional model, has a distinct advantage.

6. Summary and interpretation

Throughout the papers in this Special Issue we have explored how children from poor backgrounds typically show lower educational attainment compared to children from better off backgrounds, and why this gap widens throughout much of childhood. We begin our story at the very earliest stages of childhood, and follow young people up until the age of 16, when they potentially obtain their first formal qualifications. Our main analysis splits childhood into three periods, broadly conforming to pre-school, primary and secondary phases of education, recognising that cognitive development and attainment within each period builds on learning

in the previous one(s). The papers show a wealth of simple evidence that, from the earliest of ages, poorer children experience much less advantageous environments at home than children from better off backgrounds, and that differences in these environments have a strong association with poor children's lower cognitive development in early childhood, and progressively poorer academic attainment through school. The differences we have found cover many different aspects of home life, from home-learning environments and parenting styles at a young age, to parents' aspirations and expectations for their child's future education during primary and secondary school, measures of family closeness, and the availability of material resources such as a computer and internet at home during the teenage years. At the same time we have also found that children from poor families typically display many more behavioural problems, at all ages, than children from better off backgrounds.

The research also highlights a number of key findings on the stability or otherwise of measured ability across generations and over the course of childhood. Our analysis of the BCS explores the inter-generational heritability of cognitive capabilities, with approximately one fifth of the gap between richest and poorest explained by a direct link between the cognitive skills of the parent and child, one that is unmediated by the rich set of environmental factors observed in our surveys. Such a relationship may reflect genetic inheritance or the inheritance of environmental disadvantage not captured by the variables we can observe. However, it does suggest that direct genetic heritability of cognitive ability can only be a small but non-trivial component of the socio-economic gradient in attainment. A second general point relates to the role played by prior attainment, as pupils age. When considering our value added models where prior attainment is included, we find that it accounts for between 40 and 60% of the variation in current attainment in each period. The contribution of prior attainment is lowest for age sixteen, when prior attainment is measured at age 11. Such differences may reflect measurement errors in attainment, the assessment of a wider range of subjects at age 16 than at prior ages, the fact that children develop at somewhat different ages or that environmental influences impact on children's progress between assessments. Whilst we cannot fully isolate the relative importance of these different explanations, the data certainly point to a potentially

important role for the last of these and hence for policy in reducing the socio-economic gradient.

The big question arising from our work is what it can tell us about policy formation. Will improved parenting skills in the very early stages of life lead to better outcomes at school, many years later? Will raising maternal aspirations for education, young people's self-esteem and ability beliefs have a similar effect? By the teenage years, can improving young people's own aspirations, reducing their involvement in risky behaviours and encouraging positive behaviours help to close the gap between the poorest children and those from better off backgrounds, and hence help to break the cycle of poverty across the generations?

The evidence presented offers three major areas in which policy may make a contribution to reducing educational inequalities. Of course these three broad areas do not operate in isolation from each other – each having extremely important feedbacks on the others.

(i) Parents and the family home:

- Improving the home learning environment in poorer families (e.g. books and reading pre-school, computers in teen years)
- Helping parents from poorer families to believe that their own actions and efforts can lead to higher educational outcomes
- Raising families' aspirations and desire for advanced education – from primary schooling onwards

(ii) The child's own attitudes and behaviours, and their approach in taking forward their past experiences into learning:

- Reducing children's behavioural problems; improving coping and management capabilities for risky behaviours, conduct disorder and ADHD
- Helping children from poorer families to believe that their own actions and efforts can lead to higher educational outcomes
- Raising children's aspirations and desire for advanced education – from primary schooling onwards

(iii) The school's approach:

- Schools could arguably be doing more to reduce inequalities in attainment between rich and poor, and potentially have a very significant role to play in counteracting the effects of the big inequalities in family backgrounds and home environments that our study has revealed.

When relating the findings to policy questions in more detail, it is necessary to sound a strong note of caution. While our models generally include prior attainment and long-run background factors as controls - helping us to isolate the effects of specific age-related factors - our research is nevertheless based on detailed statistical correlations, rather than robust trials. This means that we have not established robust causal relationships from this work. More generally, the measures of aspirations, attitudes and behaviours that we include in our model are likely to be indicative of wider processes operating within families and peer groups, and there are likely to be other unmeasured differences across families which our measures are partially capturing. The possibility of correlated unobservable characteristics, and of reverse causation, mean that taking our findings purely at face value could lead us to misplaced policy conclusions. Moreover, many of the aspects of parental and child attitudes and behaviours that we have considered are strongly related to each other. Hence it is not always appropriate to isolate one of these factors as a focus for intervention, when it might reflect a broader set of attitudes and beliefs that are not easily measured independently.

One way to throw light on the causality or otherwise of the associations identified in the research, is to look for corroborating evidence from the implementation of existing policies. UK governments have introduced a number of policies based around these broad areas aimed at closing the attainment gaps between rich and poor. In order to understand how successful these policies have been in reducing the gap in school attainment between rich and poor children, we need address several key questions. Are these factors - namely early environments, attitudes, aspirations and the like – malleable, and have these policies actually been successful at improving them? Do such improvements raise poor children's attainment in the way that is hoped? The following section reviews the current policy evidence base in the context of our findings, and highlights areas in which further evaluation studies are needed.

7. Policy Interventions

We begin by discussing programmes designed to influence parenting, the home learning environment, and early years' childcare and education provision. Sure Start is now a national

programme that aims to reach all families, with more intensive support for the more needy. The early evidence on Sure Start among children at age 3 was rather mixed (NESS Research team, 2008), although we understand that the evidence for age 5, which will soon be available, is more encouraging. More targeted programmes, by their nature, are more straightforward to evaluate and there is clearer, positive evaluation evidence on some of these. For example, the introduction of the Family Nurse Partnership in 30 pilot sites in the UK – aimed at improving very early parenting skills, and parent and child health - is backed up by randomised control trials, showing the effectiveness of this programme in the US in improving children's long-term behavioural and cognitive outcomes (up to thirteen years after involvement in the programme; Olds et al 1998). The parenting elements of the Incredible Years Programme, operating in various guises around the UK, is another well-evaluated parenting programme showing success in improving child behaviours among children at a young age (Hutchings et al 2007 and Bywater et al 2009). Some other parent-centred programmes, while not yet subject to fully robust outcome evaluations, appear quite promising. These include Family Intervention Projects, which address the problems of a small number of families with severe behavioural problems, tackling what is typically a complex web of mental and physical health problems, substance misuse and domestic violence (White et al 2008).

Three features of the parenting-based work discussed above are worth drawing out. The first is that the majority of parenting support programmes are aimed at pre-school aged children. Whilst there is a clear and obvious reason for this, our research highlights the ongoing potential for improved parenting to reduce inequalities in child development, certainly into the primary years and perhaps to a lesser extent into the secondary school period. Second, the best evidence we have on programmes being successful is for high intensity (and costly) programmes concentrated on the most needy families and children. While intensive programmes that focus on helping small numbers of children most in need tend to have the strongest evidence base behind them, educational disadvantage affects a very large number of children from low income families, but with lower intensity than those at the extreme, and it may be that policy needs to focus more on these (although Sure Start is

a major exception here). Finally, the evaluation evidence tends to be clearer about the positive impact of these programmes on children's social and emotional well-being, and health, but is generally much less clear about their impacts on children's long-term cognitive development, and educational attainment. While both are clearly important, if one is trying to reduce *educational* inequalities, then this latter point is clearly a relevant concern. The question mark over whether such programmes improve cognitive development and raise educational attainment chimes with our own findings. For example, Dearden, Sibieta and Sylva (this issue, pp 19-40) highlighted that although children from poor families typically experience much less advantageous early caring environments, most aspects of the home environment (except for specifically the home *learning* environment) were not directly responsible for the big gaps in cognitive development we sought to explain. However they were important for explaining differences in children's social and emotional well-being.

There are also a number of mainly school-based programmes aimed at raising children's aspirations and tackling behavioural and emotional issues. For example, one major voluntary programme for primary and secondary schools is the Social and Emotional Aspects of Learning (SEAL), which emphasises the importance of social skills such as empathy, self-awareness, and self-regulation. Aimhigher seeks to raise aspirations for Higher Education among young people, while various programmes under the National Behaviour and Attendance Strategy seek to improve behaviour within the school context; Aiming High and, within this, Extended Schools Services, aim to promote youth engagement in positive activities. Many of these programmes – such as SEAL, and various elements of the government's strategy towards behaviour and attendance - emphasise the importance of the whole-school ethos in improving young people's attitudes and behaviours, as well as individual- or small-group work.

Our reading of the evidence on these types of programmes is that in general, their effectiveness is much less robustly established than the parenting-focused programmes we discussed further above. As such, their benefit remains unproven. One exception is Aimhigher, or more specifically the Excellence Challenge element, where robust evaluation findings on attainment are positive.

Targeted at young people in urban, deprived schools, it was found that one school year's exposure to the programme in Year 11 (age 15-16) led to pupils scoring 2.5 points higher at GCSE (equivalent to 2.5 grades improvement on the current scale) and being 3.9 percentage points more likely to report that they intended to participate in higher education (Emmerson et al 2005). While Aimhigher thus appears very useful, it starts in the secondary phase of schooling. In this issue we find that aspirations are also an important potential influence on attainment even by the age of 11 (see Gregg and Washbrook, this issue, pp 41-58), suggesting that activities aimed at raising aspirations in primary school might also be valuable.

By contrast, our reading from various evaluations of SEAL suggests that this approach is as yet unproven – since in general, clear benefits have not been very robustly established. For example, in the one independent evaluation that has involved a control group design (Hallam et al 2006), statistically significant positive impacts were found for some social and emotional outcome measures, but many more outcomes did not appear affected by the interventions, and indeed there were a number of important outcomes that appeared adversely affected by some interventions. One intervention, 'Going for Goals' did show a more consistent positive impact on the children involved, though no impact was found on young people's motivation, the main aspect of learning that is supposedly addressed by this intervention. Additionally, to our knowledge this (or any other) programme's impact on young people's sense that their destiny can be shaped by their own actions (locus of control) has not been tested – though the findings from this issue suggest that this may be important.

Stronger evidence is also required on the effectiveness of the government's strategies towards behaviour improvement (the National Behaviour and Attendance Strategy), and on positive activities (the Aiming High strategy, including Extended Schools services). The Behaviour Improvement Programme (BIP) was one specific intervention within this umbrella, which was subject to a formal evaluation and found positive benefits on young people's school attendance (Hallam et al 2005). However, other formal evaluation work on the BIP, based on the LSYPE, found no discernible impacts of the programme on young people's likelihood of truancy, or on any other of a detailed set of attitudes and

behaviours, or on attainment at age 14 (Chowdry et al 2009).

More evidence is also needed regarding the promotion of positive activities (including the Aiming High strategy and the connected Extended Schools services). Aiming High is the previous government's ten year strategy aiming to increase young people's participation in constructive leisure activities. While there was piecemeal evaluation of some elements of the Aiming High strategy, such as the national evaluation of the Positive Activities for Young People, there has been no overall evaluation of the effectiveness of the approach. Under the connected Extended Schools Services (ESS) programme, councils set up activities in and around schools for the evenings, weekends and during holidays. Services offered include study support; play/recreation, sport, music, arts and crafts and other special interest clubs; volunteering and business and enterprise activities; childcare; parenting support; specialist services such as speech and language therapy; and community access to facilities including adult learning, ICT and sports facilities. While the formal national evaluation of ESS is yet to report, evaluation of a predecessor programme found some evidence for positive impacts on young people's behaviour and learning (Cummings et al 2007).

There are also a number of more intensive initiatives and teaching programmes in schools designed to directly improve the learning outcomes of children and young people in particular need of help, many of whom are from disadvantaged backgrounds. These initiatives include Special Educational Needs provision (SEN), and very intensive programmes in primary school such as Every Child a Reader, Every Child Counts and Every Child a Writer. The basic effectiveness of programmes such as Reading Recovery, the intervention at the core of the Every Child a Reader programme, in helping young children struggling to read to catch up with their peers has been robustly established in a number of different studies. However, uncertainty remains as to whether such gains are sustained in the longer-term, and the *cost-effectiveness* of these very expensive, intensive one-to-one teaching programmes has been both asserted (KPMG, 2009) and questioned (Policy Exchange, 2009). Other programmes such as the Literacy and Numeracy hours have also been backed up by positive evaluation findings, and suggest that the positive benefits are found more among children

from low income families (Machin and McNally 2004).

One set of issues not touched upon yet in this policy discussion is whether (i) the level of resources channelled towards pupils from low income backgrounds in schools, (ii) the funding mechanisms for delivering these, and (iii) the school structures into which such resources are channelled, are likely to be effective in reducing the gap in educational attainment between rich and poor children. Funding provided to schools is already biased in favour of more deprived schools (Chowdry et al 2007a). Leading up to the 2010 UK general election, both the Conservatives and the Liberal Democrats campaigned on the idea of a disadvantaged pupil premium in the school funding system in England, and a commitment to introduce a pupil premium was then included in the Coalition's programme for government. The main aim of the pupil premium is to narrow the achievement gap between children coming from rich and poor families, by targeting resources even more heavily towards schools with a high proportion of disadvantaged pupils, and reducing any disincentive that schools might have to recruit such pupils. In a recent report, Chowdry, Greaves and Sibietta (2010) examined the rationale for a pupil premium and concluded that current evidence suggests a pupil premium is only likely to have a modest impact on the achievement gap. Furthermore, as a result of planned cuts to existing funding, the pupil premium is only likely to represent a net increase in real-terms funding for a small number of schools with large numbers of deprived pupils – only 1 in 8 schools are likely to see increases in real-terms funding of 5% or more in total over the next four years¹. The vast majority of schools are likely to see net cuts in their funding over the next four years, with the least-deprived schools likely to see real-terms cuts of about 10%. To the extent that the pupil premium is likely to narrow the achievement gap, it seems only likely to do so through reducing the level of cuts imposed on relatively deprived schools.

Another set of policies of particular note are those that are designed to incentivise or force young people (particularly those from poor backgrounds) to remain longer in formal education. Education Maintenance Allowances (EMAs; introduced nationwide in 2004) were designed to encourage

more young people from low income backgrounds to remain in full-time education beyond 16, through a means-tested payment of up to £30 per week, made to young people aged 16-18. Robust evaluation evidence suggests that the financial incentive works: there have been positive impacts on staying-on rates, retention, and achievement (Chowdry et al 2007b). The coalition government has announced that EMAs are to be abolished. Yet bigger changes in this area are imminent, with the forthcoming raising of the minimum education and training participation age. New legislation means that in the academic year 2013/14, young people will have to remain in some sort of education and training until the age of 17, and in 2014/2015 until the age of 18. This will largely impact on young people from poorer backgrounds, who are the most likely to leave school and training before 18 under the current system. While previous legislation to increase the *school* leaving age has generally been shown to raise attainment and have positive economic returns, it remains to be seen whether this particular extension, which increases the minimum leaving age by a further two years, and also includes jobs with formal training, will have a similar effect.

8. Conclusion

Overall, our results suggest that the broad area of aspirations, attitudes and behaviours of parents and children have the potential to be an important area for policy intervention. Our results are not causal, and so policy trials are needed to demonstrate the degree of malleability of mediator factors and subsequent impact on attainment. The interventions described above, which have variable quality of evidence of effectiveness, support the sense that this area is ripe for such policy trials, building on best practice to date. Two areas we regard as promising are interventions designed to reach a broader range of children than the acutely deprived or low achieving targeted in many programmes, and interventions that expand the age range of children and the involvement of their parents in other programmes. Our hope is that the evidence in this Special Issue will contribute to policy thinking and innovation, particularly around interventions targeted at children beyond the early years.

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Endnote

¹ <http://www.ifs.org.uk/publications/5311>