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Abstract

Disabled children are known to fare worse in terms of educational attainment during their school years, with subsequent consequences for their later transitions and adult outcomes. But despite the acknowledged importance of the early years in children's later outcomes, we know relatively little about when disabled children's educational problems emerge or how they develop in young childhood. In this paper, we use a nationally representative longitudinal survey of UK children to address the following questions: do disabled children in England have lower cognitive skills prior to school entry? How do educational attainment and cognitive skills develop over the early school years relative to their non-disabled peer group? What role do background and environmental factors play in accounting for patterns of disabled children's progress? Using multiple measures of educational and cognitive attainment, and controlling for a number of key child, family and environmental factors, we investigate educational progress across two measures of disability. We find that disabled children have poorer cognitive skills at age 3, and that this is not accounted for by differences in home context. We also find that they make less progress over the early years than their non-disabled peers with similar levels of cognitive skills. Our findings are robust to a series of alternative specifications. Implications are discussed.

JEL codes: I21 I24 J13 J14

Keywords: Disability, children, educational progress, Millennium Cohort Study, Special Educational Needs, Longstanding Limiting Illness, school, Key Stage 1, England

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Introduction

Disabled children are known to fare worse in terms of educational attainment during their school years (DCSF 2010), and this can have long-term consequences for opportunities and outcomes into adulthood (Jones 2010; Loprest and Maag 2003). Part of the reason may lie with the nature of the disability, for example learning difficulties, or other impairments, which imply particular learning needs. However, there has been longstanding concern that disabled children's education and educational support does not necessarily enable them to fulfil their potential (Aron and Loprest 2012; Blatchford et al. 2011). Moreover most of our evidence on disabled children and on their educational and cognitive outcomes comes from their school years, and, typically their older (teenage) school years (Department for Children Schools and Families 2010; Department for Education 2011; Department for Education 2013; Keslair and McNally 2009).

This is despite the fact that increasing weight is now put on the significance of the early years as a period when cleavages in cognitive skills emerge. The importance of investing in early years to stimulate both cognitive and non-cognitive skills has been strongly emphasised (Heckman 2006). While much discussion has focused on the importance of compensating for socio-economic differentials in early development of cognitive skills and educational attainment, it is pertinent to consider the extent to which disabled children's early development warrants similar attention.

Moreover, while it is clear that disabled children fare worse than non-disabled children in terms of educational attainment within the school system, it is not clear how early educational experiences help to compensate for initial cognitive disadvantage. That is, we have little understanding of whether disabled children fall further behind or catch up in this critical early period, and how far their progress on entry to school continues to be influenced by family background and home context, especially given that we know that disabled children are more likely to come from disadvantaged backgrounds in the first place (Parsons and Platt 2013). Identifying progress is complicated by the fact that it needs to be evaluated relative to those non-disabled children who are in a comparable position to them, requiring a more detailed understanding of both family background and an appropriate baseline and comparator group for measuring progress than is typically available in the administrative sources used to explore school-children's educational progress.

This paper therefore focuses on a nationally representative sample of English children and addresses the following questions: do disabled children have significantly lower cognitive skills prior to school entry, and how far can they be explained by differences in socio-economic background and home context? How do disabled children progress on entry to school and in the early years relative to similarly able non-disabled peers? How far can their progress be linked to differences in family background and particular features of home and school environment that are more likely to impact on disabled children?

We focus on the period up to age 7, which both corresponds to what is widely considered a critical developmental phase and which coincides with the completion of the first Key Stage

of English primary schooling. Capitalising on the measures available in the longitudinal Millennium Cohort Study, we use both home-based survey measures of cognitive skills and (from age 5) school-based measures of educational development derived from linked administrative data. We are thereby able to exploit a range of test scores across different areas of learning at ages 3, 5 and 7, enabling us to assess the sensitivity of the results to different assessments. Moreover, we use two measures of disability to explore whether there is a consistent pattern across disabled children, differently defined, and, importantly, whether those children designated as having particular learning support requirements (Special Educational Needs or SEN), are also those who appear to be falling behind most within school or in terms of cognitive skill development. We also employ a modelling strategy that assesses change taking account of the different distribution of ability scores among disabled and non-disabled children; and we subject our findings to a range of robustness checks.

We further exploit the extensive family background and environmental measures in the data, to evaluate the extent to which differential starting points and progress of disabled children can be attributed to family and school contextual factors that may mediate or moderate that disadvantage. Given the emphasis on stimulating environments for children's cognitive development (Heckman 2006; Melhuish et al. 2008), we investigate the extent to which variation in the home learning environment (HLE) may be linked to disabled children's development. Children's cognitive and educational development has also been associated with peer relationships, non-cognitive skills and social-behavioural adjustment. Given that existing research shows that young disabled children have greater levels of behavioural problems (Fauth, Parsons and Platt 2014) and difficult social relations as represented by bullying victimisation (Chatzitheochari, Parsons and Platt 2014), we additionally consider these as two potential avenues contributing to patterns of cognitive and educational progress in the early years.

We find that disabled children have significantly lower levels of cognitive skills prior to school entry than non-disabled children, and that these can only be partially accounted for by family and contextual factors. We also find that they make less progress in school within the early years than their similarly able peers. These findings are consistent across different assessments and disability measures, and stand up to a range of additional robustness checks. We find that while home learning environment, bullying and behavioural problems, as well as socio-economic disadvantage, are associated with poorer age 3 outcomes and reduced levels of progress, they do not account for the poorer progress of disabled children.

We conclude that disabled children would merit from greater targeted investment in their learning in the early years, if they are not to face cumulative disadvantage across childhood and into adult life.

In the next section we elaborate on the background and context of our research questions, before, in section 3, outlining the data and measures and our analytical strategy. We describe our findings in section 4 before presenting our conclusions and our reflections on their implications in the final section.

Background

Gaps in educational attainment according to socio-economic position have stimulated and continue to result in a wealth of international research (Breen and Jonsson 2005; Breen et al. 2009). This literature has discussed the persistence of socio-economic differentials even in the face of expanding educational systems has been extensively reported and discussed. Particular interest has in recent years focused on the early years, both the early emergence of educational and cognitive gaps in children's lives (Sullivan, Ketende and Joshi 2013) and the significance of the early years as a period for intervention for disadvantaged children (Heckman 2006; Sylva et al. 2004).

However, compared to social class background, attention to the educational disadvantage associated with disability has been paid much less attention, despite its clear policy relevance and the fact that disabled children are more likely to come from disadvantaged backgrounds themselves (Burchardt 2004; Parsons and Platt 2013). As Watson (2012) notes, in spite of the high proportion of children who can be defined as disabled, 'research on disabled children is still marginalised' (p.192), being restricted to specialist studies rather than mainstream research. There is, as a result, a lack of detailed, nationally representative evidence that provides understanding of the early educational development of disabled children (Powell 2003).

While, in England, school-based administrative sources provide evidence on attainment according to a widely used, but not uncontested (Keil, Miller and Cobb 2006), measure of disability as Special Educational Needs (SEN), these sources cannot disentangle the role of family context or, by definition, contextualise outcomes in relation to pre-school cognitive measures, and non-school-based measures of attainment. Thus while there is clear evidence that disabled children perform poorly at every stage of the school system (Department for Children Schools and Families 2010; Department for Education 2013), there is little systematic research that addresses disabled children's ability and performance at pre-school and in the early school years and the role of contextual influences. This is despite the fact that long-term poorer outcomes associated with childhood disability are well attested in research (Jones 2010; Loprest and Maag 2003), and early childhood represents a potentially important time to intervene to stem the pattern of cumulative disadvantage.

Alongside the relevance of a life course approach to understanding the accumulation of disability-related disadvantage (Janus 2009; Priestley 2003), a better understanding of early educational development and disadvantage of disabled children is likely to have significant payoffs in promoting interventions with long-term consequences and contributing to the evidence base for disability policy.

Policy Context

In the UK disability is defined in the Equalities Act 2010 as being long-standing and limiting normal daily activities. This definition applies to children as to adults, and allocates them 'protected status' under the Act, but there are substantial challenges in estimating the prevalence of disability and of accurately defining children as disabled in the absence of external categorisation. While the Life Opportunities Survey incorporated detailed disability-related measures and enabled a recent estimate of disability among adults aged 16 and over, the parental-reported information on children was limited to those aged 11-15.

In practice, child disability in the school-age years is largely identified through the attribution of Special Educational Needs (SEN), and child disability policy correspondingly tends to focus on SEN. Special Educational Needs (SEN) is broad term identifying children with needs that impact their learning, whether specific skills difficulties, such as dyslexia, communication problems, such as autism spectrum disorders, social-behavioural problems as Attention Deficit Hyperactivity Disorder or sensory or physical impairments. While such an equation of learning needs with disability in policy and practice is not considered unproblematic both in terms of coverage and philosophy (Keil, Miller and Cobb 2006; Keslair and McNally 2009), the overlap with disability measured according to an Equalities Act definition is acknowledged to be large (Burchardt 2004; Keil, Miller and Cobb 2006; Parsons and Platt 2013).

Successive UK Governments have pledged their support for tackling the multiple disadvantages associated with child and adult disability, but during the recent post-recession austerity measures, support services for disability groups have been particularly vulnerable to spending cuts (Duffy 2013; Kaye, Jordan and Baker 2012; Wood, Cheetham and Gregory 2012). In this light, early intervention may be particularly necessary to limit the cumulative impacts of childhood disability. At the same time, UK education policy has paid substantial attention to the challenges faced by disabled / SEN children. In 2009 the then Labour Government set out a series of major policy developments to build the 21st century school system in the Schools White Paper. Most of these, it was claimed, would 'directly benefit children with SEN and improve their prospects for good progress and achievement' (Secretary of State for Children, Schools and Families). Most recently the structure of support for children with disabilities has changed with the Children and Families Act 2014, with greater emphasis on co-ordination of support across different domains in recognition of the interplay between education and other aspects of disabled children's lives, as well as enabling support to continue up to age 25, provided children are in education.

The background to the new legislation is recognition of the poor performance of disabled children in education, with the latest available figures from the Department for Education, showing that just 23 per cent of children with SEN, compared to 68 per cent of children with no additional needs, achieved a good level of development in the Early Years Foundation Stage Profile at age 5 (DfE, 2013). In Key Stage 1 assessments there were similarly large gaps between SEN and non-SEN children, even if these appeared to have reduced over cohorts (DfE, 2013). In 2009, around the time that the children in our sample were

undertaking their KS1 tests, children identified with SEN were between seven and 15 times less likely than their peers to reach key national thresholds from early school years through to age 16 (Department for Children Schools and Families 2010).

In the context of concerns that disabled children's education and educational support does not necessarily enable them to fulfil their potential (Aron and Loprest 2012; Blatchford et al. 2011), it is important to identify both whether children do progress in school, even if they start from positions of lower cognitive skills, and how far any differences can be attributed to more challenging school or less conducive home environments. This will then indicate the direction that an inclusive approach to support may most fruitfully pursue in order to mitigate early life educational disadvantage of disabled children and its long-term consequences.

Influences on disabled children's cognitive and educational attainment.
There have been a number of factors proposed in existing literature that might help account for or moderate both disabled children's poorer initial educational starting points and lower progress rates. Family socio-economic disadvantage is an important correlate of both child disability and poorer educational outcomes. There are also three further factors which have been shown to be important for cognitive and educational development and which differ between disabled and non-disabled children: home learning environment, bullying and social-emotional-behavioural difficulties. We discuss these in turn.

Home learning environment (HLE) has been shown to play a critical role in young children's school readiness and early educational and cognitive development (Melhuish et al. 2008). While child disability may make parenting more challenging (Kelly and Barnard 2000), nevertheless, the positive effect of early home-learning environment on a child's cognitive development, can reduce at least some of the negative effect of their disability or the chances that they will be identified with SEN (Sammons et al. 2003). Longer term effects of a child's early home learning environment and the skills learnt in the first three years have also been identified (Sammons et al. 2007; Sylva et al. 2008) (Pungello, Kainz and Burchinal 2010). We explore the role of the early home-learning environment evaluated at age 3 in reducing differences at age 3 in cognitive skills between disabled and non-disabled children as well as its longer term impact in lessening gaps in progress. Key indicators of early home-learning include parent's reading to the child, teaching behaviour and early skills, encouraging literacy activities and library visits (see also de la Rochebrochard 2012; Kiernan and Huerta 2008).

School bullying is a second factor that may be impact disabled children's educational development. It is now well-attested that being a victim of bullying in school has negative consequences for subsequent educational outcomes (Eisenberg, Neumark-Sztainer and Perry 2003; Nakamoto and Schwartz 2008; Schwartz et al. 2005). While there is more limited evidence on the enhanced risks of bullying experienced by disabled children, some qualitative (e.g. Connors and Stalker 2006; Watson et al. 1999) and school-based studies (e.g. Sweeting and West 2001) have indicated an association between chronic disability and bullying victimisation. This relationship was confirmed by recent analysis of two

longitudinal, nationally representative social surveys of children living in England (Chatzitheochari, Parsons and Platt 2014), which found that disabled children and adolescents faced higher risks of being bullied even after a wide range of demographic, socio-economic and family factors were taken into account. In light of these findings, it is important to recognize that bullying may not only be a response of other children to those with lower educational attainment, but may also be implicated in the progress disabled children do or do not make over the course of their early school years.

Behaviour problems are also potentially implicated in the educational progress of disabled relative to non-disabled children. The link between behaviour problems and the definition of disability in adolescence has led (Keslair and McNally 2009) to suggest that rather than learning needs *per* se, designation with SEN may in fact represent to some degree those with behavioural problems that pose challenges to classroom teaching. If behaviour rather than learning needs is implicated in designation as SEN, then this would also help to explain why additional learning support is not necessarily as effective in improving the attainment of SEN children as might be expected (Crawford and Vignoles 2010).

However, Fauth, Parsons and Platt (2014), using the same data we use here, have shown that disabled children in England exhibit more behaviour problems during their early years. Moreover they found that disabled children exhibited a divergent trajectory from the 'average' child, showing increases over time in peer problems, hyperactivity and emotional problems, though not in conduct problems. While the authors point out that it is hard to disentangle whether the development of problems in school is a 'consequence' of disability or is implicated in designation as disabled (as has sometimes been argued), the consistency of results across different disability measures, including prospective ones, suggested that school does offer a more challenging environment for disabled children which can exacerbate their behavioural problems. Hence, in this paper we explore whether the development of behavioural problems is one part of the route by which disabled children fail to progress educationally, given the impact on academic achievement of behavioural difficulties (Gutman and Vorhaus 2012).

Overall, then, our study therefore addresses the following questions:

1. Do disabled children have significantly lower cognitive skills prior to school entry, and how far can any pre-school differences be linked to family socio-economic background and family context?
2. How do disabled children progress in cognitive ability and educational attainment on entry to school and in the early years, relative to similarly able non-disabled peers?
3. Can any differential progress be linked to differences in family background and environmental factors?

We investigate these questions and their implications using a rich source of nationally representative longitudinal data on young children, the Millennium Cohort Study, that enables us to include a full set of covariates and potential explanatory pathways for the

different trajectories of progress. We also employ multiple measures of cognitive and educational outcomes deriving from both administrative, school-based records and in-home, survey based assessments in order to test the consistency of our findings across assessments carried out in different contexts and assessing different forms of cognitive skills. We further utilise different measures of disability to evaluate the extent to which findings are sensitive to the measure used. Specifically, we identify whether we find consistent results defining disability longstanding limiting illness (LSLI), which equates to the Equalities Act definition, or as SEN, with and without a Statement of needs, to distinguish greater or lesser severity of learning needs.

Data and sample

Millennium Cohort Study

We use data from the multi-purpose longitudinal Millennium Cohort Study (MCS), a study of approximately 19,000 babies born to families living in the UK between September 2000 and January 2002, who are followed over time (Plewis 2007). We use data from the first four sweeps of data collection, when the children were aged around 9 months, 3 years, 5 years and 7 years (University of London. Institute of Education. Centre for Longitudinal Studies 2012a; 2012b; 2012c; 2012d). We draw on information from: personal interviews and self-completion questionnaires administered to parents, a postal questionnaire of teachers at age 7, direct cognitive assessments carried out with the children (from age 3) and a self-completion questionnaire completed by the child at age 7. We focus on measures of socio-demographic family characteristics; parenting; children's cognitive, social, emotional and behavioural development; and child disability. Given the differences in education systems across the UK, the sample is restricted to children living in England. Moreover in order to investigate change and to utilise measures from all four sweeps either as covariates, in the measurement of disability or as outcome measures, we restrict our sample to those who were present in all four sweeps, amounting to just over 7,300 children. When taking into account response to the key variables of interest and to our measures of disability, our analytical sample varies from around 5,900 (where we were utilising linked education data described below) to around 7,300.

Appropriate weights were used to account for non-response bias and for the complex sampling design of the survey. We investigated patterns of attrition and found no evidence for an increased risk of dropping out among disabled children and young people, which would have potentially biased the estimates presented in this paper.

National Pupil Database

The National Pupil Database (NPD) is one of the richest education datasets in the world, holding a wide range of information about pupils who attend schools and colleges in England. It forms a significant part of the evidence base for the education sector, particularly those in the state school sector, which is the vast majority of children at primary school age. During the age 7 interview, MCS parents/carers were asked for consent to link to the child's education records, and consent was obtained for 93.9% of children in England. Of these, a

successful link was achieved in 81 per cent of cases (n=6,841). In our analysis, we use linked information on Key Stage 1 performance scores in English (Reading and Writing), Maths and Science, detailed further below. Key Stage information is only available for those in state schools (around 93 per cent of children of this age). Key Stage 1 scores were therefore able to be linked for around 5,900 (or around 81%) of our longitudinal sample of children.

Variables

Disability measures

1. Long-standing limiting illness [LSLI] at 3, 5 or 7 years.

LSLI was identified based on two successive questions that first asked the parent if the child had a longstanding illness; and if so asked if that illness limited their daily activities. This measure approximates to the definition of disability as defined in relevant UK legislation. We defined a child as disabled if they had an LSLI at one or more of the occasions it was asked between age 3 and age 7. LSLI may include long-term health conditions, such as type 1 diabetes or asthma; mental health problems; and impairments, such as partial sight. Eleven per cent of children were identified as having an LSLI.

2. Special Educational Needs [SEN] (excluding 'gifted and talented') and Statement of Needs [Statement] at age 7.

We use parent report or teacher report of whether a child had SEN at age 7. SEN classifies those children requiring additional support in school with their learning. Those whose additional learning needs cannot be met within the normal school provision and resources may be assessed for a Statement, which specifies the additional resources required to support their learning. SEN may relate to learning difficulties or impairments such as hearing loss, ADHD, or dyslexia. Thirteen per cent of children were identified with SEN and an additional four per cent had a Statement of need. There is clearly a degree of overlap between the measures with around a third of those with an LSLI defined as SEN / Statement.

Cognitive skills and educational outcomes

MCS has collected a wide range of direct measures of cognitive skills since age 3. In addition, for those consenting and being educated in the state school system it has educational outcomes through linkage to the NPD, as discussed above. It should be noted that cognitive skills are not independent of learning even if they are intended to capture some element of ability. Table 1 provides an overview of all measures available for MCS children. For further details on cognitive measures included in MCS see Connelly (2013).

Table 1: Summary of cognitive and educational measures by age collected

Age 3 (sweep 2)	Age 5 (sweep 3)	Age 7 (sweep 4)
BAS II[1] Naming Vocabulary (Expressive Verbal Ability)	**BAS II Naming Vocabulary** (Expressive Verbal Ability)	**BAS II Word Reading** (Educational knowledge of reading)
Bracken School Readiness Assessment (Knowledge and understanding of basic concepts, e.g. colours, letters, numbers, shapes, etc)	**BAS II Pattern Construction** (Spatial Problem Solving)	**BAS II Pattern Construction** (Spatial Problem Solving)
	BAS II Picture Similarities (Non Verbal Reasoning)	**NFER Progress in Maths** (Mathematical skills and knowledge)
	School based education outcomes	
	Early Years Foundation Stage Profile	**Key Stage 1**

[1] British Ability Scales II (Elliott 1996). Full details of the BAS II sub-tests, their design and their theoretical basis are provided in the BAS II Technical Manual (Elliott, Smith and McCulloch 1997).

Since we are interested in pre-school outcomes and progress in the early school years (age 5 to 7), we use the two age 3 measures for assessing pre-school cognitive ability, the school-based education outcomes (and their different domains) for evaluating within-school progress. We also use BAS II Verbal Ability for assessing progress across entry to school, as it was measured at ages 3 and 5, and we use BAS II Pattern Construction, as an alternative, home-based assessment to the school-based measures for assessing progress between ages 5 and 7 to establishing whether the findings are consistent with the school-based measures. The range of measures provide an unparalleled opportunity to ascertain whether disabled children show different or consistent patterns of progress across different learning contexts and different types of cognitive and educational ability.

We go on to describe the measures used in more detail.

School based education outcomes

Early Years Foundation Stage Profile

For children in England, all teachers of primary school children record a Foundation Stage Profile (FSP) score during their first year at school (Reception class) when age 5 (Department for Education 2012). The profile describes the child's level of attainment at the end of 'early years' education and identifies their learning needs for the next stage of school, helping Year 1 teachers to plan an effective and appropriate curriculum for the child. There are 13 scales, each divided into 9 points or descriptions of attainment. Points one to eight can be achieved in any order as they are not necessarily incremental, but point nine of each of the thirteen scales can only be achieved when all the previous eight points in that scale have been achieved. The overall score is a composite of scores on the 13 separate scales, e.g. social development, emotional development, physical development, knowledge and understanding of the world. Overall scores range between 0 and 117. We also constructed separate reading and maths FSP scores. Reading scores are based on one of the 13 scales, and cover aspects such as whether the child has developed an interest in books or can recognise a few familiar words. Maths combines three scales with a score range of 0-27. It gives a profile score for mathematics including number and counting, calculating and shape, space and measures.

Key Stage 1

Key Stage 1 (KS1) tests are completed by pupils in English state-funded schools at the end of their second year of primary school (age seven). The tests are marked by the class teacher, although some papers may be sent to the local education authority (LEA) to be moderated to make sure marking is consistent. Performance is graded as W (working towards level 1), level 1, 2C, 2B, 2A, 3 or 4. Children at age seven are expected to be working at Level 2 (2C to 2A) and very few will be at Level 4, which is the level expected of an 11 year old (Key Stage 2). Performance levels are converted into points, as detailed below. Children sat KS1 tests in Reading, Writing, Maths and Science. Reading and Writing were combined to make an 'English' score. We looked at performance in English, Maths and also constructed an overall performance score by summing average point scores across the four assessments. We were therefore able to see if disability was related to progress in specific subjects or to general education achievement. The overall performance score also provided a more continuous distribution of scores, which served as an additional check that the findings in specific domains were not an artefact of the 'lumpier' distribution.

Level	W	L1	L2c	L2b	L2a	L3	L4
Points	3	9	13	15	17	21	27

Home-assessed cognitive measures

Bracken School Readiness Assessment-Revised (BSRA-R) (age 3)

This assessment is one element of the Bracken Basic Concept Scale-Revised (Bracken, 1998). The BSRA-R is used to assess the 'readiness' of a child for formal education by testing their knowledge and understanding of basic concepts. Basic concepts are defined as aspects of children's knowledge which are taught by parents and pre-school teachers to prepare a child for formal education (e.g. numbers, letters, shapes), and upon which further knowledge builds. The cohort members completed all six sub-tests. This involved: colours (the child is asked to name basic colours from a picture); numbers/counting (the child is asked to name numbers from a picture and assign a number value to a set of objects (involves counting skills and number knowledge); sizes (the child's knowledge of sizes (e.g. tall, long, big, small, thick) is assessed using a series of pictures); comparisons (ability to match and differentiate objects is assessed using pictures); and shapes (ability to identify one-dimensional (e.g. curve, angle), two-dimensional (e.g. square, triangle), and three dimensional (e.g. cube, pyramid) shapes).

British Ability Scales (BAS II)

Naming Vocabulary (age 3 and 5)

The child is shown a series of pictures and asked to say what it is, e.g. a shoe, chair or pair of scissors. There are 36 pictures in total but the number of items a child answers is dependent on their performance. They either progress to harder or easier questions and the assessment stops when they have answered a certain number of items incorrectly. Interviewers only provide neutral encouragement to a child during the task, except for the first two 'teaching'

items. Here they provide specific feedback, i.e., 'yes, that's right', etc, but also gave the correct response if the child had not answered correctly or had not understood the question.

Pattern Construction (age 5 and 7)
In this assessment, the child attempts to recreate a pattern of a design by putting together flat squares or solid cubes with black and yellow patterns on each side. Each item is timed with a stop watch and each item has a specific time limit. How the interviewer presents each pattern varies –they either show a picture, model or demonstrate a pattern to the child, and sometimes a combination of these methods. Each item is scored according to speed of response and accuracy. There are 23 items, but again the stopping point for the assessment varies on the child's performance.

Table 2 shows the raw mean scores of non-disabled and disabled children across all the different tests and at all three ages. Disabled children have lower average scores in all assessments at all three ages, with differences between groups being most marked for children identified with SEN and a Statement of Need – and particularly in school based education assessments. For example, the overall average FSP score at age 5 for children with No SEN was 91.0 compared to 59.3 for children with a Statement of Need – that is 32 points lower.

Table 2: average scores in education and cognitive tests by disability status

	No Sen	SEN	Statement	N (100%)	No LSLI	LSLI	N (100%)
FSP total (age 5) Score range: 0-117	91.0	74.4*	59.3*	*6500*	88.3	79.7*	*6526*
FSP English (age 5) Score range: 0-18	13.0	9.6*	7.6*	*6502*	12.5	11.1*	*6528*
FSP Maths (age 5) Score range: 0-54	42.5	34.8*	27.1*	*6500*	41.3	37.4*	*6526*
KS1 Total (age 7) Score range: 12-90	65.8	51.1*	39.7*	*5916*	63.4	56.1*	*5922*
KS1 English (age 7) Score range: 6-42	32.4	23.7*	17.8*	*5921*	31.0	26.9*	*5927*
KS1 Maths (age 7) Score range: 3-27	16.9	13.5*	10.7*	*5921*	16.3	14.5*	*5927*
Bracken (age 3) Score range: 0-84	27.0	19.5*	13.8*	*6537*	25.8	22.7*	*6574*
Naming Voc (age 3) Score range: 10-141	75.0	67.1*	59.0*	*6882*	73.8	69.7*	*6923*
Naming Voc (age 5) Score range: 10-170	109.9	101.7*	92.7*	*7261*	108.6	103.7*	*7304*
Pattern Con (age 5) Score range: 10-152	90.4	79.8*	66.3*	*7241*	88.6	83.3*	*7284*
Pattern Con (age 7) Score range: 10-177)	117.9	109.9*	99.7*	*7228*	116.6	111.8*	*7265*

Note: KS1 scores are not continuous
*Mean scores significantly different from non disabled groups at p<.05 level

Covariates

Home Learning Environment, Bullying and Behaviour Problems

Home learning environment (HLE) was measured using a scale utilised a scale derived from indicators collected when the child was age 3, covering parental activities with the child – reading to, teaching numbers etc. For further details see de la Rochebrochard (2012).

Bullying: the children were asked to provide information on their bullying experiences at age 7 in their self-completion questionnaire. The question "how often do other children bully you" had three response options: never, some of the time, and all of time. We compare the impact of being bullied 'some of the time' and of being bullied 'all of the time' with the reference category of 'never'.

Child behaviour was assessed at ages 3, 5 and 7 from parent report on the Strengths and Difficulties Questionnaire (SDQ). The SDQ is widely validated cross-nationally and cross-culturally for use in non-clinical settings (Goodman 1997); and includes 25 measures comprising five scales (conduct problems, peer relationship problems, hyperactivity/inattention, emotional symptoms and prosocial behaviour) each with five items. For each negative attribute, the parent is asked to say whether it is 'not true' (0), 'somewhat true' (1) or 'certainly true' (2) about their child's behaviour, with scores reversed for positive attributes. Setting aside the non-problems scale of pro-social behaviour, we created a total difficulties score from the summed scores across the four problem scales. A behaviour difference score was calculated by subtracting the score at time 1 from the score at time 2. A positive score reflects increased behaviour problems over time, while a negative score indicates reduced behavioural problems. Behaviour difference scores ranged between -24 to +20 (age 3-5) and -18 to +30 (age 5-7).

In addition to these key covariates, a range of child, family and parent-child relationship variables that have been found to be significantly associated with academic achievement, cognitive ability and/or child disability in previous research were included in analytic models.

Child characteristics

Apart from including a child's gender and ethnicity in all models, we controlled for their age in different ways, depending on the outcome measure. As children are not the exact same age when they are interviewed for MCS, for analyses with cognitive progress scores between two age points it was necessary to consider how much time had elapsed between the two interviews – essentially the difference in a child's age between sitting the test in one survey to the next. For school assessed education outcomes, which are assessed at the end of the academic year, we included season born to take account of the age of the child relative to other children when they were being assessed. This was also included in the cognitive measures models.

Family background characteristics

A family's socio-economic situation was captured in three ways: parental education, income poverty and lone parenthood. Parental education was based on the highest qualification held

by a parent living in the household when the child was 9 months old (sweep one). Qualifications were grouped according to the national qualification framework levels[i], and were rated on 5-point scale, ranging from no qualifications to level 4 or 5, which equates to having a first degree or higher. Income poverty was measured as the number of sweeps (0-3 for outcomes at sweep 3, age 5, or 0-4 for outcomes at sweep 4, age 7) that the family's household income was less than 60 per cent that of adjusted median household income. Similarly, lone parenthood was captured as the number of sweeps (0-3 or 0-4) that the child was living in a lone parent household. Status at sweep 1 (9 months) was used when initially looking at cognitive performance at age three.

Analytical approach

For the measurement of cognitive development at age 3, we estimated ordinary least squares (OLS) models and regressed cognitive score on each of our disability measures and then added the full set of covariates, to provide unadjusted and adjusted estimates of the differences between disabled and non-disabled children in their early cognitive attainment. We then explored the contribution of HLE, bullying and change in behavioural problems to change in the disability coefficients.

To evaluate relative progress among disabled children required rather more careful consideration. The appropriate measurement of change in cognitive development is not straightforward. Where a common measurement is used at two time-points, a typical approach is to control for the first measure in exploring associations with the second measure (lagged dependent variable approach). See, for example, Keslair and McNally (2009) or Sullivan, Ketende and Joshi (2013). However, this approach by construction assumes that different groups have common starting points, and hence is driven by differences at the second time point (Allison 1990). Such assumptions of a common initial position may be implausible – as they are in this case for disabled children compared to non-disabled children who both start and end with lower average scores – and can lead to the identification of differences between groups when the average gap over time has in fact remained constant (Lord's paradox). In such circumstances measuring the change in scores between the two time points potentially offers an intrinsically simple measure of whether progress is comparable across non-disabled and disabled children, which can be extended to a multivariate context where the change is the dependent variable. But change scores also have their limitations, however, particularly when the measurement at the second time point may be causally linked to that at the first (Allison 1990). There is also the issue of 'regression to the mean'. For example, if disabled children have particularly low scores at the first time point, then they are more likely to experience positive change over time.[ii]

Since this issue of greater progress among those with low initial scores will tend to be the case for all those at the bottom of the distribution at the initial measurement point, we adopt an alternative approach that captures the progress made by a child at the second time point relative to those who had a similar initial score – essentially a 'value added' score. A positive value added score then represents higher performance relative to their peer group and a

negative value added score represents lower progress relative to the initial peer group. While the raw scores at each time point show that disabled children have consistently lower scores than other children, and their scores are concentrated towards the bottom of the distribution, the value added measure identifies, importantly, if disabled children are making progress relative to other children who started off with scores within a comparable (typically comparably low) narrow range.

Value added scores are used to evaluate the success or quality of schools in league tables, since they are not contingent on the starting performance of the intake of children, but, rather, are able demonstrate how schools with relatively poor performing intakes are – or are not – successful in improving their performance (Leckie and Goldstein 2009). Hence our measure maps onto that used for judging progress at the aggregate, policy level. The further advantage of value added scores is that they are not contingent on having precisely the same measure at both time points.

Even given these advantages in using value added scores, particularly where we are dealing with comparisons across populations with very different distributions of scores, they may still have limitations in the extent to which they are able to address differential regression to the mean between non-disabled and disabled children due to differences in underlying variances. We therefore employ a suite of robustness checks (detailed further below) to address these potential issues.

In this analysis we define the peer group for the purposes of calculating value added scores as being in the same 10 per cent of the distribution at the earlier time point. That is Foundation Stage Profile, age 5, for our school based assessments of in-school progress, and Pattern Construction, age 5, for our cognitive measure of early school progress, and Naming Vocabulary, age 3 for our cognitive measure of school entry transition. The use of 10ths of the distribution further reduces error introduced by random variation.

For each of the progress measures we carried out the following steps:

1. cohort members were split into 10 groups based on their score in the earlier (age 3/5) measures (time 1)
2. the average score in the later (age 5/7) measure was calculated for each of the ten age 3/5 groups (time 2)
3. the average achieved at time 2 for those in the same time 1 group (tenth of the distribution) was subtracted from each cohort members achieved score at time 2 on the relevant measure

A score at or near zero indicates the child made the ‘to be expected’ progress between the two ‘assessments’ for their group; a positive score indicates more progress was made than expected; a negative score indicates that less progress was made than was expected. Table 3 summarises all measures included in the value added analysis.

Table 3: Cognitive / educational measures used for value added analysis

Measures at age 5	**Measures at age 7**
FSP overall score	KS1 overall score
FSP reading and writing	KS1 reading and writing
FSP maths, numbers etc.	KS1 maths
BAS II Pattern Construction	BAS II Pattern Construction
Measure age 3	**Measure age 5**
BAS II Naming Vocabulary	BAS II Naming Vocabulary

Once we have estimated the value added progress scores we can then regress them on each of the disability measures and the full set of covariates in an OLS model.

Hence, in line with our three research questions, our analysis proceeds in three stages. We investigate the cognitive performance of disabled children at age 3, pre-school, compared to non-disabled children and identify if any original differences remain once we control for child characteristics, family socio-economic circumstances and HLE. (Question 1)

We then estimate differences in progress across disabled compared to no disabled children both from age 3 to 5 (using a single cognitive measure) and between ages 5 and 7, using both school and home-based assessments, as described above. We can thus identify whether the value added or progress of disabled children is greater, lower or equivalent to that of their non-disabled peers. (Question 2).

We then explore the extent to which differences in progress can be identified as being driven by family background and home and school contextual effects, with a specific focus on our three potential pathways of home learning environment, bullying victimisation and behavioural problems. (Question 3).

We additionally subject the analysis in questions 2 and 3 to a series of robustness checks, detailed below.

All analysis accounts for the complex survey design of MCS and survey non-response using appropriate weights. The analysis was conducted in Stata 13.1.

Robustness checks

We carried out a number of robustness checks to verify that our results were not driven by the different distribution of cognitive skills and educational attainment of disabled compared to non-disabled children. First, given the sparse number of 'high-attaining' disabled children at the earlier time point for each of our progress measures, to check that the results were not driven by outlying values for these children, we carried out the value added analysis just for those in the lower eight tenths of the distribution. Part of the reason why these 'high attaining' values could represent outliers would be if they were measured with more error for

disabled children (cf. Jerrim and Vignoles 2013). Our results were robust to this alternative specification.

Similarly, it could be argued that the differential value added score for disabled and non-disabled children represents regression to the mean from the bottom of the distribution. That is, it could be argued that the non-disabled children who are accorded a lower value at the first time point are measured with more error than the disabled children, because of differences in the underlying variance of their scores at this point. For this reason, we carried out a series of further checks to test the robustness of our results to potential assumptions about the differential distribution of error.

We averaged attainment over standardised performance in an assessment at age 3 (Bracken School Readiness Assessment) and age 5 (Foundation Stage Profile), and then used this average value as the basis of estimating the value-added to Key Stage 1 performance, hence reducing measurement error through an average calculated from different time points. Our results were robust to this alternative specification.

Then we used children's performance at age 3 in the Bracken School Readiness Assessment (percentile scores) to estimate their age 5 FSP performance. We then used these estimates, based on the overall relationship between performance at age 3 and age 5 across children, instead of their actual age 5 scores, as the basis of calculating value added by age 7. Since these are model estimates they exclude random variation, and they take account of the relationship between the two earlier time points. Again, our results were robust to this alternative specification.

Finally, given the heterogeneity among those with SEN, and the critiques that this may disguise the experience of those with particular types of disability (Keil, Miller and Cobb 2006), where numbers permitted, we estimated the models for individual types of SEN (e.g. behaviour problems, ADHD, speech difficulties, etc.) rather than the aggregate category. Once again, the findings were consistent with the main analysis presented.

Results

Question 1: Pre-school cognitive ability and disability, and the role of family background

As we saw in Table 3, disabled children did have significantly lower cognitive scores at age 3 on both the Bracken test and on the Naming Vocabulary assessment. This was the case for both disability measures as well as across the different tests, though the gaps were particularly high for those children with a Statement of Needs (around 13 points lower on the Bracken assessment and 16 points lower on the Naming Vocabulary assessment. Hence disabled children are liable to be entering school from a position of disadvantage.

This raises the question as to how far these differences are linked to differences in family socio-economic background and home context. If these factors are significantly related to the scores it may have particular implications for disability policy and family support.

Table 4 summarises the coefficients for the cognitive scores at age 3 for BAS II Naming Vocabulary and Bracken School Readiness for the different definitions of disability and from a model estimated with the full set of covariates. All measures included in the model – with the exception of family type (lone parent or two parent family) – were significantly associated with early cognitive performance, and the resulting R^2 value shows that all the measures in the model managed to explain over one-fifth of the variance between children in the age 3 scores. (Full results are provided in Table A1 in the Appendix.)

Table 4: Summary Of Results: coefficients from OLS of Naming Vocabulary and School readiness on disability status –adjusted for child and parental characteristics

	Naming Vocabulary		**School Readiness**	
	Unadjusted	Adjusted	Unadjusted	Adjusted
No SEN	0	0	0	0
SEN	-.16** (0.60)	-.12** (0.60)	-.16** (0.60)	-.14** (0.57)
Statement	-.18** (1.34)	-.12** (1.42)	-.18** (1.34)	-.14** (1.29)
R^2	.05	.25	.05	.27
N	*6409*	*6409*	*5984*	*5984*
No LSLI	0	0	0	0
LSLI	-.08** (0.84)	-.05** (0.76)	-.08** (0.79)	-.05** (0.70)
R^2	.01	.22	.01	.23
N	*6445*	*6445*	*6017*	*6017*

Standardized beta coefficients; Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$

Nevertheless, the cognitive performance of disabled children was still significantly lower than that of other children even after taking into account their socio-demographic characteristics and HLE. Indeed the adjusted estimates were not substantially different from the unadjusted estimates, indicating that it is not differences in family and background characteristics that are driving the lower cognitive abilities of disabled children before they start school.

Questions 2: Progress in the early school years

We know from this that disabled children approach school entry with poorer cognitive skills than their non-disabled counterparts, even after controlling for other child characteristics and family socio-economic circumstances. We now turn to the progress they make between age 3 and 5, age 5 and 7. Table 5 shows the average value added scores for school based Key Stage 1 scores achieved at age 7 and cognitive measures at age 5 (naming vocabulary) and age 7 (pattern construction), broken down by disability status. It clearly indicates that disabled children make less cognitive progress as they enter school, than their non-disabled peers with similar scores at age 3 (naming vocabulary results).

They continue to make lower progress than their non-disabled peers between the ages of 5 to 7 (all other measures) than non-disabled children who achieved similar scores as them at age 5. There is no evidence therefore of delayed progress or 'catching up' relative to other 'late developers'. This is the case for children with SEN, a Statement or LSLI across all types of

assessment, though it is particularly marked for children with a Statement at age 7. This indicates that these children who receive a Statement are not only those who are low attaining but those who are making lower relative progress over time. What is perhaps most striking though is the consistency of results across SEN and LSLI for all the measures.

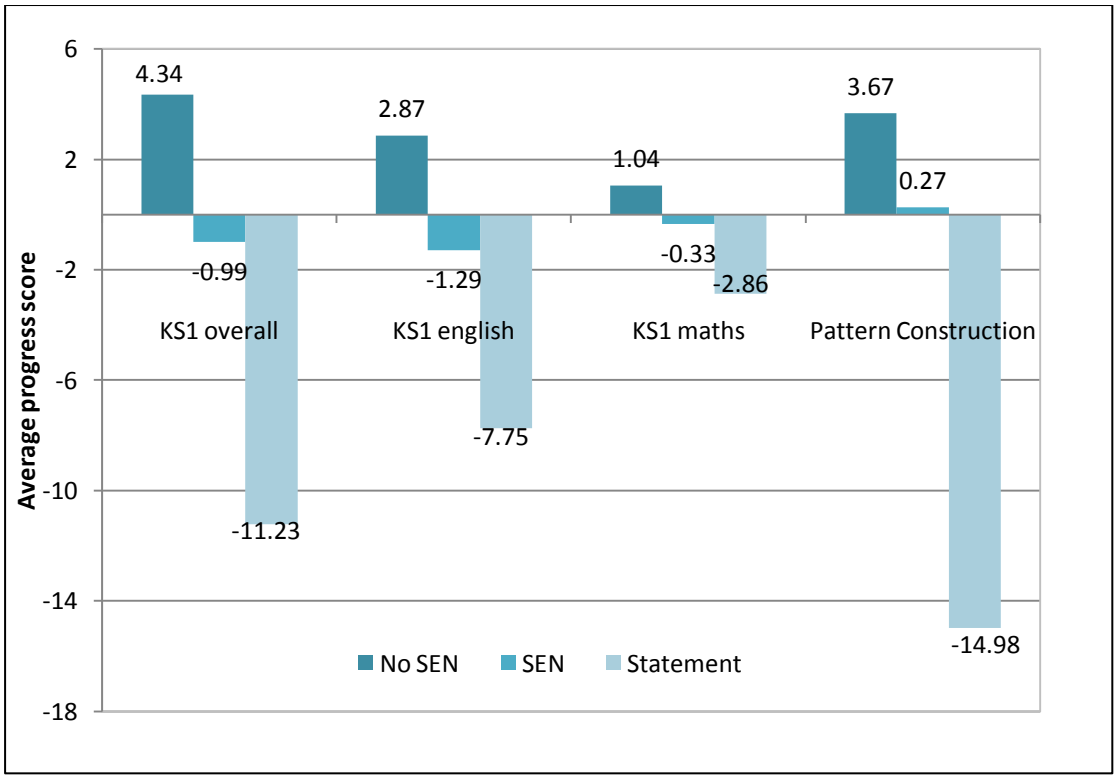
Table 5: Average 'progress' (value added) scores by disability status

	Key Stage 1 measures			MCS measures	
	Overall	**English**	**Maths**	**Naming Vocabulary**	**Pattern Construction**
No SEN	1.00	0.64	0.25	0.89	0.68
SEN	-4.68*	-2.86*	-1.13*	-3.46*	-1.50*
Statement	-10.06*	-6.27*	-2.48*	-5.98*	-6.52*
No LSLI	0.04	0.05	0.02	0.30	0.36
LSLI	-2.53*	-1.73*	-0.68*	-2.05*	-1.90*

*Mean scores significantly different from non disabled groups at p<.05 level

We found that this picture essentially holds for children across all 10 decile groups, even if small numbers of children with disabilities in the upper decile groups limit robust within-group analysis. Difference in progress between groups is, nevertheless, most extreme for children at the lower end of the distribution at the first time-point – which is where the majority of children with disabilities are clustered, particularly those with a Statement. Figure 1 illustrates this by showing the average 'value added' scores at age 7 for children in the bottom 10 percent group by SEN status.

Figure 1: Average progress scores at age 7 for children with scores in the bottom 10 percent at age 5 by SEN status



Question 3: How far do family and environmental factors account for differences in progress among disabled children?

This finding was further reinforced when value added scores were regressed simply on disability status, as shown in the Unadjusted (unadj) columns in Table 6.

Table 6: Coefficients from OLS of Value added scores on disability status – unadjusted and adjusted for child and family characteristics

	Key Stage 1 measures						**MCS measures**			
	Overall		**English**		**Maths**		**Pattern Const**		**Naming Voc**	
	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj	Unadj	Adj
No SEN	0	0	0	0	0	0	0	0	0	0
SEN	-.19**	-.17**	-.21**	-.18**	-.17**	-.15**	-.05**	-.04**	-.12**	-.09**
Statement	-.19**	-.16**	-.21**	-.18**	-.15**	-.14**	-.06**	-.05*	-.09**	-.07**
R^2	.07	.10	.08	.11	.05	.09	.01	.04	.02	.12
N	*5018*		*5021*		*5019*		*6319*		*6213*	
No LSLI	0	0	0	0	0	0	0	0	0	0
LSLI	-.05**	-.04*	-.07**	-.05**	-.05**	-.04*	-.04**	-.03*	-.06**	-.05**
R^2	.00	.06	.01	.06	.01	.06	.00	.04	.00	.11
N	*5021*		*5024*		*5022*		*6334*		*6246*	

Controls: Season born, gender, ethnicity, SDQ difference score [age7-5 or age5-3], bullying, home learning environment, parent highest qualification, number of times low income, number of times lone parent. Age difference between sweeps additionally included for MCS cognitive tests. Bullying victimisation was not included in Naming Vocabulary model as it was measured at age 7.

Moreover, we see from the adjusted (adj) columns in Table 6 that these differences are only partially attenuated when controlling for socio-economic background and key parental and child characteristics for children with SEN, a Statement of Need or LSLI. This indicates that the potential environment mediators that we posited are not strongly implicated in disabled children's failure to make as much progress as their ability peer group, while from the R2 values we see that they only contribute a small additional amount to explaining the variance in progress scores.

Nevertheless it is still worth inspecting whether they do contribute to progress across the full range of abilities represented in the data. Table 7 shows that when included in the fully adjusted models for the age 5-7 progress measures, children's change in behavioural problems, experience of bullying and quality of their home learning environment are all significantly associated with value added progress. (See Tables A2 and A3 in the Appendix for full results).

Reduced behaviour problems and a positive home learning environment tend to help children make positive progress. Similarly, being bullied "all of the time" has a negative association with children's progress across the measures. While we cannot be certain about the direction of effects, since this relationship is across the distribution of starting scores, it seems more

plausible that bullying impacts progress than that a reduction in progress leads to victimisation. A positive home learning environment also helped a child make positive value added progress in Naming Vocabulary at age 5. Interestingly there was no significant contribution of reduced behaviour difficulties to progress made in the cognitive assessments carried out at home, whereas it was significantly related to progress made at school between age five and age 7 across all disability groups. This may possibly indicate that the context matters for the evaluation of performance: a one-to-one assessment in the home may be less susceptible to a child's behaviour (and deterioration in that behaviour over time) than a school-based assessment.

Table 7: Summary of value-added score results (5&7): contribution of environmental mediators

	FSP to KS1						**Cognitive**	
	Overall		**English**		**Maths**		**Pattern con**	
	SEN	LSLI	SEN	LSLI	SEN	LSLI	SEN	LSLI
SDQ	-.08** (.04)	-.10** (.04)	-.08** (.02)	-.10** (.03)	-.07** (.01)	-.09** (.01)	-.00 (.04)	-.01 (.04)
HLE	.04* (.02)	.06** (.02)	.02 (.01)	.05** (.01)	.04* (.01)	.05** (.01)	.03 (.02)	.03* (.02)
SB	-.00 (.32)	-.00 (.33)	-.00 (.17)	-.01 (.18)	-.01 (.09)	-.01 (.10)	.01 (.38)	.01 (.38)
AB	-.03* (.60)	-.05** (.60)	-.03 (.39)	-.06** (.41)	-.06** (.17)	-.08** (.17)	-.03 (.73)	-.04* (.72)

Standadised Beta coefficients, standard errors in parentheses
Note: SDQ= SDQ difference score; HLE= Home Learning Environment; SB/AB=Sometimes/Always Bullied.

Nevertheless, despite the importance of these factors in shaping patterns of progress in general, as we saw in Table 6, they did little to reduce the association of disability with lower valued added scores. Thus, although disabled children are more likely to face a poorer HLE, more bullying and increase their behavioural problems over time, these factors do not 'explain' their lower than expected progress through their schooling.

Before reflecting further on these findings, for completeness we briefly summarise the other characteristics that were associated with enhanced or suppressed progress. (See further, appendix Tables A2 and A3.) First, the analysis supports the ongoing relevance of parental background, not only to initial attainment, but also to progress. Thus the models show that parental highest qualification level was significantly associated with children's value added progress, as was income poverty. Essentially, children who experienced less income poverty made more value added progress whereas children with parents whose highest qualification was below a degree made significantly less value added progress. Lone parenthood, however, had no significant independent impact on value added progress.

In relation to other characteristics, boys made significantly more progress than girls in overall and maths KS1 scores and in the two cognitive assessments; while girls made more progress in KS1 English. Indian children and children from other minority ethnic groups made more

progress compared to their White peers in all three KS1 assessments, whereas Black African or Black British children made significantly less progress in both Naming Vocabulary and Pattern Construction scores. Pakistani and Bangladeshi children also made significantly less progress in the Naming Vocabulary assessment. The bigger the gap between the two time points when sitting the tests the more progress or 'catching up' was made by children in Naming Vocabulary and Pattern Construction, while being a younger member of the class negatively influenced the progress made by children in relation to their equally able peers in KS1 Maths, but not KS1 English or KS1 Overall.

Conclusions

In this analysis we showed that disabled children started out with pre-school levels of cognitive ability that were lower than their disabled peers. We also showed that on entry to school, while we would not claim they made no progress, they made tangibly less progress both between age 3 and 5 and between age 5 and 7 than their non-disabled peers with the same starting scores. Thus while non-disabled 'late developers' may have caught up to some degree with their higher scoring peers, disabled children appeared to fall further at both stages.

Our results are consistent with those found by the Department for Children Families and Schools (2010) for the period in children's school lives following our analysis (i.e. from age 7 to 11). This report found that, while the gaps in progress were less than the gaps in attainment, nevertheless, children with SEN made less progress than other children who started out with scores similar to theirs. Hence, there is little evidence that periods of poor progress are compensated by some catching up, or that school intervention for learning support needs is able to equalise performance among children facing different sorts of challenges.

The comparison is also instructive since, despite the much richer nature of our data in terms of the possible influences and mechanisms, we were able to consider, we have not been able to identify any clear contextual factors that might lead to account for the reduced levels of progress of disabled children over time. While socio-economic background, home learning environment, bullying and worsening behavioural problems all impacted on children's progress in general, they were not specifically able to account for the relative lack of progress made by disabled children.

Work in schools to address bullying and behaviour is thus likely to pay dividends in terms of overall performance but not to reduce the gap between disabled and non-disabled children specifically. Nevertheless, increased awareness of the bullying and victimisation of pupils, particularly during the 'non-teaching' part of the school day when children with characteristics vulnerable to bullying may be particularly beneficial for disabled children.

Home-learning environment also only played a limited role in accounting for disabled children's lower cognitive scores pre-school and their lower rates of progress within school. This is an important result, suggesting that disability is associated with negative outcomes

independently of what parents do to construct a positive home-learning environment. Nevertheless, since home learning environment is beneficial for educational development (Dearden, Sibieta and Sylva 2011; Waldfogel and Washbrook 2011) and, as we have shown, for progress, disabled children may have more to gain from support for parental investment in children's learning in the early years to help give them a better starting point on entry to school.

By controlling for behavioural problems in the models, the results also suggest that identification as SEN / Statement is not primarily about behavioural problems as has sometimes been implied (Keslair and McNally 2009). Instead, SEN, and especially Statement seems to be capturing quite effectively those with the greatest problems in making progress. To some degree this is an endorsement as it suggests those children with the greatest challenges in developing educationally and cognitively are the most likely to be identified as needing learning support. On the other hand, the fact that poorer progress repeats across different stages of the children's lives, suggests that there may be further to go in supporting disabled children's educational development and mitigating their disadvantage. If this can be done it is likely to have long-term benefits for the children concerned.

Furthermore, we have shown that the results are not simply a function of the labelling of disabled children as SEN, and the potential circularity in identifying children as poorer performers who have already been singled out for their learning needs at the time their progress is being measured, since we have also shown that the findings are consistent if we use a definition of disability deriving from Equalities legislation rather than one based specifically on learning needs. This suggests there is all the more reason to focus on strategies maximising disabled children's educational development, whether or not they are identified with SEN.

The findings suggest that may be need for an increased understanding of the way children identified with SEN or with an LSLI are offered support in school and how this impacts on their educational progress. As has been suggested by the bullying literature, children seen as different tend not to be as socially integrated in peer groups (Sweeting and West 2001), which can impact on a child's enjoyment of school, their self-esteem and ultimately their ability to learn. Squaring the circle of providing adequate support, while not distancing children from their wider peer group is a recognised challenge, but one that is clearly worth continuing to engage with.

Finally, we should also note that the R^2s even in the final models typically remain small (of the order of 4-11 per cent). That is, most of the variation between children is child-specific and we can only account for a small amount by the host of relevant covariates we include. Thus the relationship between disability and progress, even if relatively strong and statistically significant is far from being deterministic. This suggests that it will be worth exploring further the circumstances under which disabled children (whether or not they are identified as SEN) do learn and make progress. In the context of the new legislation and

proposals for a more joined up approach, we can hope that this may facilitate new opportunities for supporting the progress of disabled children more generally.

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Endnotes

[i] http://www.educationforhealth.org/data/files/qca_framework.pdf

[ii] Additional analysis, not shown, does indeed demonstrate that typically those with lower scores at time T, tend to make more progress by time T+1 than those with higher scores at time T.

Appendix

Table A1: cognitive ability at age 3: final models

	Bracken School Readiness		BAS II Naming Vocabulary	
	SEN	**LSLI**	**SEN**	**LSLI**
Disability status (ref cat: none)				
SEN / LSLI	-0.142**	-0.047**	-0.118**	-0.046**
	(0.573)	(0.698)	(0.596)	(0.759)
Statement of Need	-0.140**		-0.121**	
	(1.294)		(1.416)	
Child characteristics				
Age S2	0.055**	0.053**	0.180**	0.179**
	(1.034)	(1.066)	(1.050)	(1.087)
Gender (ref cat: boy)				
Girl	0.043**	0.062**	0.074**	0.089**
	(0.395)	(0.404)	(0.379)	(0.375)
Ethnicity (ref=White)				
Mixed	-0.004	-0.002	-0.026*	-0.026*
	(1.144)	(1.172)	(1.133)	(1.120)
Indian	-0.024*	-0.019	-0.096**	-0.090**
	(1.425)	(1.456)	(1.811)	(1.859)
Pakistani/Bangladeshi	-0.097**	-0.086**	-0.186**	-0.179**
	(1.179)	(1.137)	(1.581)	(1.466)
Black/Black British	-0.071**	-0.068**	-0.083**	-0.083**
	(1.171)	(1.349)	(0.959)	(1.000)
Other	-0.008	-0.005	-0.076**	-0.075**
	(2.865)	(2.505)	(3.496)	(3.161)
Family background characteristics				
Parent highest qual S1 (ref cat: Level 4)				
Level 3	-0.105**	-0.109**	-0.071**	-0.074**
	(0.687)	(0.701)	(0.614)	(0.627)
Level 2	-0.162**	-0.167**	-0.098**	-0.103**
	(0.552)	(0.574)	(0.575)	(0.584)
Level 1	-0.115**	-0.118**	-0.082**	-0.084**
	(1.061)	(1.089)	(1.041)	(0.996)
None	-0.128**	-0.140**	-0.122**	-0.127**
	(1.010)	(0.970)	(1.016)	(1.035)
Family status S1 (ref cat: two parents)				
Lone Parent	-0.016	-0.009	0.003	0.012
	(0.714)	(0.693)	(0.727)	(0.748)
Income Poverty S1 (ref cat: No)				
Yes	-0.114**	-0.133**	-0.092**	-0.110**
	(0.588)	(0.580)	(0.601)	(0.601)
Family and environmental context				
Home Learning environment S2	0.153**	0.167**	0.111**	0.125**
	(0.031)	(0.031)	(0.032)	(0.032)
Total SDQ score S2	-0.139**	-0.160**	-0.117**	-0.134**
	(0.041)	(0.042)	(0.046)	(0.046)
R^2	0.265	0.233	0.246	0.224
N	5984	6017	6409	6445

Standardized beta coefficients; Standard errors in parentheses.
* $p < 0.05$, ** $p < 0.01$

Table A2: Value added progress in MCS cognitive assessments

	Naming Vocabulary (age 5)		Pattern Construction (age 7)	
	SEN	**LSLI**	**SEN**	**LSLI**
Disability status (ref cat: none)				
SEN / LSLI	-0.091**	-0.046**	-0.040**	-0.031*
	(0.617)	(0.593)	(0.530)	(0.576)
Statement of Need	-0.066**		-0.054**	
	(1.036)		(1.533)	
Child characteristics				
Age difference (S3-S2)	0.235**	0.233**	0.103**	0.102**
	(0.838)	(0.837)	(1.175)	(1.174)
Season born (ref cat: Autumn)				
Winter	-0.029	-0.034	-0.001	-0.002
	(0.493)	(0.502)	(0.453)	(0.456)
Spring	-0.020	-0.026	-0.025	-0.028
	(0.478)	(0.487)	(0.455)	(0.455)
Summer	-0.010	-0.021	-0.008	-0.011
	(0.648)	(0.670)	(0.502)	(0.513)
Gender: Boy v Girl	-0.053**	-0.042**	-0.054**	-0.048**
	(0.359)	(0.354)	(0.353)	(0.352)
Ethnicity (ref=White)				
Mixed	-0.005	-0.005	-0.022	-0.020
	(1.016)	(1.005)	(1.093)	(1.086)
Indian	-0.013	-0.009	-0.014	-0.013
	(1.076)	(1.165)	(1.046)	(1.020)
Pakistani/Bangladeshi	-0.041**	-0.036**	-0.029	-0.026
	(0.992)	(1.023)	(1.110)	(1.142)
Black/Black British	-0.046**	-0.044**	-0.043**	-0.042**
	(0.935)	(0.896)	(1.139)	(1.132)
Other	-0.006	-0.007	0.011	0.011
	(2.413)	(2.344)	(1.664)	(1.603)
Family background characteristics				
Parent highest qual S1 (ref cat: NVQ4/5)				
NVQ3	-0.073**	-0.075**	-0.049**	-0.051**
	(0.504)	(0.511)	(0.470)	(0.468)
NVQ2	-0.098**	-0.102**	-0.082**	-0.084**
	(0.428)	(0.438)	(0.436)	(0.435)
NVQ1	-0.046**	-0.050**	-0.068**	-0.069**
	(0.772)	(0.787)	(0.819)	(0.812)
None	-0.086**	-0.089**	-0.062**	-0.065**
	(0.792)	(0.808)	(0.797)	(0.791)
No. of times lone parent (S1-S3/S4)	-0.008	-0.007	-0.017	-0.014
	(0.217)	(0.218)	(0.174)	(0.177)
No. of times income poverty (S1-S3/S4)	-0.034	-0.047*	-0.029	-0.036
	(0.219)	(0.216)	(0.167)	(0.165)
Family and environmental context				
SDQ difference score (S4/3-S3/2))	-0.017	-0.024	-0.003	-0.008
	(0.038)	(0.038)	(0.040)	(0.040)
Home Learning environment S2	0.048**	0.059**	0.025	0.032*
	(0.022)	(0.023)	(0.023)	(0.023)
Ever bullied (S4) Never v Sometimes			0.012	0.012
			(0.381)	(0.378)
Never v All the time			-0.030	-0.035*
			(0.728)	(0.723)
N	6213	6246	6319	6334
R^2	0.115	0.107	0.044	0.041

Standardized beta coefficients; Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$

Table A3: Value added progress in Key Stage 1 assessments

	KS1 Overall		KS1 English		KS1 Maths	
	SEN	**LSLI**	**SEN**	**LSLI**	**SEN**	**LSLI**
Disability status (ref cat: none)						
SEN / LSLI	-0.165**	-0.035*	-0.181**	-0.050**	-0.146**	-0.038*
	(0.500)	(0.550)	(0.277)	(0.309)	(0.143)	(0.152)
Statement of Need	-0.164**		-0.183**		-0.139**	
	(1.111)		(0.576)		(0.326)	
Child characteristics						
Season born (ref cat: Autumn)						
Winter	-0.007	-0.014	0.016	0.008	-0.042*	-0.049**
	(0.437)	(0.428)	(0.247)	(0.243)	(0.117)	(0.114)
Spring	-0.004	-0.016	0.032	0.018	-0.037*	-0.046*
	(0.450)	(0.482)	(0.249)	(0.266)	(0.120)	(0.126)
Summer	-0.007	-0.021	0.035	0.019	-0.054**	-0.067**
	(0.437)	(0.470)	(0.252)	(0.270)	(0.115)	(0.121)
Gender: Boy v Girl	-0.036*	-0.014	0.041*	0.065**	-0.091**	-0.073**
	(0.328)	(0.340)	(0.191)	(0.194)	(0.085)	(0.088)
Ethnicity (ref=White)						
Mixed	0.021	0.023	0.024	0.026	0.006	0.008
	(0.855)	(0.883)	(0.419)	(0.443)	(0.244)	(0.252)
Indian	0.019	0.024*	0.012	0.019	0.035**	0.040**
	(0.807)	(0.881)	(0.453)	(0.473)	(0.250)	(0.269)
Pakistani/Bangladeshi	0.012	0.024	0.012	0.025	-0.011	-0.001
	(1.000)	(1.066)	(0.504)	(0.542)	(0.255)	(0.274)
Black/Black British	-0.028	-0.027	-0.013	-0.012	-0.027	-0.026
	(1.145)	(1.132)	(0.644)	(0.635)	(0.280)	(0.281)
Other	0.042*	0.042**	0.041*	0.042*	0.038*	0.039**
	(1.723)	(1.482)	(1.091)	(0.974)	(0.436)	(0.372)
Family background characteristics						
Parent highest qual S1 (ref cat: Level 4)						
Level 3	-0.075**	-0.078**	-0.050*	-0.054*	-0.065**	-0.067**
	(0.496)	(0.516)	(0.297)	(0.314)	(0.123)	(0.128)
Level 2	-0.107**	-0.115**	-0.087**	-0.096**	-0.074**	-0.080**
	(0.409)	(0.438)	(0.226)	(0.246)	(0.110)	(0.116)
Level 1	-0.069**	-0.080**	-0.053**	-0.066**	-0.063**	-0.072**
	(0.786)	(0.824)	(0.437)	(0.458)	(0.205)	(0.214)
None	-0.051*	-0.063**	-0.049*	-0.063**	-0.020	-0.030
	(0.743)	(0.735)	(0.430)	(0.433)	(0.199)	(0.197)
No. of times lone parent (S1-S3/S4)	-0.006	0.003	0.002	0.012	-0.029	-0.020
	(0.169)	(0.163)	(0.088)	(0.085)	(0.044)	(0.043)
No. of times income poverty (S1-S3/S4)	-0.053*	-0.080**	-0.065**	-0.094**	-0.036	-0.060**
	(0.156)	(0.157)	(0.090)	(0.092)	(0.041)	(0.040)
Family and environmental context						
SDQ difference score (S4/3-S3/2))	-0.080**	-0.098**	-0.081**	-0.100**	-0.069**	-0.085**
	(0.042)	(0.043)	(0.024)	(0.025)	(0.011)	(0.012)
Home Learning environment S2	0.039*	0.059**	0.022	0.046**	0.036*	0.053**
	(0.021)	(0.021)	(0.012)	(0.012)	(0.006)	(0.006)
Ever bullied (S4) Never v Sometimes	-0.003	-0.006	-0.003	-0.005	-0.008	-0.012
	(0.321)	(0.334)	(0.170)	(0.180)	(0.091)	(0.095)
Never v All the time	-0.034*	-0.054**	-0.034	-0.055**	-0.059**	-0.076**
	(0.599)	(0.602)	(0.394)	(0.405)	(0.170)	(0.167)
R^2	0.104	0.058	0.114	0.060	0.089	0.056
N	5018	5021	5021	5024	5019	5022

Standardized beta coefficients; Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$