

Special Educational Needs at Age 10 Assessed by Teachers: A Longitudinal Investigation of the Influence of Child, Family, Home Factors and Pre-school Education on the Identification of SEN

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Abstract

The early identification of young children's special educational needs (SEN) as well as the development of specific strategies to support those children identified with special needs are increasingly recognised as crucial to facilitating good adjustment to school and to ensuring that such children are helped to reach their full potential in education.

Using a large national sample of young children in England whose developmental progress was followed up from pre-school this study investigates which child, family, home and pre-school factors can be viewed as risk or protective factors for later SEN-status at age 10. The experience of high quality pre-school education is shown to reduce the likelihood of a child being identified as experiencing SEN in the long run. Teachers' assessments of SEN are found to be strongly related to children's reading and mathematics attainment, but other factors also predict SEN including a child's age within a year group.

Theoretical Background and Objectives

This paper investigates children identified as showing *special educational needs* (SEN) in England and explores the factors that help predict SEN status at age 10 drawing on a large data set collected as part of a major longitudinal study of pre-school and primary school influences on children's developmental outcomes (Sammons et al. 2004, 2005; Sylva et al. 2008, 2010). The paper examines current definitions of SEN and seeks to identify both 'risk' and 'protective' factors that influence the likelihood of later identification in primary school.

In England, the term SEN is defined by policy makers to refer to children who "have a learning difficulty which calls for special educational provision to be made for them" (Department for Education and Skills [DfES], 2001). Children are seen to have learning difficulties if they (1) have a significantly greater difficulty learning than the majority of children of the same age or (2) have a disability which prevents or hinders them from making use of educational facilities of a kind generally provided for children of the same age in schools within the area of the local education authority or (3) are under compulsory school age and fall within the definitions above or would do so if special educational provision was not made for them. English as an additional language, giftedness and high ability are not included within the definition of SEN. More than thirty years ago, the Warnock-Report (Department of Education and Science [DES], 1978) suggested that about 20% of children would at some stage in their school career experience special needs of some kind, acknowledging the fluid nature of SEN for many children who might move into or out of SEN status during their time in school. There has been much debate about this figure, which was largely based on teachers' estimates, and drew in particular on seminal research in the Isle of Wight Study (Rutter, Tizard, & Whitmore, 1970), but it still reflects current levels on SEN identification in England.

Croll and Moses (2003) conducted two survey studies of schools and teachers in 1981 and in 1998, which give a detailed picture of changes over nearly two decades with regard to the identification and definition of SEN in England. Two central findings were the high proportion of teachers who believed that special educational needs were fairly widespread among children in mainstream schools and an increase in their reported incidence over time. Levels of SEN as perceived by the teachers were 18.8% in 1981 but had risen to 26.1% in 1998. According to the teachers' reports, in 1998 23.1% of pupils were classed as having some form of learning difficulties which summarizes the large majority of all SEN cases reported by teachers (88.7% of those reported were linked to learning difficulties). There have been many changes in the characteristics of the child population in England over the last 20 years (reflecting increased ethnic and language diversity), as well as a stronger emphasis on the identification of SEN, with the introduction of Special Educational Needs Coordinators (SENCOs) into all schools and much additional guidance and professional development. The policy of integrating children with special needs into mainstream schools and closing many special schools is also likely to have influenced teachers' perceptions and the identification process; therefore, it is difficult to establish the extent to which increased awareness and better identification has led to an increased proportion of children being classified as having some form of SEN (Farrell, 2001). As definitions and processes of identifying SEN have evolved over time and vary markedly between different countries, it is not only difficult to compare the incidence of SEN over countries (European Commission, 2005) but also over time (see Lindsay, 2007 for an overview about the variation in terminology used to define SEN in different contexts).

Identifying and Providing for SEN

The early identification of SEN in primary school is considered one important prerequisite for children to reach their full potential (Davie, 1996). Teachers' beliefs and classroom practice are major features that shape children's educational experiences (Day et al., 2006) and class teachers play a key role in identifying and catering for SEN in mainstream classes. Their expectations, processes of assessment and professional judgments influence which children are seen to require special support and which are not identified, in day to day practice. However, the *Statementing* procedures used to identify children with more specific and higher levels of need in England are more formal (DfES, 2001) than in many other countries. This paper focuses on the general features of SEN as applied by teachers and primary schools in England rather than on the much smaller group of children who have been given a Statement of needs. Class teachers' interpretations and perceptions of just what constitutes a SEN are as crucial as their general diagnostic skills. With respect to learning difficulties, this means that the perception of SEN may not be based on objective measures of low achievement, but can be seen as a subjective judgment process that might be affected by a combination of child's attainment and teachers' expectancies and subjective perceptions, as well as their knowledge and experience. Thus Croll (2002) reported a significant relationship between poverty and children's SEN status after controlling for their attainment; this finding is in line with earlier research in England showing that teachers' judgements of pupils' attainment tend to be lower for specific groups, such as children eligible for free school meals (FSM, an indicator of low income) (Mortimore et al., 1988). It seems likely that teachers may – to some extent – judge special needs relative to levels of pupil achievement in their own schools or classes, and also that their expectations of some groups may be lower (i.e., they do not necessarily apply consistent standards within or across schools).

As SEN is a term which is applied in very varying circumstances, the amounts and types of extra help or support given or seen as required may depend on the individual situation. Children who struggle with reading acquisition may be seen to benefit from supplemental, intensive instruction but teachers' perceptions about what is appropriate can differ (e.g., Linan-Thompson et al., 2003; Torgesen et al., 2001). The developmental outcomes of children showing severe and persistent behavioural characteristics of inattention, impulsiveness and hyperactivity (often termed as general behaviour "problems" by teachers) may be enhanced by classroom interventions or special teaching methods (DuPaul & Eckert, 1997) or exacerbated by lack of support. But rather than relying solely on strategies implemented in primary school, it may be more effective to investigate what influences children's development at an earlier age (in pre-school), because children showing higher skills at primary school entry often maintain this advantage at later ages (e.g., Magnuson et al., 2004; Sammons & Smees, 1998; Sammons et al., 2004; Tymms et al., 1997). Promoting better adjustment to school and *school readiness* might therefore be hypothesised to be a means to help protect children from later being identified as having some form of SEN while they move through primary and secondary school.

One way of promoting school readiness lies in early pre-school education programs. There is now growing evidence of the benefits of pre-school education for children generally (e.g., Magnuson et al., 2004; Melhuish et al., 2006; Sammons et al., 2004; Sammons et al., 2008; Sylva et al., 2004). Such evidence has led to increased state and federal support for early education programs in England, the United States and several other countries (e.g., Austria and Germany). Whereas evidence of the short-term academic benefits of early education or pre-school programs is now well established, only a few studies have investigated the longer-term benefits of pre-school education, and some have concluded that the advantages associated with

pre-school education tend to fade by the second or third year of formal schooling (Barnett, 1985; Lazar et al., 1982; McKey et al., 1985). However, others demonstrate that high quality intervention programs during the pre-school period have longer term beneficial effects (e.g. Clements, Reynolds & Hickey, 2004; Reynolds et al., 2001). Nonetheless, very little attention has been paid to the question of whether pre-school has particular benefits in relation to children with SEN or at risk of developing SEN (Taggart et al., 2006),

The EPPE 3-11 and the EYTSEN Project

The *Effective Pre-School and Primary Education 3-11 project (EPPE 3-11)*, a major longitudinal study of a national sample of young children in England, followed children's cognitive and social/behavioural development between the ages of 3 and 11 years, and was funded by the Department of Children, Schools and Families (DCSF). The project collected a wide range of data on over 3,000 children, their background and the pre-school settings they attended in order to investigate the possible effects of pre-school and primary school on children's cognitive and social development at different ages. The original EPPE pre-school sample was recruited to the study at age 3 years plus and followed to the end of Key Stage 1 (Year 2) in primary school. An additional *home* sample of around 300 children (who had not attended pre-school) was recruited at the start of primary school (age rising 5 years). The EPPE 3-11 project studied the whole sample to the end of primary schooling (age 11 years plus). The research adopted a mixed methods approach (Sammons et al., 2005; Siraj-Blatchford et al., 2006) in order to investigate child, family and home influences on children's developmental outcomes, so that the relative importance of these influences could be studied in relation to the strength of pre-school and primary school factors.

The *Early Years Transition and Special Educational Needs (EYTSSEN)* study was an additional project commissioned by the DfES two years into the main EPPE study. The EYTSSEN project used EPPE data but focused on aspects of SEN in children between the ages of 3 and 6 years (from pre-school to the end of Year 1 in primary school). Children who might be considered as *at risk* of developing SEN in relation to their cognitive or behavioural development by entry to pre-school were identified and monitored up to the end of Year 1. One-third of the children were considered *at risk* at entry to pre-school. By the start of primary school, this proportion had decreased to one in five. Children who had attended pre-school were significantly less likely to be reported as having any SEN by teachers (one in four) than the home group (four in ten) during Key Stage 1 of primary school (Sammons et al., 2003; Taggart et al., 2006). Findings from the main EPPE research on children's cognitive attainment and progress in Key Stage 2 have been published (Sammons et al., 2007, 2008). These analyses explored the predictive power of various child, parent and home characteristics on children's attainment at age 10 (Year 5). It was further investigated whether any continuing impact of pre-school could be established. However, there was no further analysis of children's SEN status and the factors that predict this in the main follow up. We include a brief summary of the findings of the main Year 5 attainment models for information and background and to facilitate later comparison of the attainment models with those on the prediction of whether teachers identified children as showing a SEN in relation to learning difficulties in the two cognitive areas that form the main focus of this paper. While the list of factors identified as affecting attainment is in line with many previous studies of educational disadvantage (e.g. Coleman et al., 1966), it does throw light on some factors that have received little attention previously, such as the role of the early years home learning environment (Melhuish et al., 2008). Moreover, the ability to compare these more

general attainment models with those specifically designed to predict SEN provides a new contribution to the understanding of teacher identification of SEN for this age group and how this is also influenced by various child, family and educational factors.

For reading, the results indicated that low birth weight, large family size, early developmental problems and need of English as an Additional Language (EAL) support at age 10 are associated with poorer attainment outcomes. Girls show better attainment than boys at this age; some ethnic groups show lower attainment in reading than white UK children. With regard to family factors, results show that FSM eligibility, low family SES and low parental education are related to lower attainment. Maternal education has the strongest net impact on children's outcomes in reading. In addition to these background factors, the impact of the home learning environment (HLE) in the early years was investigated. The quality of the early years HLE was measured by an index which represents the self-reported frequency of parental activities such as reading to the child, listening to the child read and taking the child to the library (Melhuish et al., 2008). Controlling for child and family factors, a high HLE-index is one of the strongest predictors of high attainment in reading at age 10. For mathematics, the analyses showed that low birth weight, need of EAL support and early health problems are related to lower attainment at age 10. Children from an Indian background have significantly better outcomes. With regard to family factors, the results are in line with those for reading: FSM eligibility, low family SES, low family salary and low parental education are related to lower attainment, with maternal education being the strongest predictor. As with reading, a high early years HLE has a strong net positive impact on attainment in mathematics. The results also showed that beneficial effects of pre-school education persisted for those who attended high quality or highly effective pre-school centres controlling for relevant child, family and home factors (Sammons et al., 2007, 2008).

The Present Study

The present study investigates which child, family and home factors predict primary teachers' identification of children's SEN status in relation to difficulties with reading and number work at age 10. The analyses also explored whether children's earlier pre-school experience is still related to later incidence of SEN. Children with very low or low scores in reading and mathematics tests might be expected to be identified by teachers as having SEN, so it was anticipated that factors predicting SEN status might be similar to those found to have predictive power for attainment. On the other hand, factors with the potential to predict overall differences in attainment assessed by standardized tests for all children may not necessarily be the same factors which predict a child's experience of SEN as assessed by teachers. Further, teacher-based ratings may show possible bias for some pupil groups; and this could also influence which children are identified as having a SEN and which are not.

The present investigation involved four analysis stages. The first tested the strength of the relationship between children's cognitive outcomes at age 10 and the likelihood of a child being identified by the teacher as having SEN in relation to reported difficulties with reading or number work. The second treated the two SEN-measures (reading difficulties, difficulties with number work) as outcomes and explored which child, family and home factors were significant predictors in terms of increased risk or, alternatively, functioned as protective factors for SEN identification (i.e., reduced the likelihood of identification). The third investigated which factors other than attainment influence teachers' ratings. To this end, the two SEN measures were again treated as outcomes, and we explored which child, family and home factors were significant predictors of SEN status while controlling for current (Year 5) attainment in reading and

mathematics. The fourth stage tested whether earlier experience of pre-school education, particularly of high quality, shows long term benefits in explaining variance in SEN status at age 10, controlling for all relevant background factors. In the discussion we further compare the results with those from multilevel models for standardized cognitive outcomes reported by Sammons and colleagues (2007, 2008) to establish whether the prediction of later SEN status shows distinctive features in that are not covered by general models of attainment.

Data Source and Methods

Participants and Procedure

The sample for this study consists of 2,509 EPPE3-11 children which represent 78% of the original EPPE pre-school sample recruited when children entered the study (age 3 years plus). In addition to standardized cognitive and behavioural outcomes, EPPE collected a wide range of background information on the sample children through parental interviews, questionnaires and teacher questionnaires. At each assessment of the longitudinal investigation, teachers completed a child social behavioural profile for each EPPE-child and reported details of any SEN. This investigation uses the child profiles completed at the end of Year 5 (age 10).

In the sample used for this analysis (children with valid child profiles and cognitive outcomes at the end of Year 5), 2,263 (90.2%) of the children had attended a pre-school centre. 74.9% have white UK background, 90.6% have English as mother tongue. In terms of social class, 35.9% of the families belong to the high SES (professional) classes, 25.0% were categorized as low SES and 37.8% as medium SES. 19.3% were eligible for free school meals at the end of Year 5, indicating low family income. In terms of parents' highest qualification levels,

just under a fifth (17.6% of mothers and 19.1% of fathers) had a degree or higher degree, while 19.6% of mothers and 15.5% of fathers had no qualifications.

Measures

Outcome Measures

Teachers' assessments of SEN at the end of Year 5 (age 10).

Teachers reported on present SEN in the child profiles. Part of these profiles was a list of possible special needs, e.g. whether the child had been identified as having any form of learning difficulties, behavioural problems etc.. The current analyses focused on two forms of reported SEN: difficulties with reading and difficulties with number work. The teachers' ratings of these two forms of SEN were used as dichotomous outcomes (difficulties in Year 5: yes/no) in the further analyses.

Cognitive attainments at the end of Year 5 (age 10).

In addition to teachers' ratings, cognitive attainments were assessed by the NFER-Nelson Reading Level 2 and Mathematics Age 10 tests (France, 1981; Patilla, 1994). The test scores were age-standardized using the EPPE sample as reference group ($M = 0$, $SD = 1$). The child profiles were collected independently from the reading and mathematics assessments administered at age 10 years.

Predictors.

Child Factors: Gender, EAL, age in months, ethnic group, birth weight, number of early health problems and number of early developmental problems as reported by the the parents in pre-school interviews, premature child and number of siblings.

Family Factors: Family structure, parents' employment status, parental education, family salary at time of pre-school education, family SES and child eligibility for free school meals (FSM), a proxy measure for low income.

Home Learning Environment (HLE): Parent-child activities and routines during the pre-school years which provide an indication of aspects of the early years home learning environment (HLE), such as reading to the child, listening to the child read, taking the child to the library, practicing numbers with the child, teaching songs and nursery rhymes etc., were aggregated to a scale measure of the frequency of parent-reported activities shortly after the children were recruited to the study (Melhuish et al., 2008). The HLE scale has a range of 0 to 45; the higher the value, the better the quality of the HLE. In the present sample, the HLE was between 0 and 24 for 53% of the sample, and 25 points or higher for 43.1% of the sample (missing: 3.9%). The information on child factors, family factors and HLE were obtained by the parental interviews and questionnaires. The FSM - status was taken from the child profiles completed by the teachers. For further details on the instruments used and the research design, see Sammons et al. (2005; 2007).

Pre-school Measures: The duration of pre-school attendance and the quality and effectiveness of the pre-school centre were regarded as potentially protective factors. The quality of pre-school measure was based on trained researchers' observations of each pre-school centre using environment ratings (ECERS-R and ECERS -E) (Sylva, Siraj-Blatchford & Taggart, 2003; Sylva et al., 2006). Measures of individual pre-school centres effectiveness in terms of promoting children's progress in pre-reading and early numeracy were obtained from earlier multilevel analyses of children's progress between age 3 and 5 years. They represent each pre-school centre's value added residual estimate and were categorised into low, medium and high

effective groups for comparison with the home group of children who had not attended pre-school (Sammons et al., 2003; 2004).

Statistical Analysis

The association between teachers' ratings of whether a child had a SEN and children's attainments measured by standardized test scores was analyzed using t-tests for two independent groups and point-biserial correlations. Analyses for the two dichotomous outcomes used multivariate logistic regressions to investigate which of the potential risk and protective factors had a significant impact in terms of predicting the likelihood of a child being identified as showing SEN at age 10.

First, all available child, family and home characteristics were tested as potential risk or protective factors for SEN. Stepwise analyses were conducted and only statistically significant variables were retained in the models. This procedure resulted in two background models predicting a child's identification by the teacher as showing SEN in terms of difficulties with 1) reading and 2) number work. The influence of the different factors was compared using odds ratios (OR). In a second step, the child's actual attainment in reading or in mathematics at age 10 (Year 5) was included as an additional predictor in the background models. We thus tested which background factors were related to teachers' identification of SEN, while controlling for children's current level of cognitive attainment. Subsequently, the impact of indicators of pre-school education was tested individually in logistic regression models controlling for all statistically significant variables retained in the background models (all analyses used STATA 9).

As the data have a nested structure, with children being nested within primary schools at age 10, multilevel analyses would be the appropriate methodological approach for disentangling effects on the school level from effects on the child level (Raudenbush & Bryk, 2002). Ignoring the multilevel structure might lead to unreliable standard errors of the coefficients in the model. However, in this sample the average number of children per primary school at age 10 was only 2.7 (min = 1, max = 47). When multilevel logistic regression analyses were applied, the intraclass correlations (ICC) turned out to be low (approximately 0.08) even before any background factors were included in the models. Results obtained with multilevel analyses differed only negligibly and differences were non-significant in comparison with those produced by ordinary logistic regression with no random effect included; therefore, all results reported here were derived from ordinary multivariate logistic regression analyses without inclusion of random effects.

Results

In total, 12.4% of the children in the sample were identified by their teachers as showing SEN in relation to reading, and 11.4% as showing SEN in relation to number work. In all 8.4% of the children were identified as showing SEN in both areas at age 10. The majority of children, 84.8%, were not identified as showing SEN in either area (in addition some children were identified with SEN in other areas, such as behaviour, but this aspect of SEN is beyond the scope of this paper).

Association between Teachers' Ratings and Standardized Test Scores

Children identified as showing SEN by their teachers had significantly lower scores in the corresponding NFER-Nelson test, as would be anticipated. Test scores were internally age-standardized for the whole sample ($M = 100$, $SD = 15$). The average reading score for children identified as showing SEN in relation to reading difficulties was 81.5 compared to a mean of 102.7 for non-SEN children ($p < 0.01$, $r_{bis} = -0.46$). Children identified as showing SEN in relation to difficulties with number work had a mean of 82.2 in the mathematics test compared to a mean of 102.3 for the children without SEN ($p < 0.01$, $r_{bis} = -0.43$). These group differences confirm that teachers' ratings reflect difficulties that are strongly linked to current attainment outcomes and are therefore likely to provide fairly reliable measures of the lower extreme groups.

Risk Factors for Teacher Identification of SEN in Relation to Reading Difficulties at Age 10

Table 1 summarises the final multivariate logistic model which includes all background factors found to be significant predictors in terms of either increasing or decreasing the risk of a child being identified as showing SEN at age 10 (model 1). These background factors account for 9.1% of the overall variance (log likelihood = -765.85, $LR X^2_{(13)} = 152.47$, $p < 0.001$). Gender, age, birth weight and early developmental problems are significant risk or protective factors for children being identified as showing SEN at age 10. Compared to girls, the odds of boys showing SEN in relation to reading are 1.67 times as high. With regard to birth weight, the odds are 1.88 times as high for children with low or very low birth weight than for the normal birth weight group. The OR for children reported to have early developmental problems in the pre-school period compared to those not identified as showing early problems is of a similar size

(OR = 1.79). By contrast, child age has a protective impact, with each month of age reducing the odds of being identified as showing SEN in relation to reading difficulties by 4%.

Examining family factors, higher levels of maternal education (measured in terms of the highest qualification level) have the strongest protective impact of all the factors in the model. Compared to children whose mothers have a degree or higher degree, the odds of children whose mothers have no qualifications being identified with SEN in relation to reading difficulties are 2.3 times as high. The FSM measure for low family income was also found to be a highly significant predictor of a higher risk of SEN identification (OR = 2.1). With regard to family SES, the odds of a child being identified as showing SEN are 1.5/1.6 times higher for medium/low SES children than for high SES children. Low scores on the early years HLE-index were also found to have a significant impact on later identification (OR = 1.49). It is important to stress that these results *are net effects* controlling for all other factors. With respect to HLE, this means that a rich early years home-learning environment has a protective effect, even when the influence of child factors and other family factors such as family SES and maternal qualification level are controlled.

<Table 1 here>

Do the Risk Factors for SEN Identification in Relation to Reading Difficulties Reflect Risk Factors for Low Attainment Only?

In the next step, we tested whether the background factors found to be predictive for SEN status reflect risk factors for low attainment only or whether certain groups of children are more likely to be identified with SEN when their current level of attainment is controlled. Table 1

(model 2) shows the results with reading attainment at age 10 included as a predictor in the model. Attainment is the strongest predictor of teacher identification of SEN; a difference of 1SD in attainment reduces or increases the probability of being identified as SEN by 90%. Including attainment in the model increases the proportion of variance explained substantially from a total of 9.1% when only background measures are included to 37.6%. Although teachers' ratings of SEN in relation to reading difficulties are strongly linked to current the attainment we also find that children with one or more early developmental problems and children with low or very low birth weight are still more likely to be identified as having this form of SEN when the effects of attainment is controlled. These groups of children might also show delayed development in other areas, such as health or behaviour. Therefore, the results may point to the teachers' enhanced sensitivity to the learning difficulties of these groups of children. Another possible explanation may be a *halo* effect, where teachers generalize their overall impression of certain groups of pupils. Additionally, and more surprisingly both boys (OR = 1.52) and children young for their year (OR = 0.95) are more likely to be identified as showing SEN. Given that the current attainment scores controlled in the analyses were already age-standardized, the latter result comes as a surprise. It suggests that teachers may be using a class reference rather than an individual reference when assessing SEN; in other words, they use the same frame of reference for the whole class, irrespective of differences between the children which can be explained by younger age. The result for boys is also of interest given concerns about a gender gap in attainment. It may be that boys' behaviour in class also affects teachers' perceptions of whether they have SEN, over and above their current attainment level. Further research is needed to test this possibility. The results confirm that teachers' judgments of SEN are not only related to actual attainment levels of children and suggest that some groups of children are

disproportionately over represented. This has important equity implications since SEN identification may affect children and parents' perceptions or expectations of a child and their future educational trajectories.

Pre-school Education as a Protective Factor Reducing the Risk of Later Identification of SEN

A fifth of the home children, those who had not attended pre-school, (20.3%) were later identified as showing SEN in relation to reading difficulties at age 10, whereas in the group of children with pre-school experience, the proportion was much lower at 11.5%. The no-pre-school group differed substantially in their child, family and HLE characteristics, and this helps to account for much of the differences in SEN identification rates between the two groups. The most basic indicator of pre-school experience – *pre-school attendance vs. no pre-school* – was not found to be significantly related to SEN identification when the other background variables were controlled (model 1). The same holds for two other pre-school measures, duration of pre-school attendance and pre-school centre effectiveness.

In contrast, the *quality* of pre-school attended (measured by the ECERS-E observational scale) still had a statistically significant relationship with the identification of SEN in relation to reading difficulties in Year 5 even when other background factors were controlled. To investigate the impact of pre-school quality, we divided the sample into groups of children whose pre-school centre experience could be classified as ranging from *no quality* (the *home* group, approximately 9.8% of the sample) through *low* (14.2%), *medium* (54.1%) and *high* quality (21.9%), based on the individual pre-school centres' average ECERS-E scores. Compared to children in the high quality pre-school group, the odds of a child being identified as showing SEN in relation to reading difficulties in Year 5 are 1.65 times as high for children

without pre-school education ($p = 0.051$), 1.40 times as high for children who attended only a low quality pre-school ($p = 0.154$), and 1.43 times as high for children who attended a medium quality pre-school ($p = 0.049^*$). Note that children without pre-school education (*home* children) represent just 9.8% of the sample, whereas the ‘medium quality’ group represents the largest subgroup. This difference in sample size helps to explain why the risk for *home* children just failed to reach statistical significance ($p = 0.051$), whereas the smaller effect for medium quality than for high quality, based on larger numbers, reaches statistical significance. It is notable that in this analysis the effects of low quality pre-school are similar in size to those for medium quality. Thus the results suggest that only high quality pre-school experience significantly reduces the risk of a child later showing SEN at age 10.

<Table 2 here>

Including pre-school quality in the model makes little difference to the overall proportion of variance explained; it increases from 9.1% to only 9.3%. However, proportion of total variance explained is not the best indicator of the significance of the effects. It should be noted that the results for pre-school quality also persist when controlling for the academic effectiveness of the primary school attended after pre-school education.

Risk Factors for Teacher Identification as SEN in Relation to Difficulties with Number Work at Age 10

An equivalent set of analyses was conducted for the SEN measure of difficulties with number work. Age, birth weight, early health problems and early developmental problems were

significant child predictors of teacher identification of SEN in relation to difficulties with number work at age 10 (see table 2, model 1). As for reading, the analyses for SEN in relation to number work found age within the year group to be a significant protective factor; each month of age reduced the likelihood of identification of SEN in relation to number work by 3.4%. With regard to birth weight, the odds are 1.69 times higher for children with low or very low birth weight than for children with normal birth weight and a similar effect for children reported to have early developmental problems compared to those not identified as showing early problems is found (OR = 1.65). Additionally, children with early health problems are at higher risk (OR = 1.33).

With respect to family factors, in line with the results for reading, high maternal education has the strongest impact on identification of SEN in relation to number work. The odds for children of mothers with no qualifications being identified are 2.86 times as high as for children of mothers with a degree or higher degree. The FSM measure is also a significant predictor (OR = 1.86). Turning to family salary, the odds of SEN are only half as high (OR = 0.51) for children in the highest salary group than for children from families with no earned income. In line with the related SEN measure for reading, a low early years HLE proved to be a significant risk factor (OR = 1.36) for SEN identification in relation to difficulties with number work. Background factors account for 8.1% of the overall variance in teacher identification of SEN in relation to number work, a slightly lower proportion than that found for teacher-identified SEN in relation to reading (log likelihood = -741.99, $LR X^2_{(15)} = 131.36$, $p < 0.001$).

<Table 3 here>

Do the Risk Factors for SEN Identification in Relation to Difficulties with Number Work Reflect Risk Factors for Low Attainment Only?

Table 2 (model 2) shows the results with attainment in mathematics at age 10 being added as a predictor to the background model. Current attainment is the strongest predictor, increasing the overall explained variance to 31.6%. A difference of 1SD in attainment reduces or increases the probability of being identified with SEN by 86%. As for SEN in relation to reading, we can conclude that teacher identification of SEN in relation to number work is strongly linked to the child's attainment. The only other significant factor is age of the child, which again – given that attainment was age-standardized – suggests that teachers may be using a class reference when assessing SEN and do not take account of age-related differences within the year group. This shows that teacher assessment of SEN disadvantages children young for their year (summer born).

Pre-school Education as a Protective Factor for Identification of SEN in Relation to Number Work at Age 10

Overall, 18.3% of the children who had not attended pre-school before starting primary school were identified as showing SEN in relation to number work at age 10, in contrast to just 10.7% of the children who had attended a pre-school centre. Again, the most basic indicator – *pre-school attendance vs. no pre-school* – failed to have a significant impact on the risk of being identified with SEN when the relevant background factors described above were controlled (model 1). However, pre-school quality (measured by the ECERS-E) is significantly related to a reduced risk of identification with SEN in relation to number work at age 10 (table 4). Compared to children who attended a high quality pre-school centre, the odds of children who attended a

low quality pre-school centre being identified as having difficulties with number work are 1.7 times as high. The overall variance explained in the model is 8.6% when pre-school quality is added to the relevant background factors (compared to 8.1% in the background model).

<Table 4 here>

We also found previous measures of pre-school centre effectiveness in promoting children's skills in early number concepts (between ages 3 and 5) to be related to the risk of being identified as showing SEN due to difficulties with number work at age 10. To investigate the potential protective influence of pre-school effectiveness, we divided the sample into groups of children whose pre-school experience could be classified as ranging from *no* effectiveness (the *home* group, approximately 9.8% of the sample) through *low* (12.9%), *medium* (58.8%) and *high* effectiveness (18.5%), based on the individual pre-school centres' effectiveness scores.

Compared to children who had attended a highly effective pre-school centre before starting primary school, the odds for being identified as SEN are significantly higher for all other groups: OR = 1.65 for medium effectiveness pre-school centres, OR = 1.79 for low effectiveness pre-school centres and OR = 1.74 for no pre-school experience (table 5). Including the pre-school centre effectiveness measure into the model increased the explained variance from 8.1% to 8.6%. The reported pre-school effects remain significant when controlling for the effectiveness of the primary school attended later on.

<Table 5 here>

Discussion and Conclusions

Results indicate that the EPPE3-11 children identified as showing SEN in Key Stage 2 have much lower attainments in independent tests conducted by the research team at age 10, as might be expected. This finding can be seen in general as a form of validation of the teachers' ratings, an important result with regard to the central role the class teacher has in assessing and identifying children as in need of special support. The results apply to the context of English pre-schools and primary schools, where the identification of SEN has received considerable policy focus in the last decade. Second, the study highlights those family, child and home factors which *increase the likelihood of a child being identified by teachers as having SEN* in relation to reading or number work at age 10. It provides evidence on important factors concerning the cognitive development of highly disadvantaged children in England relevant to current policy concerns to enhance equity and narrow the attainment gap. In terms of family factors, the results demonstrate that children who grow up in families with low SES, whose parents have low educational qualifications and a low income are more likely to be identified as having SEN in terms of learning difficulties in reading or number work later in primary school. These results are in line with findings from previous research on the association between SES, parental education, family income and cognitive development and achievement (e.g., Feinstein, 2003; Sammons et al., 2007).

Although teachers' ratings of SEN are strongly linked to current attainment, the results clearly show that teachers are more likely to identify SEN for certain groups of pupils, even when attainment is controlled. The results for the effect of age reported here suggest that teachers may use class achievement as a reference for judging students' SEN status, without taking into account age-related developmental differences between children, which means young

for the year (summer born) children are over-represented, even when attainment differences are controlled. Many studies have shown that children who are young for their year (summer born in the English system of education) tend to have significantly lower attainment than their older (autumn born) classmates (Mortimore et al., 1988; Sammons et al., 2003, 2008; Crawford, Dearden & Meghir, 2007). However, very few studies have examined age effects in relation to SEN identification (Taggart et al., 2006). The use of age standardised tests is a practice that seeks to address such developmental differences in attainment specifically and thus can provide teachers with a more accurate picture of a child's attainment relative to his or her peers. In some education systems, however, the use of standardised tests is frowned upon, especially for primary age children and there is a strong emphasis on teacher assessment (TA) in England. When teachers receive appropriate professional development the formative role of TA may have advantages, nonetheless, the present research results indicate that teachers' judgments may be less accurate and subject to unintended bias given the increased likelihood that children who are just young for their year are more often viewed as having a learning problem and then identified as having a SEN. One practical implication of the findings is that schools and teachers need greater guidance to enhance their awareness of the developmental nature of age related differences in attainment and to check that they do not over identify attainment differences as reflecting SEN for children who are young for their year.

In contrast to findings reported by Croll (2002), we did not find a relationship between family SES or FSM and SEN identification after controlling for current attainment level, which is an encouraging result in terms of promoting equal opportunities for children irrespective of their social background' although there are some methodological differences between this study and that of Croll (2002).

The results also emphasize that factors with the potential to predict attainment on the whole range of an attainment scale in standardized tests are not necessarily the same factors which predict membership of a high risk group such as identification of SEN as assessed by teachers. Whereas a whole set of family factors was shown to have net impact on attainment (Sammons et al. 2007; 2008), only a subset of these factors was found to be predictive for membership of such a high risk group. The predictors with net impact in models for SEN represent parsimonious reduced models of those created for the test scores. These findings suggest that certain factors predicting attainment do not seem to affect SEN status in a systematic way, while other factors are found to be influential for both.

Several child factors found to be risk factors for later SEN identification (early developmental problems, early health problems, low birth weight) may be evident well before children enter either pre-school or primary school. In addition, the quality of the HLE in the early years is highly predictive for later SEN identification. Strategies for supporting groups of children at greater risk of developing SEN during their school career should therefore target factors affecting children's development before they begin primary schooling. Over the last decade or more inclusive education has been a major policy initiative designed to improve the educational opportunities of children with SEN and disabilities. Results on the effectiveness of this approach are heterogeneous (Lindsay, 2007). Strategies adopted when children have already started primary school may pose a challenge for the professionals involved as well as for the children and their parents, while parents may feel that the extra support was provided too late to enable their child to catch up with their peers (e.g., Avramidis, Bayliss, & Burden, 2000; Knight 1999). The results of the present study suggest that a range of preventive strategies which support children's development in the early years may improve 'school readiness' and therefore

reduce the number of children who may be at risk of developing SEN in later years. A new contribution to knowledge made in this paper concerns the important continuing effect of preschool quality as a factor that not only improves children's subsequent attainment up to age 10 years in primary school but that also has a specific role in reducing the likelihood of later SEN identification. Quality of preschool thus appears to have both a general and specific differential effect on later cognitive development. The implication of this finding as we have noted is that high quality preschool may be viewed as an effective intervention for enhancing resilience in young children (see also discussion of this by Hall et al., 2009 for the sample of children at younger ages). More specifically we conclude that the targeting of additional resources and professional development to enhancing the quality of preschool provision may be an effective strategy in trying to combat the adverse effects of social disadvantage and that this should focus particularly on preschool settings in the most disadvantaged communities, since previous research has already shown, and the current data also confirm, that more disadvantaged children (those with poor HLE, from low family income and low SES families with parents who have low levels of educational qualifications etc.) are significantly more likely to be identified as showing SEN in primary school. In England the recent policy of introducing Children's Centres in areas of high disadvantage and attempts to raise the quality as well as the availability of preschool in these areas are policy developments that could have long term benefits in helping to reduce the risk of SEN and may help to narrow the attainment 'gap' between advantaged and disadvantaged children (Taggart et al., 2008; Sylva et al., 2010). It is beyond the scope of this paper to provide detailed guidance on the improvement of preschool practice but the EPPE3-11 research has identified and published findings on ways of measuring preschool quality and provided rich descriptions of more effective practice from qualitative case studies that have

influenced both policy and practice (Sylva et al., 2006, 2010; Siraj-Blatchford et al., 2003, 2006; 2008).

The quality of the HLE in the early years is predictive not only for cognitive attainment at age 10 and cognitive progress between age 6 and age 10 (Sammons et al., 2007; 2008), but also for SEN status as assessed by teachers (as well as for better social and behavioural development). Such findings suggest that policies for disadvantaged children and parents that encourage active parenting strategies may help to promote young children's overall cognitive development and facilitate their emerging literacy and numeracy and later academic achievement. However, the provision of high quality and effective pre-school education from 3 years of age is likely to produce further benefits which persist until the end of Year 5 of primary education. Children not only get a "better" start to school but are also less likely to need extra support in reading or mathematics up to age 10 (year 5), suggesting that the cognitive gains remain evident in the mid term. On the other hand, the results indicate that although low quality or low effective pre-school provision might also promote small beneficial short-term effects, little positive impact remains in the mid to longer term. For high-risk groups of children, only high quality provision is likely to offer lasting benefits. Improving access to high quality and more effective pre-school is likely to foster better educational outcomes for disadvantaged children in the longer term (because they have a higher risk of later difficulties) by promoting their cognitive development and reducing the likelihood of later special needs. Studies of successful pre-schools by Siraj-Blatchford et al. (2003) indicate that pre-schools which promote joint activities for parents and children are likely to be especially beneficial for young children. The implications of these findings are that policy makers and practitioners should promote strategies to support improvements in the early years HLE as well as in the quality of pre-school centres. In addition, knowledge of *at risk* factors can

be used to help direct resources and programs to target high-risk groups of children and communities, for example through appropriate Children's Centre provision. In the light of the greater emphasis given to teacher assessment in primary schools there are dangers that certain pupil groups are being disadvantaged through unintentional teacher bias in the identification of SEN. The EPPE research study is continuing to follow the sample of children through secondary education and will examine a range of outcomes and follow up the research questions for these students at age 14 and age 16 years.

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Tables

Table 1: Multivariate logistic models for identification of SEN in relation to reading difficulties at age 10 (Year 5 of primary schooling).

Factor	<i>Model 1: child, family and home risk factors</i>			<i>Model 2: child, family and home risk factors controlling for attainment</i>		
	Odds Ratio (OR)	S.E.	Z	Odds Ratio (OR)	S.E.	Z
<i>Gender</i>						
Female						
Male (reference group)	1.67	0.23	3.67***	1.52	0.11	2.54*
<i>Age in months</i>						
	0.96	0.02	-2.05*	0.95	0.02	-2.18*
<i>Birth weight</i>						
Low or very low	1.88	0.38	3.14**	1.80	0.46	2.33*
Normal (reference group)						
<i>Developmental problems</i>						
None (reference group)						
1 plus	1.79	0.31	3.34**	1.58	0.33	2.21*
<i>FSM</i>						
No (reference group)						
Yes	2.17	0.36	4.67***	1.33	0.26	1.45

<i>Mother's qualification</i>						
None (reference group)						
Vocational	1.13	0.23	0.59	1.55	0.38	1.77
16/18 Academic	0.68	0.12	-2.30*	1.05	0.21	0.25
Degree/Higher degree	0.43	0.14	-2.67**	1.69	0.64	1.40
Other Professional	0.41	0.31	-1.20	1.08	0.85	0.09
<i>Family SES</i>						
High (reference group)						
Medium	1.58	0.31	2.32*	0.95	0.24	-0.21
Low	1.51	0.34	1.84	0.96	0.19	-0.20
<i>Early Years HLE</i>						
HLE-index						
0-24	1.49	0.10	2.63**	1.01	0.18	0.05
25-42 (reference group)						
<i>Attainment in reading at age 10</i>	-	-	-	0.10	0.01	-16.15***
			$R^2 = 0.09$			$R^2 = 0.38$

Table 2: The effect of pre-school quality on identification of SEN in relation to reading at age 10 (Year 5 of primary schooling) controlling for all relevant background factors.

Pre-school quality (ECERS-E)	Odds Ratio (OR)	S.E.	Z
No pre-school	1.65	0.42	1.95
Low quality	1.40	0.33	1.43
Medium quality	1.43	0.26	1.97*
High quality (reference group)			

Table 3: Multivariate logistic models for identification of SEN in relation to difficulties with number work at age 10 (Year 5 of primary schooling).

Factor	<i>Model 1: child, family and home risk factors</i>			<i>Model 2: child, family and home risk factors controlling for attainment</i>		
	Odds Ratio (OR)	S.E.	Z	Odds Ratio (OR)	S.E.	Z
<i>Age in months</i>	0.96	0.02	-2.22*	0.95	0.02	-2.32*
<i>Birth weight</i>						
Low or very low	1.69	0.35	2.53*	1.44	0.34	1.52
Normal (reference group)						
<i>Developmental problems</i>						
None (reference group)						
1 plus	1.65	0.30	2.75**	1.46	0.32	1.76
<i>Early health problems</i>						
None (reference group)						
1 plus	1.33	0.19	2.05*	1.14	0.14	0.78
<i>FSM</i>						
No (reference group)						
Yes	1.86	0.32	3.62***	1.35	0.26	1.53

<i>Mother's qualification</i>						
None (reference group)						
Vocational	1.09	0.23	0.41	1.29	0.31	1.06
16/18 Academic	0.72	0.12	-1.90	0.10	0.20	-0.01
Degree/Higher degree	0.35	0.12	-3.17**	0.91	0.34	-0.25
Other Professional	0.46	0.35	-1.03	0.84	0.69	-0.22
<i>Family salary</i>						
None (reference group)						
£ 2,500-15,000	1.12	0.24	0.55	1.07	0.26	0.26
£ 17,500-35,000	0.78	0.17	-1.12	0.96	0.24	-0.16
£ 37,500-132,000	0.51	0.15	-2.35	1.17	0.37	0.48
<i>Early Years HLE</i>						
HLE-index						
0-24	1.36	0.11	2.02*	1.04	0.18	0.24
25-42 (reference group)						
Attainment in mathematics at age 10				0.88	0.01	-15.35***
			$R^2 = 0.08$	$R^2 = 0.32$		

Table 4: The effect of pre-school quality on identification of SEN in relation to number work at age 10 (Year 5 of primary schooling) controlling for all relevant background factors.

Pre-school quality (ECERS-E)	Odds Ratio (OR)	S.E.	Z
No pre-school	1.53	0.40	1.62
Low quality	1.70	0.40	2.25*
Medium quality	1.43	0.27	1.95
High quality (reference group)			

Table 5: The impact of pre-school effectiveness on identification of SEN in relation to number work at age 10 (Year 5 of primary schooling) controlling for all relevant background factors.

Pre-school effectiveness (early number concepts)	Odds Ratio (OR)	S.E.	Z
No pre-school	1.74	0.49	1.98*
Low effectiveness	1.79	0.47	2.24*
Medium effectiveness	1.65	0.34	2.44*
High effectiveness (reference group)			

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