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Home, Pre-school and Primary school influences upon children's educational attainment at age 11.

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Home, Pre-school and Primary school influences upon children's social adjustment.

Pre-school centre experience can produce benefits for disadvantaged children's school readiness, educational achievements and social adjustment (Karoly, Kilburn & Cannon 2005; Ramey and Ramey, 1998; Reynolds, Temple, Robertson and Mann, 2001; Schweinhart, Barnes and Weikart, 1993). One mechanism for these effects is via the developmental advantage children gain from pre-school participation. There is also evidence that home/parental support programs can also produce developmental benefit for children (Seitz, Rosenbaum and Apfel, 1985) particularly if combined with centre-based programs (Love et al., 2005).

Additionally when children enter primary school, school quality can also affect disadvantaged children's progress (Lee and Loeb, 1995). Moreover Currie and Thomas (2000) found that the longer-term effects of pre-school Head Start experience was mediated by achievement levels of the schools subsequently attended, and similar results are reported by Reynolds, Ou, & Topitzes (2004) for the Chicago Longitudinal Study. However such evidence on pre-school and school influences have predominantly accumulated from studies of interventions with disadvantaged children in the USA, and tell us less of relevance to the general population.

Nonetheless such evidence has fuelled an increasing interest in the provision of pre-school education for all children as a means of advancing the school readiness and later attainment of children (Zigler, Gilliam and Jones, 2006), and it has been argued that the longer term benefits far outweigh the costs involved, particularly for disadvantaged groups (Heckman 2006). Some authors argue that pre-school experience is critical for children's future competence, coping skills, health, and success in the labour market, and consequently the economic health of the nation (e.g. McCain & Mustard, 1999). Yet the evidence backing such claims for general populations is sparse.

With general populations evidence also exists for the importance of the home environment (Melhuish et al, 2001, Bradley, 2002) and home environment effects can be separable and greater than the effects of socio-demographic characteristics such as parental occupational or educational status (Melhuish et al., 2008). Additionally for all children variations between primary schools in educational effectiveness will also affect children's development for educational outcomes (Sammons 1999) and potentially for social outcomes.

Countries vary in the provision of pre-school education (Melhuish and Petrogiannis, 2006), with some countries showing close to universal provision e.g. Norway, Sweden, France, others having patchy provision e.g., USA, and other countries have moved rapidly to increase

their provision e.g., China. In the UK there have been high levels of pre-school use by children from 3 years to the start of school.

Most research has been in the USA with little systematic longitudinal research on the effects of pre-school in other countries. In the UK, an exception was the Child Health Education Study which indicated that children with some form of pre-school education had better outcomes at school (Osborn & Milbank, 1987). Other evidence had been provided concerning the influence of different pre-school environments on children's development (Melhuish, 1993, 2004; Sylva & Wiltshire, 1993). Some researchers adopted cross-sectional designs to explore the impact of different types of pre-school provision (Davies & Brember, 1997). A major enquiry into UK early years education and care, The 'Start Right' Enquiry (Ball, 1994) recommended the use of longitudinal studies to investigate child outcomes in relation to pre-school education so that the results might be used to inform policy makers.

This article describes findings from a large-scale longitudinal study in England that provides evidence on the contribution of home, pre-school, primary and secondary school to children's development up to age 14 years. This evidence is unique in being for a sample that is close to nationally representative rather than for disadvantaged groups only and thus provides stronger evidence relevant to the issue of the benefits that might accrue generally from universal pre-school provision. This study has shown that pre-school produces benefits over no pre-school in the early school years (Sammons et al.,2004a,b; Sylva et al., 2004), and case studies on the pre-school centres in this study (Siraj-Blatchford et al. 2003) have revealed the characteristics and processes within pre-schools that are associated with greater pre-school benefits for children. Also data from this study can be used to look at the relative benefits accruing from home, pre-school and school influences for the general population, and the relative magnitude of the benefits associated with variation in home, pre-school and school environments (Sammons et al; 2005 2008; Sylva et al., 2010).

Design and Method

The EPPE research is an example of a mixed method, longitudinal study with an educational effectiveness design (Sammons et al 2005; Siraj-Blatchford et al., 2006; Sylva et al., 2010).

Participants

One hundred and forty one pre-school centres were randomly chosen in 6 local authorities, that had a demographic make-up similar to that of England overall. From these 141 centres 2857 children were recruited into a longitudinal study. Children already in pre-schools were recruited when they became 3 years old; children starting pre-school after their third birthday were recruited at entry to pre-school. Their mean age at entry to the study was 3 years

5 months (S.D. = 4.6 months), and all preschool children attended for at least 3 sessions (session = half-day or 2.5 hours) a week.

In addition when children started primary school (age 5 years) children in the same classes as EPPE children but who had not attended a preschool centre were also recruited to the study as a home (no preschool) group (n=310). This allows comparison of not attending a pre-school with the effects of different patterns of preschool experience. Thus 3167 children were recruited to the study in total.

Measures

Background

When children entered the study (age 3+), one of the child's parents or guardians was interviewed (usually the mother). Most questions in the semi-structured interview were pre-coded, with some open-ended questions coded post hoc. A follow-up interview when children were 6-7 years provided additional data. The interviews covered: parents' education, occupation and employment, family income, family structure, ethnicity and languages used in the home, the child's birth weight, health, development and behavior, the use of preschool provision and childcare history, and significant life events. Also the first parental interview included questions concerning the frequency that children engaged in various activities in the home that were used to construct a home learning environment measure.

Social Development

3+ years: A pre-school centre worker who was familiar with the child was asked to complete the Adaptive Social Behavior Inventory (ASBI) (Hogan *et al.*, 1992). The 30 items of the ASBI were used in a principal components analysis with varimax rotation that revealed 5 factors of social development. These were:

Factor 1 Co-operation/conformity; *Example item*: is obedient and compliant.

Factor 2 Peer sociability; *Example item*: will join a group of children playing

Factor 3 Confidence; *Example item*: is confident with other people

Factor 4 Antisocial; *Example item*: teases other children, calls them names.

Factor 5 Worried/upset; *Example item*: gets upset if you don't pay enough attention

For further information see Melhuish et al. 2001; Sammons et al., 2002.

Age 5: Within the first term of primary school teachers with at least 1 month's experience of a particular child would rate that child on the Child Social Behaviour Questionnaire (CSBQ), which is an expanded version of the ASBI, in that 15 additional items were added to the original 30.

The extra 15 items were selected to sample behaviours emerging in 5-year-old children including independence, attention related behaviours, empathy and adherence to routines. This questionnaire consists of 45 items rated on a 5-point scale:

1=rarely/never 2= not often 3=sometimes 4=usually 5=almost always

A principal components analysis with varimax rotation of the 45 items identified 4 factors, for further details see Sammons et al., (2003).

The CSBQ provides a measure of current social behavioural development at exit from pre-school and a baseline measure for entry to primary school. Social behavioural factors were obtained from a principal components analysis of the child social behavioural items in the CSBQ at entry to primary school. The analysis identified a number of underlying dimensions (factors) which reflect patterns of associations amongst the questionnaire items. The four main factors are detailed below:

- **Primary School Entry Social Behavioural Factor 1: Independence & Concentration**
  Example items*: *Item 45 – 'sees tasks through to the end, good attention span';

  ***Item 14 – 'easily distracted, concentration wanders'* (note that this item was reversed in the analysis)**

  This factor measures the child's ability to play or work independently showing a certain level of concentration.

- **Primary School Entry Social Behavioural Factor 2: Co-operation & Conformity**
  Example items*: *Item 13 – 'co-operates with your request's;

  Item 21 – ' follows school rules'

  This factor measures the child's co-operative behaviour and conformity to requests or rules.

- **Primary School Entry Social Behavioural Factor 3: Peer Sociability**
  Example items*: *Item 18 – 'will join a group of children playing';

  ***Item 20 – 'In social activities, tends to just watch* others' (note that this item was reversed in the analysis)**

  This factor measures the child's ability to play or work well with peers and in groups.

- **Primary School Entry Social Behavioural Factor 4: Anti-social / Worried**
  Example items*: *Item 29 –'teases other children, calls them names';

  Item 37 – 'bullies other children'

  This factor measures the child's tendency to show behaviour that is disruptive to others or that is aggressive or destructive. Often, but not always, such behaviour occurs together with indications of worry or upset by the child.

Analytic strategy

Children and families were clustered by pre-school centre and by primary school and data were hierarchical. Using standard regression with such data can lead to inaccurate error variance estimates. Potentially there was greater similarity between participants within the same centres or schools so the independence of measurement assumption would be violated and misestimating levels of significance was likely. Hence multilevel modeling (Goldstein, 2003) was used to overcome such problems, and also to provide estimates of pre-school centre effects that allowed the identification of pre-school centres that were particularly effective or ineffective in fostering children's development (Sammons et al., 2002).

This article focuses on educational attainment at age 11 and the dependent variables (outcomes) in analyses were English and mathematics attainment at the end of primary school (age 11 years). The independent variables (predictors) used in building the multilevel models were:

Child Characteristics: age at assessment, gender, ethnicity, early developmental, health, and behaviour problems, and birth weight.

Family Demographics: maternal age at child's birth, lone parenthood, mother's and father's education, mother's maternal work status (employed or not), socio-economic status of family (based on highest occupational status of parents), household language (English only, English and other language(s), other language(s) only), household income, and number of siblings.

Area characteristics: The Index of Multiple Deprivation (ODPM, 2004) was used to provide measures of area deprivation for where the child lived through matching by postcode. Also there were two parental perception measures; ratings of neighbourhood safety and degree of social cohesion (social interaction with neighbours).

Home Learning Environment: The parental interview at 3-4 years of age included questions concerning the frequency that children engaged in a range of activities in the home, which was coded on a 0-7 scale (0=not at all; 7= very frequent). Seven of these activities, going to the library, playing with letters/numbers, painting or drawing, being read to, learning activities with the alphabet, numbers/shapes and songs/poems/nursery rhymes, were used in the construction of a home learning environment index as described in online appendix I. The home learning environment index ranged from 0 to 45 (mean= 23; S.D.=7.81) (see Melhuish et al., 2001; 2008).

In the first stage of analysis the multi-level model for each outcome was developed using the predictors just described. Having established a model with the significant predictors from child, family, neighbourhood and home learning environment characteristics, the next predictors

were added one at a time to this model to test for their effects. These predictors included pre-school characteristics, duration, quality and effectiveness and primary school effectiveness.

Pre-school characteristics: months in pre-school, type of pre-school, composition of the pre-school in terms of percentage of mothers with a university degree, and average cognitive ability level of children at 3-4 years old.

Pre-school quality and characteristics: Detailed information was collected on the pre-school centres children attended (Sylva et al., 2006). This included the use of observational rating scales of structural and process quality. Pre-school quality was measured by observation in 141 pre-school settings using the Early Childhood Environment Rating Scale – Revised (ECERS-R) (Harms et al., 1998); focusing on emotional and social care and the Early Childhood Environment Rating Scale – Extension ECERS-E (Sylva et al., 2003) focusing on the pre-school curriculum. The Caregiver Interaction Scale was also used to rate pre-school centres (Arnett, 1998). Interviews with the Centre Managers provided extensive additional information on the characteristics of pre-school centre, including: group size, child-staff ratio, staff training, aims, policies, curriculum, and parental involvement.

In additional we used measures of pre-school and primary school effectiveness. Where children in a pre-school or primary school perform better than expected on the basis of initial attainment and background characteristics that pre-school or school is regarded as effective. Conversely where the children perform less well than expected then it was considered an ineffective pre-school or school. We constructed continuous measure of the degree of effectiveness for pre-schools and primary schools.

Pre-School effectiveness: Children's attainment at the start of primary school (4-5 years) was analyzed in multilevel models controlling for their prior attainment at entry to the study and background influences. As children were clustered in the model by pre-school centre, centre level residuals from the statistical model provided a measure of the pre-school centre's effectiveness in promoting numeracy, as described in online appendix II. Pre-school effectiveness was calculated for attainment in pre-reading (literacy) and early number concepts (numeracy) at the start of primary school. Further details of this approach to measuring pre-school effectiveness are in Sammons et al., (2002).

Primary School effectiveness: All children in state primary schools in England will normally take national assessments at age 7 (Key stage 1) and 11 years (Key Stage 2). The progress between 7 and 11 years of children within a primary school provides a measure of the

effectiveness of that school. The progress from Key Stage 1 to Key Stage 2 of all primary school children in England was analyzed in multilevel models with children clustered by school. However variation in school intakes is great and needs to be taken into account. In England national databases provide a means to do this and adjust the measure of effectiveness for contextual factors. These databases provide pupil information on gender, date of birth, postcode, ethnicity, whether English is first language (EAL), eligibility for free school meals (FSM) (poverty indicator), and special educational needs. From the pupil's postcode it is possible to supplement these data with data on the level of deprivation of the area in which the pupil lives. Having controlled for prior ability, eligibility for free school meals (a marker for poverty), gender, age, ethnicity, English as a second language, school composition, and home area characteristics (deprivation etc.) the multilevel model school level residuals provide a measure of school effectiveness in promoting educational attainment. These analyses involved data for around 540,000 pupils from almost 15,000 primary schools for any one year. Thus the study produced measures of primary school effectiveness that were standardized against all state primary schools in England. The procedure is described in detail in Melhuish et al. (2006). In order that year by year instability in primary school effectiveness measures might be reduced the measures were calculated for 3 successive years (2003-2005), which corresponded to the attendance years for the study children, and then the measures of primary school effectiveness were based on the average over the 3 years. These primary school effectiveness measures were used in subsequent analyses. The effectiveness measures were converted to z-scores ranging from -3.12 to 5.7 (mean=0, S.D.=1). For the children in the longitudinal study the primary school effectiveness scores were extracted for their particular primary schools and matched to individual children.

Full details of data collection procedures, instruments and response rates are contained in the technical reports associated with each phase of the study (see http://eppe.ioe.ac.uk/ or http://www.dcsf.gov.uk/research/programmeofresearch/index.cfm?type=5).

Results

In the multilevel models, demographic, family and pre-school and primary school composition effects were controlled for. Children's attainment in English and Mathematics at the end of primary school (age 11 years) was analysed using multilevel models with children nested within primary schools (Sammons et al., 2008). In the first stage of analysis the effects of child, family and area characteristics and the early home learning environment upon educational attainment in English and mathematics were tested.

Effect sizes are often used to quantify the magnitude of the effect associated with a particular predictor variable. Effects sizes are calculated from the final model, indicating effects having allowed for all other variables. In this report for the categorical explanatory variables, effect size = β/σ_{pupil}; where β is the model parameter estimate and σ_{pupil} is the standard deviation at the pupil level. This means that the effect size (ES) is equivalent to the difference between the means of categories, measured in standard deviation units.

For English gender, birth weight, ethnicity, English not first language (and needing language support) and early developmental problems are all found to have statistically significant effects that are distinct from the effects of all other characteristics considered. For Mathematics, birth weight, early health problems, gender and ethnicity were all found to have a significant effect after allowing for all other variables.

For both English and mathematics the early home learning environment that was measured when the children were 3-4 years old exerted a powerful effect upon attainment at age 11. The effect was particularly strong for English (ES=0.69) but it was also important for mathematics (ES=0.42). These effects were net of all other child, family and area characteristics.

Pre-school versus no pre-school

Once the child, family, area characteristics and the early home learning environment had been allowed for the effects of pre-school were tested. Comparing differences in the educational attainment of children who attended pre-school with the no pre-school (home) group at age 11 years showed that pre-school effects persist and that the home group continued to have poorer outcomes than the group that had attended preschool. There are significant effects on attainment in English and Mathematics: attendance at pre-school compared to no pre-school (ES=0.22 and ES=0.26, respectively) which is consistent with earlier findings (see Sammons et al., 2002; 2004). While these effects are relatively modest they represent a significant long term boost, and the size of the effect is comparable to a child's eligibility for Free School Meals (an

indicator of family poverty). Thus results support the conclusion that going to pre-school does have a lasting and positive impact on educational attainment.

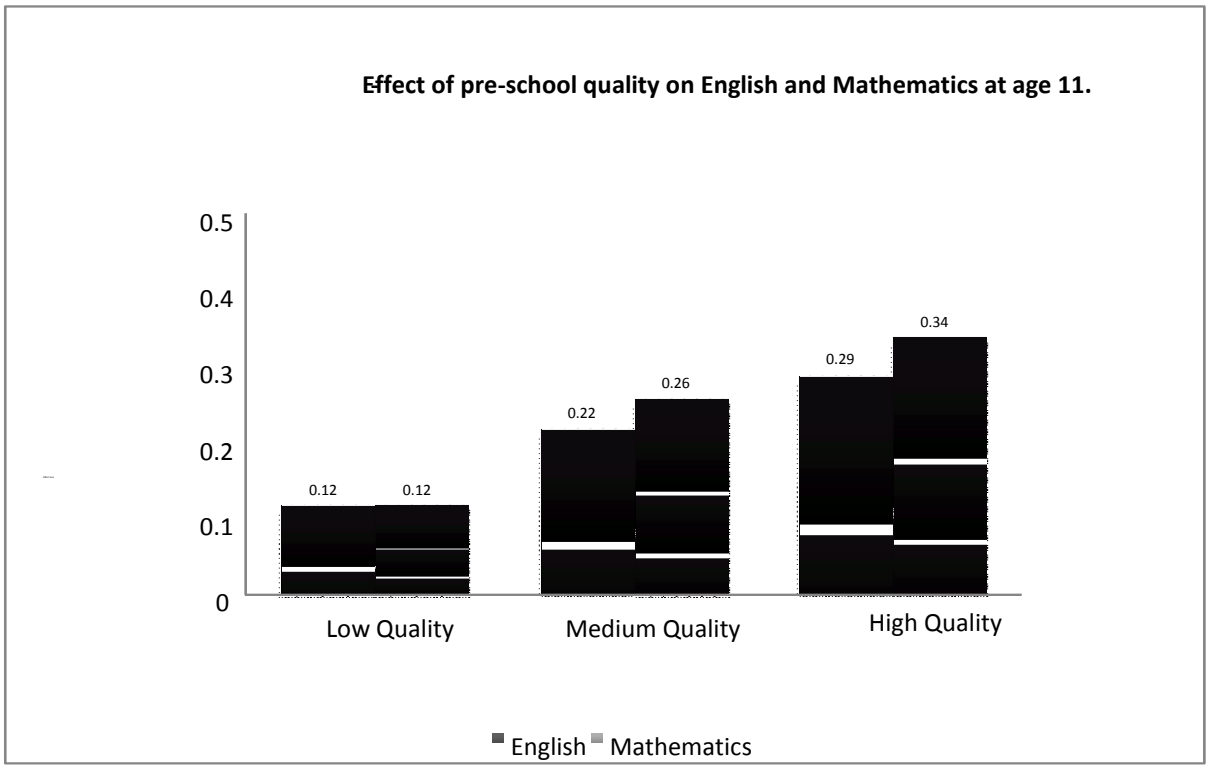
Pre-school quality

The aspect of quality most clearly linked to educational attainment was the total ECERS-E score, i.e. those aspects of quality related to the curriculum and pedagogy. We divided the sample into groups of children with different pre-school experiences to test the effects of preschool quality on the basis of ECERS-E scores:

1. no pre-school experience (i.e. the 'home' group, 10% of sample),
2. low quality pre-school (15%),
3. medium quality pre-school (52%) and
4. high quality pre-school (23%),

After adjusting for all background factors the effects associated with each of these groups can be seen in Figure 1 where the no pre-school ('home' children) group is used as the comparison or baseline group (effect size =0).

Figure 1: Pre-school quality and attainment in English and Mathematics at age 11



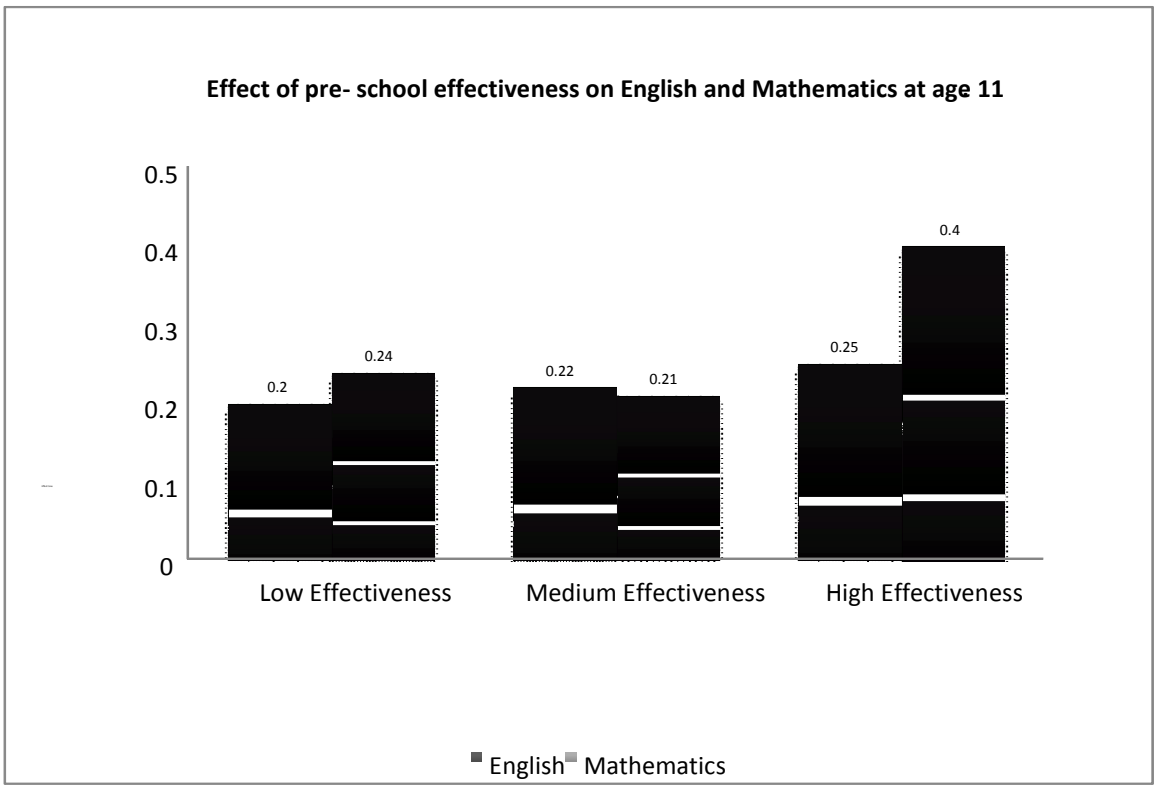
Pupils' attainment increases as pre-school quality increases. The low quality group scores more highly on English and Mathematics than the no pre-school group (ES=0.12) however the differences do not reach statistical significance. The effects for the medium and high quality groups were statistically significant. The effect of high quality versus none is most noticeable for Mathematics (ES=0.34) but still clear for English (ES=0.29). Thus pre-school quality remains a significant predictor of children's attainment in both English and Mathematics at age 11. Also medium and high quality pre-school is associated with significantly enhanced attainment compared to no pre-school or low quality pre-school, and the effects are comparable in size to the difference between boys and girls in attainment. It is worth noting that there is little association between family socio-economic characteristics and pre-school quality in the UK as a result of previous government policies on supporting high quality pre-school in disadvantaged areas.

Pre-school centre effectiveness

Further analyses tested whether pre-school centre effectiveness (in terms of promoting children's progress in Pre-reading at the start of school) predicted better English attainment at age 11, and also whether pre-school centre effectiveness (in terms of promoting children's progress in Early number concepts at the start of school) predicted better Mathematics attainment at age 11. The sample was divided into groups as follows: no pre-school, low pre-school effectiveness, medium pre-school effectiveness, and high pre-school effectiveness. The no-pre-school group (home group) was used as the comparison group in testing for effects.

After controlling for child, family and home learning environment influences, pre-school effectiveness showed a positive impact on attainment in both English and Mathematics at age 11. Children who had attended a more effective pre-school show significantly better attainment than children who had attended no or only a low effective pre-school setting, although the gradient is less strong than for pre-school quality as discussed earlier.

Figure 2: Pre-school effectiveness and attainment in English and Mathematics at age 11



For English attainment, compared to 'no pre-school', children who went to low, medium, or high effective pre-schools still have significantly higher attainment six years later at age 11. Also for Mathematics attainment children who went to low, medium, or high effective pre-school (defined by its impact on promoting early number concepts at the start of school) still have significantly higher attainment than those with no preschool. In addition, those who attended high effective pre-schools did significantly better than those who had attended low or medium effective pre-schools.

Primary school effectiveness

The effectiveness of the primary school attended had a significant influence on pupils' attainment in English and Mathematics at age 11, taking account of background influences. For English, attending a highly effective primary school was associated with a significant boost to attainment (ES=0.24). Also for Mathematics the effectiveness of the primary school was an important predictor of Mathematics attainment (ES=0.38) at age 11. This is in line with earlier school effectiveness research indicating that school effects tend to be stronger for Mathematics and Science.

The results of the above analyses are summarised in Table 1 that shows the effect sizes associated with an independent variable after allowing for all other variables.

Table 1: Effect sizes for significant variables

Predictor Variable	Effect Size English	Effect Size Mathematics
Birth Weight: <1500 gms. Vs. normal	0.47	0.48
Gender: girls versus boys	0.29	0.19
Family Socio-Economic Status: Professional vs. Unemployed	0.25	0.30
Eligible for Free School Meals	0.23	0.15
Early developmental problems: more than 1 versus none	0.38	0.32
English as additional language & needs support	0.59	0.64
Mother's Education: Degree vs. unqualified	0.76	0.71
Father's Education: Degree vs. unqualified	0.30	0.28
Family income: £67500+ p.a. vs. none (2002 figures)	0.26	0.25
Home Learning Environment: high (32+) vs. low (<20)	0.70	0.42
Pre-school vs. no pre-school	0.22	0.26
Pre-school quality (ECERS-E): high vs. no pre-school	0.29	0.33
Pre-school effectiveness: high vs. no pre-school	0.25	0.40
Primary school effectiveness: high vs. low	0.24	0.38

The combined impact of pre-school experience and primary school effectiveness

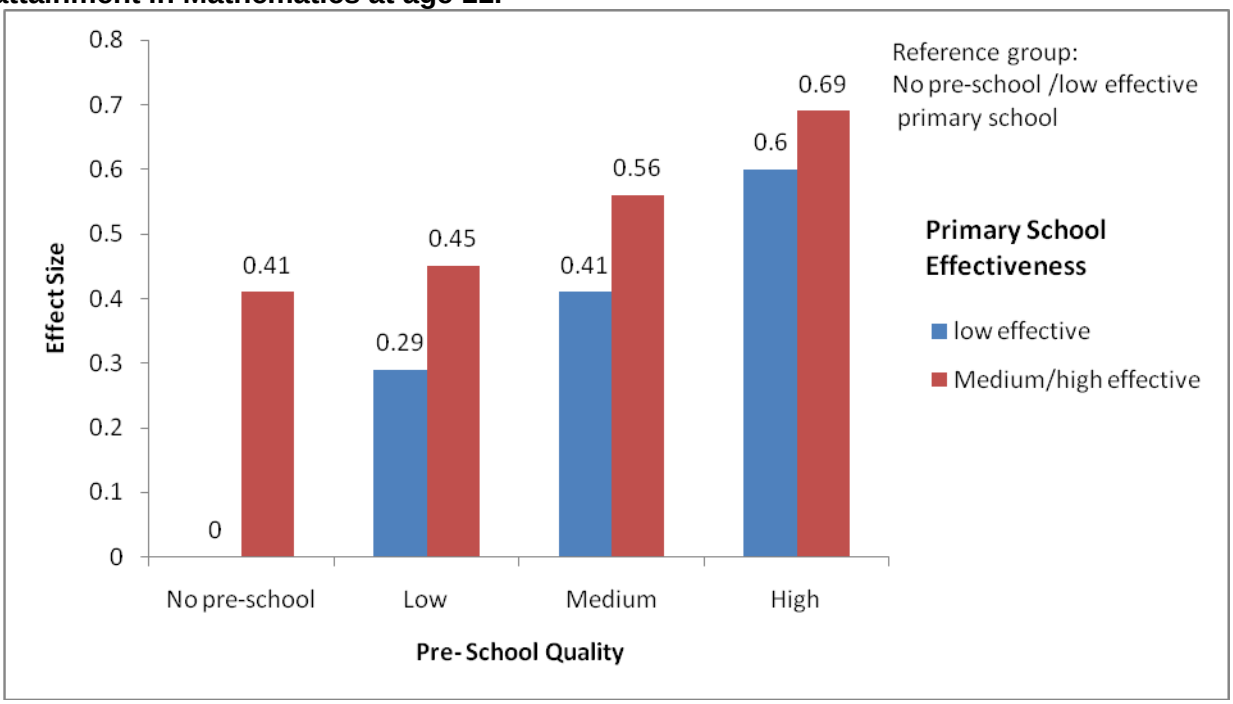
Having calculated the individual effects associated with predictor variables, the joint effects of two predictors, pre-school quality and primary school effectiveness, were investigated. Groups were constructed of children who varied in their experience of pre-school quality (assured by the ECERS-E score of the pre-school) and primary school effectiveness. Due to small numbers, medium and highly effective primary schools were grouped together The groups were:

1. No pre-school and low primary school effectiveness (*comparison group*)
2. No pre-school and medium/high primary school effectiveness
3. Low pre-school quality and low primary school effectiveness
4. Low pre-school quality and medium/high primary school effectiveness
5. Medium pre-school quality and low primary school effectiveness
6. Medium pre-school quality and medium/high primary school effectiveness
7. High pre-school quality and low primary school effectiveness
8. High pre-school quality and medium/high primary school effectiveness.

In analyses the group with no pre-school and low primary school effectiveness was used as a basis for comparison for all the other groups.

The pattern of results for English was less clear than for mathematics, although the combined impact of attending a high quality pre-school followed by an effective primary had the most positive impact. The pattern of results for mathematics was stronger and are shown in Figure 3, the better the quality of pre-school the higher the attainment in Mathematics, and the more effective the primary school the higher the Mathematics attainment.

Figure 3: The combined impact of pre-school quality and primary school effectiveness on attainment in Mathematics at age 11.



The results reveal that 'home' children who did not attend pre-school gain a particularly strong benefit from attending a more effective primary school (ES=0.43). Children who went to a low or medium quality pre-school centre and low effective primary school later on are still doing better than those children who did not have any pre-school experience and went to a low effective primary school (ES=0.29). Children who went to high quality pre-school are doing particularly well, even if they then moved onto a low effective primary school later on. This suggests that high quality preschool may protect children from the disadvantage of attending a low effective primary school. For children who went to a high quality pre-school centre and a medium/high effective primary school, there is an additive effect. These children show the greatest boost in attainment at age 11 controlling for the influence of all other background factors (ES=0.67), so for those who went to a high quality pre-school the effectiveness of the primary school had less impact than it did for those who did not go to pre-school or who had attended a low quality pre-school.

Summary

Further analyses from this study can be seen in Sammons et al., (2008a), and the main findings of this article can be summarized as follows.

Child and family background characteristics: The most important background predictors of English and Mathematics attainment at age 11 are: the early years HLE measured at age 3-4, mothers' highest educational levels, and continued need for support with English as an Additional Language (EAL). Gender has an effect on both English (girls have higher attainment) and Maths (boys have higher attainment). The strength of the effects associated with the home learning environment are particularly noteworthy, as they are independent of the socio-demographic characteristics of the child or family.

Pre-school effects: Attending a pre-school has benefits for English and mathematics attainment at age 11, but the impact is carried mainly by the pre-school quality and effectiveness effects. The findings suggest that low quality and less effective pre-school has only a small benefit on children's longer term outcomes at age 11 in comparison with the 'home' (no pre-school) group. Conversely, medium (the most common experience) and particularly high quality pre-school show more significant benefits for children's educational attainment at age 11. 'Home' children do less well in English and mathematics at age 11 compared to those who attended medium or

higher quality pre-school even when we take account of influence of a wide range of background influences, and the effects persist even after six years in primary school.

Primary school effects: The primary school is also important. Attending a more effective primary school also boosts children's academic outcomes in English and particularly in Mathematics. Other analyses (see Sammons et al., 2008) reveal that primary school effectiveness is a particularly significant influence for those children who did not have the advantage of attending a pre-school, many of whom came from families with low levels of education. This finding is very relevant to policies that aim to encourage social inclusion as well as raising standards.

The interaction of pre-school quality and primary school effectiveness: Children who went to a higher quality pre-school centre and a medium/high effective primary school had the greatest boost in attainment at age 11 controlling for background factors. Also for children who went to a high quality pre-school the effectiveness of the primary school is less important than for those who did not go to pre-school or attended a low quality pre-school.

Discussion

In a technologically sophisticated world a population's educational attainment is likely to be increasingly important for a nation's economic development. This study shows the factors that can influence such attainment. The effects associated with various child and family background variables in this study are very similar to those frequently reported in other studies. However the effects associated with the home learning environment have been rarely studied, are large and occur after allowing for other significant variables. Also it is noteworthy that the home learning environment shows low correlations with measures of parents' SES or education (r=0.28-0.32), and shows effects greater than socio-economic status or family income and similar in size to those of parent education. Other studies investigating home influences have used the Home Observation for the Measurement of the Environment (HOME), and the correlations between HOME and maternal education or SES are in the range 0.36 to 0.50 for differing social and ethnic groups. Generally HOME measures are significantly associated with social and cognitive development after controlling for demographic factors (Bradley, Corwyn, Burchinal, McAdoo & Coll, 2001). So there is supporting evidence for the importance of the

home learning environment, and the conclusion that what parents do is as important as who parents are.

The effects of the early home environment and parenting upon children's development may partly be due to the teaching and learning of specific skills, e.g. letter-sound relationships. However, the multiplicity of learning opportunities included in the home learning environment suggests that the effects may be related to more generalised and motivational aspects of child development, e.g. learning to learn. Also children may internalise aspects of parental values and expectations (implicit in the home learning environment activities) as they form a self-concept of themselves as a learner. Such a perspective is congruent with Vygotsky's (1978) theory that children learn higher psychological processes through their social environment and specifically with adult guidance operating within a child's "zone of proximal development" (stimulation within the child's comprehension) and reinforces the idea that children acquire cognitive skills such as literacy through interaction with others who aid and encourage skill development.

It is quite possible that the strong relationship between the home learning environment and cognitive scores is mediated by some intervening unmeasured factor. For example those parents who participate in the home learning activities may have other characteristics that lead their children to have higher cognitive scores. Even if this were so, the home learning environment would still be an efficient proxy measure of such unmeasured factors.

Whatever the mechanisms, the influences of parenting upon child development are pervasive. Research involving 0-3 year-olds from the evaluation of the Early Head Start program, which provided combinations of home-visits and center childcare intervention for disadvantaged families, found that the intervention increased both the quantity and quality of parents' interaction with children, as well as children's social and cognitive development (Love et al., 2005). A review of early interventions concluded that, to gain the most impact, interventions should include both parent and child together with a focus on enhancing interactions (Barnes & Freude-Lagevardi, 2003). Such work indicates that parenting behaviors are learnable, and changes in parenting are predictive of improved child development. Similar conclusions derive from a study by Hannon, Nutbrown & Morgan (2005) in the UK, where children showed better literacy progress when parents received a program on ways to improve child literacy during the preschool period.

The EPPE study has been highly influential for policy in the UK and beyond (Siraj-Blatchford et al., 2008; Taggart et al., 2008). No other study has attained the same level of control of background factors with such a large sample, and having allowed for all significant child, parent, family, home learning environment and school composition variables there are still

substantial effects associated with the pre-school and primary school that the child attended (see Sylva et al., 2010). These effects are sufficiently large that they are important in policy terms for any government wishing to maximize educational attainment across the population. They are of similar magnitude to the effect for father's education and family income. In this study the typical child attended pre-school for 18 months, and would have attended primary school for six years at the time of final assessment. This indicates that a relatively short period of attendance at an effective pre-school has effects that are roughly equivalent to a substantially greater period of attendance at an effective primary school, thus indicating the efficacy of pre-school.

British cohort studies with less control of background factors also indicate the benefit of pre-school education over none. Osborn and Milbank (1987) followed 8500 children born in 1970 and found that preschool generally boosts cognitive attainment at ages 5 and 10. Also Goodman and Sianesi (2005) analyzed data from a cohort born in 1958 and found that pre-school education led to improvements in cognitive scores, including mathematics and reading at age 7. Although these effects diminished in size, they remained significant up to age 16. In adulthood, pre-school experience was associated with an increased probability of obtaining qualifications, of being employed, and a 3-4% wage gain at 33.

In the US the Early Childhood Longitudinal Study (ECLS-K), a nationally representative sample of children who entered kindergarten in 1998, was used by Magnuson, Ruhm and Waldfogel (2004), who found that pre-kindergarten increases mathematics and reading skills at kindergarten entry, but the cognitive gains largely dissipate by the spring of first grade. Using the same sample Loeb et al., (2007) find that the gains are greatest if pre-school starts between 2 and 3 years of age as found by Sammons et al., (2004a) in England. Other US research also finds benefits for children from pre-school education (Gormley, Phillips, & Gayer, 2008). Also Aboud (2006) found that pre-school boosted primary school achievement in Bangladesh, with similar results reported for ten countries by Montie, Xiang & Schweinhart (2006). Other recent research also compares children having pre-school experience versus none. Berlinski, Galiani & Manacorda (2007) used administrative data in research in Uruguay. A period of expansion of preschool in the 1990's allowed this study to compare a) siblings with and without preschool and b) regions that varied in speed of preschool expansion. Controlling for background characteristics, both comparisons indicated clear benefit of preschool for school performance in primary and secondary school. Similarly Berlinski, Galiani & Gertler (2006) used the expansion of the preschool education in Argentina in the 1990's to explore the covariation amongst regions of changes in school performance with increases in preschool education. They found benefits

for literacy and numeracy such that that 1 year of preschool education increased attainment in primary school by 0.23 of a standard deviation, which is very similar in size to the effect of attending pre-school reported here.

Such research indicates the importance of enhancing young children's school readiness. Academic achievement in adolescence and beyond can be linked back to academic skills at school entry (Alexander, Entwisle, & Horsey, 1997), and school entry ability can, in turn, be linked to preschool abilities (Agostin & Bain, 1997). Possibly preschool experience in the home and in pre-school centres matters because behavior is more susceptible to environmental influences during the pre-school years compared to later in childhood, or because starting school is a critical social transition when ability predicts longer-term achievement through creating expectations. However as demonstrated in this study and supported by US evidence (Peisner-Feinberg et al., 2001) and evidence from Northern Ireland (Melhuish et al., 2006b), the quality of pre-school is extremely important and significant benefits will not accrue from poor quality pre-school.

Such studies do not have the range of covariates included in the current study in order to control for selection effects, and this is very important given the significant effects associated with other variables such as the home learning environment, parents' education and primary school effectiveness. Nonetheless they mostly provide evidence consistent with the findings reported here, which are consistent with findings from the NICHD study (NICHD, 2002), where family characteristics have a greater impact on outcomes for children than pre-school factors, although pre-school effects were also significant.

The current study demonstrates the relative magnitude of home, pre-school and school effects upon educational attainment. Other reports from this study also show important benefits deriving from pre-school education for social development (e.g. Sammons et al., 2008b). Such consistent evidence on the benefits of pre-school education is a strong argument for the universal provision of pre-school education. This is already present in many advanced societies and is increasingly sought by many other countries, which are actively planning for improved social and economic development.

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