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Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to age five years

Research report

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**Study of Early Education
& Development**



Social Science in Government

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Executive Summary

Several decades of research indicated that early childhood education and care (ECEC) can have a positive effect on children's educational, cognitive, behavioural and social outcomes, in both the short and long term, particularly if it is of good quality (Sylva et al., 2010; Melhuish et al., 2015; Melhuish & Barnes, 2018). From September 2004, all three- and four-year-olds in England have been entitled to funded early education. Since September 2010 this entitlement was for 570 hours per year (commonly taken as 15 hours per week for 38 weeks of the year). From September 2017 the entitlement doubled to 1140 hours per year (equivalent to 30 hours per week for 38 weeks of the year) for families where parents are each earning at least the equivalent of the National Minimum Wage or Living Wage for 16 hours per week.¹

Research also indicated that the benefits of high quality early education exist from as young as two years of age (Sammons et al., 2002). In 2013, the UK Government expanded the funded early education entitlement to two-year-old children living in certain disadvantaged households in England. Specifically, from September 2013 the entitlement of 570 hours per year was introduced for two-year-olds looked after by the local authority and those from families receiving specified benefits, who might be regarded as the most disadvantaged. It was further extended in September 2014 to two-year-olds from low income families, two-year-olds with special needs and two-year-olds who have left care.

The Study of Early Education and Development (SEED)² includes a major longitudinal study designed to provide evidence on the effectiveness of early years education and to identify any short- and longer-term benefits from this investment in early education. The study is being conducted by a consortium including the National Centre for Social Research, the University of Oxford, Action for Children and Frontier Economics. SEED aims to study children at age two, three, four, five and seven years to seek information on how variation in early childhood education and care experience may be associated with cognitive and socio-emotional development. This report focuses on how ECEC may be related to children's development during school reception year / school year one, with these objectives:

1. To study the associations between the amounts of different types of ECEC that children received between the age of two and the start of school and child development at school reception year / school year one.
2. To study the associations between the quality of the ECEC group settings that children have attended aged two to four and child development at school reception year / school year one.
3. To consider how age of starting ECEC may be associated with child development at school reception year / school year one.

¹ 30 hours childcare are available if parents and partners with whom the child lives are in work (including on parental leave, sick leave or annual leave) and each earning at least the national minimum wage for 16 hours a week and less than £100,000 per year.

² Further information about the SEED study and reports published to date are available at <http://www.seed.natcen.ac.uk/>.

4. To study the associations between combinations of types of ECEC between age two and the start of school and development at reception year / school year one.
5. To investigate the impact of the home environment, parenting and the quality of the parent/child relationship on development at reception year / school year one.

Historical context

The last comparable study of ECEC in England was the Effective Pre-school, Primary & Secondary Education (EPPSE) study which studied the impact of use and the quality of ECEC on child development in the period 1997-2000.³ Since that time, there have been considerable changes in the use of ECEC and in the provision available. Most notably:

1. The proportion of children using some group ECEC (in playgroups, nursery classes, nursery schools etc.) has increased so that now the use of such provision is almost universal; 98.8% of children in the SEED study attended some group ECEC between age two and the start of school.⁴
2. The quality of the group ECEC available has increased. For example, the average score on the Early Childhood Environment Rating scale (ECERS-R), a measure of overall quality for ECEC settings, increased from 4.29 for settings in the EPPSE study (an “adequate” rating) to 5.18 for settings in the SEED study (a “good” rating).⁵

These historical shifts in ECEC use and the quality of ECEC provision are important for the interpretation of the findings of the SEED study.

Method

Sample

The study participants consisted of 3,186 children and their families on whom data were collected when children were aged two, three, four and five years old. Additionally, data from the Early Years Foundation Stage Profile (EYFSP) was available for 4,942 children when they were in reception class.

The aim was to have approximately equal numbers from three levels of disadvantage, as defined by family income and benefits received:

1. The 20% most disadvantaged families (“most disadvantaged” group)
2. The 20%-40% disadvantaged families (“moderately disadvantaged” group)
3. The 60% least disadvantaged families (“least disadvantaged” group)

³ See Sylva, 2004.

⁴ See section Early Childhood Education and Care (ECEC), p 16.

⁵ See Melhuish & Gardiner, 2017.

Early Childhood Education and Care (ECEC)

In this study, ECEC settings eligible for government funding were labelled as ‘formal’; those not eligible for government funding were labelled as ‘informal’. Settings in a non-domestic setting were labelled as ‘group’, whilst those in a domestic setting were labelled as ‘individual’. All group ECEC was formal, whereas some individual ECEC was formal and some informal. The following three-way grouping of ECEC is used:

1. **Formal group ECEC** – ECEC in a non-domestic setting and eligible for government funding (e.g. day nurseries, nursery classes or schools and playgroups).
2. **Formal individual ECEC** – ECEC in a domestic setting and eligible for government funding (i.e. childminders).
3. **Informal individual ECEC** – ECEC in a domestic setting and not eligible for government funding (e.g. childcare with relatives, friends, neighbours and nannies).

Children in SEED may attend any form of ECEC, and some children attended more than one type. Of the 3,186 children in Wave 4 of the SEED study, 3,149 had some formal group ECEC between age two and the start of school, 419 had some formal individual (childminder) ECEC during this period and 1,686 had some informal individual ECEC.

A further breakdown of the formal group ECEC category was used in some analyses to compare private, voluntary and independent (PVI) settings with maintained settings defined as follows:

- a. Private, voluntary and independent (PVI) formal group ECEC administered privately or by voluntary / charitable organisations.
- b. Maintained formal group ECEC, which is local government administered (i.e. nursery classes, nursery schools, Local Authority nurseries, children’s centres).

Child development measures

This report brings together data on child development from different sources. The National Pupil Database (NPD) provided Early Years Foundation Stage Profile (EYFSP) information, which is a teacher assessment of cognitive and socio-emotional outcomes at the end of the reception year. Children were assessed directly during school year one by research staff using subscales of the British Ability Scales (BAS) and by teacher ratings using the Children’s Self-regulation and Behaviour Questionnaire (CSBQ).

Educational achievement and development

The Early Years Foundation Stage Profile (EYFSP) is a teacher rated assessment of children at the end (May to June) of reception year.⁶ Child outcomes from five areas were considered:

⁶ See Early Years Foundation Profile, 2018.

- A. Communication and Language
- B. Physical Development
- C. Personal, Social and Emotional Development (PSED)
- D. Literacy
- E. Numeracy

In addition, an Overall Good Level of Development was derived from these five outcomes and the EYFSP total score was derived from the complete EYFSP assessment.

Cognitive development

Children’s cognitive development was assessed at the start (September to December) of school year one using two British Ability Scales (BAS) measures:⁷

1. Verbal ability (“naming vocabulary”).
2. Non-verbal ability (“picture similarities”).

Socio-emotional development

Children’s socio-emotional development was assessed using the Children’s Self-regulation and Behaviour Questionnaire (CSBQ), completed by children’s teachers in the later part (March to May) of school year one.⁸ This was scored to produce two socio-emotional problems scales:

1. Externalising behaviour (e.g. child loses temper, argues with other children)
2. Internalising behaviour (e.g. child is easily upset, is anxious)

and five socio-emotional strengths scales:

1. Sociability (e.g. child has friends, plays with other children)
2. Prosocial behaviour (e.g. child is co-operative, is helpful, shares things)
3. Behavioural self-regulation (e.g. child follows instructions, waits their turn)
4. Cognitive self-regulation (e.g. child chooses their own tasks, persists with tasks)
5. Emotional self-regulation (e.g. child is calm, keeps temper)

ECEC quality measures

Researchers assessed the quality of 1,000 ECEC settings attended by the SEED children: 402 settings attended at age two, and 598 settings attended at age three.

At age two (Wave 1), setting quality was assessed using:

1. Sustained Shared Thinking and Emotional Well-being (SSTEW) scale – measuring the quality of staff / child interaction.
2. Infant and Toddler Environment Rating Scale – Revised (ITERS-R) – an overall measure of quality for under-threes (e.g. activities, interactions, routines).

At age three (Wave 2) setting quality was assessed using:

1. SSTEW – measuring the quality of staff / child interaction.

⁷ See Elliot, Smith & McCullough, 2011.

⁸ See Howard & Melhuish, 2017.

2. Early Childhood Environment Rating Scale – Revised (ECERS-R) – an overall measure of quality for over-threes (e.g. activities, interactions, routines).
3. Early Childhood Environment Rating Scale – Extended (ECERS-E) – an extension of ECERS-R focussing on aspects of educational and learning opportunities.

Home environment measures

Nine home environment measures were included in the analyses. These were derived from the SEED Wave 1, Wave 2 and Wave 3 interviews:

1. Home Learning Environment (HLE) index (learning activities in home: e.g. parents read with child, child draws/paints at home)
2. Household Disorder (CHAOS scale: e.g. house is noisy, house is disorganised).
3. Parent's Psychological Distress (e.g. symptoms of depression or anxiety).
4. Limit Setting (i.e. how often parents set limits on their child's behaviour).
5. Warmth (MORS scale, closeness in the parent/child relationship: e.g. relationship is affectionate, parent and child do things together).⁹
6. Invasiveness (MORS scale, conflict in the parent/child relationship: e.g. parent finds child annoying).⁹
7. Authoritative parenting, characterized by high demands / high responsiveness.¹⁰
8. Authoritarian parenting, characterized by high demands / low responsiveness.¹⁰
9. Permissive parenting, characterized by low demands / low or high responsiveness.¹⁰

Where measures were available from multiple waves, the mean value was taken.

Demographic measures

Models were also controlled for demographic family characteristics. Details are in Chapter 2.

Results

Statistical significance and effect size

The analyses assess whether results are statistically significant; a result is considered statistically significant if it is unlikely to have occurred by chance. Only statistically significant results are discussed in the executive summary. Having established that a result is statistically significant, it may also be helpful to know whether it should be considered a small, medium or large effect. These benchmark classifications are informal, but they will be used as an aid to describing the results.¹¹

⁹ See Simkiss et al., 2013.

¹⁰ See Robinson, 1995.

¹¹ Details are given in Chapter 2, p 57.

Is the amount and type of ECEC associated with child development?

All children were compared according to their ECEC use, which was treated as a continuous variable. The statistical models were organised so that the reported effect is the change in the standardized outcome corresponding to a ten hour per week change in ECEC use. Formal group, formal individual (childminder) and informal individual ECEC were treated separately. A summary of results is given in Table 1. Where significant effects of ECEC use were found in initial analyses, further analyses were conducted comparing the effects of specific ECEC usage bands.

Table 1: Summary of associations between children's time (hours per week) in ECEC between age two and start of school and children's outcomes during reception year / school year one.

Outcome variable	ECEC use aged 2 to start of school		
	Formal group	Formal individual	Informal individual
Cognitive development			
Verbal ability	+0.029	+0.058	+0.059 **
Non-verbal ability	+0.033	+0.020	+0.007
Socio-emotional problems			
Externalising behaviour	+0.127 ***	+0.102 **	-0.016
Internalising behaviour	+0.068 **	+0.069	-0.006
Socio-emotional strengths			
Sociability	-0.031	-0.049	+0.016
Prosocial behaviour	-0.052 *	+0.017	+0.025
Behavioural self-regulation	-0.094 ***	-0.017	-0.002
Cognitive self-regulation	-0.026	+0.020	+0.012
Emotional self-regulation	-0.125 ***	-0.080 *	-0.009
Early Years Foundation Stage Profile (EYFSP) Outcomes			
Communication and Language	1.034	1.232	1.054
Physical Development	1.081	1.287	0.954
Personal, Social & Emotional Development	1.013	1.241	1.028
Literacy	1.015	1.074	0.984
Numeracy	1.058	1.093	1.108
Good level of development	1.011	1.091	0.999
Early Years Foundation Stage Profile: Total score			
EYFSP total score	+0.001	+0.009	+0.011

Sample size = 3186 (cognitive and socio-emotional outcomes); = 4942 (EYFSP outcomes)

The table shows coefficients for associations between hours of ECEC type and each outcome. Statistically significant coefficients are in **bold italics**, significance thus: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes (cognitive and socio-emotional outcomes and EYFSP total score), coefficients give the change in the standardized outcome corresponding to a ten hour per week change in the ECEC use covariate, controlling for all other covariates.

For binary outcomes (Early Years Foundation Stage Profile Outcomes), coefficients give the change in probability of achieving the expected level of development for a ten hour per week change in ECEC use, expressed as an odds ratio. Values greater than one show increased probability; values less than one show decreased probability of achieving the expected level of development.

Informal individual ECEC (with friends, relatives etc.)

More informal individual ECEC hours per week between age two and the start of school was associated with small benefits for child verbal ability measured during school year one. This finding is consistent with results in the SEED age three and age four studies.

Mean hours per week of Informal individual ECEC was not associated with socio-emotional or EYFSP outcomes.

Formal individual (childminder) ECEC

More hours per week of formal individual (childminder) ECEC between age two and the start of school was associated with two poorer child outcomes, more externalising behaviour and less emotional self-regulation, assessed during school year one. These effects were of medium size for children using over twenty hours per week of childminder ECEC.

There were no associations between childminder hours per week and cognitive outcomes. There were also no significant associations between childminder ECEC use and the EYFSP outcomes overall, but some significant associations emerged in separate analyses for the different disadvantage groups (see below).

Formal group ECEC (e.g. in playgroups, nursery classes, nursery schools)

Using more formal group ECEC between age two and start of school was associated with several poorer outcomes: more externalising behaviour, more internalising behaviour, less prosocial behaviour, less behavioural self-regulation and less emotional self-regulation, during school year one, at age five to six.

Further analysis showed that for internalising behaviour, poorer outcomes were associated particularly with high formal group ECEC use, greater than thirty-five hours per week; this was an effect of medium size. For other outcomes (externalising behaviour and emotional self-regulation) poorer outcomes were found for children using a mean of more than fifteen hours per week between age two and the start of school (a small effect) and for children using more than twenty hours per week (a medium effect).

These unfavourable associations between formal ECEC use and children's socio-emotional outcomes contrast with the largely positive associations between formal ECEC use and children's socio-emotional outcomes found in the SEED study when children were age three and age four, except more than 35 hours per week which was associated with higher levels of conduct problems at ages three and four. For children's socio-emotional outcomes during school year one, the negative associations with higher levels of formal ECEC use between age two and the start of school were more wide ranging.

Part of the reason for these unexpected differences may be differences in the source of the socio-emotional measures. The age four socio-emotional measures were derived from parent report, whereas the later outcomes were derived from teacher report. Whilst the parent and teacher assessed socio-emotional measures are positively associated as would be expected, these associations are relatively weak. It is likely that differences in the relationships that a parent and a teacher have with a child affects the child's behaviour and how it is perceived, leading to significant differences between socio-emotional measures. Also, it is possible that coping with the new environment of school was influencing children's socio-emotional behaviour.

In order to consider the extent to which poorer socio-emotional outcomes associated with formal ECEC use were indicative of socio-emotional problems, a definition of marked child socio-emotional problems was established. A child was considered to have socio-emotional problems if four or more of the seven socio-emotional measures were more than one standard deviation from the mean. According to this definition, 12.5% of the children had socio-emotional problems. Having socio-emotional problems was associated with poorer child cognitive and EYFSP outcomes, with medium to large effects for EYFSP. This indicates the interrelatedness of socio-emotional well-being and children's cognitive development and educational attainment.¹² There was also a small association between having definite problems and the amount of formal group ECEC used between age two and the start of school. The importance of this finding will depend on whether this is a transient effect or whether it persists into children's later school careers. This question will be considered at age seven in a later SEED report.

Outcomes not significantly associated with ECEC use

There were no overall effects associated with ECEC use between age two and the start of school on non-verbal ability, sociability, cognitive self-regulation and the EYFSP measures.

What do these results mean in practice?

The effects associated with ECEC are small overall, making only a small difference to development, not always identifiable in practice. As an example of the sort of differences which ECEC use may make, consider the difference between a child who has experienced no informal individual ECEC between age two and the start of school and a child who has had on average twenty hours informal individual ECEC per week. The analysis predicts that the latter child will score, on average, 1.2 points higher on the BAS verbal ability test, a test on which the poorest performing children score 20 and the best performing score 80.

As a second example, consider the difference between a child who has no formal group ECEC use between age two and the start of school and a child who has an average of twenty hours formal group ECEC per week. The analysis predicts that the latter child will score, on average, 0.9 points higher on the externalising behaviour scale, a scale that runs from 5 for children showing the least externalising behaviour to 24 for those children showing the most.

Variation in results by disadvantage group and by the home learning environment

The effect of ECEC on children may vary according to differences in disadvantage and the home learning environment. The initial analyses looked for interactions between

¹² Since the EYFSP assessments (made during May to June of children's reception year) and the cognitive assessments (made during September to December of school year one) preceded the socio-emotional assessment (made during March to May of school year one), the most straightforward explanation for these associations is that good educational and cognitive development promotes positive socio-emotional outcomes. However, it is plausible that the causal relationship is in fact bi-directional, with feedback from good socio-emotional development to good cognitive and educational development as well as vice versa.

ECEC use and disadvantage group as well as interactions with the home learning environment score. Only statistically significant interactions are discussed.

Variation by disadvantage group

The association between formal individual (childminder) ECEC use and EYFSP total score varied according to SEED disadvantage group. All effects were of small size.

For children from the 20% most disadvantaged families, a larger number of hours per week spent in childminder ECEC between age two and the start of school was associated with poorer EYFSP total score during school reception year. For children from the 20%-40% moderately disadvantaged families, more hours per week spent in childminder ECEC between age two and the start of school was associated with better EYFSP total score during school reception year. The interpretation of these findings is not clear, but it may be that the most disadvantaged families are more likely to have access to poorer quality childminder care.¹³

For children in the 60% least disadvantaged families there was no association between childminder ECEC use and EYFSP total score. This lack of association may reflect a saturation effect, i.e. the relatively advantaged already have “enough” learning opportunities.

Note that there were no corresponding effects associated with the use of formal group ECEC (i.e. playgroups, nursery classes etc.)

Variations by home learning environment

When children were aged four years more use of formal group ECEC was associated with better cognitive outcomes overall, specifically for non-verbal ability. In the current report for school year one, there was a small association between formal group ECEC use and better verbal ability during school year one, and only for children from families in the lowest quartile of home learning environment score (i.e. the least enhancing home learning environments). This again may reflect a “saturation effect” where the benefit children experience from out of home learning opportunities is less for those children who already experience many learning opportunities at home.

Is the quality of ECEC associated with child development?

A small positive association occurred between children attending better quality ECEC at age two and poorer non-verbal ability during school year one. In the absence of supporting evidence from other studies (including earlier SEED ages 3 and 4 analysis), it is cautiously concluded that this unexpected finding is an instance of a Type I error: that is, a chance finding rather than a causal association. This issue is discussed in Chapter 4.

Accepting this interpretation, there is of a lack of association between the ECEC quality aged two to four and child outcomes during reception / school year one, for two reasons:

¹³ In a recent Ofsted report, the proportion of childminders judged good or outstanding was higher in less deprived areas, although even in deprived areas the majority of provision was of good or outstanding quality. See Ofsted, 2018.

1. The sample size for the quality analyses is smaller than for other analyses, so the minimum size of effect that can be detected needs to be larger. It may be that there are associations between ECEC quality and child outcomes, but the small sample size means analyses are not sensitive enough to detect them.
2. The quality of ECEC has increased substantially over the last twenty years.¹⁴ The resulting comparative homogeneity in ECEC quality, particularly the relative lack of poor quality provision, may lead to a lack of statistical associations between ECEC quality and child outcomes.

Maintained and private / voluntary / independent (PVI) ECEC

The effects of ECEC appeared to be equivalent for maintained and PVI settings, with no significant differences.

The age formal ECEC use starts

Models were fitted in terms of the age when children first used ten or more hours per week of either formal group or formal individual ECEC. Because the start age and the amount of formal ECEC between age two and the start of school are positively associated, the model used a combined start age / use factor; see Table 2. Analyses controlled for informal ECEC and for demographic and home environment factors.¹⁵

Table 2: Breakdown by factor combining the age at which ten or more hours per week formal ECEC was first used and the mean formal ECEC usage between age two and the start of school.

Factor level	Age formal ECEC started 10 or more hours/ week	Mean weekly formal ECEC use	Number in group
Early start / high use	0-24 months	Over 20 hours per week	551
Early start / low to medium use	0-24 months	Up to 20 hours per week	336
Intermediate start / high use	25-36 months	Over 20 hours per week	194
Intermediate start / low to medium use	25-36 months	Up to 20 hours per week	656
Late start / medium to high use	37-54 months	Over 10 hours per week	755
Late start / low use	37-54 months	Up to 10 hours per week	507
Never used 10+ hours/ week formal ECEC	Never		187

The late start / low use group — children who first used ten or more hours per week formal ECEC aged 37-54 months and who used a mean of up to ten hours per week formal ECEC between age two and the start of school — was used as the reference group with which the other usage groups were compared.

60% least disadvantaged children

For children from the 60% least disadvantaged families, the greatest benefits were associated with an early start in formal ECEC combined with a low to medium use (up to

¹⁴ See Melhuish & Gardiner, 2017.

¹⁵ There were variations in the home environment and demographic variables by level of the formal ECEC start age / use factor. These are tabulated in the Technical Annexe to this report. Since these variables were controlled for in the models, these differences do not invalidate the analysis.

20 hours per week) of formal ECEC between age two and the start of school. These children had better EYFSP numeracy (a medium sized effect) and better sociability and prosocial behaviour compared with the late start / low use reference group. Children in the intermediate start / high use group had poorer outcomes for externalising behaviour than children in the reference group; this was a medium sized effect.

40% most disadvantaged children

For this analysis the most and the moderately disadvantaged groups were combined. For children from the 40% most disadvantaged families, compared with children with a later start and lower use of formal ECEC, an early start and a mean of over 20 hours per week formal ECEC between two and the start of school had benefits for EYFSP outcomes (except physical development), as well as small benefits on verbal ability. However, early start and high use was associated with poorer outcomes than the reference group for externalising behaviour and emotional self-regulation (small to medium sized effects).

Children belonging to the intermediate start / high use group showed small benefits on verbal ability, but medium sized negative effects on their externalising behaviour and emotional self-regulation.

These results concerning age of starting formal ECEC indicate the possible benefits of an early start in formal ECEC, especially for more disadvantaged children, as well as the potential disadvantages of high use of formal ECEC.

Combination of types of ECEC

Analyses compared four combinations, defined according to formal and informal ECEC use:

1. Low formal group use (mean of up to fifteen hours per week) and no informal use (N = 892).
2. Low formal group use (mean of up to fifteen hours per week) and some informal use (N = 1222).
3. High formal group use (mean of greater than fifteen hours per week) and no informal use (N = 447).
4. High formal group use (mean of greater than fifteen hours per week) and some informal use (N = 625).

Analyses controlled for demographic and home environment covariates.¹⁶ The “low formal group / no informal” children (1) were used as the reference group with which other children were compared. All the effects were of small size.

1. The low formal group / some individual children (2) had better verbal ability in school year one than the reference group.
2. The high formal group / no individual (3) differed from the reference group as follows:
 - a. Higher non-verbal ability during school year one.

¹⁶ There were variations in the home environment and demographic variables by level of the ECEC use factor. These are tabulated in the Technical Annexe to this report. Since these variables were controlled for in the models, these differences do not invalidate the analysis.

- b. Poorer socio-emotional outcomes in school year one: externalising behaviour, sociability, prosocial behaviour, behavioural self-regulation and emotional self-regulation.
 - c. Poorer outcomes for EYFSP personal, social and emotional development and for EYFSP total score.
- 3. Children using high formal group / some individual (4) differed from the reference group as follows:
 - a. Higher verbal ability during school year one.
 - b. Poorer outcomes in school year one for socio-emotional outcomes externalising behaviour and emotional self-regulation. Note that these effects were smaller than the corresponding effects for the high formal group / no individual (3) children. There were no effects for EYFSP scores.

These results will require further exploration within the SEED study and in other research studies before a full interpretation can be made. However, a tentative conclusion might be that the addition of some individual ECEC (childminders, friends / relatives) is able to mitigate some of the negative socio-emotional outcomes that children may otherwise experience from high use of formal group ECEC. It may be that a greater level of one-to-one interaction in individual ECEC is helpful in building children's emotional resilience. If this finding is confirmed by further research, it may be of considerable policy significance.

Are variations in the home environment associated with child development?

Analyses were conducted to look at the relevance of the home environment, controlling for the amount and type of ECEC use between age two and the start of school and demographic variables.

The associations amongst the home environment variables have the potential to produce misleading results. For this reason, effects of home environment variables are considered only if there was additionally a significant association between an outcome and a given home environment covariate in a separate regression of the outcome on the relevant home environment variable alone, controlling only for demographic covariates, i.e. the home variable had to produce a significant result in two separate regressions.¹⁷

All effects were of small size. Results are given in Table 3. Of nine home factors, the most influential on EYFSP outcomes were the Home Learning Environment (HLE), household chaos and warmth of the parent / child relationship; better scores for all these variables were associated with better outcomes on all EYFSP measures.

Table 3: Summary of the associations between home environment variables and children's outcomes during reception year / school year one.

	Home environment variables
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¹⁷ Further details are given on p. 114.

Outcome variable	Home learning environment	Household CHAOS	Parent's psychological distress	Limit setting	Warmth	Invasiveness	Authoritative parenting	Authoritarian parenting	Permissive parenting
Cognitive development									
Verbal ability	+0.165 ***			+0.227 ***	+0.175 ***		+0.053	-0.129 **	
Non-verbal ability				+0.187 ***					
Socio-emotional problems									
Externalising behaviour		+0.084	-0.007	+0.174 ***	-0.089 *	+0.046	-0.052	+0.008	
Internalising behaviour		+0.117 *	+0.055	+0.046	-0.090 *	+0.026			
Socio-emotional strengths									
Sociability		-0.138 **	-0.098 *		+0.206 ***	-0.088	+0.045		-0.057
Prosocial behaviour	+0.019	-0.114 **	-0.004		+0.182 ***	-0.070	+0.046	0.000	-0.049
Behavioural self-regulation	+0.042	-0.135 **		-0.060	+0.108 **	-0.038	+0.046	-0.041	+0.021
Cognitive self-regulation	+0.049	-0.105 *			+0.116 **	-0.031	+0.017		-0.077
Emotional self-regulation		-0.121 **		-0.150 **	+0.132 **	-0.058	+0.052	-0.003	
Early Years Foundation Stage Profile (EYFSP) Outcomes									
Comm ⁿ and Language	1.285 **	0.796 *		1.716 ***	1.633 ***	0.761 *	1.064		0.869
Physical Development	1.276 *	0.726 **		1.819 ***	1.578 ***	0.805	1.138		0.844
PSE Development	1.232 *	0.757 **			1.570 ***	0.877	1.008		0.856
Literacy	1.424 ***	0.723 ***		1.508 ***	1.328 ***	0.937	1.007	0.928	0.786 *
Numeracy	1.405 ***	0.732 ***			1.310 **	0.853	1.040	0.973	0.784 *
Good level of development	1.351 ***	0.730 ***		1.535 ***	1.343 ***	0.917	1.014	0.930	0.782 **
Early Years Foundation Stage Profile: Total score									
Total points score	+0.112 ***	-0.099 **	-0.017	+0.215 ***	+0.158 ***	-0.044	+0.003		-0.106 **

Sample size = 3186 (cognitive and socio-emotional outcomes); = 4942 (EYFSP outcomes)

The table shows coefficients for associations between the home environment covariates and each outcome. Statistically significant coefficients are in **bold italics**, significance thus: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes (cognitive and socio-emotional outcomes and EYFSP total score), coefficients give the change in the standardized outcome corresponding to a two standard deviation change in the home environment covariate, controlling for all other covariates.

For binary outcomes (Early Years Foundation Stage Profile Outcomes), coefficients give the change in probability of achieving the expected level of development for a two standard deviation change in the home environment covariate, expressed as an odds ratio. Values greater than one show increased probability; values less than one show decreased probability of achieving the expected level of development.

In summary:

Home learning environment

A higher home learning environment was associated with better outcomes on all EYFSP measures during reception and better verbal ability during school year one.

Household CHAOS

Higher levels of household chaos were associated with poorer outcomes on all EYFSP measures during reception and with poorer outcomes on all socio-emotional measures with the exception of externalising behaviour.

Parent's psychological distress

Higher parental psychological distress was associated with lower child sociability.

Limit setting

Higher levels of limit setting were associated with better outcomes on all EYFSP measures, with the exceptions of Personal, Social and Emotional Development and numeracy, and with better verbal and non-verbal ability. In contrast, higher levels of limit setting were also associated with higher externalising behaviour and with lower emotional self-regulation. In interpreting these negative associations, it is possible that poorer socio-emotional outcomes may be a consequence of higher limit setting but also higher limit setting may be a response to children's challenging behaviour.

Warmth in the parent / child relationship

Higher levels of warmth in the parent / child relationship were associated with better outcomes on all EYFSP measures and with better verbal ability. Higher levels of warmth were also associated with better outcomes on all socio-emotional measures.

Invasiveness in the parent / child relationship

Higher levels of invasiveness in the parent / child relationship were associated with poorer outcomes for EYFSP communication and language.

Authoritarian parenting

Higher levels of authoritarian parenting were associated with lower verbal ability during school year one.

Permissive parenting

Higher levels of permissive parenting were associated with poorer outcomes for EYFSP literacy and numeracy, EYFSP good level of development and EYFSP total score.

The relative importance of ECEC use, home environment and demographic factors

Demographic factors were associated with all child outcomes. The effects of demographic factors were of small to medium size. Their associations with EYFSP outcomes were particularly notable. For example, there were better outcomes for children who were older in their school year, even in the first year of school. Previous research

has also found demographic effects to be stronger for teacher-rated measures than objective measures

The associations between ECEC use and children's outcomes assessed during reception / school year one were similar in size to those of the home environment and smaller than those of the most important demographic factors.

Unmeasured factors

As in any observational study, the possibility that results are affected by confounding from unobserved factors should be considered. In this study, this risk is reduced by controlling the analyses for a wide range of home environment and demographic variables. There remains the risk of a confounder which is independent of the home environment and demographic variables. A possible example is whether or not a child has a Special Educational Need (SEN). Children with an SEN are less likely to use formal ECEC and are likely to have on average poorer cognitive and educational outcomes. This confounding could increase the apparent positive effects of formal ECEC use on child outcomes.

Discussion

The findings show some continuity with the earlier SEED reports looking at children's outcomes at ages three and four, as well as some divergence from earlier findings, particularly for socio-emotional outcomes. Consistency in the pattern of results is important, which can derive from supporting results from other stages of SEED or other studies. Hence, where results are new or unexpected, the conclusions from those results in the report must be tentative until confirmed by supporting evidence from SEED or other studies

The effect of the amount and type of ECEC used

The effects of ECEC associated with children's cognitive outcomes at the start of school were more limited than those found in the EPPSE study, the last comparable study in England.¹⁸ Why is this? Consider the situation where all environmental variation between individuals is removed. In this scenario any differences would be only due to genetic variation. Similarly where we reduce variation in ECEC experience, the effects attributable to ECEC experience reduce. In England we see that variation in both the amount and quality of ECEC have reduced between the time of ECEC experience (1997-2000) in EPPSE and the time of ECEC experience (2014-2017) in SEED. Hence the differences between EPPSE and SEED results may partly reflect the increase in ECEC use since the EPPSE study (1997-2000), as it is no longer possible to use a no ECEC group in comparisons; this study utilises a low ECEC use comparison group instead. Also the percentage of children experiencing low quality ECEC has substantially reduced. Another difference is that the EPPSE measures were taken when children had finished their preschool period but before experiencing reception class, whereas the SEED start of school measures were assessed at the end of reception and during school year one.

¹⁸ See Sylva, 2004.

This may have allowed children with less pre-school ECEC use to catch up with those who used more pre-school ECEC, resulting in less impact of ECEC use in SEED as compared to the EPPSE study.

The results also reveal rather more limited effects associated with ECEC use than in previous SEED reports. In contrast, the effects associated with the home environment are wide-ranging, indicating the substantial influence on development of a range of aspects of the home and parenting. The key conclusions to this SEED report are:

1. Higher use of informal individual ECEC (with friends, relatives etc.) between age two and the start of school was associated with better verbal ability measured during school year one.
2. Greater use of formal group ECEC (mean hours per week) between age two and the start of school is associated with negative effects on socio-emotional well-being in school year one.
3. There is evidence that the use of some individual ECEC (childminders, friends, relatives) mitigates the negative socio-emotional effects of high formal group ECEC use.
4. For the 40% most disadvantaged children, starting to use a minimum of ten hours per week formal ECEC no later than age two, combined with a mean use of over twenty hours per week of formal ECEC between age two and the start of school, increases the chances of achieving expected EYFSP levels in school reception year and improves children's verbal ability in school year one.
5. There was a positive association between formal group ECEC use (in nursery classes, nursery schools etc.) and better verbal ability during school year one, but only for children from families in the lowest quartile of home learning environment score (i.e. children with the least enhancing home learning environments).
6. There was no clear evidence of associations between the quality of ECEC which children had attended between ages two and four and their developmental outcomes during reception year / school year one: though these findings may relate to the relatively small sample of settings for the SEED quality study and the similarities in ECEC quality across the sample.

It remains to be seen how persistent these new findings are. This will be assessed in later follow-ups in the SEED study.

Chapter 1: Introduction

Background

Internationally, the number of children attending non-parental childcare and education services before school entry has been increasing since the 1960s, and in developed countries some preschool education or care has become the norm for most children.

‘Today’s rising generation in the countries of the OECD is the first in which a majority are spending a large part of their early childhoods not in their own families but in some form of childcare’ (UNICEF Innocenti Research Centre, 2008:3).

The terms ‘day care’, ‘child care’ and ‘early childhood education and care’ (ECEC) have all been used to refer to non-parental childcare and early education occurring before school. This includes childcare with relatives, childminders, and group or centre-based childcare and early education. The Organisation for Economic Co-operation and Development (OECD) and the European Commission have adopted the term ‘early childhood education and care’ (ECEC) in their publications to encompass all these forms of childcare and early education. Sometimes ECEC has an explicit educational component and sometimes not. However, in that all experience can potentially be educational, this distinction is not clear-cut.

ECEC has the potential to benefit families as well as children. It can enable parents to work, re-enter the labour market, undergo training to improve employability and work more hours. Thus, it can play a role in improving family income, reducing welfare dependency and poverty, and improving social mobility for families – and later for the children themselves. Also, ECEC provision may have implications for fertility rates and is embedded in a broader context of educational and family policies (e.g. European Commission, Directorate-general for Education, Youth, Sport and Culture, 2014). Rates and type of ECEC use and the content and quality of ECEC differ by child age and socio-political context. For instance, on average across OECD countries, 70 per cent of three-year-olds, 85 per cent of four-year-olds and 95 per cent of five-year-olds were enrolled in paid ECEC of some form (or primary education) in 2014 (OECD, 2017). In England in 2018, 94 per cent of three- and four-year-olds received some government-funded ECEC (DfE, 2018), while take-up of formal ECEC for children aged zero to two in England was 40% (DfE, 2018a).

ECEC and child development

A great deal is already known about the benefits of early years education in terms of benefits for educational, cognitive, behavioural and social outcomes of children, both in the short and long term. There is good evidence that early education has a considerable influence on school readiness, long-term school attainment and lifelong outcomes (e.g. Melhuish, 2004; Smith et al., 2009; Sylva et al., 2004, 2010). Attending high quality ECEC helps prepare young children to be ‘school ready’, i.e. achieving the level of development that helps their ability to learn when they start school (Becker, 2011), which is important as a foundation for a successful educational career and long-term life outcomes.

For provision from three years onwards, the evidence is consistent that preschool provision is beneficial to educational and social development for the whole population (e.g. Sylva et al., 2010). An example of the multi-national nature of positive ECEC effects was provided by an OECD (2011) report on PISA results, reporting that 15-year-olds who had attended some pre-primary education outperformed students who had not by about a year of achievement.

ECEC interventions also boost children's confidence and social skills, which provides a better foundation for success at school, and subsequently in the workplace (Sim 2018). Reviews of the research often infer that it is the social skills and higher motivation that lead to lower levels of special education and school failure, and to higher educational achievement in children exposed to early childhood development programmes (e.g. Oden et al., 1996). Longer-term socio-emotional outcomes may not only be driven by short term socio-emotional benefits of ECEC, but also by the cognitive and academic outcomes. For example, studies into adulthood have indicated that educational success is likely to be followed by increased success in employment, better social integration and sometimes in reduced criminality (e.g. Barnett, 2011; Muennig, Schweinhart, Montie, & Neidell, 2009).

Studies have also indicated that there are a number of characteristics of ECEC which lead to improved outcomes. For example, the benefits are often seen to be greater for high-quality provision (Sylva et al., 2004). There is also evidence that a starting age from two years of age onwards is most effective for preschool education (Sammons et al., 2002), and that the duration in months in ECEC may be have a stronger influence than the number of hours per week (Sylva et al., 2004). There has also been some evidence that high levels of ECEC, particularly group care in the first two years, may elevate the risk for developing antisocial behaviour (Belsky et al., 2007; Eryigit-Madzwamuse & Barnes, 2013). However subsequent research indicates that this may be related to high levels of poor quality care, particularly in group care and in the first two years (Melhuish et al., 2015).

ECEC has been used as an intervention strategy to improve the lives and development of specific groups, particularly children living in disadvantaged households. Children from disadvantaged family backgrounds often enter school with fewer academic skills than their more advantaged peers, and they often lag behind in their cognitive development during the later school years (Stipek & Ryan, 1997; Sylva et al., 2012). More than 40 years of research have shown that good quality preschool experiences can produce benefits for cognitive, language and social development for disadvantaged children (e.g. Ramey et al., 2000) and help prepare them for school entry (see, for example, reviews by Barnett, 1995; Brooks-Gunn, 2003; Heckman, 2006; Melhuish, 2004; Yoshikawa et al., 2013). Some evidence suggests that early education can have the greatest impact on children from disadvantaged families (e.g. Cattani et al., 2014), and may at least be of particular importance to disadvantaged children who are already behind their peers from an early age (Speight et al., 2015). Therefore, ECEC is crucial in narrowing the gap in development and attainment between groups of children. However, children from disadvantaged families are less likely to attend early years settings, even for provision that is funded by the Government (Department for Education, 2017).

With regard to provision for children from three years of age onwards, disadvantaged children benefit particularly from high-quality early education provision (e.g. Muennig et al., 2009; Reynolds et al., 2011). Research also suggests that children benefit more in socially mixed groups rather than in homogeneously disadvantaged groups (Melhuish et

al., 2008a). Some interventions have shown improvements in cognitive development, but such benefits may not persist throughout children's school careers. This may be because subsequent poor school experiences for disadvantaged children overcome earlier benefits from high-quality ECEC experience (Barnett, 1995; Karoly et al., 1998).

There may also be geographic and regional differences in the benefits of ECEC which may relate in part to regional variation in quality (Melhuish & Gardiner, 2017). A recent DfE publication using data from the Millennium Cohort Study also suggests the number of hours per week that children spend in ECEC contributes to regional differences in early years attainment, although a number of other factors such as ethnic composition contribute more strongly to this variation and much regional variation remains unexplained (Dunatchik et al., 2018).

Child development is affected by a range of children's experiences, and the early years can be a particularly sensitive period of development (e.g. Tierney & Nelson, 2009). ECEC is one such influence that constitutes a substantial part of young children's experiences, which can influence short and longer-term outcomes (e.g. Sylva et al., 2010). Home environment, parenting and demographic characteristics are also seen to play a role in child development. Some evidence suggests that these factors do not function alone, but interact with each other. Hence the potential effects of ECEC experience may be partly moderated by family factors, such as disadvantage and the Home Learning Environment (e.g. Sammons et al., 2008).

Recent policy and ECEC in England

Since the late 1990s, policy for early childhood education and care (ECEC) in England has developed rapidly (Melhuish, 2016). Following the evidence from the Effective Pre-school, Primary and Secondary Education (EPPSE) study of the positive effects of ECEC upon children's development (Sylva et al., 2004), the government implemented policies to provide a free part-time early education place (12.5 hours per week for 38 weeks of the year) for every child from their third birthday until the start of school which came into effect from September 2004. From September 2010 all three- and four-year-olds in the England have been entitled to funded early education for 570 hours per year (commonly taken as 15 hours per week for 38 weeks of the year). In 2013 the early education offer was extended to two-year-olds looked after by the local authority and those from families in receipt of specified benefits. It was further extended in September 2014 to two-year-olds from low income families, two-year-olds with special needs and two-year-olds who have left care. This measure was taken to increase the life chances of children from disadvantaged families following EPPSE evidence (Sammons et al., 2002; Sylva et al., 2010) that ECEC could be beneficial from two years of age upwards. These policy changes have been motivated by the desire to improve early child development and school readiness and to enable and encourage parents to undertake paid employment. These developments have been underpinned by measures to raise the quality and availability of provision to provide support for the development of the quality of the workforce. Financial support for early education has included reimbursement of early

education expenses in tax credits (currently being replaced by Universal Credit) and childcare vouchers, which are being replaced by Tax Free Childcare from 2017.¹⁹

From September 2017 funded provision for three- and four-year-old children has been extended from 15 to 30 hours each week (for 38 weeks of the year). To receive the extended entitlement, parents (both parents in two parent households) must be working and each earning at least the equivalent of the national minimum wage for 16 hours a week, and not earning more than £100,000 each a year.²⁰

It should be noted that SEED commenced before the Childcare Act 2016 and was not designed to study the 30 hours free childcare policy. When this policy was introduced in September 2017 the children within the SEED sample were too old to be eligible for the 30 hours free childcare. Therefore, the impact of the 30 hours of free childcare policy will not be directly addressed by this study.

Study of Early Education and Development (SEED)

The Study of Early Education and Development (SEED) is a major eight-year study commissioned by the Department for Education to explore how early education can give children the best start in life and to investigate factors that are important for the delivery of high quality ECEC provision.²¹ The study is being undertaken by a consortium including the National Centre for Social Research, the University of Oxford, Action for Children and Frontier Economics.

The aim of SEED overall is to provide a robust evidence base to inform policy development to improve children's readiness for school by:

- Giving evidence of the impact of early years provision on children's outcomes and providing a basis for the longitudinal assessment of any later impact.
- Assessing the role and influence of the quality of ECEC provision on children's outcomes.
- Assessing the overall value for money of ECEC and the relative value for money associated with different types of early childhood education and care (e.g. private, voluntary, local authority) and the quality of ECEC provision.
- Exploring how the Home Learning Environment may interact with early education use in affecting children's outcomes.

To address these aims, SEED has several inter-related research strands:

- A longitudinal survey that initially included 5,642 families with preschool children from the age of two years to the end of Key Stage 1 (age seven years).
- Around 1,000 visits to early years group settings and to around 100 childminders to study the quality, characteristics and process of provision.
- Case studies of good practice in early years settings.
- A value for money study involving cost data from 166 early years settings.

¹⁹ See the childcare service website, available at: <https://childcare-support.tax.service.gov.uk/>.

²⁰ See the Childcare Act, 2016, available at: <http://www.legislation.gov.uk/ukpga/2016/5/enacted>.

²¹ Further information about the SEED study and reports published to date are available at <http://www.seed.natcen.ac.uk/>.

- Qualitative studies of childminders and of early education provision for children with special educational needs and/or disabilities (SEN/D).
- A study of experiences of the Early Years Pupil Premium (EYPP).

Objectives of this report

This is the third report from the longitudinal study (Melhuish, Gardiner & Morris 2017; Melhuish & Gardiner, 2018). This report has four main objectives:

1. To study the associations between the amount of differing types of ECEC which children receive between age two and the start of school and child development in reception / school year one.
2. To explore the associations between the quality of the childcare ECEC settings which children have attended at age two and three and child development in reception / school year one
3. To explore the associations between the age at which formal ECEC (e.g. nursery classes, playgroups and childminders) was first used for ten or more hours per week on child development in reception / school year one.
4. To explore the associations between the combination of types of ECEC used between ages two and four and child development in reception / school year one.
5. To investigate the associations between the home environment at age two, three and four, including the quality of the parent/child relationship, and child development in reception / school year one.

A strength of this report is that it triangulates data from different sources: teacher rated cognitive and socio-emotional development from the EYFSP at the end of reception year, direct assessment of cognitive development and teacher ratings of socio-emotional development in year one.

The remainder of this report is structured in the following way:

- Chapter 2 describes the design and methodology of the longitudinal study.
- Chapter 3 analyses the associations between ECEC use between age two and the start of school and cognitive, socio-emotional and educational outcomes in reception / school year one, controlling for demographic, parenting and home environment variables.
- Chapter 4 examines the associations between the quality of the ECEC provision which children have attended between aged two and four and their cognitive and socio-emotional outcomes in reception / school year one. Further models explore differences for private, voluntary and independent (PVI) and maintained ECEC.
- Chapter 5 analyses the associations between the age at which children first used ten or more hours per week of nursery class, playgroup or childminder (formal) ECEC on child cognitive, socio-emotional and educational outcomes in reception / school year one. Further models consider the possible effects of the combination of types of ECEC which children used.
- Chapter 6 uses the analyses described in Chapter 3 to examine the associations of parenting and home environment with child cognitive, socio-emotional and educational outcomes in reception / school year one.
- Chapter 7 draws the findings of the report together and discusses the results in relation to other UK and international research.

Chapter 2: The SEED longitudinal study: Design and methodology

This chapter describes the SEED longitudinal study design including details of sampling. Further details of methods are in the Technical Annexe accompanying this report.

An overview of the SEED study

Research objectives

The SEED study uses a longitudinal, multi-cohort sample survey research design. It is designed to meet several related objectives:

1. To explore the impact on take-up of early education following of the policy of free early education for disadvantaged two-year-olds, in the year following its introduction.²²
2. To study factors affecting children's development and behaviour during the early years. The focus is on effects of ECEC, in particular ECEC between age two and the start of school, on cognitive, socio-emotional and educational development. Other factors explored are parenting (Home Learning Environment, household disorder, parental distress, parent/child relationship and Limit Setting), and demographics.
3. To study the impact of the quality of the ECEC settings that children attend, on their cognitive, socio-emotional and educational development.

Sample selection

A three-stage clustered sample design was implemented, with sample members selected from Child Benefit records (Speight et al., 2015). Initially postcode districts were designated primary sampling units (PSUs). At the second stage groups of postal sectors within each PSU were designated Secondary Sampling Units (SSUs). Finally, eligible families with children of the relevant age were selected for interview within each SSU. This approach was designed to generate a clustered sample of children and a sample of ECEC settings within the SSUs that the sampled children were likely to use.

The sample was selected so that children were chosen from three groups varying in level of disadvantage to match as closely as possible the policy eligibility criteria:

1. Most disadvantaged 20% who had a parent in receipt of one of:
 - Income-based Jobseeker's Allowance (JSA-IB);
 - Income-related Employment Support Allowance (ESA-IR);
 - Income Support (IS);
 - Guaranteed element of the State Pension Credit (PC with Guarantee Credit);
 - Child Tax Credit only (not in receipt of an accompanying Working Tax Credit award) with household gross earnings of less than £16,190.

²² The results can be found in the earlier report "Study of Early Education and Development (SEED): Impact Study on Early Education Use and Child Outcomes up to Age Three, July 2017".
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/627098/SEED_ECEC_impact_at_age_3.pdf.

2. Moderately disadvantaged 20%-40% who had a parent in receipt of Working Tax Credits with household gross earnings of less than £16,190.
3. Least disadvantaged 60% who had parents not in receipt of any of the qualifying benefits or tax credits.

The sampling frame ensured that families from all levels of disadvantage were included in the study. By design, the disadvantaged and moderately disadvantage groups were over-represented in the sample.

Sample weights were calculated to correct for differential sampling by level of family disadvantage and for non-response bias. These were used in calculating summary statistics for the sample.

Longitudinal study

The study was designed to collect information from families at four time points:

- Wave 1 (baseline) when the target child was about two years old
- Wave 2 when the child was about three years old
- Wave 3 when the child was about four years old
- Wave 4 when the child was about five years old

Further, the study aims to link survey data to educational outcomes from the Early Years Foundation Stage Profile (EYFSP) assessment in reception, and from the Key Stage 1 assessments at age seven.

The samples analysed

Because the outcome variables were available for different sets of children, two different samples of children were analysed.

The SEED Wave 4 (age five years) sample (N = 3186)

This sample consisted of all children included in the SEED wave 4 survey, excluding 30 children who were being home schooled. This **wave 4 sample** comprises 56.5% of those in the SEED baseline survey. Some degree of family dropout from follow-up assessments in this type of longitudinal research is to be expected, and the follow-up rate of 56.5% at Wave 4 would be considered acceptable such that interpretation of results was unlikely to be significantly affected by non-response bias, i.e. the potential difference between families in the sample and those who choose not to participate.²³ All children had previously had data collected at waves 1, 2, and 3 of the SEED study when children were aged two, three, and four years old, respectively.

The cognitive (BAS) and socio-emotional (CSBQ) outcomes were analysed on this sample. 98.3% of these children had cognitive outcome data and 80.5% had socio-

²³ When calculating summary statistics, non-response bias was corrected for using sample weights.

emotional data. 100% of these children had early childhood education and care data measured from birth to the start of school.

The EYFSP sample (N = 4942)

This sample consisted of all children for whom Early Years Foundation Stage Profile (EYFSP) data was available from the National Pupil Database (NPD). This **EYFSP sample** comprises 87.6% of those in the SEED baseline survey. These children participated in SEED at wave 1 (age two), but some may not have been seen at all subsequent data collection waves.

The EYFSP outcomes were analysed on this sample. 72.7% of these children had ECEC measured from age 4 to the start of school.

ECEC use

ECEC in England was of various types including:

1. Childminder
2. Nursery school
3. Nursery class attached to a primary/infant school
4. Private day nursery
5. Local Authority day nursery
6. Pre-school or playgroup
7. SEN day school, nursery or unit
8. Relative, friend or neighbour
9. Nanny or au pair
10. Other early education

Children in SEED may have attended any form of ECEC, although only the first seven were eligible for government funding. In the classification of setting types for this report, settings eligible for government funding were referred to as 'formal'. Settings classified as 'group' based were those that were in a non-domestic setting, while those classified as 'individual' were in a domestic (i.e. home) setting.

A three-way classification of ECEC is used for this report:

1. "Formal group" ECEC in a non-domestic setting and eligible for government funding (e.g. day nurseries, nursery classes or schools and playgroups)
2. "Formal individual" ECEC in a domestic setting and eligible for government funding (i.e. childminders)
3. "Informal individual" ECEC in a domestic setting and not eligible for government funding (e.g. relatives, friends, neighbours or nannies)²⁴

²⁴ The DfE Survey of Parents indicates that grandparents are by far the largest informal provider of ECEC in England (DfE, 2017).

Of the 3186 children in Wave 4 of the SEED study, 3149 had some formal group ECEC between age two and the start of school, 419 had some formal individual ECEC during this period and 1686 had some informal individual ECEC.

A further breakdown of the formal group ECEC category was used in later analysis to compare private, voluntary and independent settings with maintained settings, as follows:²⁵

- a. Private, voluntary and independent (PVI) ECEC, which is funded privately or by voluntary / charitable organisations.
- b. Maintained ECEC, which is local government administered (i.e. nursery classes, nursery schools, Local Authority nurseries or children's centres).

Sample size limitations meant that it was not possible to consider any further breakdown of these groupings in the analyses.

Take up of ECEC by type and disadvantage group

The take up of formal group, formal individual and informal individual ECEC is summarised by disadvantage group in Tables 4 to 6.²⁶ Both weighted and unweighted statistics are presented. The patterns across the three tables indicate that the most frequently used type of ECEC was formal group ECEC (e.g. in nursery classes, nursery schools and playgroups).

By the start of school, almost all children across the most to least disadvantaged groups had used some sort of formal group ECEC (Table 4). Those in the most disadvantaged group were more likely to start using formal group ECEC at age two, the age at which the funded early education offer for disadvantaged two year olds becomes available.

Childminder provision was the least commonly used of the three classifications of ECEC between age two and the start of school (Table 5). It was more likely to be used by the least disadvantaged children relative to the most disadvantaged children.

Informal individual ECEC (e.g. with relatives and friends) was used by just over half of children at some point between age two and the start of school (Table 6). It was more likely to be used by the least disadvantaged children relative to the most disadvantaged children.

²⁵ Further detail of how settings were classified is available in the Technical Annexe.

²⁶ These tables give the data for the Wave 4 sample (N = 3186). The corresponding statistics for the EYFSP sample (N = 4942) are similar: these are given in the Technical Annexe.

Table 4: Use of formal group ECEC between age two and the start of school / age at which formal group ECEC was first used, broken down by disadvantage group.

Formal group ECEC (e.g. in nursery classes, nursery school and playgroups)									
Unweighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	89.8%	10.68	98.0%	16.14	4.9%	7.9%	77.2%	8.1%	1.9%
20%-40% moderately disadvantaged	88.0%	11.45	98.9%	17.25	17.0%	11.8%	59.6%	10.7%	1.0%
60% least disadvantaged	92.6%	12.27	99.2%	18.28	18.4%	18.6%	55.9%	6.3%	0.8%
All children	90.3%	11.62	98.8%	17.42	14.8%	13.7%	62.1%	8.3%	1.1%
Weighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	89.3%	10.86	98.1%	16.15	5.8%	8.2%	75.5%	8.7%	1.8%
20%-40% moderately disadvantaged	88.3%	11.73	99.0%	17.27	16.0%	12.1%	60.6%	10.5%	0.9%
60% least disadvantaged	92.2%	12.36	99.2%	18.08	17.1%	18.4%	57.0%	6.7%	0.8%
All children	90.2%	11.82	98.9%	17.38	14.2%	14.0%	62.4%	8.4%	1.0%

Wave 4 sample, sample size = 3186

The mean hours used was calculated for children with some formal group ECEC use.

The age at which children first started using formal group ECEC was the age at which *any* ECEC of this type was first used.

Table 5: Use of formal individual ECEC (with childminders) between age two and the start of school / age at which formal individual ECEC was first used, broken down by disadvantage group.

Formal individual ECEC (i.e. childminders)									
Unweighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	5.2%	10.40	7.0%	8.93	1.5%	1.5%	3.4%	2.5%	91.1%
20%-40% moderately disadvantaged	11.3%	16.80	10.9%	12.82	6.8%	4.4%	2.6%	1.8%	84.4%
60% least disadvantaged	13.9%	14.42	14.5%	9.98	7.8%	5.5%	3.3%	2.1%	81.3%
All children	11.0%	14.85	11.5%	10.79	6.0%	4.2%	3.0%	2.1%	84.7%
Weighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	4.2%	9.65	6.1%	8.22	1.1%	1.0%	3.0%	2.5%	92.5%
20%-40% moderately disadvantaged	10.3%	16.56	9.9%	12.06	6.1%	4.2%	2.3%	1.8%	85.6%
60% least disadvantaged	12.7%	14.69	13.3%	10.01	7.2%	5.1%	3.1%	1.9%	82.7%
All children	10.0%	14.87	10.5%	10.43	5.5%	3.8%	2.8%	2.0%	85.9%

Wave 4 sample, sample size = 3186

The mean hours used was calculated for children with some formal individual ECEC use.

The age at which children first started using formal individual ECEC was the age at which *any* ECEC of this type was first used.

Table 6: Use of informal individual ECEC (e.g. with relatives and friends) between age two and the start of school / age at which informal individual ECEC was first used, broken down by disadvantage group.

Informal individual ECEC (e.g. with relatives and friends)									
Unweighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	27.2%	6.77	34.4%	7.58	14.3%	4.5%	14.1%	8.9%	58.2%
20%-40% moderately disadvantaged	44.7%	10.80	48.5%	9.51	30.1%	8.8%	10.3%	7.4%	43.4%
60% least disadvantaged	54.1%	11.49	57.6%	9.92	31.1%	16.4%	11.6%	6.5%	34.3%
All children	44.6%	10.58	49.1%	9.40	26.9%	11.0%	11.7%	7.4%	43.0%
Weighted results									
Disadvantage group	Use between ages two and three		Use between age three and start of school		% breakdown of sample by age child started using this type of ECEC (years)				
	% using any ECEC of this type	Mean hours used	% using any ECEC of this type	Mean hours used	Up to 1	>1 to 2	>2 to 3	>3	Never used
20% most disadvantaged	25.6%	7.23	31.6%	7.53	12.8%	4.7%	13.9%	8.0%	60.6%
20%-40% moderately disadvantaged	42.4%	10.88	46.7%	9.66	28.5%	8.3%	10.5%	7.9%	44.8%
60% least disadvantaged	52.7%	11.73	55.8%	10.13	29.4%	16.1%	12.0%	6.4%	36.1%
All children	43.1%	10.85	47.3%	9.58	25.4%	10.9%	11.9%	7.3%	44.6%

Wave 4 sample, sample size = 3186

The mean hours used was calculated for children with some informal individual ECEC use.

The age at which children first started using informal individual ECEC was the age at which *any* ECEC of this type was first used.

Measures

Home Environment measures

Nine home environment measures were included in the analyses. Where home environment measures were available from more than one wave, the mean value of the variable was taken over all available waves.

Averaged across the Wave 1, Wave 2 and Wave 3 interviews:

1. Home Learning Environment (HLE) index, i.e. home activities that allow learning opportunities for the child; e.g. child read to, taken to library, painting/drawing, play with letters/numbers, songs/rhymes (Melhuish et al., 2001; 2008a)

Averaged across the Wave 1 and Wave 2 interviews:

2. Household Disorder (CHAOS scale including confusion, hubbub and disorder scale), adapted from Matheny et al., 1995 by NESS (2005) and Melhuish et al., (2008b)
3. Parent's Psychological Distress (using the Kessler scale) e.g. symptoms of depression or anxiety
4. Limit Setting (i.e. how often parents set limits on their child's behaviour such as time out or telling off)

From the Wave 2 interview:

5. Warm from the Mothers Object Relations Scales (MORS) (a measure of closeness in the parent/child relationship e.g. relationship characterised by affection, doing things together)²⁷
6. Invasiveness from the MORS (a measure of conflict in the parent/child relationship e.g. regarding child as demanding of attention, feeling annoyance toward child)²⁷

From the Wave 3 interview:

7. Authoritative parenting, a parenting style characterized by high demands and high responsiveness, from Parenting Styles and Dimensions (PSD).²⁸
8. Authoritarian parenting, a parenting style characterized by high demands and low responsiveness, from Parenting Styles and Dimensions (PSD).²⁸
9. Permissive parenting, a parenting style characterized by low demands and high or low responsiveness, from Parenting Styles and Dimensions (PSD).²⁸

²⁷ See Simkiss et. al. 2013.

²⁸ See Robinson 1995.

Demographic measures

These measures were assessed at the Wave 1, Wave 2 and Wave 3 interviews carried out with parents when the children were aged two, three and four, respectively.

1. Child's month of birth / age in school year
2. Child's gender
3. Child's ethnic group
4. Child's birth weight
5. Maternal age at birth of child
6. Number of siblings living in the same household as child
7. Whether child was living in a couple or lone parent household
8. Whether child was living in a workless or working household
9. Household income
10. Area Deprivation (Index of Multiple Deprivation, IMD)²⁹
11. SEED disadvantage group (most disadvantaged, moderately disadvantaged, least disadvantaged) according to household income and benefits at baseline
12. Type of accommodation tenure (renting / owner occupier)
13. Mother's highest academic qualification
14. Highest parental socio-economic status

Where demographic measures varied over time, the Wave 2 values were used.

Settings quality measures

The quality of 1000 ECEC settings was assessed through half day observations by trained observers. These observations took place in 402 settings that children had attended at age two (Wave 1), and 598 settings that children had attended at age three (Wave 2).

At Wave 1, settings were assessed using the SSTEW and ITERS-R scales. At Wave 2, settings were assessed using the SSTEW, ECERS-R and ECERS-E scales.³⁰

The Sustained Shared Thinking and Emotional Well-being scale (SSTEW)³¹ focuses on the quality of interactions between staff and children, and was used in the SEED study to assess settings (both for under-threes and over-threes) across five domains:

- I. Building Trust, Confidence and Independence
- II. Supporting and Extending Language and Communication
- III. Supporting Emotional Well-being
- IV. Supporting Learning and Critical Thinking
- V. Assessing Learning and Language

²⁹ A measure which ranks every small area (average 1,500 residents) in England from most to least deprived (based on income deprivation, employment deprivation, education, skills and training deprivation, health deprivation and disability, crime, barriers to housing and services, living environment deprivation).

³⁰ More detail on these measures is available in the SEED Study of Quality of Early Years Provision in England (Melhuish et al., 2017).

³¹ For more information on this scale see: Siraj, Kingston & Melhuish, 2015.

The Infant and Toddler Environment Rating Scale – Revised (ITERS-R)³² is an overall measure of quality for the under-threes, and assesses settings across six domains:

- I. Space and Furnishings
- II. Personal Care Routines
- III. Listening and Talking
- IV. Activities
- V. Interaction
- VI. Program Structure

The Early Childhood Environment Rating Scale - Revised (ECERS-R)³³ is an overall measure of quality for the over-threes, and was used in the SEED study to assess settings across five domains:

- I. Personal Care Routines
- II. Language Reasoning
- III. Activities
- IV. Interaction
- V. Programme Structure

The Extension to the Early Childhood Environment Rating Scale (ECERS-E)³⁴ focuses on the educational aspects of experience for the over-threes, and was used in the SEED study to assess settings across 3 domains:

- I. Literacy
- II. Mathematics
- III. Diversity

Because only a subsample of settings was assessed for quality, only a subgroup of the main sample of children was able to be included in analysis of quality; see Table 21. Use of a subsample for quality analysis has implications for interpreting the results given that a smaller sample size may make it harder to detect small effects.

Child development

This report includes analyses of child cognitive development based on direct assessment (BAS) and reports from reception teachers (EYFSP) as well as socio-emotional development reported by reception teachers (EYFSP) and year one teachers (CSBQ). The assessments were carried out when children were approximately aged five. Details of the measures used are provided below.

³² Harms, Cryer & Clifford, 2006.

³³ Harms, Cryer & Clifford, 2005.

³⁴ Sylva, Siraj-Blatchford & Taggart, 2011.

Direct cognitive assessment, using BAS scales

Children's cognitive development was assessed directly in the first term of year one using two British Ability Scales (BAS) measures:³⁵

1. BAS verbal ability ("naming vocabulary")
2. BAS non-verbal ability ("picture similarities")

Age adjusted BAS scores have been used throughout this report.

Socio-emotional assessment, using CSBQ scales

Children's socio-emotional development was assessed using the Children's Social Behaviour Questionnaire (CSBQ) (Howard and Melhuish, 2017).

As part of the Wave 4 survey interview, parents were asked to provide details of the school attended by their child and the teacher currently teaching them. They were also asked for written consent to approach the teacher to complete a CSBQ questionnaire about the child. Where consent was given, the teachers were approached by post and invited to complete a paper questionnaire. The assessment was completed during Spring of children's primary school year one. The response rate for the teacher survey was 83%.

This CSBQ questionnaire was scored to produce two socio-emotional problems scales:

Children's socio-emotional development was assessed using the Children's Self-regulation and Behaviour Questionnaire (CSBQ), completed by children's teachers.³⁶ This was scored to produce two socio-emotional problems scales:

1. Externalising behaviour (e.g. child loses temper, child argues with other children)
2. Internalising behaviour (e.g. child is easily upset, child is anxious)

and five socio-emotional strengths scales:

1. Sociability (e.g. child has friends, child plays with other children)
2. Prosocial behaviour (e.g. child is co-operative, child is helpful, child shares things)
3. Behavioural self-regulation (e.g. child follows instructions, child waits their turn)
4. Cognitive self-regulation (e.g. child chooses their own tasks, child persists with tasks)
5. Emotional self-regulation (e.g. child is calm, child keeps temper)

Educational assessment, using the EYFSP profile

Children's educational progress was assessed using the teacher rated Early Years Foundation Stage Profile (EYFSP) at the end of reception year (Early Years Foundation Stage Profile, 2017), including 17 early learning goals (ELGs) across seven areas:³⁷

³⁵ See Elliot 2011.

³⁶ See Howard and Melhuish 2017.

³⁷ See Early Years Foundation Profile 2018. The EYFSP is a teacher rated assessment completed for all children in England. Data used in this study was accessed via the DfE's National Pupil Database.

- (A) Communication and Language
 - 1. Listening and attention
 - 2. Understanding
 - 3. Speaking
- (B) Physical Development
 - 4. Moving and handling
 - 5. Health and self-care
- (C) Personal, Social and Emotional Development (PSED)
 - 6. Self-confidence and self-awareness
 - 7. Managing feelings and behaviour
 - 8. Making relationships
- (D) Literacy
 - 9. Reading
 - 10. Writing
- (E) Numeracy
 - 11. Numbers
 - 12. Shapes and measures
- (F) Understanding the World
 - 13. People and communities
 - 14. The World
 - 15. Technology
- (G) Expressive Arts and Design
 - 16. Exploring and using media and materials
 - 17. Being imaginative

For each of the 17 ELGs a child is recorded as either “emerging”, “expected level” or “exceeding expected level”. Binary outcome variables were extracted for each of the areas A to E which are the areas that comprise the ‘Good Level of Development’ in national reporting, that is:

- A. Communication and Language
- B. Physical Development
- C. Personal, Social and Emotional Development (PSED)
- D. Literacy
- E. Numeracy

These binary outcome variables were scored 1 if all the ELGs for that area were rated as “expected level” or “exceeds expected level” and scored 0 if any ELG for that area was rated as “emerging”.

Two additional outcomes were defined:

- Overall good level of development

This binary outcome was scored 1 if all ELGs in areas A to E were as “expected level” or “exceeds expected level” and was scored 0 if any ELG in these areas was “emerging”.

Finally, a continuous outcome was defined over all 17 ELGs:

- EYFSP total score

This was the sum of the results from the 17 ELGs scored as follows:

- “Emerging” = 1
- “Expected” = 2
- “Exceeds expected level” = 3

Overview of children’s ages when outcomes were measured

Outcomes were measured between the May of children’s reception year at school and May of school year one. The timing of these measurements and children’s age range when measurements were taken are summarised in Table 7.

Table 7: Summary of the timing of outcome measurements and children’s ages when outcomes were measured.

Outcome measures	Number of children with data for this outcome	When measures were taken	Time elapsed since the start of school reception year	Age of children when measures taken
EYFSP measures	4942	May to June of reception year	8 to 10 months	4 years 8 months to 5 years 10 months
BAS measures	3186	September to December of year one	12 to 16 months	5 years 0 months to 6 years 4 months
CSBQ measures	2566	March to May of year one	18 to 21 months	5 years 6 months to 6 years 9 months

Summary statistics for children’s outcomes

The outcome variables are summarised by disadvantage group in Tables 8 and 9. For the continuous outcomes, means are given. For the EYFSP test scores, the percentage of children achieving a “good” level of development, or better, is recorded. The means / percentages in the most disadvantaged and moderately disadvantaged groups were tested for significant differences from those in the least disadvantaged group, which as the largest group, was used as the reference group. These statistics were calculated both without using sampling weights (Table 8) and with sampling weights (Table 9).

Table 8: Means of continuous outcomes / percentage of children achieving “good level of development” on binary EYFSP outcomes. Unweighted results.

Outcome	All children	Most disadvantaged group	Moderately disadvantaged group	Least disadvantaged group
Cognitive outcomes				
Verbal ability	59.76	57.27 ***	58.19 ***	62.43
Non-verbal ability	54.31	51.68 ***	53.32 ***	56.59
N =	3186	732	1131	1323
Socio-emotional problems				
Externalising behaviour	8.42	9.26 ***	8.33	8.04
Internalising behaviour	7.38	7.91 ***	7.37	7.11
N =	2566	579	903	1084
Socio-emotional strengths				
Sociability	16.65	15.97 ***	16.78	16.91
Prosocial behaviour	32.36	31.06 ***	32.46 *	32.96
Behavioural self-regulation	20.67	19.56 ***	20.82	21.13
Cognitive self-regulation	29.54	27.29 ***	29.67 ***	30.62
Emotional self-regulation	24.60	23.59 ***	24.72	25.05
N =	2566	579	903	1084
Early Years Foundation Stage Profile (EYFSP)				
Communication and Language	82.6%	73.5% ***	82.0% ***	91.0%
Physical Development	87.7%	80.3% ***	88.3% ***	93.4%
Personal, Social & Emotional Development	85.8%	76.9% ***	87.0% ***	92.1%
Literacy	72.4%	58.7% ***	72.0% ***	84.5%
Numeracy	78.0%	65.5% ***	78.4% ***	88.5%
Good level of development	70.8%	56.9% ***	70.4% ***	83.0%
Total points score	34.44	31.88 ***	34.24 ***	36.83
N =	4942	1474	1742	1726

Higher scores represent better outcomes for the cognitive measures.

Lower scores represent better outcomes for the socio-emotional problems.

Higher scores represent better outcomes for the socio-emotional strengths.

Higher %s represent better results for the Early Years Foundation Stage Assessment tests, as do higher values for the Early Years Foundation Stage Assessment total score.

Tests were carried out to determine whether means / percentages were significantly different between the most disadvantaged / moderately disadvantaged groups and the least disadvantage group (this, as the largest group, was used as the reference group). For the continuous outcomes, means were compared using the non-parametric Wilcoxon rank-sum test. For the binary outcomes, a chi-square test of proportions was used. Significant differences are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 9: Means of continuous outcomes / percentage of children achieving “good level of development” on binary EYFSP outcomes; weighted results.

Outcome	All children	Most disadvantaged group	Moderately disadvantaged group	Least disadvantaged group
Cognitive outcomes				
Verbal ability	59.25	56.77 ***	57.41 ***	61.93
Non-verbal ability	54.47	52.20 ***	53.27 ***	56.57
N =	3183.5	714.4	1085.4	1383.8
Socio-emotional problems				
Externalising behaviour	8.45	9.31 ***	8.42	8.05
Internalising behaviour	7.42	7.94 ***	7.40	7.17
N =	2534.6	555.9	851.8	1126.9
Socio-emotional strengths				
Sociability	16.59	16.06 ***	16.70	16.77
Prosocial behaviour	32.18	31.12 ***	32.24 *	32.66
Behavioural self-regulation	20.58	19.57 ***	20.69	20.99
Cognitive self-regulation	29.36	27.44 ***	29.42 ***	30.26
Emotional self-regulation	24.56	23.51 ***	24.62	25.03
N =	2534.6	555.9	851.8	1126.9
Early Years Foundation Stage Profile (EYFSP)				
Communication and Language	83.4%	72.7% ***	81.4% ***	90.8%
Physical Development	88.3%	80.0% ***	87.9% ***	93.1%
Personal, Social & Emotional Development	86.6%	76.6% ***	86.6% ***	92.0%
Literacy	73.7%	58.6% ***	71.3% ***	83.8%
Numeracy	79.3%	64.5% ***	78.0% ***	88.2%
Good level of development	72.1%	56.7% ***	69.8% ***	82.2%
Total points score	34.62	31.73 ***	34.07 ***	36.61
N =	4889.8	1120.1	1683.1	2086.6

Higher scores represent better outcomes for the cognitive measures.

Lower scores represent better outcomes for the socio-emotional problems.

Higher scores represent better outcomes for the socio-emotional strengths.

Higher %s represent better results for the Early Years Foundation Stage Assessment tests, as do higher values for the Early Years Foundation Stage Assessment total score.

Tests were carried out to determine whether means / percentages were significantly different between the most disadvantaged / moderately disadvantaged groups and the least disadvantage group (this, as the largest group, was used as the reference group). For the continuous outcomes, means were compared using the non-parametric Wilcoxon rank-sum test. For the binary outcomes, a chi-square test of proportions was used. Significant differences are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Choice of statistical models

Most analyses use regression modelling of children's cognitive, socio-emotional and educational outcomes measured during children's school reception year or school year one. These outcomes are modelled in terms of some aspect of children's ECEC usage up to the start of school (amount, type, timing or quality). For continuous outcomes linear models are used, for binary (yes / no) outcomes logistic regression models are used.

Clustering

Because the data are clustered, mixed-effects regression models were used in all cases. Random effects are fitted for government region, for stratum within government region and for primary sampling unit within stratum.

Weighting

Sampling weights were not used in the regression models; this is standard practice for regression models of cohort data (Hansen, 2012).

Multiple imputation

The analyses use multiple imputation to control for missing data in the outcome variables and the covariates. The imputation model included all outcome variables, home environment variables, demographic covariates and ECEC usage data. Ten imputed data sets were generated and used for all statistical models, and the results were combined. Further details of the multiple imputation process are given in the Technical Annexe.

Model interpretation

Statistical significance

Statistical models give us two sorts of information: information about **effect sizes** and information about **statistical significance**. As an example of an effect size, a statistical model may tell us that a certain outcome variable increases by 0.2 units for every 10 hour per week increase in the amount of out of home ECEC that a child has received.

However, in addition to the systematic relationships between the variables measured, the data also contains random variation. For this reason, the confidence which can be placed on the effects estimated varies according to the sample size, the size of the effects and the amount of random "noise" in the data. In order to draw firm conclusions, it is necessary to be confident that a particular effect did not arise by chance. When this is the case, it can be said that an effect is **statistically significant**, or **significantly different from zero**. That is, whilst there is always uncertainty in the exact value of an effect, one can be sufficiently confident that a particular effect is not due to chance alone.

It is also possible to test whether two different effects are significantly different; that is, whether one can be confident that the difference between the size of the two effects is real, or whether an apparent difference between the size of the two effects could be due to chance alone.

Multiple testing

When testing a hypothesis requires performing several statistical tests it is necessary to make a correction for multiple testing, otherwise there is an increased risk of a false positive: that is, significance being ascribed to an apparent association which is in fact due to chance.

This arises in the SEED study when testing a hypothesis that there is an interaction between the effects of ECEC use and another covariate. Because there are three types of ECEC to be considered, three tests are performed and a multiple testing correction is applied. This issue is discussed in more detail in the Technical Annex.

Effect sizes

Having established that there is a statistically significant relationship between an outcome variable and a covariate, it is useful to know whether this may be considered a small, medium or large effect. These classifications are informal. Rough guidelines for distinguishing small, medium and large effects are given in Table 10.

Table 10: Small, medium and large effect sizes.

Effect size	Standardized model coefficient	Odds ratio less than one	Odds ratio greater than one
Small	≤ 0.3	≥ 0.5	≤ 2.0
Medium	> 0.3 and ≤ 0.7	< 0.5 and ≥ 0.25	> 2.0 and ≤ 4.0
Large	> 0.7	< 0.25	> 4.0

Causality

Although descriptions of statistical models often speak of ‘effects’, this is potentially misleading, since establishing that there is a statistically significant association between an outcome variable and a covariate does not in itself prove that there is a causal link between the two. There may be causation, in either direction or in both, and there may also be “confounding”, in which both covariate and outcome are influenced by some other causal factor which we have not observed. This issue is discussed further in the Technical Annex.

Because of the timing of the measurements and because an extensive range of factors was controlled for in the analyses, the relationships between ECEC use and child outcomes and the relationships between home environment variables and child outcomes may generally be assumed to be causal. However, this assumption should be subject to critical consideration throughout.

Chapter 3: Models of outcomes in terms of the amount of ECEC used

Key findings

- More hours per week spent in informal individual ECEC (with relatives or friends) between age two and the start of school was associated with higher levels of children's verbal ability assessed during school year one. Informal individual ECEC was not associated with any other cognitive, socio-emotional or EYFSP outcomes.
- More hours per week spent in formal group ECEC (e.g. in nursery classes, nursery schools and playgroups) between age two and the start of school was not associated with any overall benefits for children. However, for children who experienced less enhancing home learning environments, more hours per week spent in formal group ECEC use was associated with higher levels of verbal ability assessed during school year one.
- More hours per week spent in formal individual ECEC (with childminders) between age two and the start of school was not associated with any overall benefits for children. However, for children in the moderately disadvantaged group, childminder use was associated with a higher total EYFSP points score. On the other hand, for children in the most disadvantaged group, childminder use was associated with a lower total EYFSP score.
- More hours per week spent in formal group ECEC use between age two and the start of school was associated with poorer teacher assessed socio-emotional outcomes during school year one for the measures externalising behaviour, internalising behaviour, prosocial behaviour, behaviour self-regulation and emotional self-regulation. For internalising behaviour, this association was specifically for children with mean formal group ECEC use of greater than 35 hours per week. For externalising behaviour and emotional self-regulation, poorer results were found for children with mean formal group ECEC use of greater than 15 hours per week.
- More hours per week in formal individual ECEC use (with childminders) between age two and the start of school was associated with poorer teacher assessed externalising behaviour and emotional self-regulation scores during school year one.
- Children who had four or more of the seven CSBQ socio-emotional outcomes more than one standard deviation from the mean in the direction of poorer outcomes were defined as having socio-emotional problems; 12.5% of the children had socio-emotional problems according to this definition.
- Having socio-emotional problems during school year one was associated with poorer outcomes on all cognitive and EYFSP measures in models controlling for demographic and home environment variables.
- More hours per week spent in formal group ECEC (e.g. in nursery classes, nursery schools and playgroups) between age two and the start of school was associated with a higher probability of children having socio-emotional problems during school year one in a model controlling for demographic and home environment variables.

This chapter considers the relationship between the amount of ECEC used between age two and the start of school and children's cognitive, socio-emotional and Early Years Foundation Stage Profile outcomes during reception / school year one. The chapter also examines whether any relationships between ECEC use and developmental outcomes were moderated by family disadvantage and the home learning environment. The relationship between the teacher assessed socio-emotional outcomes and other socio-emotional measures from the SEED study is explored, and it is investigated whether there is any relationship between ECEC use and child socio-emotional problems.

These analyses examine the quantity of the ECEC which children receive. Further investigation of the type and quality of formal group ECEC received is discussed in Chapter 4. The effect of the age at which formal group ECEC was first used and of the potential impact of the combination of types of ECEC used is considered in Chapter 5.

Analysis of outcomes in terms of ECEC use between age two and the start of school

Methods

The analyses were principally focused on the association between amount of ECEC of differing types used by children between age two and the start of school and children's outcomes during reception / school year one. Partly because legislation is particularly focussed on ECEC from age two upwards and also because there was a high correlation between amount of ECEC use aged one to two and amount of ECEC used from age two upwards, these analysis models did not control for earlier ECEC use.³⁸ This high correlation indicates considerable continuity of ECEC use over time.

Child outcomes were analysed in terms of the amount (mean hours per week) of ECEC use in three categories: formal group ECEC, formal individual ECEC (with childminders) and informal individual ECEC.

Following on from the initial analysis assessing whether the overall amount of ECEC was associated with child outcomes, further analyses considered how outcomes were associated with specific levels of ECEC use. In order to avoid testing a large number of hypotheses, with the consequent risk of false positive findings, results from these "detail models" were only considered if there were significant effects found in the initial models.

Where significant effects were found in the initial models, the possibility of a curvilinear relationship between ECEC use and the outcome variable was investigated by adding quadratic terms to the models.

All models were controlled for nine home environment measures and fourteen demographic measures, further details of which are available in Chapter 2.

³⁸ Because of the high correlation between ECEC use aged one to two and ECEC use between age two and the start of school, a model including both sets of covariates would be subject to multicollinearity, making model interpretation difficult.

Results by amount of ECEC use

Analyses controlled for home environment and demographic measures. A summary of the results is shown in Table 11. All significant effects were of small size (see p 50).

Table 11: Summary of associations between children’s time (hours per week) in ECEC between age two and start of school and children’s outcomes during reception year / school year one.

Outcome variable	ECEC usage aged 2 to start of school		
	Formal group	Formal individual	Informal individual
Cognitive development			
Verbal ability	+0.029	+0.058	+0.059 **
Non-verbal ability	+0.033	+0.020	+0.007
Socio-emotional problems			
Externalising behaviour	+0.127 ***	+0.102 **	-0.016
Internalising behaviour	+0.068 **	+0.069	-0.006
Socio-emotional strengths			
Sociability	-0.031	-0.049	+0.016
Prosocial behaviour	-0.052 *	+0.017	+0.025
Behavioural self-regulation	-0.094 ***	-0.017	-0.002
Cognitive self-regulation	-0.026	+0.020	+0.012
Emotional self-regulation	-0.125 ***	-0.080 *	-0.009
Early Years Foundation Stage Profile (EYFSP) – Odds Ratio - OR			
Communication and Language	1.034	1.232	1.054
Physical Development	1.081	1.287	0.954
Personal, Social & Emotional Development	1.013	1.241	1.028
Literacy	1.015	1.074	0.984
Numeracy	1.058	1.093	1.108
Good level of development	1.011	1.091	0.999
EYFSP total score – continuous variable - coefficient			
EYFSP total score	+0.001	+0.009	+0.011

Sample size = 3186 (cognitive and socio-emotional outcomes)

Sample size = 4942 (Early Years Foundation Stage Profile outcomes)

The table displays coefficients for the associations between hours of each type of ECEC and each outcome. Statistically significant coefficients are shown in **bold italics**, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a ten hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving at least the expected level of development corresponding to a ten hour per week change in the ECEC use covariate, expressed as an odds ratio - “OR”. Values greater than one indicate that increased ECEC use was associated with an increased probability of achieving at least the expected level of development; values less than one indicate that increased ECEC use was associated with a decreased probability of achieving at least the expected level of development.

In order to confirm that results were not artefacts of collinearity, univariate ECEC models of outcomes controlling for demographics, were also fitted. These are discussed in the Technical Annexe to this report.

Formal group ECEC use (e.g. day nursery, nursery class, nursery school, playgroup)

Longer hours per week of formal group ECEC were associated with poorer socio-emotional outcomes. There were associations between higher levels of formal group ECEC use and higher levels of externalising behaviour and internalising behaviour and between higher levels of formal group ECEC use and lower levels of prosocial behaviour, behavioural self-regulation and emotional self-regulation. Results for specific levels of ECEC use are presented in the next section.

There were no statistically significant associations between longer hours per week spent in formal group ECEC and child cognitive development outcomes. Interaction analysis considering associations for specific groups of children is presented below (investigating outcomes by disadvantage group and home learning environment).

Formal individual ECEC with childminders

There were also some associations between longer hours per week spent in formal individual ECEC and poorer socio-emotional outcomes, although these were weaker and less wide ranging than the associations found for formal group ECEC use. Higher levels of formal individual ECEC use were associated with higher levels of externalising behaviour and lower levels of emotional self-regulation.

There were no statistically significant associations between longer hours per week spent in formal individual ECEC with childminders and child cognitive development outcomes.

Informal individual ECEC with e.g. relatives or friends

Longer hours per week spent in informal individual ECEC (e.g. with relatives or friends) were associated with higher levels of BAS verbal ability. This is consistent with findings from the SEED age three and age four reports.

There were no statistically significant associations between longer hours per week spent in informal individual ECEC (e.g. with relatives or friends) and socio-emotional outcomes at age five.

The Early Years Foundation Stage Profile (EYFSP) outcomes

There were no statistically significant associations in the initial models between the Early Years Foundation Stage Profile outcomes and the mean hours per week of ECEC used between age two and the start of school. Subsequent interaction analysis showed an association between EYFSP total score and formal individual ECEC use for specific disadvantage groups; this is discussed below (investigating outcomes by disadvantage group and home learning environment).

Results by specific levels of ECEC use

For this analysis, formal group ECEC use was classified according to eight levels of use, with the lowest level (up to 5 hours per week) used as the reference level.³⁹ The levels of formal group ECEC use were:

- Five hours or below (reference level) per week
- Above 5 hours to 10 hours per week
- Above 10 hours to 15 hours per week
- Above 15 hours to 20 hours per week
- Above 20 hours to 25 hours per week
- Above 25 hours to 30 hours per week
- Above 30 hours to 35 hours per week
- Above 35 hours per week

Because the usage of formal individual and informal individual ECEC was lower, it was necessary to adopt a different set of usage bands for these types of ECEC in order that the numbers of children in each usage band were sufficient for reliable analysis:

- No ECEC of this type (reference level)
- Up to 5 hours per week
- Above 5 to 10 hours per week
- Above 10 to 20 hours per week
- Above 20 hours per week

These usage bands were the same as those used in the analysis by specific usage bands in the SEED age four report. Breakdowns of the analysis samples by these ECEC usage bands are given in the Technical Annexe.

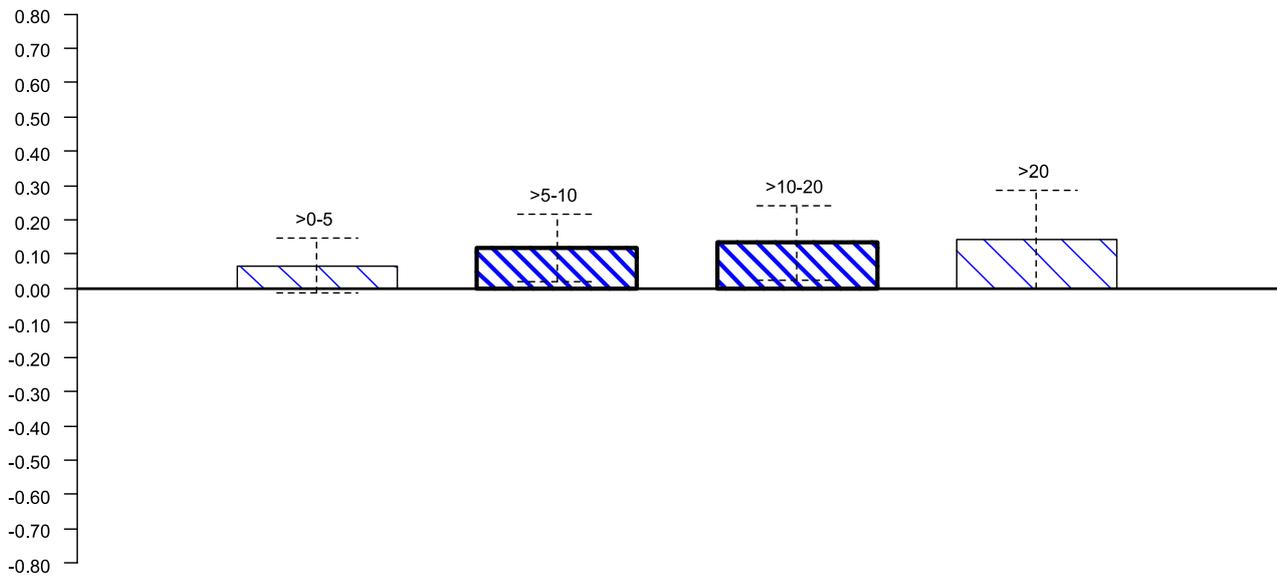
The effects of specific usage bands were of small to medium size. The conventional threshold for medium effect size is an absolute value of 0.3, see p 50.

Results are shown in Figures 1 to 8. Full results are given in the Technical Annexe to this report.

³⁹ N = 123 (cognitive and socio-emotional outcomes); N = 137 (EYFSP outcomes).

Figure 1: Association between informal individual ECEC use between age two and the start of school and children's Verbal ability during school year one.

Verbal ability during school year one by hours spent per week in informal individual ECEC

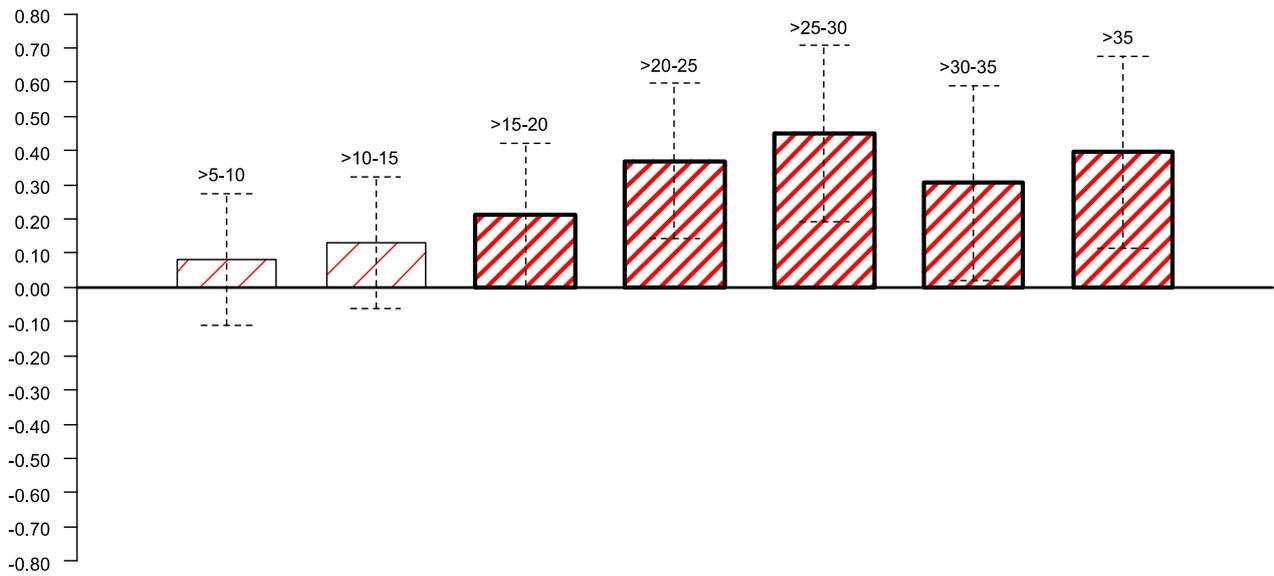


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of informal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 2: Association between formal group ECEC use between age two and the start of school and children's Externalising behaviour during school year one.

Externalising behaviour during school year one by hours spent per week in formal group ECEC

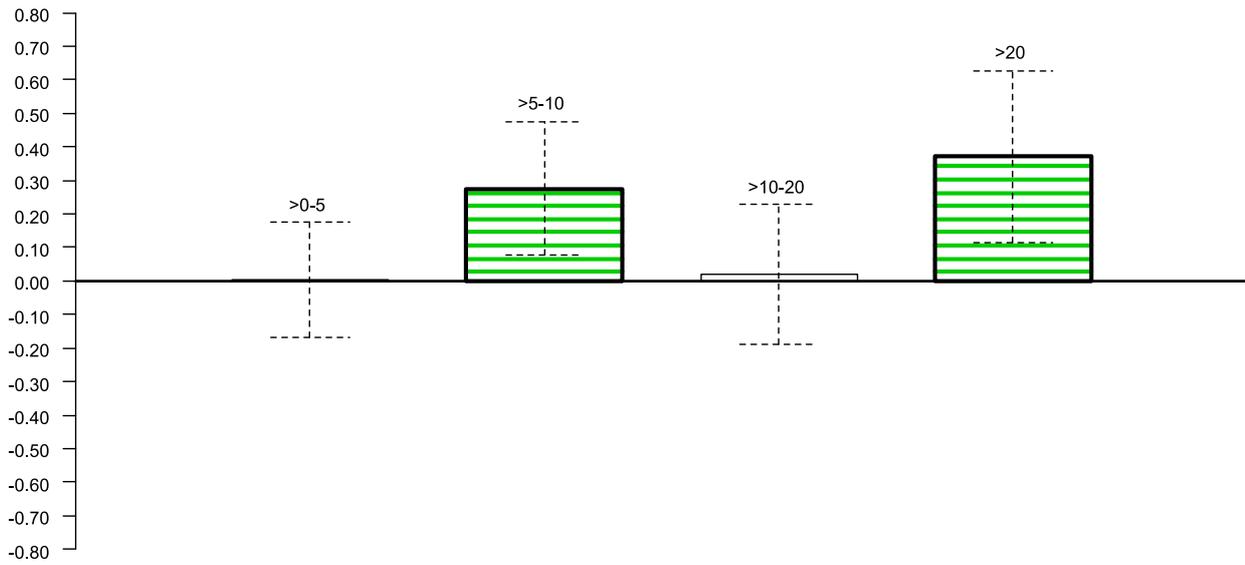


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to five hours per week formal group ECEC use. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 3: Association between formal individual (childminder) ECEC use between age two and the start of school and children's Externalising during school year one.

Externalising behaviour during school year one by hours spent per week in formal individual ECEC

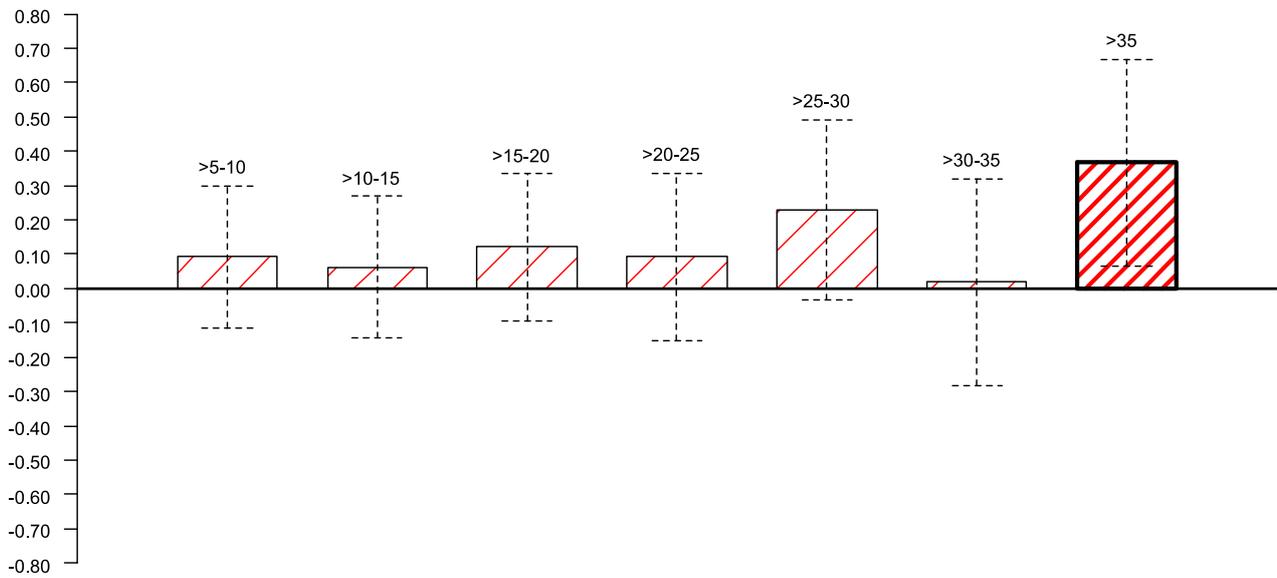


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 4: Association between formal group ECEC use between age two and the start of school and children's Internalising behaviour during school year one.

Internalising behaviour during school year one by hours spent per week in formal group ECEC

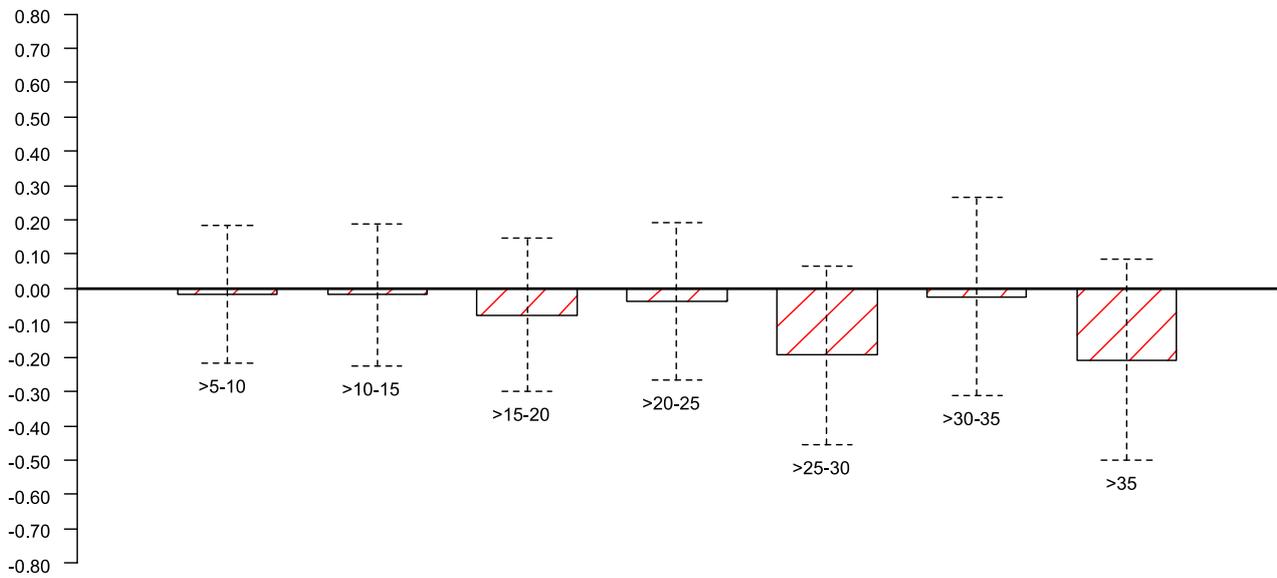


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to five hours per week formal group ECEC use. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 5: Association between formal group ECEC use between age two and the start of school and children's Prosocial behaviour during school year one.

Prosocial behaviour during school year one by hours spent per week in formal group ECEC

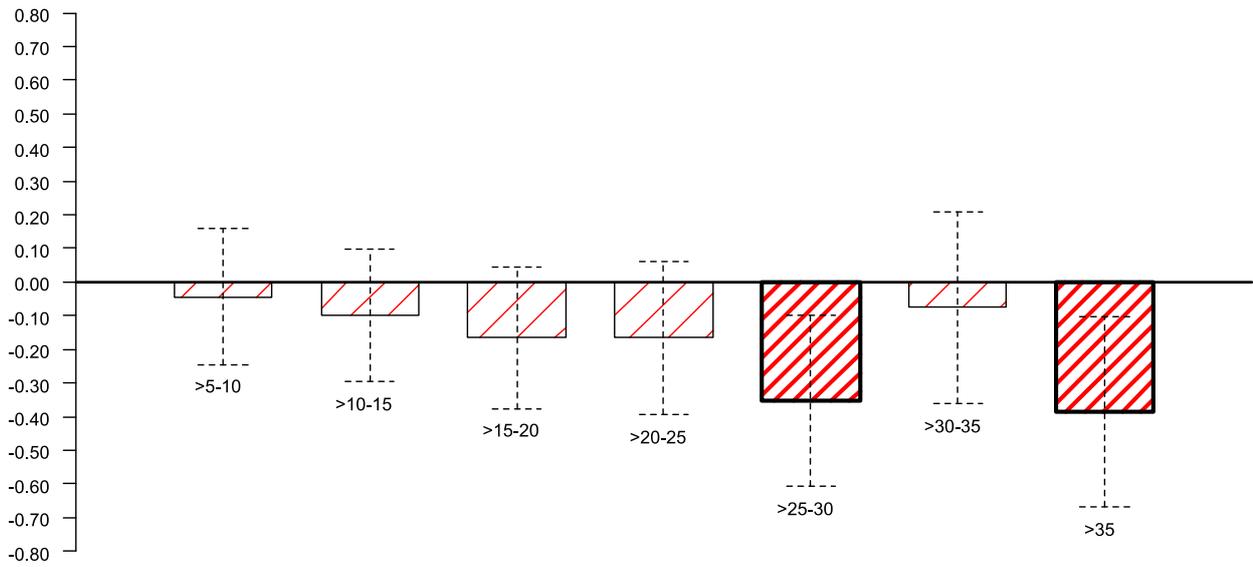


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to five hours per week formal group ECEC use. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 6: Association between formal group ECEC use between age two and the start of school and children's Behavioural self-regulation during school year one.

Behavioural self-regulation during school year one by hours spent per week in formal group ECEC

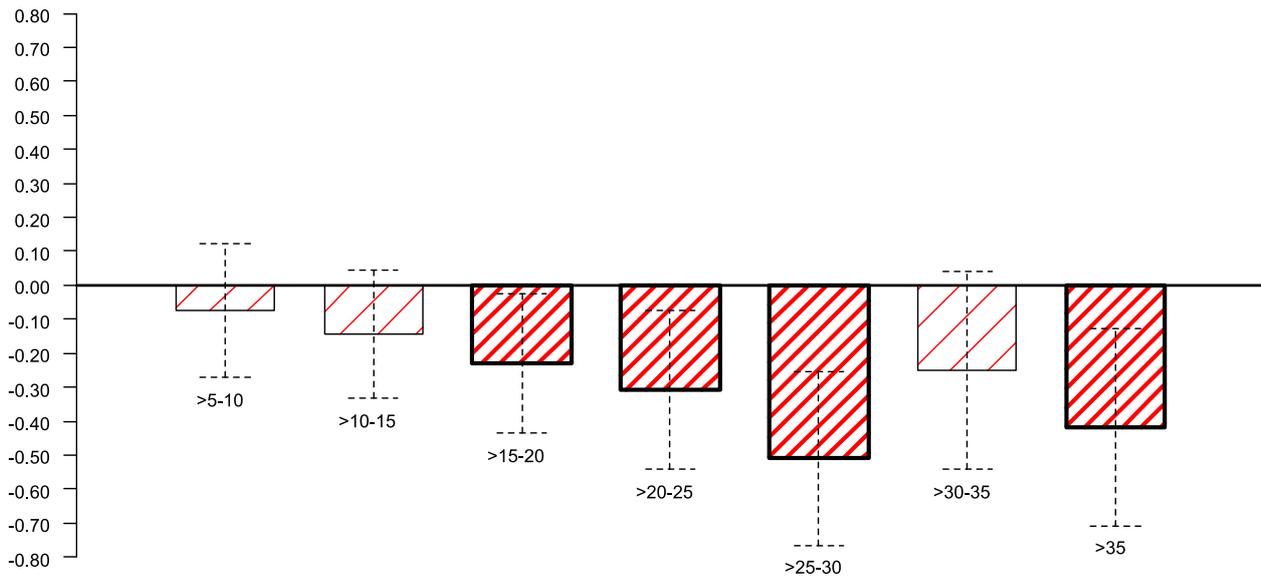


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to five hours per week formal group ECEC use. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 7: Association between formal group ECEC use between age two and the start of school and children's Emotional self-regulation during school year one.

Emotional self-regulation during school year one by hours spent per week in formal group ECEC

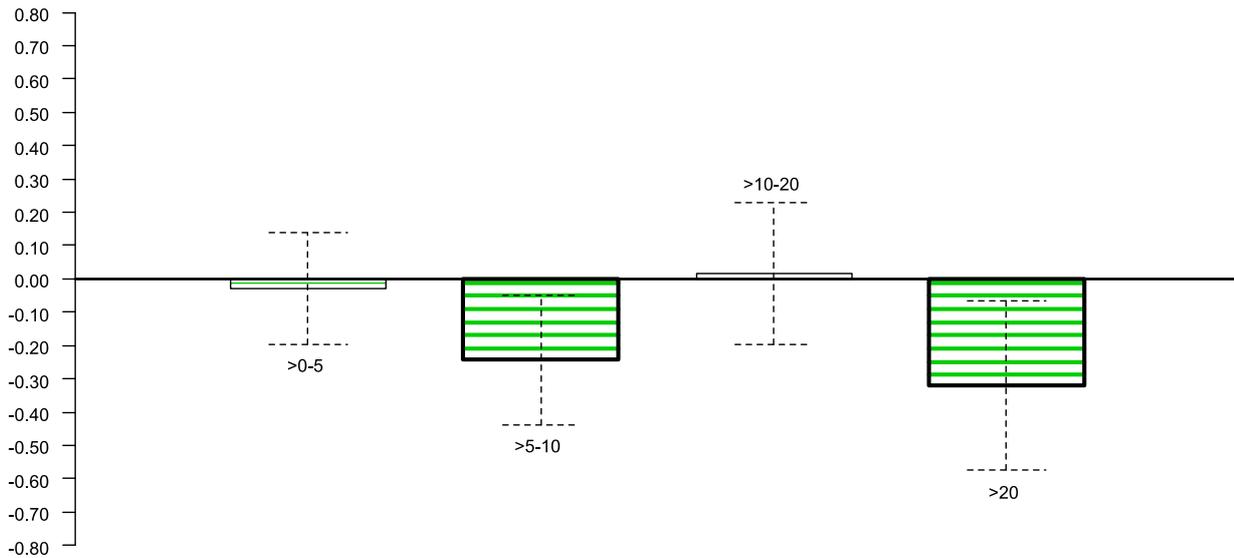


Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal group ECEC compared to a reference group of children with up to five hours per week formal group ECEC use. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

Figure 8: Association between formal individual (childminder) ECEC use between age two and the start of school and children’s Emotional self-regulation during school year one.

Emotional self-regulation during school year one by hours spent per week in formal individual ECEC



Sample size = 3186.

The plot shows the effect on the standardized outcome of specific mean weekly usage bands of formal individual ECEC compared to a reference group of children with no ECEC usage of this kind. 95% confidence intervals are shown by error bars. Models control for home environment and demographic covariates. Statistically significant effects are shown in bold.

BAS verbal ability / informal individual ECEC

Children who used a moderate amount of informal individual ECEC (10 to 20 hours per week) on average between age two and the start of school showed significantly higher levels of verbal ability at age five than children who did not use ECEC of this type; see Figure 1. Those using small (10 hours or less per week) or high average amounts (20+ hours per week) of informal individual ECEC did not show statistically significant benefits relative to those not using ECEC. No other subgroup analysis was carried out for informal individual ECEC as there were no other main effects in original models (see Table 11).

Socio-emotional outcomes / formal individual ECEC

Children using an average of greater than 5 hours per week of formal individual ECEC (i.e. with childminders) between age two and the start of school tended to show higher levels of externalising behaviour and lower levels of emotional self-regulation at age five than children who did not use ECEC of this type; see Figures 3 and 8. There were statistically significant effects for children using an average of greater than 5 hours and up to 10 hours per week and greater than 20 hours per week for both outcomes. No other subgroup analysis was carried out for formal individual ECEC as there were no other main effects in the original models (see Table 5).

Socio-emotional outcomes / formal group ECEC

Use of formal group ECEC (e.g. in nurseries, playgroups) was associated with poorer outcomes on five of the socio-emotional scales; see Table 11 and Figures 2, 4–7. Average usage of formal group ECEC of greater than 15 hours per week between age two and the start of school was associated with higher levels of externalising behaviour at age five, and lower levels of emotional self-regulation, compared with children using an average of up to 5 hours per week. Children using 15 hours or less per week of formal group ECEC, on average, between age two and the start of school did not show any statistically significant difference in their externalising behaviour or emotional self-regulation relative to children using an average of up to 5 hours per week.

Higher levels of internalising behaviour during school year one were statistically significantly associated only with formal group ECEC usage of greater than 35 hours per week, on average, between age two and the start of school. Children using 35 hours or less per week of formal group ECEC, on average, between age two and the start of school did not show any statistically significant difference in their internalising behaviour relative to children using an average of up to 5 hours per week.

Although there was an overall negative association between formal group ECEC use and prosocial behaviour scores at age five (Table 11), this is the smallest of the significant effects detected in the initial models and there were no significant effects of specific usage bands in the “detail model”.

Compared to a reference group of children using a mean of up to five hours per week of formal group ECEC between age two and the start of school, levels of behavioural self-regulation during school year one were lower for children attending formal group ECEC for a mean of greater than 25 and up to 30 hours per week and for children attending formal group ECEC for a mean of greater than 35 hours per week.

No other subgroup analysis was carried out for formal group ECEC as there were no other main effects in the original models (see Table 11).

Testing for curvilinear relationships

The models testing for curvilinear relationships produced no significant results, indicating that there is no clear evidence for non-linear relationships between the ECEC covariates and child outcomes. Details are given in the Technical Annexe.

Investigating whether ECEC use interacts with disadvantage group or home learning environment

Method

There is some reason to believe that the association between ECEC use and the outcome variables may vary according to the level of family disadvantage and / or according to the nature of the home learning environment. For this reason, the initial models were tested for evidence of interactions between the effects of ECEC use and (a) children's SEED disadvantage group and (b) the home learning environment. Further details of these interaction tests are given in the Technical Annexe to the main report.

Results: disadvantage group

There was only one statistically significant interaction, this was between the effect of formal individual ECEC use (with childminders) and SEED disadvantage group for the outcome EYFSP total score. There were no other statistically significant interactions, suggesting that all other associations between hours in ECEC and child development were the same regardless of whether the family was in the most, moderately or least disadvantaged group.

In order to investigate the significant association further, separate models of this outcome were fitted for each SEED disadvantage group. The associations between formal individual ECEC use and the EYFSP total score are shown in Table 12. The effects are of small size (see p 50).

Table 12: Effects of formal individual (childminder) ECEC use on EYFSP total score in separate models by SEED disadvantage group.

Disadvantage group	Coefficient
20% most disadvantaged	-0.199 *
20%-40% moderately disadvantaged	+0.099 *
60% least disadvantaged	-0.035

Sample size = 1474 (20% most disadvantaged group)

Sample size = 1742 (20%-40% moderately disadvantaged group)

Sample size = 1726 (60% least disadvantaged group)

Coefficients give the change in the standardised outcome variable corresponding to a change of ten hour per week in formal individual ECEC use. Statistically significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

For the most disadvantaged group, higher usage (more hours per week) of formal individual ECEC (with childminders) between age two and the start of school was associated with lower levels of EYFSP total score at the end of reception.

For the moderately disadvantaged group, higher usage (more hours per week) of formal individual ECEC (with childminders) between age two and the start of school was associated with higher levels of EYFSP total score at the end of reception.

There was no association between hours per week in formal individual ECEC and EYFSP total score for the least disadvantaged group.

A possible explanation for these differences in the formal individual (childminder) ECEC / total EYFSP points score relationships in the three disadvantage groups could be that families in the most disadvantaged group may be more likely to have access to lower quality childminder care, whilst children in the two less disadvantaged groups tend to have access to better quality childminder provision.⁴⁰ The absence of a relationship between hours in childminder care and EYFSP total score in the least disadvantaged group could perhaps be explained as a saturation effect: these children may have more educational opportunities at home and so derive less benefit from additional educational opportunities in a childminder setting. This explanation is necessarily tentative; it could be investigated in a future study.

Results: home learning environment

A statistically significant interaction was found between formal group ECEC usage and home learning environment for the cognitive outcome BAS verbal ability. There were no other statistically significant interactions, suggesting that all other associations between hours in ECEC and child development were the same regardless of the quality of the home learning environment.

A model was fitted with separate effects for formal group ECEC use for each quartile of the HLE variable; see Table 13. The effects are of small size (see p 50).

Table 13: Effects of formal group ECEC use on BAS verbal ability score in a model with separate effects by quartile of Home Learning Environment score.

Outcome	HLE band	Coefficient
Verbal ability (BAS)	Quantile 1 (lowest quality HLE)	+0.087 *
	Quantile 2	+0.067
	Quantile 3	+0.025
	Quantile 4 (highest quality HLE)	-0.048

Sample size = 3186

Coefficients give the change in the standardised outcome variable corresponding to a change of 10 hour per week in formal group ECEC use. Statistical significance was shown by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

⁴⁰ In a recent Ofsted report, the proportion of childminders judged good or outstanding was higher in less deprived areas, although even in deprived areas the majority of provision was of good or outstanding quality. See (Ofsted 2018).

There was a statistically significant positive association between hours per week in formal group ECEC between age two and the start of school and BAS verbal ability during school year one only for children in the lowest quartile of HLE score. For children with higher quality HLE, time spent in formal group ECEC between age two and the start of school was not associated with verbal ability during school year one.

This difference in the effect of formal group ECEC use on children's verbal ability by home learning environment level may be explained as a "saturation effect". Children experiencing more enhancing home learning environments may have already had sufficient "learning opportunities" and so stand to gain less by exposure to out of home ECEC. On the other hand, children experiencing less enhancing home learning environments gain more benefit from the learning opportunities that out of home ECEC provides because they have fewer learning opportunities at home.

Relationships between different socio-emotional measures

The associations between formal ECEC use and poorer child socio-emotional outcomes during school year one are unexpected given that associations between ECEC use and children's socio-emotional outcomes at ages 3 and 4 were generally in the direction of ECEC use being associated with better child socio-emotional outcomes. There were some exceptions to this pattern, with negative associations found between formal group ECEC use and higher child SDQ conduct problems at ages 3 and 4,⁴¹ and between higher formal group ECEC use and lower levels of emotional self-regulation at age 3. However, these negative associations were somewhat limited in nature. Firstly, they were confined to children having a mean of greater than 35 hours per week formal group ECEC. Secondly, at age 4, although there was an association between high formal group ECEC use and higher conduct problems found in a model controlling for demographic and home environment factors, there was no absolute difference between the conduct problems level of the high formal group ECEC use children and other children. This indicates that these children had higher than expected conduct problems for children of their demographic and home background but did not have absolutely higher levels of conduct problems.

The picture during school year one is strikingly different, with poorer socio-emotional outcomes found over five different socio-emotional measures, and evidence that poorer outcomes may be associated with children using a mean of fifteen hours per week or more of formal group ECEC.

This raises the question of how comparable the teacher assessed CSBQ measures used at the wave 4 survey are with (a) the teacher assessed SDQ measures used at the wave 2 (age 3) survey, and (b) the parent assessed CSBQ measures from the wave 4 survey.

⁴¹ There was also an association between formal individual (childminder) ECEC use at and higher levels of conduct problems at age 3.

Method

Correlations were calculated between wave 4 teacher assessed CSBQ measures and:

- (a) ECEC provider assessed SDQ scales from wave 2 (age 3).
- (b) Parent assessed CSBQ measures from Wave 4 (school year one).

The Pearson product moment correlation was used. Correlations were tested to see if they were significantly different from zero.

Results

Correlations between Wave 4 teacher assessed CSBQ scores and wave 2 (age 3) ECEC provider assessed SDQ scores are shown in Table 14. Correlations between wave 4 teacher assessed CSBQ scores and Wave 4 parent assessed CSBQ scores are shown in Table 15.

Discussion

Of the 56 correlations calculated between teacher assessed CSBQ scores assessed during school year one and ECEC provider assessed SDQ at age 3, 53 were statistically significant (Table 14). In all cases these correlations were in the expected direction: i.e. socio-emotional strengths are positively correlated with socio-emotional strengths and negatively correlated with socio-emotional problems, socio-emotional problems are positively correlated with socio-emotional problems and negatively correlated with socio-emotional strengths. These statistically significant correlations were small to moderate in size with absolute values in the range 0.068 to 0.451.

All the correlations calculated between Wave 4 teacher assessed CSBQ scores and Wave 4 parent assessed CSBQ scores were statistically significant. All were in the expected direction. These correlations were small to moderate in size with absolute values in the range 0.124 to 0.398.

Conclusion

The Wave 4 teacher assessed CSBQ scores show the correlations that would be expected with two other sets of socio-emotional measures from the SEED study. This suggests that the different relationships found between ECEC use and socio-emotional outcomes at age 3 to 4 and during school year one is not mainly due to differences between the socio-emotional measures used.

Whilst the Wave 4 teacher assessed and parent assessed CSBQ are correlated in the manner that would be expected, the correlations may be considered surprisingly weak for the same socio-emotional measures taken at similar times. These differences are at least partly explained by differences in children's behaviour between the school and home environments; it is also likely that a child's behaviour is perceived and evaluated differently by teachers and parents given the different types of relationship that they have with the child.

Table 14: Correlations between Wave 4 teacher assessed CSBQ scales and ECEC provider assessed SDQ and related scales at age 3.

			ECEC provider assessed SDQ and related scales (age 3)							
			Socio-emotional problems				Socio-emotional strengths			
			SDQ Hyperactivity Scale	SDQ Emotional Symptoms Scale	SDQ Conduct Problems Scale	SDQ Peer Problems Scale	SDQ Prosocial Scale	Behavioural Self-Regulation Scale	Emotional Self-Regulation Scale	Co-operation Scale
Wave 4 teacher assessed CSBQ scales	Socio-emotional problems	Externalising behaviour	0.335 ***	-0.020	0.405 ***	0.091 ***	-0.272 ***	-0.135 ***	-0.359 ***	-0.343 ***
		Internalising behaviour	0.174 ***	0.168 ***	0.185 ***	0.183 ***	-0.177 ***	-0.197 ***	-0.204 ***	-0.213 ***
	Socio-emotional strengths	Sociability	-0.341 ***	-0.141 ***	-0.265 ***	-0.327 ***	0.333 ***	0.299 ***	0.262 ***	0.345 ***
		Prosocial behaviour	-0.420 ***	-0.082 **	-0.286 ***	-0.247 ***	0.386 ***	0.303 ***	0.304 ***	0.365 ***
		Behavioural self-regulation	-0.451 ***	0.006	-0.333 ***	-0.143 ***	0.339 ***	0.245 ***	0.334 ***	0.352 ***
		Cognitive self-regulation	-0.426 ***	-0.068 *	-0.244 ***	-0.217 ***	0.332 ***	0.319 ***	0.257 ***	0.332 ***
		Emotional self-regulation	-0.396 ***	0.010	-0.412 ***	-0.095 ***	0.296 ***	0.160 ***	0.404 ***	0.359 ***

Sample size = 1378

Significant correlations are shown in ***bold italics***.

p-values give the statistical significance of a test that the correlation is non-zero: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 15: Correlations between Wave 4 teacher assessed CSBQ scales and Wave 4 parent assessed CSBQ scales.

			Wave 4 parent assessed CSBQ scales						
			Socio-emotional problems		Socio-emotional strengths				
			Externalising behaviour	Internalising behaviour	Sociability	Prosocial behaviour	Behavioural self-regulation	Cognitive self-regulation	Emotional self-regulation
Wave 4 teacher assessed CSBQ scales	Socio-emotional problems	Externalising behaviour	<i>0.319 ***</i>	<i>0.124 ***</i>	<i>-0.183 ***</i>	<i>-0.221 ***</i>	<i>-0.325 ***</i>	<i>-0.216 ***</i>	<i>-0.324 ***</i>
		Internalising behaviour	<i>0.184 ***</i>	<i>0.218 ***</i>	<i>-0.204 ***</i>	<i>-0.182 ***</i>	<i>-0.209 ***</i>	<i>-0.205 ***</i>	<i>-0.182 ***</i>
	Socio-emotional strengths	Sociability	<i>-0.245 ***</i>	<i>-0.198 ***</i>	<i>0.332 ***</i>	<i>0.315 ***</i>	<i>0.319 ***</i>	<i>0.310 ***</i>	<i>0.249 ***</i>
		Prosocial behaviour	<i>-0.265 ***</i>	<i>-0.167 ***</i>	<i>0.311 ***</i>	<i>0.345 ***</i>	<i>0.369 ***</i>	<i>0.353 ***</i>	<i>0.271 ***</i>
		Behavioural self-regulation	<i>-0.290 ***</i>	<i>-0.132 ***</i>	<i>0.238 ***</i>	<i>0.305 ***</i>	<i>0.398 ***</i>	<i>0.339 ***</i>	<i>0.307 ***</i>
		Cognitive self-regulation	<i>-0.247 ***</i>	<i>-0.172 ***</i>	<i>0.263 ***</i>	<i>0.319 ***</i>	<i>0.378 ***</i>	<i>0.385 ***</i>	<i>0.256 ***</i>
		Emotional self-regulation	<i>-0.308 ***</i>	<i>-0.125 ***</i>	<i>0.197 ***</i>	<i>0.242 ***</i>	<i>0.357 ***</i>	<i>0.250 ***</i>	<i>0.333 ***</i>

Sample size = 2541

Significant correlations are shown in ***bold italics***.

p-values give the statistical significance of a test that the correlation is non-zero: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Investigating whether formal ECEC use is associated with socio-emotional problems

The associations found in controlled models between formal ECEC use and poorer child socio-emotional outcomes at age five raise the question as to whether children's outcomes remain within the expected range for the socio-emotional measures or whether these associations are contributing to children's having socio-emotional problems.

Note that these associations do not necessarily imply that socio-emotional problems are absolutely higher among children with higher formal ECEC use. This section investigates this question. Further, a definition of "child socio-emotional problems" is proposed in terms of a child having CSBQ scores more than one standard deviation from the mean in the direction of poorer outcomes on more than half of the seven CSBQ scales. The relationship between child socio-emotional problems thus defined and children's cognitive and educational outcomes is examined. Finally, it is investigated whether ECEC use between age two and the start of school is associated with children having socio-emotional problems during school year one.

Method

Children's mean CSBQ scores were compared between three formal group ECEC usage bands:

- Up to ten hours per week
- Greater than ten to fifteen hours per week
- Greater than fifteen hours per week

and between three formal individual ECEC usage bands:

- No usage
- Up to ten hours per week
- Greater than ten hours per week

Means were compared using the non-parametric Wilcoxon rank sum test. The lowest usage band was used as the reference group.

The number of children with N or more CSBQ scores more than one standard deviation from the mean in the direction of poorer outcomes was investigated. Children with four or more CSBQ scores more than one standard deviation from the mean in the direction of poorer outcomes were defined as having socio-emotional problems.

Models were fitted of children's cognitive and educational (EYFSP) outcomes in terms of whether or not children had socio-emotional problems during school year one. Models were also fitted of whether or not children had socio-emotional problems during school year one in terms of ECEC usage between age two and the start of school. All models were controlled for demographic and home environment variables.

Results

The comparison between mean CSBQ scores by formal group ECEC usage band is summarised in Table 16. The comparison between mean CSBQ scores by formal individual (childminder) ECEC usage band is given in Table 17.

Table 16: Mean CSBQ scores by bands of formal group ECEC usage (age two to start of school).

CSBQ measure		Formal group ECEC usage		
		Up to 10 hours per week	>10 to 15 hours per week	>15 hours per week
Socio-emotional problems	Externalising behaviour	8.00	8.35 *	8.82 ***
	Internalising behaviour	7.38	7.33	7.44
Socio-emotional strengths	Sociability	16.58	16.76	16.59
	Prosocial behaviour	32.44	32.39	32.25
	Behavioural self-regulation	20.96	20.65 *	20.45 **
	Cognitive self-regulation	29.62	29.23	29.80
	Emotional self-regulation	25.13	24.64 *	24.14 ***

Sample size = 2566.

The mean outcomes in the higher usage bands were compared with those in the lowest usage band using a Wilcoxon rank sum test. Statistically significant differences are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Table 17: Mean CSBQ scores by bands of formal individual (childminder) ECEC usage (age two to start of school).

CSBQ measure		Formal individual ECEC usage		
		Zero	>0 to 10 hours per week	>10 hours per week
Socio-emotional problems	Externalising behaviour	8.40	8.62	8.41
	Internalising behaviour	7.38	7.31	7.50
Socio-emotional strengths	Sociability	16.62	16.94	16.74
	Prosocial behaviour	32.22	33.08 *	33.34
	Behavioural self-regulation	20.61	20.88	21.27
	Cognitive self-regulation	29.40	30.02	30.98 **
	Emotional self-regulation	24.61	24.40	24.83

Sample size = 2566.

The mean outcomes in the higher usage bands were compared with those in the lowest usage band using a Wilcoxon rank sum test. Statistically significant differences are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

For the CSBQ measures externalising behaviour, behavioural self-regulation and emotional self-regulation, the two higher formal group ECEC usage bands showed significantly poorer mean outcomes than the lowest (reference) band (Table 16).

For formal individual (childminder) ECEC the results were strikingly different. Mean prosocial behaviour score was significantly better in the up to ten hours per week band than in the zero usage (reference) band (Table 17). Also, cognitive self-regulation was significantly better in the greater than ten hours per week band than in the zero usage (reference) band.

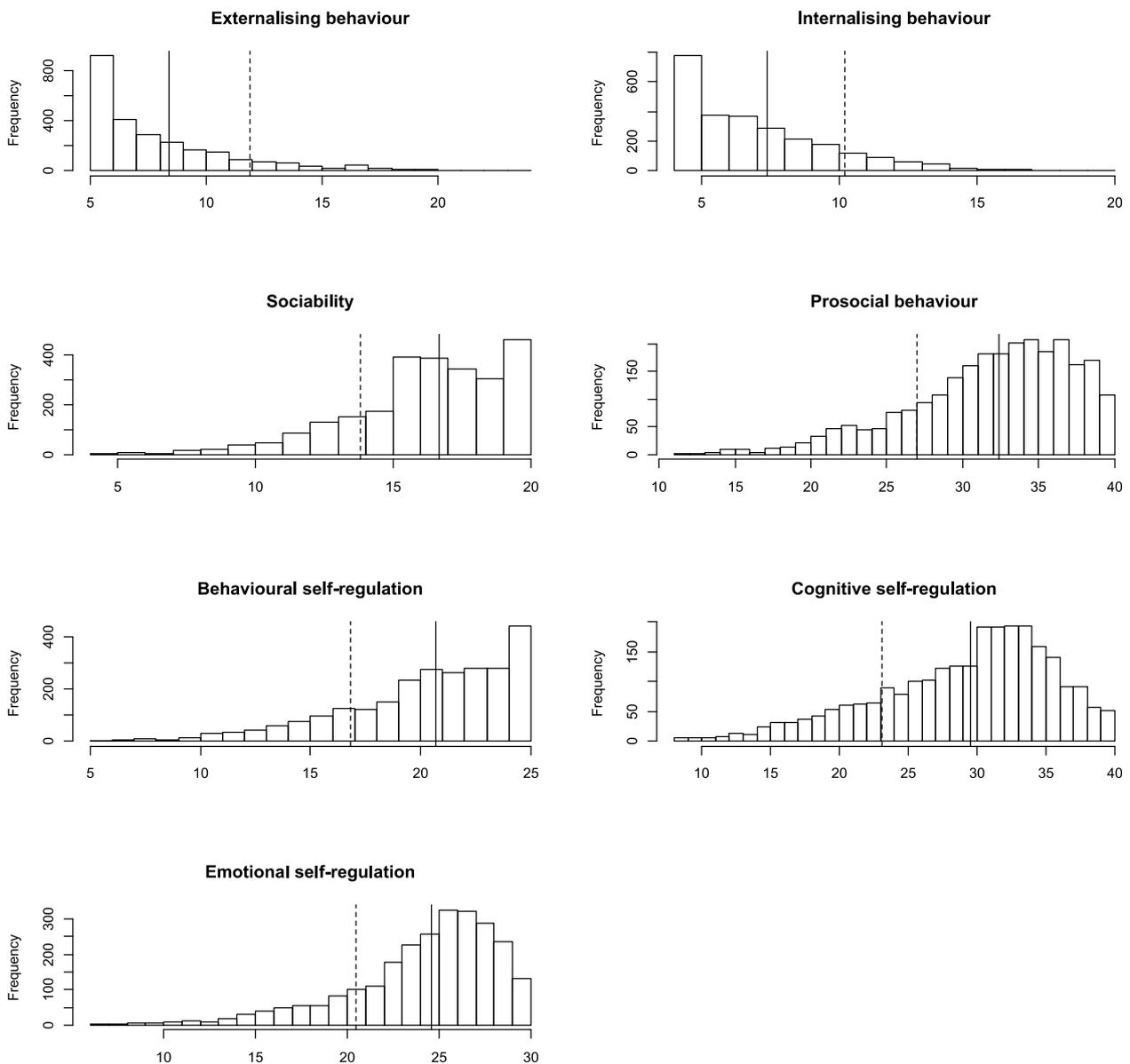
Histograms of the teacher assessed CSBQ scores are given in Figure 9. The distributions are skewed, with children clustered towards the end of the scale indicating better outcomes (i.e. higher levels of socio-emotional strengths and lower levels of socio-emotional problems). A dotted line has been plotted one standard deviation from the mean in the direction of poorer outcomes. Children in the tail of the distribution beyond this line may be considered to have poor outcomes on a given measure. The percentages of children with (a) exactly N and (b) N or more poor outcomes on the seven CSBQ scales is shown in Table 18. Children with poor outcomes on more than half of the scales (i.e. four or more) were defined as having socio-emotional problems; 12.5% of children had socio-emotional problems according to this definition.⁴²

The results of the models of children's cognitive and educational (EYFSP) outcomes in terms of whether or not the child has socio-emotional problems during school year one are given in Table 19. Models were controlled for demographic and home environment variables. Having socio-emotional problems during school year one was associated with poorer child outcomes on all cognitive and EYFSP measures. The associations with the cognitive outcomes were of small size, whilst those with the EYFSP outcomes were of medium to large size (see p 50),

The results of the model of whether or not children have socio-emotional problems during school year one in terms of their ECEC use between ages two and the start of school are shown in Table 20. Models were controlled for demographic and home environment variables. There was a small association between formal group ECEC use between age two and the start of school and a child's having socio-emotional problems during school year one.

⁴² A comparison of demographic and home environment variables between children with and without socio-emotional problems is given in the Technical Annex to this report.

Figure 9: Histograms of CSBQ measures.



Sample size = 2566.

A solid vertical line marks the mean of the distribution. A dotted vertical line is shown one standard deviation from the mean in the direction of poorer child outcomes.

Table 18: Percentages of children with poor outcomes on (a) exactly N, and (b) N or more CSBQ socio-emotional scales.

N	Percentage of children with poor outcomes on exactly N CBSQ socio-emotional scales	Percentage of children with poor outcomes on N or more CBSQ socio-emotional scales
0	62.6	100.0
1	12.6	37.4
2	6.6	24.8
3	5.7	18.2
4	4.8	12.5
5	3.2	7.7
6	2.7	4.5
7	1.8	1.8

Sample size = 2566.

Table 19: Models of children’s cognitive and EYFSP outcomes in terms of whether the child has socio-emotional problems.

Outcome variable		Coefficient
Cognitive development	Verbal ability	-0.226 ***
	Non-verbal ability	-0.206 ***
EYFSP outcomes	Communication and Language	OR 0.186 ***
	Physical Development	OR 0.220 ***
	Personal, Social & Emotional Development	OR 0.163 ***
	Literacy	OR 0.242 ***
	Numeracy	OR 0.258 ***
	Good level of development	OR 0.243 ***
	EYFSP total score	-0.676 ***

Sample size = 2566.

Statistically significant results are indicated by stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Models were controlled for demographic and home environment variables.

Table 20: Model of whether child has socio-emotional problems in terms of the amount of ECEC used between age two and the start of school.

Outcome variable	ECEC use between age two and the start of school		
	Formal group	Formal individual	Informal individual
Child has socio-emotional problems	OR 1.019 *	OR 1.001	OR 1.003

Sample size = 2566.

Statistically significant results are indicated by stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Coefficients give the change in the probability of a child having socio-emotional problems corresponding to a ten hour per week change in the ECEC use covariate, expressed as an odds ratio. Values greater than one indicate that increased ECEC use was associated with an increased probability of socio-emotional problems.

Models were controlled for demographic and home environment variables.

Discussion

This section confirms the association between poorer socio-emotional outcomes on certain CSBQ scales and formal group ECEC use, not merely a relative association in controlled models. The situation for formal individual (childminder) ECEC is different, with some limited associations between higher formal individual ECEC use and better socio-emotional outcomes in uncontrolled comparisons.

A working definition of child socio-emotional problems ascribes such problems to 12.5% of children. Socio-emotional problems, so defined, are strongly associated with poorer child cognitive and educational (EYFSP) outcomes. There is a small but significant association between higher formal group ECEC use and children having socio-emotional problems during school year one.

Chapter conclusions

Before discussing the individual results, it should be considered how robust these results are, taken as a whole. Of the 48 primary associations investigated between 16 outcomes and 3 types of ECEC, 8 statistically significant results were found (see Table 11). This is considerably higher than the 1 in 20 significant results that might be expected if the results were due to chance alone. Also, the results are coherent: the seven results for socio-emotional outcomes are all in the direction of higher ECEC use being associated with poorer socio-emotional outcomes; a finding that would not be expected by chance. Finally, it should be noted that of the 8 significant results, 2 are significant at the 5% level, 3 at the 1% level and 3 at the 0.1% level. That most of the results are significant at higher levels than the 5% threshold confirms that there is a statistically robust pattern of associations between ECEC use and the outcome variables.

Although the results are statistically strong, it should also be noted that, as in the age 3 and age 4 studies, the effects of ECEC on child outcomes are fairly small, generally being smaller than those attributable to demographic and home environment factors.⁴³

These results show some unexpected differences from those found in the analyses of children's age three and age four outcomes, as well as some degree of continuity with the earlier results. Given the timing of measurement, and because an extensive number of factors were controlled for in the analyses, the relationships between ECEC and child outcomes, may be assumed to be causal.⁴⁴ However, it should be noted that this study is observational and therefore there could be other unmeasured factors driving or contributing to the observed relationships.

The use of informal individual ECEC (with grandparents, relatives, friends etc.) was associated with higher levels of verbal ability during school year one. This association was consistent with findings at ages three and four (Melhuish & Gardiner, 2018). This result was found across all disadvantage groups and regardless of the quality of the home learning environment experienced. This finding may suggest that there is a particular benefit for language development from being in a one to one adult environment. No other cognitive outcomes and no socio-emotional outcomes were found to be associated with informal individual ECEC; this includes teacher-rated language and communication outcomes from the EYFSP. This difference between finding an association through direct assessment of language development on the BAS but no association with teacher rated communication and language development on the EYFSP may be because the EYFSP is a less sensitive measure of language development. This difference in sensitivity reflects that the EYFSP domain comprises a wider scope across language and communication, and that the EYFSP is teacher rated while the BAS is directly assessed. Additionally the individual domains within the EYFSP are scored on a binary scale and are therefore less able to detect small differences in ability than the BAS, which uses a continuous scale.

The previous SEED impact report indicated that the use of formal group ECEC (in playgroups, nursery schools etc.) between age two and four was associated with better child cognitive outcomes at age four, specifically for children's non-verbal ability (Melhuish & Gardiner, 2018). At age five the association between formal group ECEC use and children's cognitive development was no longer seen when considering the study population as a whole, suggesting that the overall benefits of formal group ECEC for cognitive development seen just before entry to school did not persist a year after starting school. This might suggest that for many children school is able to compensate for any gaps in development resulting from prior ECEC experience. However, findings from studying interactions suggested that the association with cognitive development did persist at age five for some subgroups of children. The association between time spent in formal group ECEC and verbal ability depended on the home learning environment. Specifically, the benefits of formal group ECEC for children's verbal cognitive ability was found only for children who experience less enhancing home learning environments. This may be described as a "saturation effect" where the benefit children experience from out

⁴³ See Chapter 6.

⁴⁴ Further discussion of causal relationships is available in the associated Technical Annexe.

of home learning opportunities was less for those children who already experience many learning opportunities at home.

The initial models showed no associations between children's ECEC use between age two and the start of school and children's outcomes from the Early Years Foundation Stage Profile (EYFSP), a teacher rated assessment at the end of reception year. Subsequent analysis showed an association between time spent in formal individual ECEC (with childminders) and lower EYFSP total scores (the composite across cognitive and socio-emotional domains) for children from the most disadvantaged families; however, for children from moderately disadvantaged families, time spent in formal individual (childminder) ECEC was associated with higher EYFSP total scores. It is tentatively suggested that these differences in the formal individual (childminder) ECEC / total EYFSP points score relationship by disadvantage group could be due to families in the most disadvantaged group being more likely to have access to lower quality childminder care, whilst children in the two less disadvantaged groups are more likely to have access to better quality childminder provision. The absence of a relationship between hours in childminder care and EYFSP total score in the least disadvantaged group could perhaps be explained as a saturation effect: children in the least disadvantaged group may have more educational opportunities at home and so derive less benefit from additional educational opportunities in a childminder setting.

The most striking contrast with results from earlier SEED reports concerns the relationship between formal group and formal individual ECEC use and children's socio-emotional outcomes. At ages 3 and 4 the use of formal group and formal individual ECEC was generally associated with better child socio-emotional outcomes. At age 3, formal group ECEC use was associated with lower levels of child emotional symptoms and peer problems and with higher levels of prosocial behaviour, whilst formal individual ECEC use was associated with lower levels of child emotional symptoms⁴⁵ and higher levels of behavioural self-regulation. At age 4, formal group ECEC use was associated with lower levels of child peer problems and with higher levels of prosocial behaviour and behavioural self-regulation, whilst formal individual ECEC use was associated with lower levels of emotional symptoms. The exception to this pattern of positive associations between formal ECEC use and children's socio-emotional outcomes was the association found at ages 3 and 4 between formal group ECEC use and higher levels of conduct problems; at age 3 there was also an association between formal group ECEC use and lower levels of emotional self-regulation. However, these unfavourable associations were confined to children with mean formal group ECEC use of greater than 35 hours per week. It should also be noted that at age 4 these high formal group ECEC use children did not have absolutely higher levels of conduct problems than other children, rather they failed to show the lower levels of conduct problems that would otherwise be expected from children with their home environment and demographic background.

However, the findings in this report suggest that, by school year one, formal group ECEC use between age two and the start of school was no longer associated with socio-emotional benefits but rather associated with small to medium sized negative effects on socio-emotional outcomes across a wide number of domains. Specifically, these were externalising behaviour, internalising behaviour, prosocial behaviour, behavioural self-regulation and emotional self-regulation. For internalising behaviour, this negative

⁴⁵ This effect was statistically significant for children in the moderately disadvantaged group only.

association was specifically for the highest use group (greater than 35 hours per week). For other socio-emotional measures these poorer outcomes were found for children with rather lower mean weekly usage: e.g. for externalising behaviour and emotional self-regulation poorer outcomes were associated with mean weekly usage of greater than 15 hours per week. These findings therefore indicate that children spending an average of longer than 15 hours per week in formal group ECEC may have some small negative behavioural outcomes during school year one.

No overall benefits for cognitive or socio-emotional development were seen for increased time spent in formal individual ECEC (with childminders), but use of childminder ECEC was associated with poorer outcomes for externalising behaviour and emotional symptoms. Some poorer socio-emotional outcomes associated with childminder use were also seen at age 3, where conduct problems were higher for children using this type of ECEC. This was not observed at age four, perhaps because the socio-emotional outcomes were parent rated, which may result in less sensitive measures.

Children using more than ten hours per week formal group ECEC use also had absolutely poorer outcomes for externalising behaviour, behavioural self-regulation and emotional self-regulation than children using up to ten hours per week formal group ECEC. This was in contrast with the results for formal individual (childminder) ECEC where children with higher formal individual ECEC use actually showed some evidence of better socio-emotional outcomes in uncontrolled comparisons.

A working definition of child socio-emotional problems in terms of children having four or more out of the seven socio-emotional measures more than one standard deviation from the mean in the direction of poorer outcomes identified a group comprising 12.5% of the children who had a cluster of poor socio-emotional outcomes. Membership of this socio-emotional problems group was strongly associated with poorer outcomes on all cognitive and EYFSP measures in models controlling for children's demographic and home environment background. This finding points to the interrelatedness of socio-emotional well-being and children's cognitive and educational development.⁴⁶

There was a small association between the amount of formal group ECEC used between age two and the start of school and the probability of children having socio-emotional problems, thus defined, during school year one.

Part of the reason these findings appear to be more negative during reception / school year one than they appeared at age four may be because the measurements of socio-emotional development used in this report were more accurate. The age four socio-emotional measures were derived from the SDQ completed by parents, while those used in this report were derived from the CSBQ completed by children's teachers. Parent-assessed and teacher-assessed socio-emotional measures differ both because of differences in children's behaviour at home and at school and because of the differences between the teacher / child and parent / child relationships. Also teachers have access to

⁴⁶ Since the EYFSP assessments (made during May to June of children's reception year) and the cognitive assessments (made during September to December of school year one) preceded the socio-emotional assessment (made during March to May of school year one), the most straightforward explanation for these associations is that good educational and cognitive development promotes positive socio-emotional outcomes. However, it is plausible that the causal relationship is in fact bi-directional, with feedback from good socio-emotional development to good cognitive and educational development as well as vice versa.

a wider frame of reference than parents, i.e. the behaviour of other children; this may make their assessments less subjective than those of parents. It should also be noted that the CSBQ may be a more sensitive measure than the SDQ (Howard and Melhuish 2017). For these reasons, the socio-emotional measurements assessed during school year one may be both more accurate and more sensitive than the age 4 measurements.

It remains to be seen whether or not these poorer socio-emotional outcomes associated with higher levels of formal ECEC use between age two and the start of school will persist as children progress through primary school.

Chapter 4: Models of outcomes in terms of the quality and type of formal group ECEC

Key findings

- This study did not detect evidence of consistent associations between the quality of formal group ECEC which children attend aged two to four and cognitive socio-emotional and educational outcomes during reception / school year one.
- The quality analysis has a smaller sample size than other analyses. This means that the minimum effect size that can be detected in the quality analyses is larger than for the other analyses in this study. It is therefore possible that there are effects of quality, but they are too small to be detectable with the sample size available.
- The only statistically significant associations found were between higher formal group ECEC quality and lower BAS non-verbal ability during school year one. Possible interpretations of this unexpected finding are discussed on p 84.
- There was no evidence of systematic differences between the effects of PVI and maintained formal group ECEC on children's outcomes.

The analyses in this chapter examine

1. the possible effects of the quality of formal group ECEC which children have attended on their outcomes during reception / school year one, and
2. (ii) whether there are differences in the effects of PVI formal group ECEC and maintained formal group ECEC on children's outcomes.

The sample size for the quality analyses was smaller than for the analyses discussed in Chapters 3, 5 and 6. More detail on the quality study is available in the SEED quality report (Melhuish & Gardiner, 2017).

Analysis in terms of formal group ECEC quality

Because of the intensive nature of the quality observational assessments, a subsample of all settings attended by children in the study was selected for this component. At Wave 1, the quality of 402 settings attended by children at age two to three was assessed. At Wave 2, the quality of 598 settings attended by children at age three was assessed.

Because only a subsample of settings was assessed for quality, only a subgroup of the main sample of children was able to be included in the analysis of quality. Use of a subsample for quality analysis has implications for interpreting the results, given that a smaller sample size may make it less likely that small effects will be detected.

The settings for children aged two were assessed using:

- Sustained Shared Thinking and Emotional Well-being Scale (SSTEW)
- Infant and Toddler Environment Rating Scale – Revised (ITERS-R)

The settings for children aged three were assessed using:

- Sustained Shared Thinking and Emotional Well-being Scale (SSTEW)
- Early Childhood Environment Rating Scale – Revised (ECERS-R)
- Early Childhood Environment Rating Scale – Extended (ECERS-E)

Further details of these measures are given in Chapter 2.

Methods

The quality of the formal group ECEC that children had experienced was analysed in three different ways:

1. For children with quality data from Wave 1, the quality of the settings which children had attended at age two was assessed using three different measures:
 - a. Sustained Shared Thinking and Emotional Well-being Scale (SSTEW).
 - b. Infant and Toddler Environment Rating Scale – Revised (ITERS-R).
 - c. A composite measure of overall quality.⁴⁷
2. For children with quality data from Wave 2, the quality of the settings which children had attended at age three was assessed using four different measures:
 - a. Sustained Shared Thinking and Emotional Well-being Scale (SSTEW).
 - b. Early Childhood Environment Rating Scale – Revised (ECERS-R).
 - c. Early Childhood Environment Rating Scale – Extended (ECERS-E).
 - d. A composite measure of overall quality.⁴⁸
3. For children with quality data from Waves 1 and 2, a composite measure of the overall quality of the settings which children had attended at age two and at age three was derived.⁴⁹

In order for there to be a realistic expectation that the quality of settings which children had attended would have an impact on their outcomes it was necessary that children had a significant level of exposure to the settings. In order to meet this requirement the sample was restricted to children who had a mean level of formal group ECEC use aged two to four of at least 10 hours per week.⁵⁰

The numbers of children in the quality models are summarised in Table 21.

⁴⁷ This was the mean of the SSTEW and ITERS-R measures.

⁴⁸ This was extracted from the SSTEW, ECERS-R and ECERS-E measurements using factor analysis. Full details are given in the Technical Annexe.

⁴⁹ This was extracted from the SSTEW and ITERS-R measures from Wave 1 and the SSTEW, ECERS-R and ECERS-E measurements from Wave 2 using factor analysis. Full details are given in the Technical Annexe.

⁵⁰ See the Technical Annexe for discussion of the decision to omit children with low formal group ECEC usage from the quality models.

Table 21: Numbers of children with quality data who also had a mean of at least 10 hours per week formal group ECEC between ages 2 and 4.

Children with quality data from:	Wave 4 data	EYFSP data
Wave 1	539	593
Wave 2	641	709
Waves 1 and 2	302	329

The outcome variables were modelled in terms of each of the quality measures. Models were controlled for ECEC use between age two and the start of school (formal group / formal individual / informal individual) and for home environment and demographic measures.

Table 22: Summary of quality measures by SEED disadvantage group.

Quality variable	Data set	Mean value of quality variable			
		All children	Most disadvantaged group	Moderately disadvantaged group	Least disadvantaged group
Wave 1 ITERS-R	Wave 4	5.22	5.29	5.16	5.23
Wave 1 SSTEW		4.50	4.53	4.37	4.58
N =		539	130	178	231
Wave 1 ITERS-R	EYFSP	5.21	5.24	5.14	5.23
Wave 1 SSTEW		4.48	4.48	4.37	4.57
N =		593	162	192	239
Wave 2 ECERS-R	Wave 4	5.33	5.40	5.19 *	5.41
Wave 2 ECERS-E		4.22	4.28	4.06 **	4.34
Wave 2 SSTEW		4.78	4.88	4.60 **	4.89
N =		641	141	239	261
Wave 2 ECERS-R	EYFSP	5.29	5.31	5.15 **	5.42
Wave 2 ECERS-E		4.19	4.19	4.04 **	4.33
Wave 2 SSTEW		4.73	4.76	4.52 ***	4.90
N =		709	169	266	274

The means for the most disadvantaged and moderately disadvantaged groups were compared to those from the least disadvantaged group, which as the largest group was used as the reference group. Where a Wilcoxon rank sum test showed a significant difference between the means this is marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Results

Mean quality scores are shown by SEED disadvantage group in Table 22. The means in the most disadvantaged group and the moderately disadvantaged group were compared with those in the least disadvantaged group which, as the largest group, was used as the reference group. There was no statistically significant difference between the mean quality of settings attended by the least and most disadvantaged children. The moderately disadvantaged children attended settings at Wave 2 which were on average of significantly lower quality than those attended by the least disadvantaged group; see Table 22. Note that these differences do not invalidate the models of children's outcomes in terms of quality of ECEC attended since child disadvantage is controlled in the models.

Table 23: Results of models of BAS non-verbal ability in terms of Wave 1 quality measures.

Outcome variable	Wave 1 Quality measure		
	SSTEW	ITERS-R	Overall quality
BAS non-verbal ability	-0.169	-0.188 *	-0.181 *

Sample size = 539

Statistically significant coefficients are marked with stars: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

There were statistically significant associations between the quality covariates and one of the outcomes. BAS non-verbal ability showed a significant association with Wave 1 ITERS-R and with Wave 1 overall quality. See Table 23. The effects were of small size (see p 50).

Note that the model coefficients were negative. That is, higher levels of ECEC settings quality at age two were associated with lower levels of BAS non-verbal ability assessed during school year one.

No other associations between any of the quality measures at age two or age three and any of the cognitive, socio-emotional and EYFSP outcomes were statistically significant.

Complete results of the quality models are given in the Technical Annexe.

Discussion

An association between children attending higher quality formal group ECEC between ages two and four and children having lower BAS non-verbal ability scores measured during school year one is unexpected. There are several possible interpretations of this finding:

1. This association, though surprising, does in fact represent a causal link between attending better quality formal group ECEC aged two to four and poorer BAS non-verbal ability during school year one.
2. This finding is due to confounding, that is, there is some unobserved factor which is associated with attending better formal group ECEC aged two to four and also associated with children having poorer BAS non-verbal ability during school year one.
3. The finding does not represent a true association but is due to statistical chance.

Whilst we cannot rule out (1), a causal link in the opposite direction to what we would expect, this explanation is unlikely for three reasons:

- a. The quality measures are well-established, and it is inherently unlikely that attending ECEC that had been measured to be of higher quality will in fact be harming the development of children's non-verbal skills.
- b. This finding is at odds with the SEED age 4 study, where higher ECEC quality was associated with better child outcomes at age 4, including BAS non-verbal ability.
- c. This finding is not supported by the published results of other studies.

In observational studies, the existence of unobserved confounders (2) is always a possibility. There are two main reasons for thinking this explanation unlikely:

- a. The models control for a wide range of home environment and demographic covariates.
- b. The inherent unlikeliness of a confounder associated both with attending better quality ECEC aged two to four and with children later having poorer non-verbal ability during school year one.

Finally, there is explanation (3), that this is a chance finding. That is, this may be an apparent association between variables due to statistical chance rather than genuine causal factors. The main reasons for thinking that this is the most probable explanation for these findings are:

- a. That neither of the other explanations is particularly plausible.
- b. The quality analysis has involved testing a large number of statistical hypotheses increasing the possibility of chance findings.

The quality models have involved testing for associations between 16 outcome variables and 8 quality measures, so 128 statistical hypotheses have been tested. With this number of hypotheses, the overall probability of a Type I error (i.e. an apparently significant but spurious result) is fairly high.

Investigating differences between the effects of PVI and maintained formal group ECEC

The initial models considered the associations between children's ECEC use between age two and the start of school and outcomes assessed during reception / school year one, with ECEC use being considered in three categories:

1. Formal group ECEC (in nursery classes, nursery schools, playgroups etc.)
2. Formal individual ECEC (with childminders).
3. Informal individual ECEC (with relatives, friends or neighbours).

As funding and administration differ between settings administered by local authorities and other group settings, a further division of formal group ECEC was made as follows:

- a. Private, voluntary and independent (PVI) ECEC, which was funded privately or by voluntary / charitable organisations
- b. Maintained ECEC, which was local government administered (i.e. nursery classes, nursery schools, Local Authority nurseries or children's centres)

Methods

A breakdown of the two analysis samples by PVI / maintained formal group ECEC usage is given in Table 24. Some children were known from the parental report to have used formal group ECEC, but the type of formal group ECEC (maintained or PVI) could not be determined due to incomplete data on the settings attended; these children were excluded from the model (see Table 24). Children in the EYFSP sample were present at SEED wave 1, but not necessarily in subsequent waves;⁵¹ children who were not present at Wave 4 had incomplete formal group ECEC data and were omitted from the analysis sample (see Table 24). Full details of how children's formal group ECEC usage was categorized as PVI or maintained are in the Technical Annexe to the main report.

Models were fitted in terms of children's PVI and maintained ECEC usage between age two and start of school. Models were controlled for children's formal individual (childminder) ECEC use and for children's informal individual ECEC use (with relatives, friends etc.). Models also controlled for demographic and home environment variables. In addition to calculating effects for PVI and maintained ECEC usage, a test checked whether there was a significant difference between effects associated with these two types of ECEC.

⁵¹ See Chapter 2, p 40.

Table 24: Breakdown of sample by type of formal group ECEC used between age two and start of school.

Breakdown of sample by type of formal group ECEC	Wave 4 data	EYFSP data
No formal group ECEC age two to start of school	37	39
PVI ECEC age two to start of school	2078	2315
Maintained ECEC age two to start of school	514	596
PVI and maintained ECEC age two to start of school	202	230
SUBTOTAL (= Number in models)	2831	3180
Missing formal group ECEC usage age two to start of school	0	1348
Formal group ECEC usage age two to start of school which could not be assigned to PVI or maintained	355	414
TOTAL	3186	4942

Results

Model results are given in Table 25. All effects are of small size (see p 50).

Table 25: Summary of the associations between children’s time (hours per week) in ECEC between age two and the start of school and children’s outcomes during reception year / school year one; models with separate effects for PVI and maintained formal group ECEC.

Outcome variable	ECEC usage aged 2 to start of school		
	PVI	Maintained	Maintained over PVI
Cognitive development			
Verbal ability	+0.027	+0.001	-0.026
Non-verbal ability	+0.037	+0.055	+0.018
Socio-emotional problems			
Externalising behaviour	+0.129 ***	+0.159 ***	+0.030
Internalising behaviour	+0.072 **	+0.104 *	+0.032
Socio-emotional strengths			
Sociability	-0.020	-0.012	+0.008
Prosocial behaviour	-0.049	-0.024	+0.025
Behavioural self-regulation	-0.094 ***	-0.076	+0.018
Cognitive self-regulation	-0.025	+0.024	+0.049
Emotional self-regulation	-0.126 ***	-0.160 ***	-0.035
Early Years Foundation Stage Profile – ODDS RATIO - OR			
Communication and Language	0.959	1.088	1.134
Physical Development	1.049	0.990	0.943
Personal, Social & Emotional Development	0.909	1.015	1.117
Literacy	0.995	1.019	1.024
Numeracy	1.024	1.195	1.167
Good level of development	0.990	1.069	1.080
EYFSP total score – continuous variable - coefficient			
EYFSP total score	-0.007	-0.003	+0.004

Sample size = 2831 (cognitive and socio-emotional outcomes)

Sample size = 3180 (EYFSP outcomes)

Models control for formal individual ECEC use (with childminders), informal individual ECEC use and demographic and home environment variables.

For the continuous outcomes, coefficients give the change in the standardized outcome corresponding to a ten hour per week change in the ECEC use covariate, controlling for all other covariates.

For the binary outcomes, coefficients give the change in probability of achieving at least the expected level of development corresponding to a ten hour per week change in the ECEC use covariate, expressed as an odds ratio: these coefficients are marked “OR”. Values greater than one indicate that increased ECEC use was associated with an increased probability of achieving at least the expected level of development; values less than one indicate that increased ECEC use was associated with a decreased probability of achieving a at least the expected level of development.

Statistically significant covariates are marked: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Discussion

There were some moderate differences in the coefficients for PVI and maintained ECEC usage. However, in the analysis of the differences in the effects of PVI and maintained ECEC usage (Table 25, column titled 'Maintained over PVI') there were no statistically significant differences found. It is concluded that there is no clear evidence of systematic differences between the effects of time spent in PVI and maintained formal group ECEC usage from age two up to the start of school on children's development assessed during reception year / school year one.

Chapter conclusions

The association between children attending higher quality formal group ECEC between ages 2 and 4 and children having lower BAS verbal ability may or may not be a true causal association. A conclusion in either direction can only be drawn in the light of further research, both from subsequent waves of the SEED study and from other studies of the effects of the quality of ECEC on children's cognitive and educational development. Given the information currently available, it is suggested that the most likely explanation is that this is a chance finding and not a causal association.

Subject to this assumption, the picture remaining is that there are no observable associations between the quality of the ECEC which children attend between ages 2 and 4 and their cognitive, socio-emotional and educational outcomes during reception / school year one. There may be a number of reasons for this.

The first is the limitations due to the smaller sample size available for the quality analysis. This makes it possible that there are associations between the quality of ECEC which children have attended and their outcomes, but that this analysis is not sensitive enough to detect them.

The second is that the quality of ECEC in England has improved by a considerable margin over the last twenty years (Melhuish & Gardiner, 2017). This has led to a clumping of quality toward the higher end. This means that, because the quality of most ECEC settings is moderate to good, the amount of variation in quality is less than in earlier Research e.g. EPPSE study) when there were a substantially greater number of poor quality ECEC settings. This reduced variation in ECEC quality may lead to an absence of observable associations between the quality of ECEC which children attend and the children's educational progress. It should not be concluded from this lack of association that ECEC quality is not of importance. If, for example, ECEC quality were to decline at some point in the future the available evidence indicates that this would adversely affect children's socio-emotional and educational outcomes.

The absence of associations between the quality of ECEC attended by children and their outcomes during reception / school year one contrasts with the findings of the SEED age four study, where attending better quality ECEC was associated with better BAS verbal ability at age four and also with lower levels of SDQ conduct problems (Melhuish & Gardiner, 2018). It may be that one consequence of children's first year in school is to enable children who have experienced lower quality ECEC to catch up with those who have experienced higher quality ECEC. Some support for this conclusion comes from the EPPE study where children's reading, maths and socio-emotional measures at age six

generally showed no difference between children who had attended high quality ECEC and children who had attended medium or low quality ECEC (Sammons 2004).⁵²

The comparison between the effects of PVI and maintained formal group settings shows that, whilst there may be differences between the benefits which children derive from these different types of formal group ECEC, the differences are relatively small and they appear to be less important than the differences between the effects of formal group, formal individual and informal individual ECEC that were explored in Chapter 3.

⁵² The one exception to this pattern was that children who had attended high quality ECEC had better outcomes for the anti-social behaviour measure than children who had attended low or medium quality ECEC.

Chapter 5: Models of outcomes in terms of the timing of formal ECEC use and the combination of types of ECEC

Key findings

- Children from the 60% least disadvantaged families who started using a mean of ten or more hours per week formal ECEC aged up to two years and who had a mean of up to twenty hours per week formal ECEC between age two and the start of school had significantly better outcomes during reception / year one for sociability, prosocial behaviour and EYFSP numeracy than a reference group who started using ten or more hours per week formal ECEC aged over three and who had a mean of up to ten hours per week formal ECEC between age two and the start of school.
- Children from the 40% most disadvantaged families who started using a mean of ten or more hours per week formal ECEC aged up to two years and who had a mean of over twenty hours per week formal ECEC between age two and the start of school showed significantly different outcomes during reception / year one as compared to a reference group who started using ten or more hours per week formal ECEC aged over three and who had a mean of up to ten hours per week formal ECEC between age two and the start of school. These consisted of better verbal ability and better outcomes on all EYFSP measures (excluding physical development). These children also had poorer outcomes for externalising behaviour and emotional self-regulation.
- Children from the 40% most disadvantaged families who started using a mean of ten or more hours per week formal ECEC aged over two and up to three years and who had a mean of over twenty hours per week formal ECEC between age two and the start of school showed significantly different outcomes during reception / year one as compared to a reference group who started using ten or more hours per week formal ECEC aged over three and who had a mean of up to ten hours per week formal ECEC between age two and the start of school. These consisted of better verbal ability and poorer outcomes for externalising behaviour and emotional self-regulation.
- Children with a mean of up to fifteen hours per week formal group ECEC between age two and the start of school and some individual ECEC (childminder, friends, relatives) during this period had better verbal ability measured during school year one than children who had a mean of up to fifteen hours per week formal group ECEC between age two and the start of school and no individual ECEC during this period.
- Children who had a mean over fifteen hours per week formal group ECEC between age two and the start of school and no individual ECEC (childminder, friends, relatives) during this period showed differences on a number of outcomes from a reference group of children who had a mean of up to fifteen hours per week formal group ECEC between age two and the start of school and no individual ECEC during this period. These consisted of better verbal ability and poorer outcomes on five socio-emotional outcomes and two EYFSP measures.
- Children who had a mean over fifteen hours per week formal group ECEC between age two and the start of school and some individual ECEC (childminder, friends, relatives) during this period showed differences on a number of outcomes from a

reference group with a mean of up to fifteen hours per week formal group ECEC between age two and the start of school and no individual ECEC. These consisted of better verbal ability and poorer outcomes on two socio-emotional measures.

In Chapter 3, models were developed in terms of the amount of ECEC used between age two and the start of school, with ECEC considered in three categories: formal group ECEC (in nursery classes, nursery schools, playgroups etc.), formal individual (childminder) ECEC and informal individual ECEC (with friends and relatives). In Chapter 4 the effects associated with the quality of formal group ECEC were investigated as well as possible differences between maintained formal group ECEC and PVI formal group ECEC.

In this chapter two different aspects of ECEC use are explored:

1. The timing of formal ECEC use: specifically, the age when children first used a mean of more than ten hours per week formal ECEC, and
2. The possible consequences of the combination of types of ECEC that children use.

Analysis in terms of the age at which formal ECEC use started

This analysis focuses on the possible effects associated with the age at which children first used formal ECEC to a considerable extent. A variable was defined as the age at which children first used a mean of ten or more hours per week formal ECEC, grouped into age bands of one to two years in size. A breakdown of the sample by the age at which children first used ten or more hours per week formal ECEC is given in Table 26. The variable is also broken down by whether children belong to the 60% least disadvantaged families or the 40% most disadvantaged families.

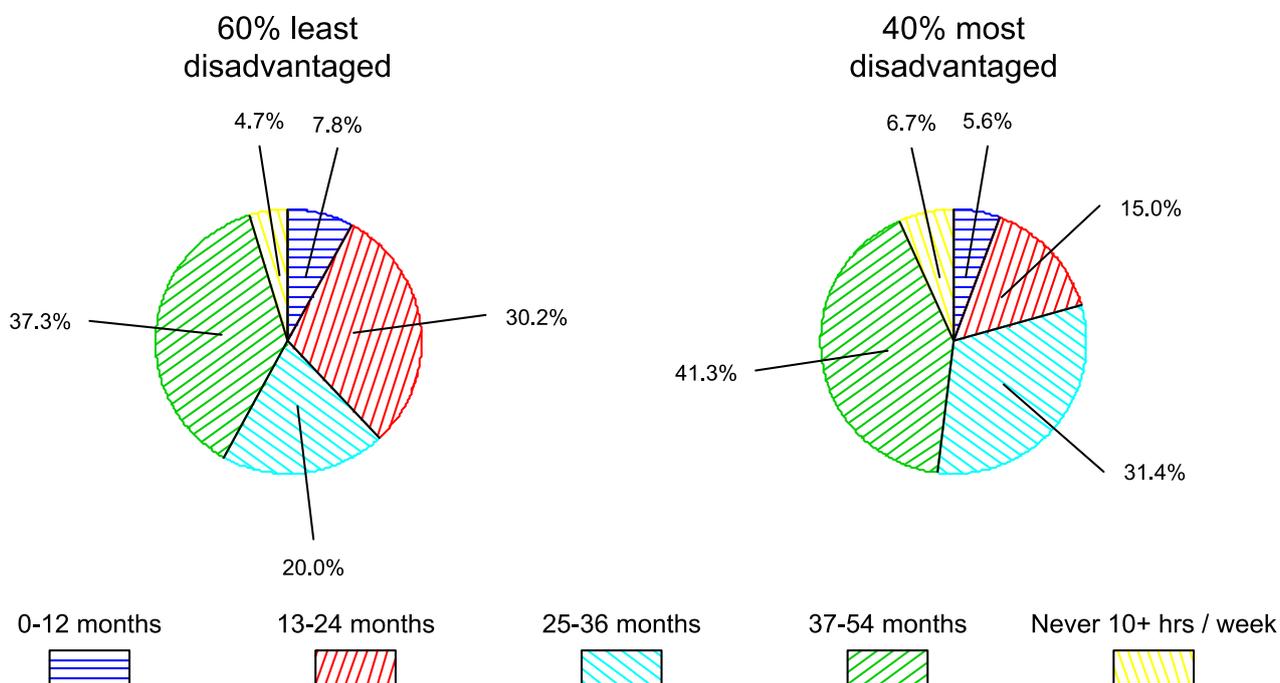
Table 26: Breakdown of the sample by the age at which children first received a mean of ten or more hours per week formal ECEC. The sample is also broken down by family disadvantage.

Age first used ten or more hours per week formal ECEC	Wave 4 dataset			EYFSP dataset		
	All children N=3186	60% least disadvantaged N=1323	40% most disadvantaged N=1863	All children N=4942	60% least disadvantaged N=1726	40% most disadvantaged N=3216
0-12	207	103	104	280	129	151
13-24	680	400	280	918	492	426
25-36	850	265	585	1159	315	844
37-54	1262	493	769	1450	541	909
Never 10+ hrs/week	187	62	125	216	67	149
Missing	0	0	0	919	182	737

There is a considerable difference between the 60% most disadvantaged families and the 40% most disadvantaged families in the distribution of this variable. This can be seen more clearly in the pie charts shown in Figure 10.

Figure 10: Pie charts showing the proportion of children starting a mean of ten or more hours per week formal ECEC in given age bands for (a) the 60% least disadvantaged children, and (b) the 40% most disadvantaged children.

Age children first started ten or more hours per week formal ECEC



Because of this difference in the distribution of formal ECEC start age, analysis was carried out separately for the 60% least disadvantaged children and the 40% most disadvantaged children.

Method

There is a considerable correlation between the age at which formal ECEC was first used for ten or more hours per week and the amount of ECEC used between age two and the start of school. For this reason, a model including the age at which formal ECEC was first used for ten or more hours per week and the amount of ECEC used between age two and the start of school might have problems with fit and would also be difficult to interpret. This problem can be avoided by analysing the outcome variables in terms of a single factor that combines the age at which formal ECEC was first used for ten or more hours a week, with the amount of formal ECEC used between age two and the start of school.

Table 27: Cross tabulation of the age at which a mean of ten or more hours per week formal ECEC was first used and the amount of formal ECEC used between age two and the start of school for (a) all children, (b) the 60% least disadvantaged children and (c) the 40% most disadvantaged children.

All children					
Mean weekly formal ECEC use between age two and start of school	Age 10+ hours / week formal ECEC first used				
	Never	0-12	13-24	25-36	37-54
Up to 10	187	6	20	26	507
>10 to 20	0	40	270	630	735
>20	0	161	390	194	20
60% least disadvantaged					
Mean weekly formal ECEC use between age two and start of school	Age 10+ hours / week formal ECEC first used				
	Never	0-12	13-24	25-36	37-54
Up to 10	62	1	10	5	183
>10 to 20	0	17	158	184	304
>20	0	85	232	76	6
40% most disadvantaged					
Mean weekly formal ECEC use between age two and start of school	Age 10+ hours / week formal ECEC first used				
	Never	0-12	13-24	25-36	37-54
Up to 10	125	5	10	21	324
>10 to 20	0	23	112	446	431
>20	0	76	158	118	14

Data are from the Wave 4 sample.

It is necessary to define this factor in such a way that each level has a sufficient number of children to produce a reliable analysis. Informed by the cross tabulation (shown in Table 27) of start age of formal ECEC use and amount of formal ECEC use, a combined formal ECEC start age / use factor was defined; see Table 28.⁵³

⁵³ A comparison of demographic and home environment variables between the different formal ECEC start age / usage groups is given in the Technical Annexe to this report.

Table 28: Breakdown of sample by factor combining the age at which ten or more hours per week formal ECEC was first used and the mean formal ECEC usage between age 2 and the start of school.

Level number	Level name	Age ten or more hours per week formal ECEC started	Mean weekly formal ECEC use between age two and start of school	All children	60% least disadvantaged	40% most disadvantaged
1	Early start / high use	0-24 months	Over 20 hours per week	551	317	234
2	Early start / low to medium use	0-24 months	Up to 20 hours per week	336	186	150
3	Intermediate start / high use	25-36 months	Over 20 hours per week	194	76	118
4	Intermediate start / low to medium use	25-36 months	Up to 20 hours per week	656	189	467
5	Late start / medium to high use	37-54 months	Over 10 hours per week	755	310	445
6	Late start / low use	37-54 months	Up to 10 hours per week	507	183	324
7	Never 10+ hours per week formal ECEC	Never		187	62	125

Data from Wave 4 sample.

Models of the outcome variables were fitted in terms of this factor combining age formal ECEC use started and amount of formal ECEC used between age two and the start of school. Models were fitted separately for children from the 60% least disadvantaged families and children from the 40% most disadvantaged families. Models were controlled for informal individual ECEC use between age two and start of school and demographic and home environment covariates. The reference level for the combined factor was chosen to be Level 6: the “Late start / low use” group, i.e. mean formal ECEC usage between age two and start of school of up to ten hours per week and ten or more hours per week formal ECEC first used aged thirty-seven to fifty-four months. This group was chosen for two reasons: (a) it was one of the larger groups, and (b) choosing a relatively late start / low use baseline group will provide informative contrasts with the earlier start / higher use comparison groups.

Results

Model results are shown in Table 29 (60% least disadvantaged families) and in Table 30 (40% most disadvantage families). Effects were of small to medium size (see p 50). Medium sized effects are distinguished in the tables (the table cell is shaded in red).

Table 29: Associations between child outcomes and formal ECEC (mean usage between age two and start of school / the age that children first used ten or more hours per week). Models for children from the 60% least disadvantaged families.

Outcome variable	Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
Cognitive outcomes							
Verbal ability	+0.002	-0.002	+0.153	+0.050	+0.042	Reference	+0.023
Non-verbal ability	+0.075	-0.151	+0.173	-0.043	+0.009	Reference	+0.082
Socio-emotional problems							
Externalising behaviour	+0.051	-0.110	+0.328 *	-0.119	-0.024	Reference	-0.139
Internalising behaviour	-0.071	-0.153	+0.020	-0.133	-0.142	Reference	-0.085
Socio-emotional strengths							
Sociability	+0.110	+0.223 *	+0.064	+0.143	+0.073	Reference	-0.043
Prosocial behaviour	+0.122	+0.226 *	+0.050	+0.105	+0.051	Reference	+0.015
Behavioural self-regulation	+0.033	+0.191	-0.056	+0.082	-0.020	Reference	+0.077
Cognitive self-regulation	+0.083	+0.199	+0.094	+0.034	+0.005	Reference	-0.046
Emotional self-regulation	-0.036	+0.127	-0.247	+0.084	+0.016	Reference	+0.136
Early Years Foundation Stage Profile – ODDS RATIO - OR							
Communication and Language	1.105	2.117	0.860	0.915	0.834	Reference	1.100
Physical Development	1.288	1.479	1.860	1.199	0.927	Reference	1.092
Personal, Social & Emotional Development	1.359	1.796	1.409	0.831	0.984	Reference	1.051
Literacy	0.977	1.660	0.794	1.054	0.969	Reference	0.968
Numeracy	1.138	2.299 *	1.309	1.371	0.931	Reference	1.036
Good level of development	1.058	1.594	0.854	0.959	0.979	Reference	1.071
EYFSP total score – continuous variable - coefficient							
EYFSP total score	-0.016	+0.032	-0.023	+0.041	-0.032	Reference	-0.009

Models are fitted to multiply imputed data.

Sample size = 1323 (cognitive and socio-emotional outcomes)

Sample size = 1726 (EYFSP outcomes)

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the reference group, controlling for demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving at least the expected level of development between children in a given start age / usage group and the reference group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant coefficients are shown in **bold italics**. the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Where effects are of medium size the table cell is shaded in green.

Table 30: Associations between child outcomes and formal ECEC (mean usage between age two and start of school / the age that children first used ten or more hours per week). Models for children from the 40% most disadvantaged families.

Outcome variable	Early start / high use	Early start / low to medium use	Intermediate start / high use	Intermediate start / low to medium use	Late start / medium to high use	Late start / low use	Never 10+ hours per week formal ECEC
Cognitive outcomes							
Verbal ability	+0.242 **	+0.114	+0.206 *	+0.087	+0.109	Reference	+0.032
Non-verbal ability	+0.050	-0.007	+0.045	+0.078	+0.075	Reference	-0.031
Socio-emotional problems							
Externalising behaviour	+0.309 **	+0.042	+0.315 *	+0.129	+0.085	Reference	-0.079
Internalising behaviour	+0.061	-0.122	+0.078	+0.085	+0.016	Reference	-0.092
Socio-emotional strengths							
Sociability	+0.007	-0.002	-0.053	-0.099	-0.062	Reference	+0.013
Prosocial behaviour	-0.014	-0.016	-0.079	-0.058	-0.071	Reference	+0.037
Behavioural self-regulation	-0.129	-0.030	-0.125	-0.065	-0.050	Reference	+0.179
Cognitive self-regulation	-0.024	-0.080	-0.052	-0.056	-0.118	Reference	+0.011
Emotional self-regulation	-0.291 **	+0.019	-0.310 **	-0.159 *	-0.083	Reference	+0.125
Early Years Foundation Stage Profile – ODDS RATIO - OR							
Communication and Language	2.477 ***	1.104	1.198	1.122	1.061	Reference	1.015
Physical Development	1.954	1.083	1.020	1.146	0.905	Reference	0.895
Personal, Social & Emotional Development	2.023 *	1.122	1.247	1.222	1.115	Reference	1.063
Literacy	2.047 ***	0.808	0.978	0.971	0.975	Reference	1.002
Numeracy	1.868 **	0.878	1.064	1.051	0.940	Reference	1.011
Good level of development	1.895 **	0.850	1.035	0.989	0.974	Reference	1.010
EYFSP total score – continuous variable - coefficient							
EYFSP total score	+0.170 *	+0.032	+0.048	+0.072	+0.009	Reference	-0.001

Models are fitted to multiply imputed data.

Sample size = 1863 (cognitive and socio-emotional outcomes)

Sample size = 3216 (EYFSP outcomes)

For the continuous outcomes, coefficients give the difference between children in a given start age / usage group and the reference group, controlling for demographic and home environment covariates.

For the binary outcomes, coefficients give the difference in probability of achieving at least the expected level of development between children in a given start age / usage group and the reference group, expressed as an odds ratio: these coefficients are marked "OR".

Statistically significant coefficients are shown in **bold italics**, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Where effects are of medium size the table cell is shaded in green.

Discussion

Model for 60% least disadvantaged children

Model results are given in Table 29.

Note that throughout, the “late start / low use” group that first used ten or more hours per week formal ECEC aged thirty-seven to fifty-four months and used a mean of up to ten hours per week formal ECEC between age two and the start of school acts as the reference group, with which the other groups were compared.

Early start / high use

The early start / high use group showed no statistically significant differences from the late start / low use reference group.

Early start / low to medium use

The early start / low to medium use group had significantly higher sociability and pro-social behaviour scores during school year one than the reference group. They also had a significant higher probability of achieving the expected level in numeracy than the reference group.

Intermediate start / high use

The intermediate start / high use children had significantly higher externalising behaviour scores during school year one than the late start / low use reference group.

Intermediate start / low to medium use

The intermediate start / low to medium use group showed no statistically significant differences from the late start / low use reference group.

Late start / medium to high use

The late start / medium to high use group showed no statistically significant differences from the late start / low use reference group.

Late start / low use

This group acts as the reference group with which all other groups are compared.

Never ten or more hours per week formal ECEC

Children who never used ten or more hours per week formal ECEC showed no statistically significant differences from the late start / low use reference group.

Overall, for children from the 60% least disadvantaged families, those children with an early start in formal ECEC and low to medium formal ECEC use between age two and start of school showed greatest benefits on socio-emotional and educational outcomes.

Model for 40% most disadvantaged children

Model results are given in Table 30.

Note that throughout, the “late start / low use” group that first used ten or more hours per week formal ECEC aged thirty-seven to fifty-four months and used a mean of up to ten hours per week formal ECEC between age two and the start of school acts as the reference group, with which the other groups are compared.

Early start / high use

The early start / high use children had significantly higher verbal ability than the reference group, they also had a significantly higher chance of achieving the expected level in all the areas of the EYFSP (with the exception of Physical Development) and they had a significantly higher EYFSP total score. These children had poorer outcomes on two socio-emotional measures than the reference group, with higher externalising behaviour scores and lower scores for emotional self-regulation.

Early start / low to medium use

The early start / low to medium use group showed no statistically significant differences from the late start / low use reference group.

Intermediate start / high use

The intermediate start / high use children had significantly higher verbal ability than the reference group. These children had poorer outcomes on two socio-emotional measures than the reference group, with higher externalising behaviour scores and lower scores for emotional self-regulation.

Intermediate start / low to medium use

Children in the intermediate start / low to medium use group had significantly lower emotional self-regulation than children in the reference group.

Late start / medium to high use

The late start / medium to high use group showed no statistically significant differences from the late start / low use reference group.

Late start / low use

This group acts as the reference group with which all other groups are compared.

Never ten or more hours per week formal ECEC

Children who never used ten or more hours per week formal ECEC showed no statistically significant differences from the late start / low use reference group.

For children in the 40% most disadvantaged families, the group with the best cognitive and educational outcomes had an early start in formal ECEC (up to age two) and high formal ECEC use between age two and the start of school, although these children also had poorer outcomes than the reference group on two socio-emotional measures. The value of an early start in formal ECEC can be seen by comparing this group with children with high formal ECEC use between age two and the start of school who started using at least ten hours per week formal ECEC between ages two and three: although this group still had improved verbal ability they did not have the better outcomes on the EYFSP measures seen in the early start / high use group.

Models in terms of combination of types of ECEC

The analyses given in Chapters 3 and 4 have assumed that the effects associated with formal group, formal individual and informal individual ECEC can be analysed separately. That is, it has been assumed that the effects associated with the different types of ECEC do not interact. It is likely that there is in fact some level of interaction between the effects associated with the different types of ECEC; this question is explored in this section.

Method

The initial model considered the combination of ECEC used according to three factors:

1. Low or high use of formal group ECEC between age two and the start of school.
2. No or some use of formal individual (childminder) ECEC between age two and the start of school.
3. No or some use of informal individual ECEC between age two and the start of school.

The reason for considering low vs. high use for formal group ECEC and no vs. some use for the remaining types of ECEC is the generally higher use of formal group ECEC, both in terms of, the proportion of children using some of this type of ECEC and the amount of this type of ECEC that children use.

The combinations of these factors leads to eight distinct ECEC usage groups.

This initial model showed that the effects of combinations of ECEC involving formal individual (childminder) ECEC and those involving informal individual ECEC (with friends and relatives) were very similar. A simplified model was therefore adopted in terms of two factors:

1. Low or high use of formal group ECEC between age two and the start of school.
2. No or some use of individual ECEC between age two and the start of school (either formal individual or informal individual ECEC).

The analysis was carried out in terms of these four combinations of ECEC use:⁵⁴

1. Low formal group ECEC usage of up to fifteen hours per week between age two and the start of school / no individual ECEC (formal or informal).
2. Low formal group ECEC usage of up to fifteen hours per week between age two and the start of school / some individual ECEC (formal or informal).

⁵⁴ A comparison of demographic and home environment variables between groups with these different combinations of ECEC usage is given in the Technical Annexe to this report.

3. High formal group ECEC usage of greater than fifteen hours per week between age two and the start of school / no individual ECEC (formal or informal).
4. High formal group ECEC usage of greater than fifteen hours per week between age two and the start of school / some individual ECEC (formal or informal).

Models of the outcome variables were fitted in terms of the combination of ECEC used. Models were controlled for home environment and demographic covariates.

Results

The number of children in the four ECEC usage groups and the mean usage of each type of ECEC in each group are shown in Table 31.

Table 31: Numbers in each usage group and mean usage of each type of ECEC between age two and the start of school.

Group Number	Group Name	N	Mean ECEC usage between age two and the start of school		
			Formal group	Formal individual	Informal individual
1	Low formal group & no individual	892	10.04	0.00	0.00
2	Low formal group & some individual	1222	10.21	3.03	8.46
3	High formal group & no individual	447	24.86	0.00	0.00
4	High formal group & some individual	625	22.22	1.15	7.20

Model results are given in Table 32. All effects are of small size (see p 50).

Table 32: Results of models of child outcomes in terms of ECEC usage groups. Models control for home environment and demographic factors. Models are fitted to multiply imputed data.

Outcome variable	ECEC usage group			
	Group 1 Low formal group / no individual	Group 2 Low formal group / some individual	Group 3 High formal group / no individual	Group 4 High formal group / some individual
Cognitive outcomes				
Verbal ability	Reference	+0.152 ***	+0.085	+0.184 ***
Non-verbal ability	Reference	+0.063	+0.129 *	+0.053
Socio-emotional problems				
Externalising behaviour	Reference	+0.009	+0.229 ***	+0.152 *
Internalising behaviour	Reference	+0.060	+0.125	+0.077
Socio-emotional strengths				
Sociability	Reference	+0.048	-0.132 *	+0.055
Prosocial behaviour	Reference	+0.029	-0.147 *	+0.005
Behavioural self-regulation	Reference	-0.016	-0.198 **	-0.083
Cognitive self-regulation	Reference	+0.015	-0.073	+0.025
Emotional self-regulation	Reference	-0.012	-0.229 ***	-0.142 *
Early Years Foundation Stage Profile – ODDS RATIO - OR				
Communication and Language	Reference	0.852	0.793	1.058
Physical Development	Reference	0.886	0.916	1.015
Personal, Social & Emotional Development	Reference	0.884	0.685 *	1.036
Literacy	Reference	0.879	0.840	0.955
Numeracy	Reference	0.951	0.860	1.143
Good level of development	Reference	0.885	0.825	0.976
EYFSP total score – continuous variable - coefficient				
EYFSP total score	Reference	-0.050	-0.121 *	-0.011

Sample size = 3186 (cognitive and socio-emotional outcomes)

Sample size = 4942 (EYFSP outcomes)

Significant p-values are marked in **bold italics**: * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.

Models are fitted to multiply imputed data.

Discussion

Low formal group ECEC usage of up to fifteen hours per week / no individual ECEC

This group acted as the reference group with which the other groups are compared.

Low formal group ECEC usage of up to fifteen hours per week / some individual ECEC

Children with relatively low formal group ECEC use between age two and the start of school who also had some individual ECEC during this period had significantly higher verbal ability during school year one than children who had low formal group ECEC use and did not have any individual ECEC use.

High formal group ECEC usage of greater than fifteen hours per week / no individual ECEC

Children who had a mean use of formal group ECEC of greater than fifteen hours per week between age two and the start of school without any individual ECEC during this period showed considerable differences from the reference group on a number of

outcomes measured during reception year and school year one. These children had significantly higher non-verbal ability than the reference group, they also had significantly poorer outcomes on five of the socio-emotional measures:

1. Externalising behaviour
2. Sociability
3. Prosocial behaviour
4. Behavioural self-regulation
5. Emotional self-regulation

and significantly poorer outcomes on two of the EYFSP measures:

1. Probability of achieving the expected level for Personal, Social & Emotional Development
2. EYFSP total score

High formal group ECEC usage of greater than fifteen hours per week / some individual ECEC

Children who had a mean of greater than fifteen hours per week formal group ECEC between age two and the start of school combined with some individual ECEC had significantly higher verbal ability at age five than the reference group. This group also had significantly poorer outcomes than the reference group for externalising behaviour and emotional self-regulation.

The difference between the high formal group ECEC usage children who have and have not also used some individual ECEC is striking. One difference is that the children who have not had individual ECEC have benefits on non-verbal ability whilst those who have used individual ECEC have benefit on verbal ability. But the most striking difference is on the socio-emotional and EYFSP outcomes. The children who have not had any individual ECEC have poorer outcomes than the reference group on seven measures:

1. Externalising behaviour
2. Sociability
3. Prosocial behaviour
4. Behavioural self-regulation
5. Emotional self-regulation
6. EYFSP Personal, Social & Emotional Development
7. EYFSP total score

Those children who have also had some individual ECEC show no disadvantage over the reference group on five of these measures:

1. Sociability
2. Prosocial behaviour
3. Behavioural self-regulation
4. EYFSP Personal, Social & Emotional Development
5. EYFSP total score

And on the remaining two measures:

1. Externalising behaviour
2. Emotional self-regulation

the size of the disadvantage over the reference group is smaller than for those children who have had no individual ECEC between age two and the start of school.

Chapter conclusions

The initial analysis in Chapter 3 showed the potential impact of the amount of formal group, formal individual (childminder) and informal individual ECEC experienced by children between age two and the start of school on children's cognitive, socio-emotional and EYFSP outcomes during reception / school year one. The analyses in this chapter show that the amount and type of ECEC used over this period may not be the only significant factors when considering the influence of ECEC on children's school-age outcomes; the age at which ECEC use started and the combination of types of ECEC used are also important.

The models, in terms of a factor comprising the age that children first used a mean of ten or more hours per week formal ECEC and the amount of formal ECEC used between age two and the start of school, show that both these aspects of ECEC use are important for children's school-age outcomes and also, that these two aspects of formal ECEC use interact; that is, the effects on children's outcomes during reception / school year one may depend on the full pattern of formal ECEC use between birth and the start of school.

There also appear to be differences between the optimum patterns of ECEC for the 60% least disadvantaged children and for the 40% most disadvantaged children.

For the least disadvantaged children, the most beneficial trajectory would appear to involve an early start in formal ECEC (a mean of ten or more hours per week starting at some point up to age two) combined with low to medium use of formal ECEC between age two and the start of school (a mean use of up to twenty hours per week). Children following this trajectory had better outcomes for EYFSP numeracy during reception as well as better socio-emotional outcomes on the prosocial and sociability scales during school year one, both as compared with children with a late start using ten or more hours of formal ECEC per week (aged over three) and a low mean usage of formal ECEC between age two and the start of school (up to ten hours per week).

For children from the 40% most disadvantaged families, the optimum trajectory for formal ECEC use would appear to involve an early start (a mean of ten hours per week starting at some point up to age two) combined with high use of formal ECEC between age two and the start of school (a mean of over twenty hours per week). Children following this trajectory had better outcomes on all EYFSP measures (excluding physical development) during reception as well as better verbal development during year one, both as compared with children with a late start using ten or more hours of formal ECEC per week (aged over three) and a low mean usage of formal ECEC between age two and the start of school (up to ten hours per week). However, these children also had poorer socio-emotional outcomes during school year one on the measures externalising behaviour and emotional self-regulation. The benefits on EYFSP measures appear to be specifically associated with an early start in formal ECEC since, the children with over twenty hours

per week formal ECEC between age two and the start of school and who started a mean of over ten hours per week formal ECEC aged over two and up to three, did not show these benefits, although they still showed higher verbal ability during school year one.

The importance of an early start in formal ECEC for children from more disadvantaged families compared to those from less disadvantaged families may be due to children in less disadvantaged families having more educational opportunities at home.

The analysis of combinations of types of ECEC reveals that including some individual ECEC in a children's pre-school education and care may be particularly valuable. For children with relatively high formal group ECEC (a mean of over fifteen hours per week) between age two and the start of school, whether or not they also receive some individual ECEC (either from childminders or friends and relatives) during this period makes a striking difference to their outcomes during reception / school year one. As compared to children with relatively low formal ECEC between age two and the start of school (up to fifteen hours per week), children with relatively high formal group ECEC use and no informal ECEC use have poorer outcomes on a number of socio-emotional measures as well as on EYFSP personal, social and emotional development and EYFSP total score. However, children with relatively high formal group ECEC use who also receive some individual ECEC (from childminders or friends and relatives) do not show these poorer EYFSP outcomes and the socio-emotional disadvantages are smaller and less wide ranging. This difference appears not to be attributable to these children using less formal group ECEC; the difference in mean formal group ECEC usage between these two groups of children is small (see Table 31). Rather, the exposure to individual ECEC appears to be offsetting some of the risk of poorer socio-emotional and educational outcomes that may otherwise be associated with high use of formal group ECEC.

Chapter 6: The effects of home environment on child outcomes

Key findings

- Higher levels of home learning environment (HLE) were associated with better outcomes on all EYFSP measures and better child verbal ability.
- Higher levels of household chaos were associated with poorer outcomes on all EYFSP measures and with poorer outcomes on all child socio-emotional measures with the exception of externalising behaviour.
- Higher levels of parent's psychological distress were associated with lower levels of child sociability.
- Higher levels of limit setting were associated with better outcomes on all EYFSP measures with the exceptions of Personal, Social and Emotional Development and numeracy. Higher levels of limit setting were also associated with better verbal and non-verbal ability. Higher levels of limit setting were associated with higher levels of externalising behaviour and with lower levels of emotional self-regulation.
- Higher levels of warmth in the parent / child relationship were associated with better outcomes on all EYFSP measures and with better child verbal ability. Higher levels of warmth were also associated with better child outcomes on all socio-emotional measures.
- Higher levels of invasiveness in the parent / child relationship were associated with poorer outcomes for EYFSP communication and language.
- Higher levels of authoritarian parenting were associated with lower verbal ability.
- Higher levels of permissive parenting were associated with poorer outcomes for EYFSP literacy and numeracy, EYFSP good level of development and EYFSP total score.

The analyses in previous chapters have focussed on effects associated with different patterns of ECEC use and on effects associated with ECEC quality. In these analyses a range of demographic and home environment variables have acted as control measures. This was because not controlling for them might otherwise confound the relationship between ECEC use and children's outcomes.

There was considerable evidence for the influence of both the home environment and the quality of the parent/child relationship on the child's cognitive and socio-emotional outcomes. This chapter looks at the effects upon child outcomes associated with various home environment variables.

Consideration is also given to the relative size of the effects of ECEC use, home environment factors and demographic factors.

Effects of home environment on outcomes during reception / school year one

Method

The child cognitive, socio-emotional and EYFSP outcomes, home environment factors, and demographic characteristics that were included in these analyses are outlined in detail in Chapter 2.

The associations between the home environment and child outcomes, controlling for demographic measures and the amount and type of ECEC used between age two and the start of school are drawn from the initial models reported in Chapter 3; see Table 11.

The home environment variables are intercorrelated. This can make the interpretation of the coefficients difficult in models including all the home environment variables simultaneously. In order to avoid the consideration of apparent effects of home environment variables that may be misleading, the following strategy was adopted: the effect of a home environment variable on an outcome was considered reliable only if there was also a significant effect of the home variable on the outcome in a regression model of the outcome on the home environment variable alone, controlling for demographic covariates. Thus, to be considered significant, a home variable had to have significant results in two distinctly separate regressions. This strategy is discussed in more detail in the Technical Annexe to this report.

Results

The associations between the home environment and child outcomes are summarised in Table 33. All effects were of small size (see p 50).

Table 33: Summary of the associations between home environment variables and children’s outcomes during reception / school year one.

Outcome variable	Home environment variables								
	Home learning environment	Household CHAOS	Parent's psychological distress	Limit setting	Warmth	Invasiveness	Authoritative parenting	Authoritarian parenting	Permissive parenting
Cognitive development									
Verbal ability	<i>+0.165 ***</i>			<i>+0.227 ***</i>	<i>+0.175 ***</i>		+0.053	<i>-0.129 **</i>	
Non-verbal ability				<i>+0.187 ***</i>					
Socio-emotional problems									
Externalising behaviour		+0.084	-0.007	<i>+0.174 ***</i>	<i>-0.089 *</i>	+0.046	-0.052	+0.008	
Internalising behaviour		<i>+0.117 *</i>	+0.055	+0.046	<i>-0.090 *</i>	+0.026			
Socio-emotional strengths									
Sociability		<i>-0.138 **</i>	<i>-0.098 *</i>		<i>+0.206 ***</i>	-0.088	+0.045		-0.057
Prosocial behaviour	+0.019	<i>-0.114 **</i>	-0.004		<i>+0.182 ***</i>	-0.070	+0.046	0.000	-0.049
Behavioural self-regulation	+0.042	<i>-0.135 **</i>		-0.060	<i>+0.108 **</i>	-0.038	+0.046	-0.041	+0.021
Cognitive self-regulation	+0.049	<i>-0.105 *</i>			<i>+0.116 **</i>	-0.031	+0.017		-0.077
Emotional self-regulation		<i>-0.121 **</i>		<i>-0.150 **</i>	<i>+0.132 **</i>	-0.058	+0.052	-0.003	

Sample size = 3186

Coefficients give the change in the standardized outcome corresponding to a two standard deviation change in the home environment covariate, controlling for all other model covariates.

Statistically significant coefficients are shown in ***bold italics***, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Table 33 (contd.)

Outcome variable	Home environment variables								
	Home learning environment	Household CHAOS	Parent's psychological distress	Limit setting	Warmth	Invasiveness	Authoritative parenting	Authoritarian parenting	Permissive parenting
Early Years Foundation Stage Profile – ODDS RATIO - OR									
Communication and Language	1.285 **	0.796 *		1.716 ***	1.633 ***	0.761 *	1.064		0.869
Physical Development	1.276 *	0.726 **		1.819 ***	1.578 ***	0.805	1.138		0.844
Personal, Social & Emotional Development	1.232 *	0.757 **			1.570 ***	0.877	1.008		0.856
Literacy	1.424 ***	0.723 ***		1.508 ***	1.328 ***	0.937	1.007	0.928	0.786 *
Numeracy	1.405 ***	0.732 ***			1.310 **	0.853	1.040	0.973	0.784 *
Good level of development	1.351 ***	0.730 ***		1.535 ***	1.343 ***	0.917	1.014	0.930	0.782 **
EYFSP total score – continuous variable - coefficient									
EYFSP total score	+0.112 ***	-0.099 **	-0.017	+0.215 ***	+0.158 ***	-0.044	+0.003		-0.106 **

Sample size = 4942

For the binary outcomes, coefficients give the change in probability of achieving at least the expected level of development corresponding to a two standard deviation change in the home environment covariate, expressed as an odds ratio: these coefficients are marked "OR". Values greater than one indicate that higher levels of the home environment covariate are associated with an increased probability of achieving at least the expected level of development; values less than one indicate that that higher levels of the home environment covariate are associated with a decreased probability of achieving at least the expected level of development.

For the continuous outcome EYFSP total score, the coefficients give the change in the standardized outcome corresponding to a two standard deviation change in the home environment covariate, controlling for all other model covariates.

Statistically significant coefficients are shown in **bold italics**, the level of significance was indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Discussion

Home learning environment (HLE)

Higher levels of HLE were associated with better outcomes on all EYFSP measures during school reception year and with better verbal ability during school year one.

Household CHAOS

Higher levels of household chaos were associated with poorer outcomes on all EYFSP measures during the reception year and with poorer outcomes on all child socio-emotional measures with the exception of externalising behaviour.

Parent's psychological distress

Higher levels of parent's psychological distress were associated with lower levels of child sociability. Parent's psychological distress was not associated with children's cognitive or E0YFSP outcomes.

Limit setting

Higher levels of limit setting were associated with better outcomes on all the EYFSP measures with the exceptions of Personal, Social and Emotional Development and numeracy. Higher levels of limit setting were also associated with better child verbal ability and non-verbal ability. Higher levels of limit setting were associated with higher levels of externalising behaviour and with lower levels of emotional self-regulation. In interpreting these negative associations, it should be borne in mind that these poorer socio-emotional outcomes may be a consequence of higher limit setting but it is also possible that higher limit setting may be triggered as a response to children's challenging behaviour.

Warmth in the parent / child relationship

Higher levels of warmth in the parent / child relationship were associated with better outcomes on all EYFSP measures and better verbal ability. Higher levels of warmth were also associated with better child outcomes on all socio-emotional measures.

Invasiveness in the parent / child relationship

Higher levels of invasiveness in the parent / child relationship were associated with poorer outcomes for EYFSP communication and language. MORS invasiveness was not associated with child cognitive or socio-emotional outcomes.

Authoritative parenting

Authoritative parenting score was not significantly associated with any child outcome.

Authoritarian parenting

Higher levels of authoritarian parenting were associated with lower child verbal ability during school year one. This measure was not associated with any other child outcomes.

Permissive parenting

Higher levels of permissive parenting were associated with poorer outcomes for EYFSP literacy and numeracy, EYFSP good level of development and EYFSP total score. This measure was not associated with child cognitive or socio-emotional outcomes.

Comparing the effect sizes associated with ECEC use between age two and the start of school, home environment variables and demographic variables

Method

In this section figures are presented comparing the effect sizes associated with these different variables on the outcome variables, also including the effects of demographic covariates.⁵⁵ Figures include only those associations that were statistically significant. Reported associations indicate the association over and above the influence of other factors controlled for in the model.

In the report so far, the effects associated with ECEC covariates have been calculated for a ten hour per week change in ECEC use. For the purpose of these comparison plots, the effect sizes for ECEC use are calculated for a two standard deviation change in ECEC use; this has been done to make these effect sizes more directly comparable to those for the home environment and demographic variables.

Results

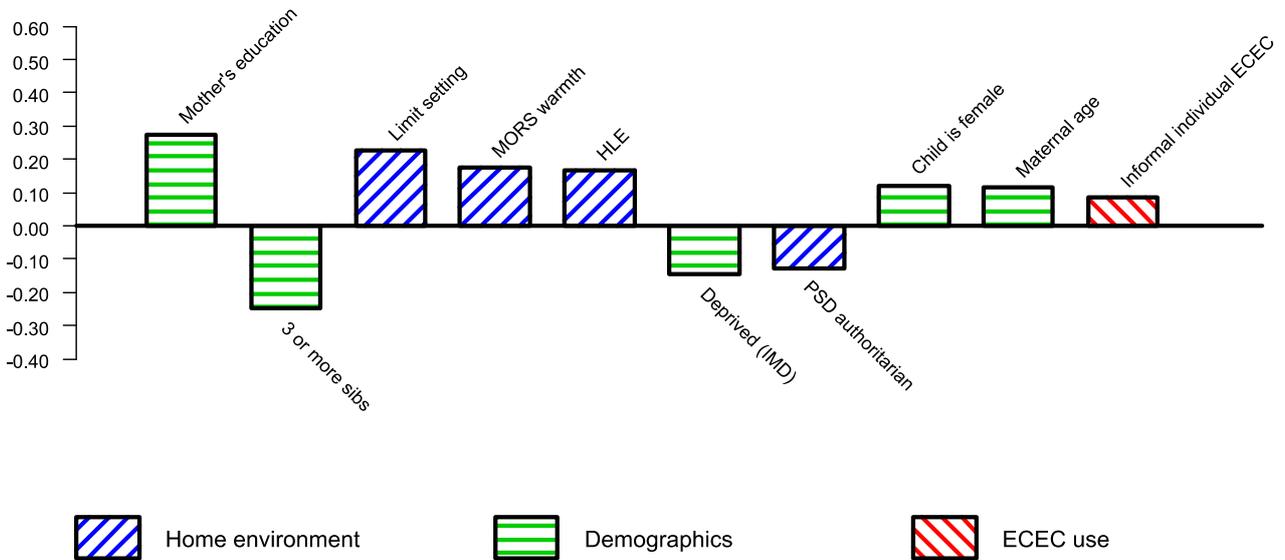
The effects associated with the home environment and ECEC covariates are all of small size. Those for the demographic covariates are of small to medium size, the conventional threshold for medium sized effects being an absolute value of 0.3 (see p 50).

Results are given in Figures 11 to 26.

⁵⁵ The demographic covariates included child's ethnic group, but because of the small sizes of most of the ethnic groups ethnicity effects were omitted from the results.

Figure 11: Comparing effect sizes for the outcome BAS verbal ability.

BAS Verbal ability



HLE = Home Learning Environment
 IMD = Index of Multiple Deprivation

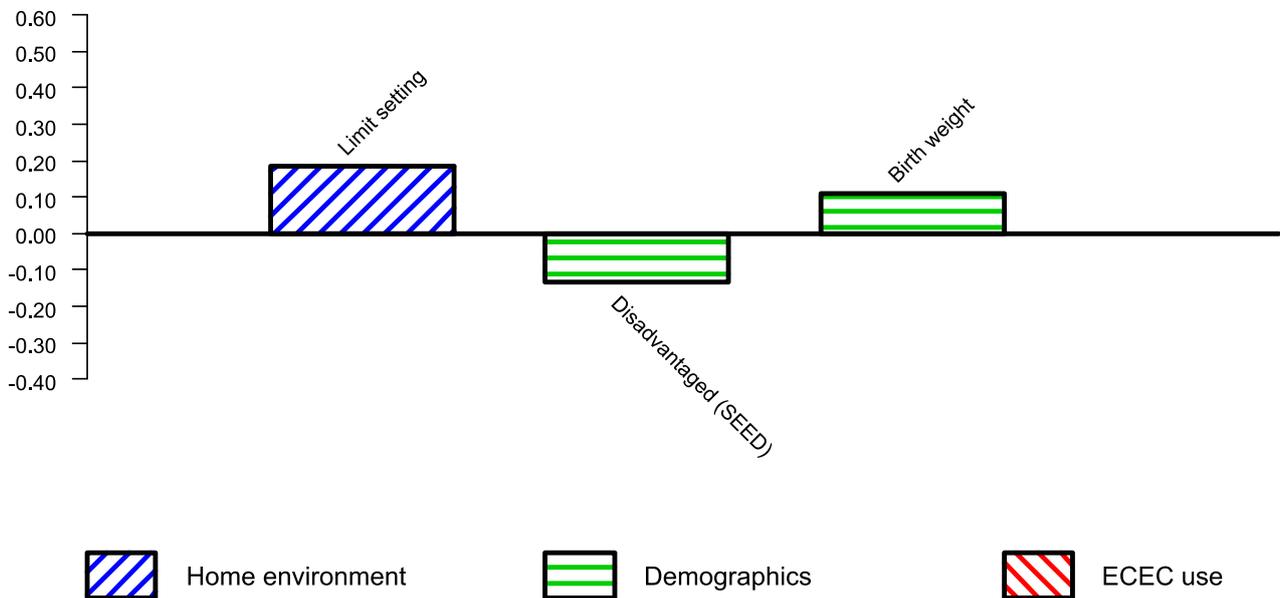
BAS verbal ability (language development)

The largest effect on BAS verbal ability during school year one was a positive association with mother’s educational level. There were positive associations with the home environment factors: limit settings, MORS warmth in the parent/child relationship, and Home Learning Environment. There was a negative association with authoritarian parenting. Verbal ability tends to be lower where there were 3 or more siblings living in the same household as the child and where the family lives in a deprived area. Verbal ability tends to be higher for girls than for boys and higher where the mother was older. There was a small positive association between informal individual ECEC use (with relatives and friends) and children’s verbal ability.

The associations between child verbal ability during school year one and home environment and demographic variables is fairly similar to those found for child verbal ability at age four.⁵⁶

⁵⁶ See (Melhuish and Gardiner 2018).

Figure 12: Comparing effect sizes for the outcome BAS non-verbal ability.
BAS Non-verbal ability



BAS non-verbal ability

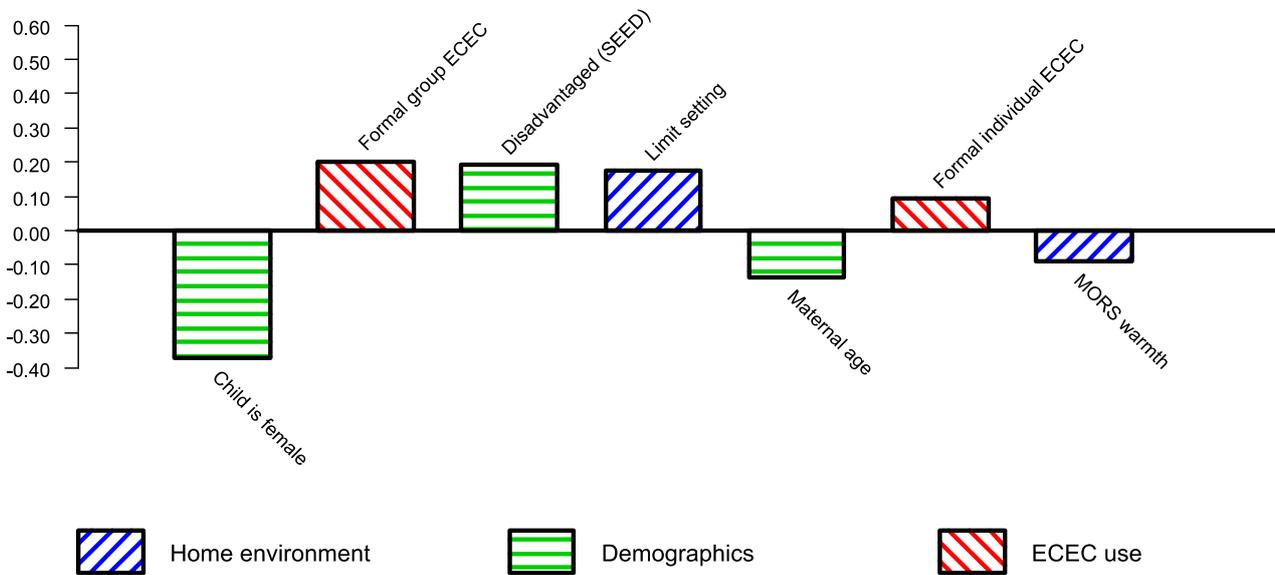
There were relatively few factors significantly associated with children’s BAS non-verbal ability scores during school year one. The largest was a positive association with parental limit setting. Scores tend to be lower for children from disadvantaged families and higher for children with a higher birth weight.

A number of factors that were associated with children’s verbal ability at age 4 were no longer significant by school year one. Specifically, there were no longer positive associations between child non-verbal ability and mother’s education, home learning environment, the child being a girl and the warmth of the parent / child relationship, nor was there a negative relationship with the invasiveness of the parent / child relationship.⁵⁷ This may be indicative of a “levelling up effect” from children’s early years in school: that is, those children with less favourable home and demographic backgrounds catch up to some extent with children from more favourable home and demographic backgrounds.

⁵⁷ See (Melhuish and Gardiner 2018).

Figure 13: Comparing effect sizes for the outcome CSBQ externalising behaviour.

CSBQ Externalising behaviour

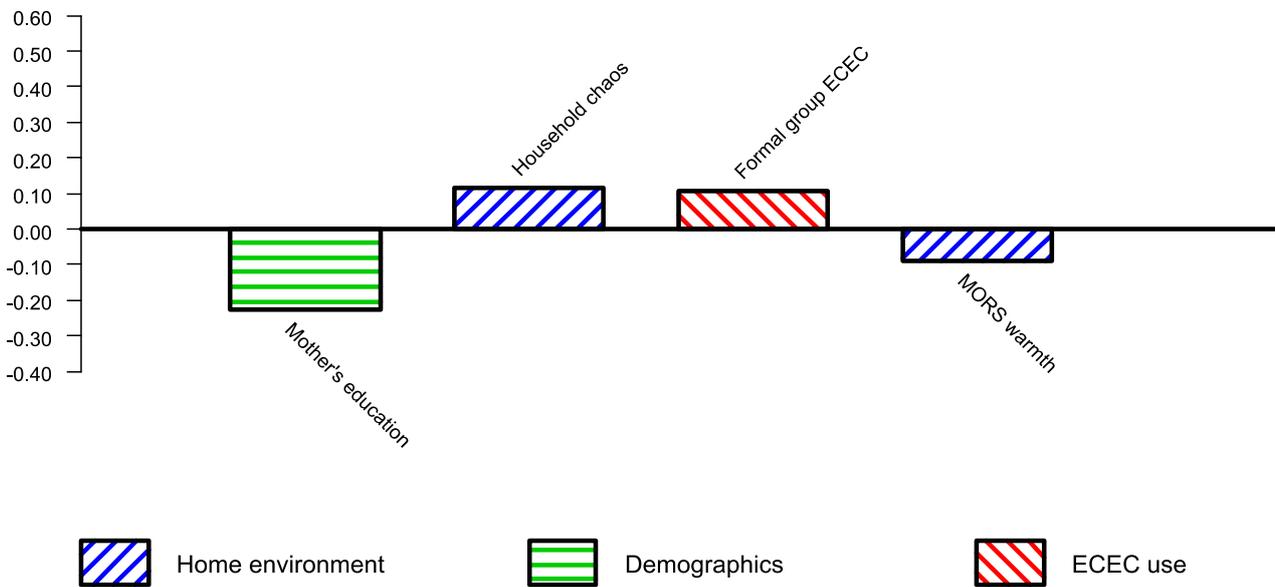


CSBQ externalising behaviour

The largest association with children’s externalising behaviour during school year one was for child’s gender, with girls being lower. Externalising behaviour tended to be higher for children from disadvantaged families and lower where the mother was older. Home environment factors were also associated with externalising behaviour with higher levels of externalising behaviour being associated with higher levels of limit setting; higher MORS warmth in the parent/child relationship was associated with lower levels of externalising behaviour. Both formal group ECEC (in nursery classes, playgroups etc.) and formal individual ECEC (with childminders) between age two and the start of school were associated with higher levels of externalising behaviour.

Figure 14: Comparing effect sizes for the outcome CSBQ internalising behaviour.

CSBQ Internalising behaviour

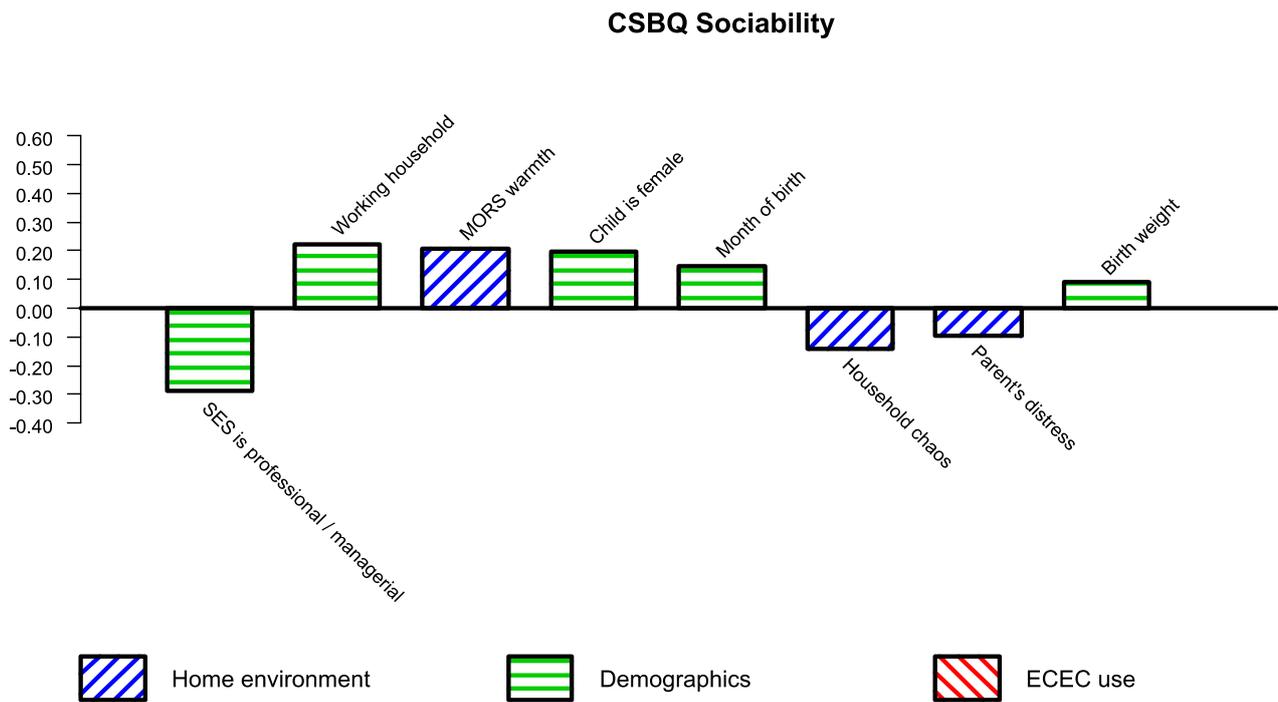


CSBQ internalising behaviour

The largest association with children’s internalising behaviour scores during school year one was mother’s education, with higher levels of maternal education being associated with lower levels of children’s internalising behaviour. Household chaos was positively associated with higher levels of internalising behaviour, whilst higher levels of MORS warmth in the parent/child relationship were associated with lower levels of children’s internalising behaviour. Time spent in formal group ECEC between age two and the start of school was associated with higher levels of children’s internalising behaviour.⁵⁸

⁵⁸ This effect was found specifically for children using a mean of greater than thirty-five hours per week formal group ECEC; see Figure 4.

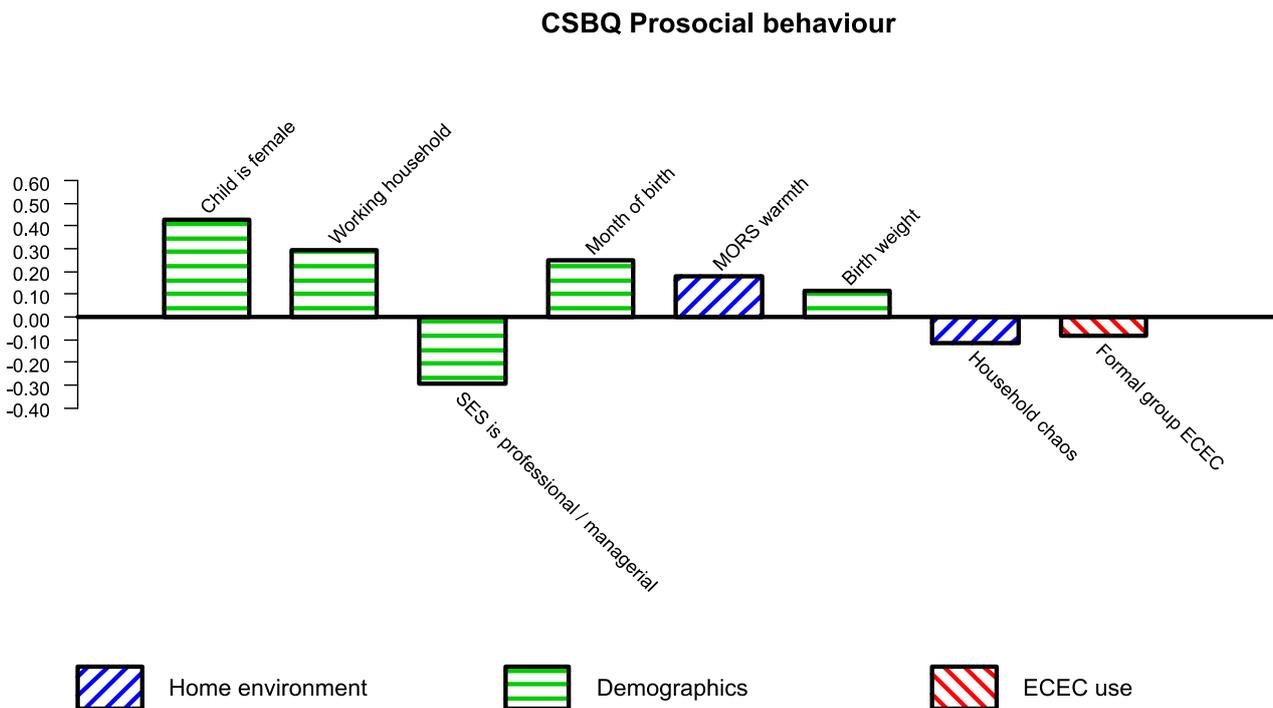
Figure 15: Comparing effect sizes for the outcome CSBQ sociability.



CSBQ sociability

Children’s CSBQ sociability scores during school year one were associated with demographic and home environment factors. The largest effect was an association with parental social class: children’s sociability scores tended to be lower where parental SES was professional / managerial. Demographic factors associated with higher levels of child’s sociability were coming from a working household, the child’s being female, the child being older in his/her school year and the child’s having a higher birth weight. Children’s sociability tended to be higher where the parent/child relationship exhibited higher levels of warmth. There were negative associations between child’s sociability and household chaos level and the parent’s level of psychological distress.

Figure 16: Comparing effect sizes for the outcome CSBQ prosocial behaviour.

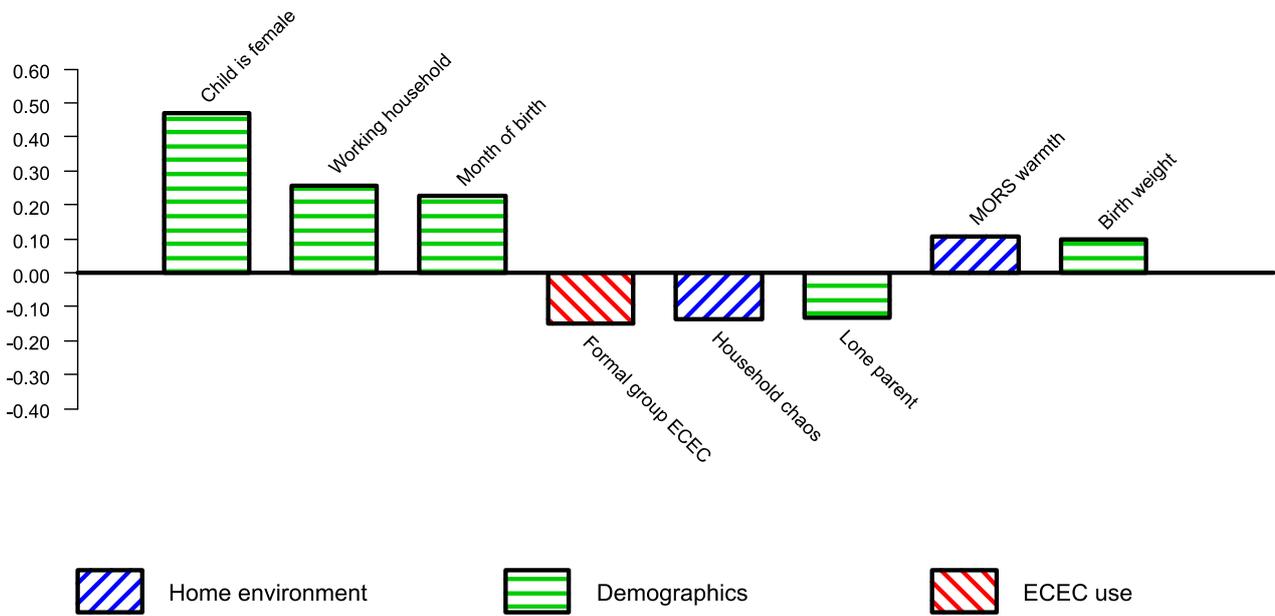


CSBQ prosocial behaviour

The largest association with children’s prosocial behaviour score during school year one was of sex, with scores tending to be higher for girls. Prosocial behaviour levels also tended to be higher where the child was from a working household, where the child was older in his/her school year and where the child’s birth weight was higher. There was a negative association between prosocial behaviour scores and parental SES being professional / managerial. There were also associations with home environment factors, with prosocial behaviour scores tending to be higher where there was a higher level of MORS warmth in the parent/child relationship and lower where household chaos scores were higher. There was a small negative association between formal group ECEC use (in playgroups, nursery classes etc.) between age two and the start of school and children’s prosocial behaviour scores.

Figure 17: Comparing effect sizes for the outcome CSBQ behavioural self-regulation.

CSBQ Behavioural self-regulation

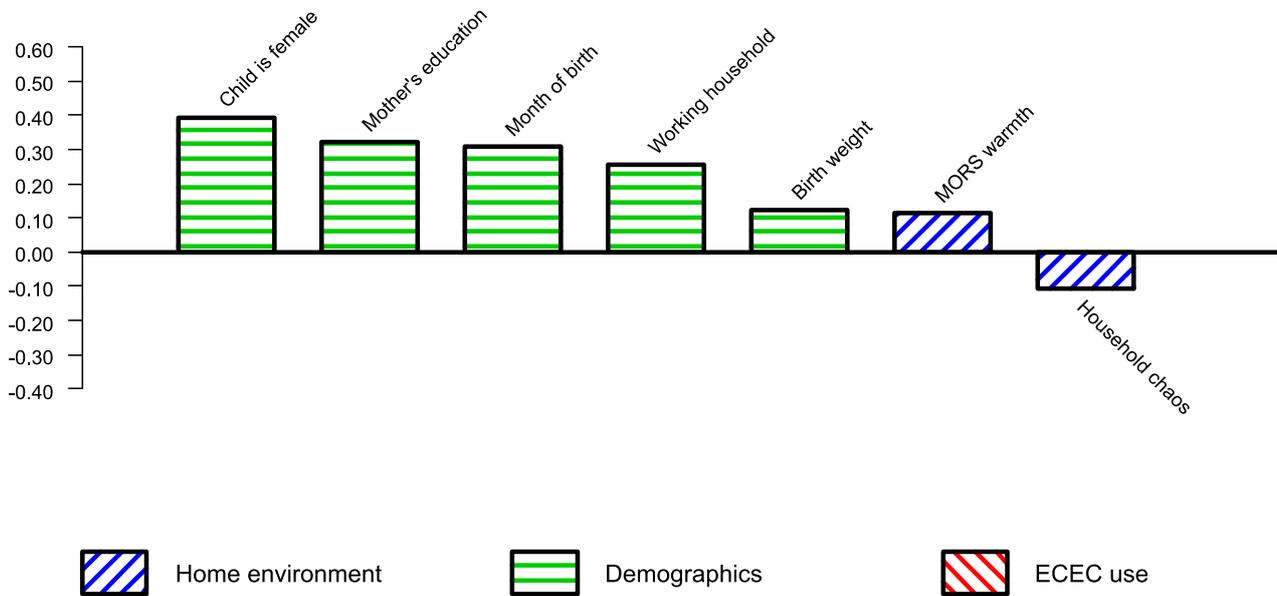


CSBQ behavioural self-regulation

The largest association with children’s behavioural self-regulation scores during school year one was sex, with scores tending to be higher for girls than for boys. Behavioural self-regulation scores also tended to be higher for children from working households, where the child was older in his/her school year and where the child’s birth weight was higher. Behavioural self-regulation tended to be lower when the child was being raised by a lone parent. Household chaos scores showed a negative association with children’s behavioural self-regulation scores whilst there was a positive association with the level of MORS warmth in the parent/child relationship. There was a negative association between time spent in formal group ECEC (in nursery classes, playgroups etc.) between age two and the start of school and children’s behavioural self-regulation scores.

Figure 18: Comparing effect sizes for the outcome CSBQ cognitive self-regulation.

CSBQ Cognitive self-regulation

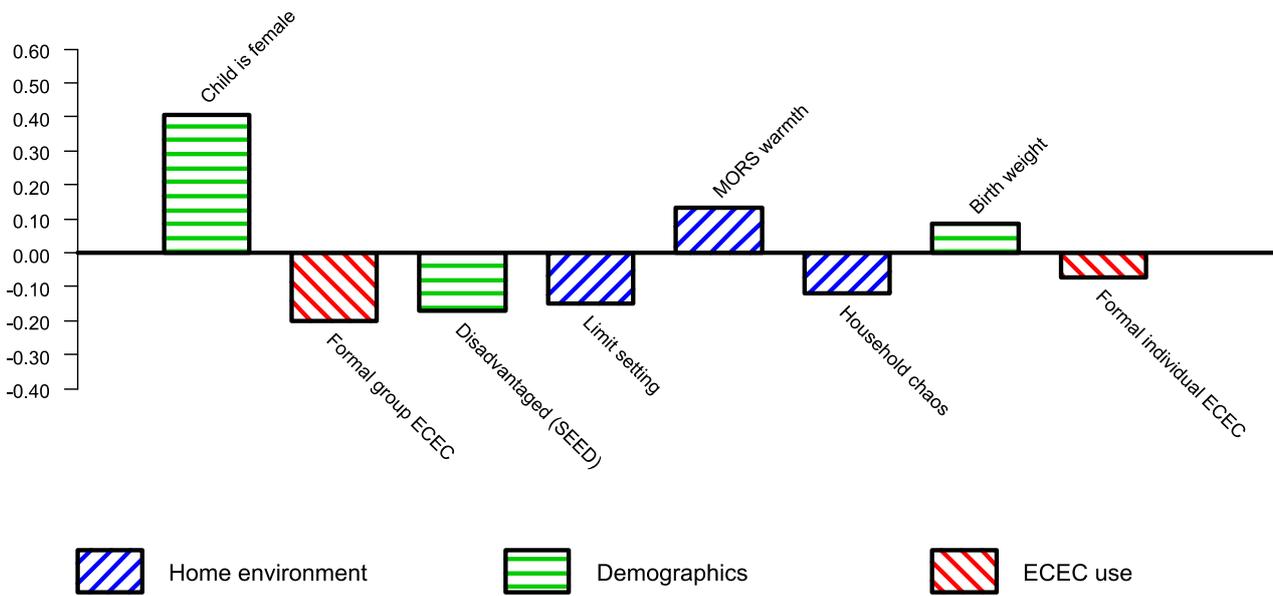


CSBQ cognitive self-regulation

Children’s cognitive self-regulation scores showed associations with demographic and home environment factors. Cognitive self-regulation tended to be higher for girls than for boys; it also tended to be higher where the mother was more highly educated, where the child was older in his/her school year, where the child was from a working household and where birth weight was higher. Higher levels of MORS warmth in the parent/child relationship were associated with higher levels of cognitive self-regulation whilst higher levels of household chaos were associated with lower levels of cognitive self-regulation.

Figure 19: Comparing effect sizes for the outcome CSBQ emotional self-regulation.

CSBQ Emotional self-regulation

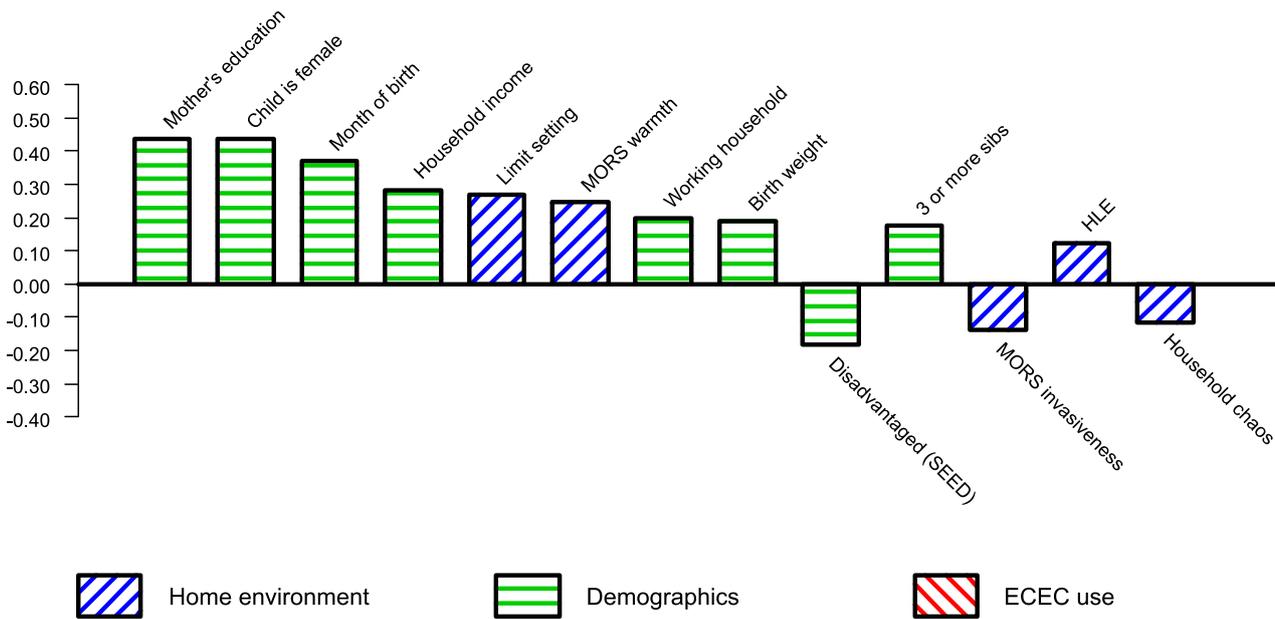


CSBQ emotional self-regulation

As with a number of socio-emotional outcomes, the largest association was with sex, with higher levels of emotional self-regulation during school year one tending to be found for girls over boys. Emotional self-regulation tended to be lower where the child was from a relatively disadvantaged family and higher where the child’s birth weight was higher. A higher level of MORS warmth in the parent/child relationship was associated with higher levels of emotional self-regulation. Higher levels of limit setting and household chaos were associated with lower levels of emotional self-regulation. There were negative associations between emotional self-regulation and both formal group ECEC use (in playgroups and nursery classes) and formal individual ECEC (with childminders) between age two and the start of school.

Figure 20: Comparing effect sizes for the outcome achieving at least the expected level in communication and language on the EYFSP.

EYFSP Communication and Language

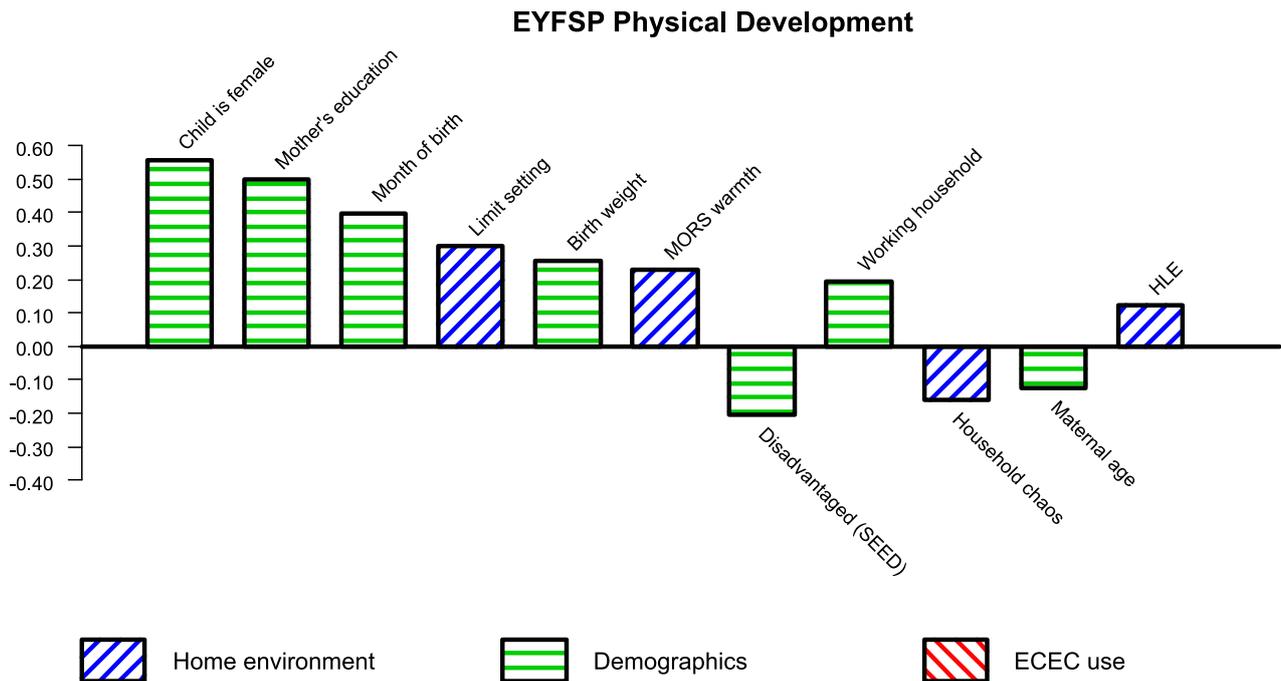


HLE = Home Learning Environment

EYFSP communication and language

Achieving at least the expected level in EYFSP communication and language was associated with a wide range of demographic and home environment factors, but not with ECEC use between age two and the start of school. The largest association was with mother's having a higher level of education. A higher chance of achieving at least the expected level for this outcome was also associated with the child being female, the child being older in his/her school year, higher household income, higher levels of limit setting and warmth in the parent/child relationship, the child being from a working household, higher birth weight, the child living in a household with three or more siblings and a higher level of Home Learning Environment. There were negative associations with coming from a relatively disadvantaged family, with invasiveness in the parent/child relationship and with higher levels of household chaos.

Figure 21: Comparing effect sizes for the outcome achieving at least the expected level in physical development on the EYFSP.

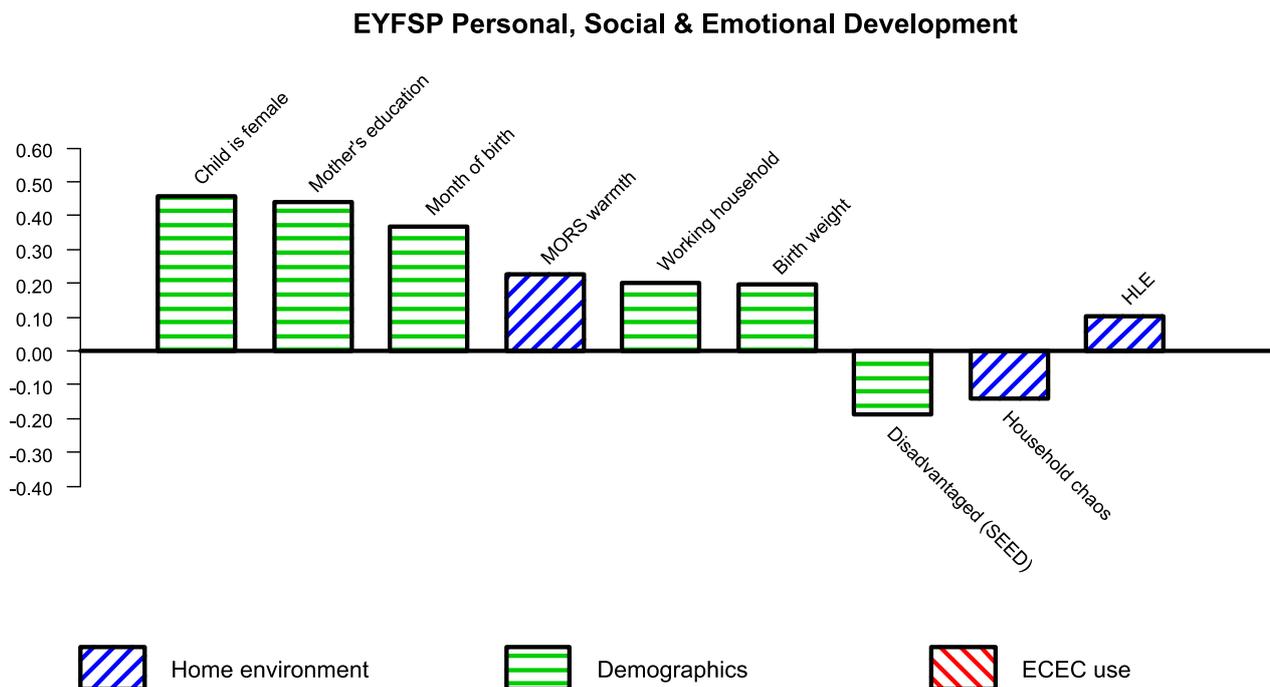


HLE = Home Learning Environment

EYFSP physical development

Achieving at least the expected level in EYFSP physical development was associated with demographic and home environment factors but not with ECEC use between age two and the start of school. There was a higher probability of achieving at least the expected level for this outcome for girls, where the mother was more highly educated, where the child was older in his/her school year, where there was a higher level of limit setting, where birth weight was higher, where there was a higher level of MORS warmth in the parent/child relationship, where the child came from a working household and where there was a higher Home Learning Environment score. There was a lower probability of achieving at least the expected level for this outcome where the child came from a relatively disadvantaged family, where household chaos was higher and where the mother was older.

Figure 22: Comparing effect sizes for the outcome achieving at least the expected level of personal, social and emotional development on the EYFSP.

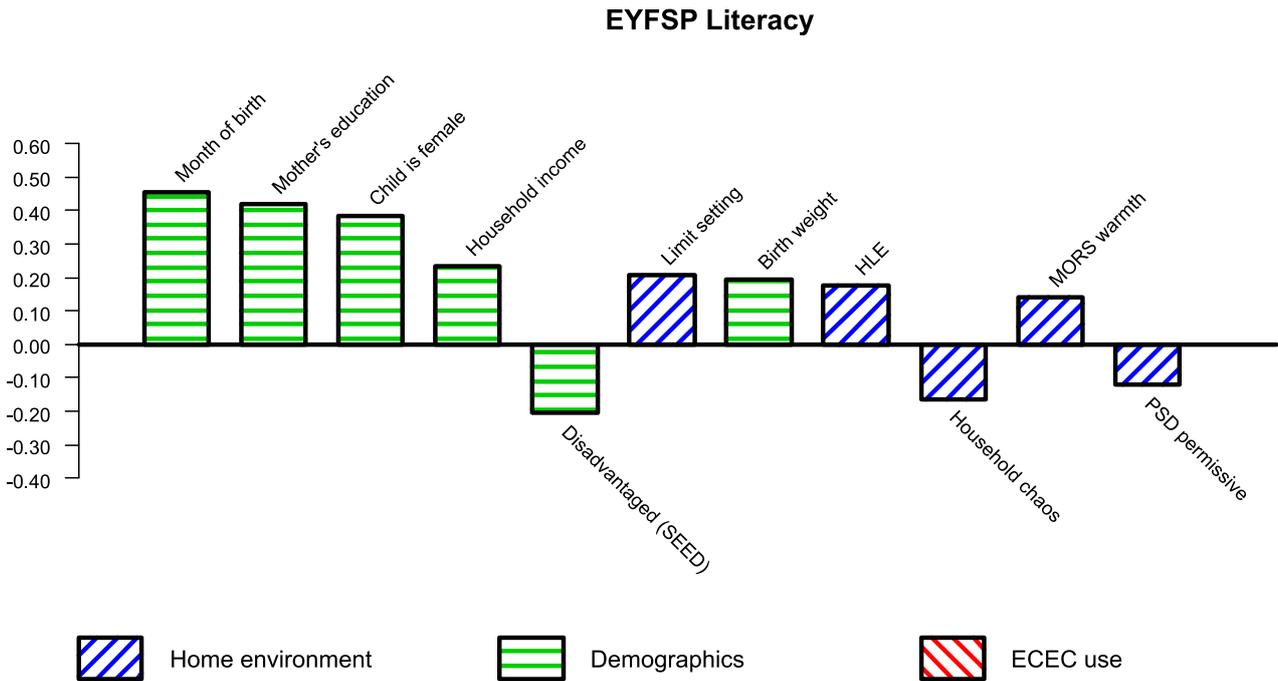


HLE = Home Learning Environment

EYFSP personal, social and emotional development

Achieving at least the expected level in EYFSP personal, social and emotional development was associated with a range of demographic and home environment factors, but not with ECEC use between age two and the start of school. The probability of achieving at least the expected level on this outcome was higher for girls, where the mother was more highly educated, where the child was older in his/her school year, where there was a higher level of MORS warmth in the parent/child relationship, where the child came from a working household, where birth weight was higher and where the Home Learning Environment score was higher. There was a lower probability of achieving at least the expected level for this outcome where the child came from a relatively disadvantaged family and where household chaos score was higher.

Figure 23: Comparing effect sizes for the outcome achieving at least the expected level of development in literacy on the EYFSP.

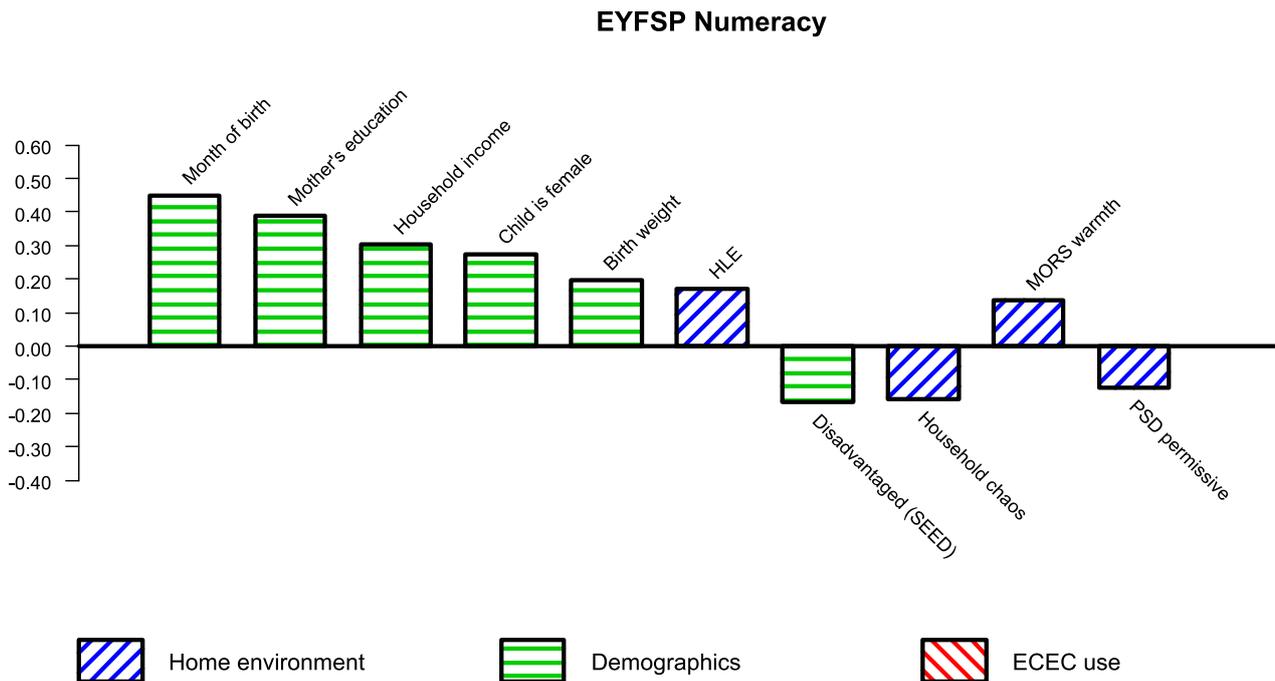


HLE = Home Learning Environment

EYFSP literacy

Achieving a at least the expected level in EYFSP literacy during school reception year was associated with demographic and home environment factors. The largest association with achieving at least the expected level was the child's being older in his/her school year. There were further positive associations with having a more highly educated mother, with the child being female, with higher household income, with higher limit setting, higher birth weight, higher levels of the Home Learning Environment and with higher levels of MORS warmth in the parent/child relationship. There were negative associations with coming from a relatively disadvantaged family, with higher levels of household chaos and with the permissive parenting score.

Figure 24: Comparing effect sizes for the outcome achieving at least the expected level of development in numeracy on the EYFSP.

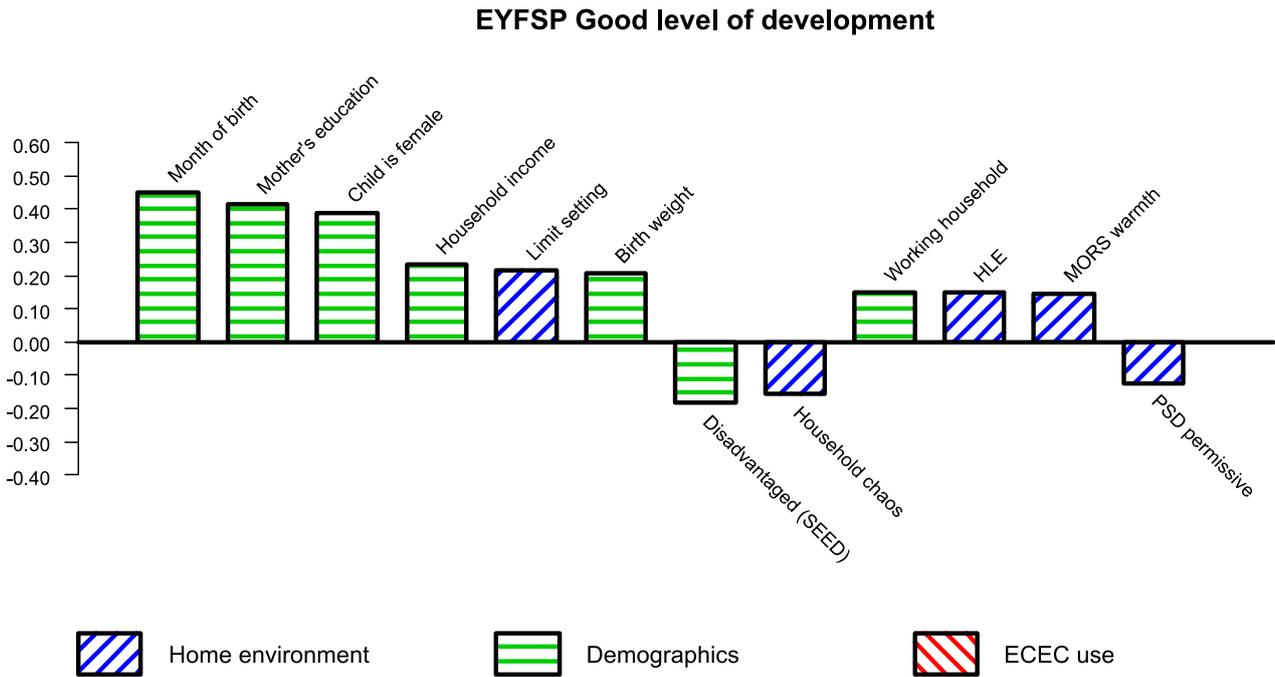


HLE = Home Learning Environment

EYFSP numeracy

Achieving at least the expected level in EYFSP numeracy during school reception year was associated with demographic and home environment factors. There was a higher probability of achieving at least the expected level in numeracy where the child was older in his/her school year, where the mother was more highly educated, where household income was higher, where the child was a girl, for higher birth weight children, where the Home Learning Environment score was higher, where there was a higher level of MORS warmth in the parent/child relationship and where the child came from a working household. There was a lower probability of achieving at least the expected level in numeracy where the child came from a relatively disadvantaged family, where household chaos was higher and where the permissive parenting score was higher.

Figure 25: Comparing effect sizes for the outcome achieving an overall good level of development on the EYFSP.

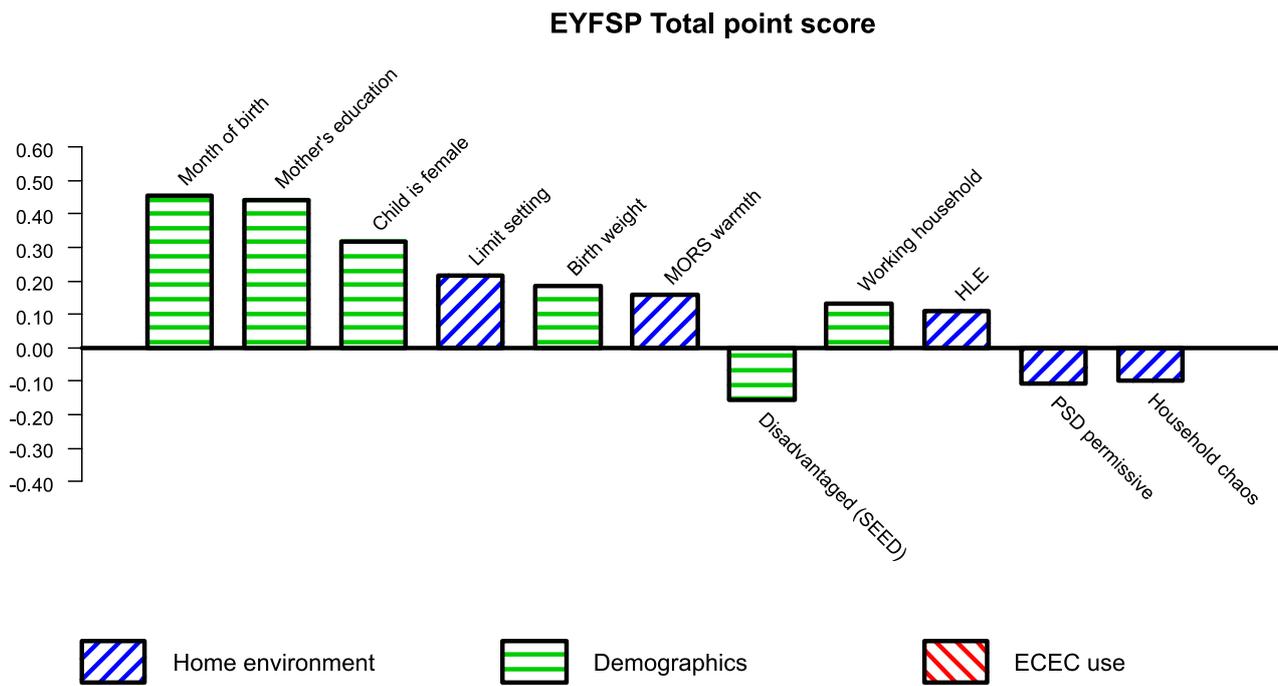


HLE = Home Learning Environment

EYFSP overall good level of development

Achieving an overall good level of development on the EYFSP during school reception year was associated with demographic and home environment factors. There was a higher probability of achieving an overall good level of development where the child was older in his/her school year, where the mother was more highly educated, where the child was a girl, where household income was higher, where limit setting was higher, for higher birth weight children, where the child came from a working household, where the Home Learning Environment score was higher and where there was a higher level of MORS warmth in the parent/child relationship. There was a lower probability of achieving an overall good level of development where the child came from a relatively disadvantaged family, where household chaos was higher and where the permissive parenting score was higher.

Figure 26: Comparing effect sizes for the outcome EYFSP total score.



HLE = Home Learning Environment

EYFSP total score

EYFSP total score was associated with demographic and home environment factors. EYFSP total score tended to be higher when the child was older in his/her school year, where the mother was more highly educated, where the child was a girl, where limit setting was higher, where birth weight was higher, where there was a higher level of MORS warmth in the parent/child relationship, where the child came from a working household and where the Home Learning Environment score was higher. EYFSP total score tended to be lower where the child came from a relatively disadvantaged family, where the permissive parenting score was higher and where there were higher levels of household chaos.

Chapter conclusions

Home environment factors, including the quality of the parent/child relationship are associated with considerable influence on children's cognitive, socio-emotional and educational outcomes during reception / school year one. Given the timing of measurement, and because an extensive number of factors were controlled for in the analyses, the relationships between home environment and child outcome are likely to be causal.⁵⁹

Higher home learning environment scores, lower levels of household chaos, higher levels of parental limit setting and higher levels of warmth in the parent/child relationship were generally associated with better outcomes on the EYFSP measures (see Table 33). Note that these effects are from models which control for children's ECEC use and demographic factors. Higher home learning environment scores were also associated with better verbal ability.

Higher household chaos was associated with higher levels of internalising behaviour and lower levels for all the socio-emotional strengths. Higher limit setting was associated with better levels of children's verbal and non-verbal ability, but also with higher levels of externalising behaviour and lower levels of emotional self-regulation. It should be remembered here that limit setting may be a response to children's more challenging behaviour as well as a driver of children's more positive behaviour. Higher levels of warmth in the parent/child relationship were associated with children's higher verbal ability and with lower levels of child socio-emotional problems and higher levels of child socio-emotional strengths.

Demographic factors were associated with all the child outcomes. Their influence on the EYFSP outcomes were particularly notable, with better outcomes for children who were older in their school year, for girls and for children with more highly educated mothers being the most prominent effects on these outcomes; although, as noted above, the three most important home environment factors also had significant effects on these outcomes in all cases.

The associations between ECEC use and children's outcome were comparable in size to those of the home environment variables. The largest effects were generally those of demographic factors.

The effects of home environment and demographic factors on children's cognitive and socio-emotional outcomes show a fair degree of continuity for the school year one outcomes considered here and the age three and four outcomes considered in earlier waves of the SEED study.⁶⁰

⁵⁹ Further discussion of causal relationships is available in the associated Technical Annexe.

⁶⁰ See (Melhuish, Gardiner and Morris 2017), (Melhuish and Gardiner 2018).

Chapter 7: Discussion and conclusions

Aims

The main objectives of this report are:

1. To study the associations between the amount of differing types of ECEC that children receive between the age of two and the start of school and child development assessed during reception / school year one.
2. To study the associations between the quality of the formal group ECEC settings that children have attended between ages two and four and child development assessed during reception / school year one.
3. To consider how age of starting formal ECEC may affect child development assessed during reception / school year one.
4. To examine the possible effects of the combination of types of ECEC use on child development assessed during reception / school year one.
5. To investigate the impact of the home environment, parenting and the quality of the parent / child relationship on child development assessed during reception / school year one.

The findings of this study show a considerable degree of continuity with the earlier SEED studies looking at children's outcomes at ages three and four, as well as some divergence from earlier findings, particularly where children's socio-emotional outcomes are concerned. Models have considered the effects on children's cognitive, socio-emotional and EYFSP outcomes measured during reception / school year one of a number of aspects of children's ECEC use: amount and type, specific usage bands, timing and quality, as well as the combination of ECEC types used. This leads to a potentially complex picture in which the final conclusions drawn may need to take account of a number of different modelling strategies. It should also be borne in mind, particularly where results are new or unexpected, that conclusions must be tentative until results can be confirmed by supporting evidence from other studies.

Assessing the effects of ECEC on child development

The possibility of confounding

As in any observational study, the possibility that results are affected by confounding from unobserved variables should be considered. In this study, the risk of confounding is reduced by controlling the models for a wide range of home environment and demographic variables. It is likely that most potential confounders, even if not directly controlled for, will be correlated with one or more of the home environment and demographic variables, so that the controlled models will reduce the effect of confounding even when it is not eliminated completely. There remains the risk of a confounder that is largely independent of the home environment and demographic variables. A possible example is whether or not a child has a Special Educational Need (SEN). Children with an SEN are less likely to use formal ECEC and are likely to have on

average poorer cognitive and educational outcomes. This confounding could increase the apparent positive effects of formal ECEC use on child outcomes.

The amount and type of ECEC used

An association was found between the amount of informal individual ECEC used (with friends and relatives) between age two and the start of school and better child verbal ability measured during school year one. This finding is consistent with results found in the SEED study at ages three and four. This result was found across all disadvantage groups, regardless of the quality of the home learning environment.

At age four, the use of formal group ECEC (in playgroups, nursery schools etc.) was associated with better cognitive outcomes, specifically for non-verbal ability. During school year one, an association was found between formal group ECEC use and children's verbal ability, but this result was only found for children who experienced a less enhancing home learning environment. This may be characterised as a "saturation effect" where the benefit children experience from out of home learning opportunities was less for those children who already experience many learning opportunities at home.

There was relatively little evidence for the impact of ECEC use on the EYFSP outcomes. This may be in part because all but one of the EYFSP outcomes were binary outcomes measuring whether or not a child achieved the expected level of development. These binary outcome measures have less power to detect small differences than the continuous BAS cognitive outcomes. There was an effect of the amount of formal individual (childminder) ECEC used associated with children's EYFSP total score — the only continuous EYFSP measure used — although this effect depended on which disadvantage group children belonged to. For the most disadvantaged children, higher use of childminder ECEC was associated with poorer EYFSP total score outcomes. The interpretation of this finding is not clear, but it may be that the most disadvantaged families tend to have access only to poorer quality childminder care. For the moderately disadvantaged children higher use of childminder ECEC was associated with better EYFSP total scores. This effect was not found for the least disadvantaged children and it may be that this is another example of a saturation effect; that is, children from the least disadvantaged homes may be experiencing more learning opportunities at home and so have less to gain from time in out of home ECEC.

The effects of ECEC on children's cognitive outcomes at the start of school are more limited than those found in the EPPSE study (1997-200), the last comparable study in this area (Sylva 2004). It is worth noting that the EPPSE study made use of a no-ECEC comparison group. By the time of the SEED study the lack of a substantial number of children with no ECEC use (which reflects the availability of universal state-funded provision) did not allow the use of a no ECEC comparison and has meant that a low-use comparison group has been adopted.

However, there was an additional difference. The start of school measures in EPPSE were taken when the children were at the end of their preschool period but before experiencing reception class, whereas the SEED start of school measures occurred at the end of reception (EYFSP) and in year one (BAS, CSBQ). It is possible that the time spent in school before the EYFSP and SEED cognitive measures were assessed has allowed children with less pre-school ECEC use to catch up with those who had more pre-school ECEC, resulting in a reduction in the measured impact of ECEC use in SEED as compared with that in the EPPSE study.

The most notable divergence from earlier SEED results was in the associations found between the use of formal ECEC and children's socio-emotional outcomes. In the earlier waves of the SEED study these associations have been predominantly positive. At age three, the use of formal group ECEC was associated with better child outcomes for child emotional symptoms scores, peer problems scores and prosocial behaviour, whilst the use of formal individual (childminder) ECEC was associated with better child emotional symptoms scores and behavioural self-regulation scores. At age four, formal group ECEC use was associated with better peer problems scores, better prosocial behaviour scores and better behavioural self-regulation, whilst the use of formal individual ECEC was associated with better emotional self-regulation scores (for moderately disadvantaged children only). There were also some limited negative associations between socio-emotional outcomes and ECEC use, although these were largely confined to children with particularly high use of formal group ECEC, specifically those children with a mean use of greater than thirty-five hours per week. This group of children had higher conduct problems scores at ages three and four and higher emotional self-regulation scores at age three only. It was notable that at age four children with high formal group ECEC use (a mean of greater than thirty-five hours per week) did not have absolutely higher levels of conduct problems in a direct comparison with other children; rather, the effect was found only in a model controlling for demographic and home environment measures. This indicates that, rather than exhibiting higher conduct problems, these children failed to exhibit the lower conduct problems that would otherwise be expected for children with their demographic background.

For children's socio-emotional outcomes measured during school year one, the negative associations with formal ECEC use between age two and the start of school were more wide ranging. Formal group ECEC use was associated with higher levels of externalising and internalising behaviour and lower levels of prosocial behaviour, behavioural self-regulation and emotional self-regulation. Formal individual (childminder) ECEC use was associated with higher levels of externalising behaviour and lower levels of emotional self-regulation. For the outcome internalising behaviour, the negative association with formal group ECEC was associated with particularly high mean use of greater than thirty-five hours per week. For two other outcomes, externalizing behaviour and emotional self-regulation, poorer outcomes were associated with somewhat lower mean use of formal group ECEC, namely use greater than fifteen hours per week.

Part of the reason for these unexpected differences between the age four results and those from school year one may be the different ways in which children's socio-emotional measures were assessed. The age four socio-emotional measures were derived from a questionnaire completed by parents, whereas the school year one outcomes were derived from a questionnaire completed by children's teachers in their year one class. Also it is possible that coping with the new environment of school was influencing this apparent change in children's socio-emotional behaviour.

Further investigation revealed that for the outcomes externalising behaviour, behavioural self-regulation and emotional self-regulation children with a mean use of more than ten hours per week formal group ECEC had absolutely poorer outcomes than children with less than ten hours per week formal group ECEC. This was in contrast to the results for formal individual (childminder) ECEC where in uncontrolled comparisons some socio-emotional measures were in fact better in higher ECEC usage bands.

It is important to consider to what extent the poorer socio-emotional outcomes which children with higher levels of formal ECEC use experience are within the normal range

for these outcomes and to what extent they may indicate that there are child socio-emotional problems. In order to answer this question, a working definition was proposed that a child had socio-emotional problems if a majority of the socio-emotional measures were more than one standard deviation away from the mean in the direction of poorer outcomes. Thus defined, 12.5% of the children had socio-emotional problems. There were strong associations between having socio-emotional problems and poorer child outcomes on all cognitive and EYFSP measures in models controlling for home environment and demographic factors. Since the EYFSP assessments (made during May to June of children's reception year) and the cognitive assessments (made during September to December of school year one) preceded the socio-emotional assessment (made during March to May of school year one), the most straightforward explanation for these associations is that good educational and cognitive development promotes positive socio-emotional outcomes. However, it is plausible that the causal relationship is in fact bi-directional, with feedback from good socio-emotional development to good cognitive and educational development as well as vice versa.

There was a small association between the amount of formal group ECEC which children used between age two and the start of school and the probability that children had socio-emotional problems during school year one. The model was controlled for home environment and demographic factors. How important this finding is will largely depend on whether this is a transient effect or whether this association persists further into children's school careers. This question will be considered in the final wave of the SEED study when children are aged seven.

The age when formal ECEC use starts

There is evidence that the age at which children first use formal ECEC can influence their cognitive, socio-emotional and EYFSP outcomes during reception / school year one. The starting age appears to interact with the amount of formal ECEC used; that is, the effects on children's outcomes depends on the full pattern of formal ECEC use between birth and the start of school. Furthermore, these effects appear to differ depending on the level of family disadvantage.

In considering starting age, the reference (comparison) group used was a "late start / low use" group whose mean weekly usage of group ECEC was no more than ten hours per week between age two and the start of school and who first used ten or more hours per week formal ECEC between thirty-seven and fifty-four months of age. For children from the 60% least disadvantaged families, children from an "early start / low to medium use" group had the best outcomes, this group having a significantly higher probability of achieving the expected level of EYFSP numeracy during school reception year and significantly better sociability and prosocial behaviour scores during school year one.

The results for children from the 40% most disadvantaged families were notably different. The most advantageous pattern of formal ECEC use appeared to be an "early start / high use" one, with children having a mean of more than twenty hours per week formal ECEC between age two and the start of school and first using ten or more hours per week formal ECEC no later than age two. This group had better outcomes than the reference group on all the EYFSP measures (with the exception of physical development) and also higher verbal ability measured in school year one. However, these children also had poorer outcomes for the socio-emotional measures externalising behaviour and emotional self-regulation, compared to the "late start / low use" reference group. It is instructive to compare these results with those for the "intermediate start / high use"

group, who first used ten or more hours per week formal ECEC aged twenty-five to thirty-six months and used a mean of over twenty hours formal ECEC per week between age two and the start of school. These children with a later start in formal ECEC had similar outcomes for verbal ability, externalising behaviour and emotional self-regulation to the “early start / high use” group, but they did not have the better EYFSP outcomes shown by the early start group. This suggests that, particularly for children from more disadvantaged families, an early start in formal ECEC may be valuable for achieving a “good” level on the EYFSP assessments made in school reception year.

The combination of ECEC types

A notable difference was found between the outcomes of children with relatively high formal group ECEC use between age two and the start of school who had used no individual ECEC during this period (either with childminders or with friends and relatives) and the outcomes for children who had the same relatively high levels of formal group ECEC use combined with some individual ECEC use. Specifically, the former group, who used no individual ECEC, experienced poorer outcomes on a number of socio-emotional measures (externalising behaviour, sociability, prosocial behaviour, behavioural self-regulation and emotional self-regulation) as well as having a lower probability of achieving the expected level for EYFSP personal, social and emotional development and a lower EYFSP total score (all results as compared with a low formal group / no individual ECEC reference group). The latter group, who did use some individual ECEC, did not exhibit the poorer EYFSP outcomes and their socio-emotional outcomes were poorer on the scales externalising behaviour and emotional self-regulation only. The sizes of these negative socio-emotional effects were also smaller for the group using some individual ECEC. This result will require further exploration within the SEED study and in other research studies before a full interpretation can be made. However, a tentative conclusion might be that the addition of some individual ECEC (either with childminders or friends / relatives) is able to mitigate some of the potential socio-emotional disadvantage that children may experience from high use of formal group ECEC during the pre-school period. It may be that the greater level of one to one adult / child interaction that can occur in individual ECEC is helpful in building children’s emotional resilience. If this finding is confirmed by further research it may be of considerable policy significance.

The quality of ECEC

The only statistically significant results found showed an association between the use of higher quality ECEC between ages two and four and poorer outcomes for children’s non-verbal ability during school year one. Given the isolated nature of this result, unless and until such a result is replicated in another study, it is argued that the most reasonable explanation for this finding is that it is a Type I error — that is, a chance finding — and not a causal association. Adopting this interpretation, this study finds an absence of associations between the quality of formal ECEC attended between ages two and four and children’s cognitive, socio-emotional and EYFSP outcomes during reception / school year one. The conclusion to be drawn from this is not that the quality of the ECEC which children attend is of no importance. Firstly, it must be borne in mind that the smaller sample size available for the quality analyses means that the size of effects that can be detected is larger than for the other analyses, and there may be associations between ECEC quality and children’s outcomes falling below the detectable effect size. Secondly, the rise in the quality of ECEC settings since the EPPSE study of around twenty years

ago means that most provision is now of distinctly better quality, with little poor quality (Melhuish and Gardiner, 2017). The relative homogeneity of ECEC quality may lead to a lack of observed associations between quality and child outcomes; it does not mean that the quality of provision is unimportant, as decreasing quality may well harm child outcomes.

The influence of the home environment on child outcomes

Home environment factors, including parenting, the quality of the parent / child relationship and the home learning environment had considerable influence on children's cognitive, socio-emotional and educational outcomes assessed during reception / school year one.

Of nine home environment factors considered, the most influential on children's EYFSP outcomes were Home Learning Environment, household chaos, parental limit setting, and the warmth of the parent / child relationship.

Higher HLE scores, lower household chaos and greater warmth in the parent / child relationship were significantly associated with better outcomes on all EYFSP measures. Higher HLE scores were associated with better verbal ability, whilst higher household chaos was associated with higher internalising behaviour and lower levels for all the socio-emotional strengths.

Higher limit setting was associated with better verbal and non-verbal ability, but also with higher externalising behaviour and lower emotional self-regulation. In interpreting these negative results, it should be remembered that limit setting may be triggered as a response to children's more challenging behaviour as well as a driver of children's more positive behaviour. Greater warmth in the parent/child relationship was linked with higher verbal ability and lower levels of socio-emotional problems.

The associations between ECEC use and children's outcomes assessed during reception / school year one were comparable in size to those of the home environment variables, all of these being statistically small effects. The largest effects on children's outcomes were those of demographic factors: child's sex, child's age in school year and mother's educational level being the most influential.

Final conclusions

The results of the analysis of children's outcomes while in reception (EYFSP) and year one (BAS and CSBQ) reveal rather more limited effects associated with ECEC use than found in previous SEED reports. In contrast the effects associated with the home environment are more wide-ranging, indicating the substantial influence on development of a range of aspects of the home and parenting.

The main conclusions to this SEED report can be summarised as follows:

1. Higher use of informal individual ECEC (with friends, relatives etc.) between age two and the start of school was associated with better verbal ability measured during school year one.

2. High use of formal group ECEC (mean hours per week) between age two and the start of school is associated with negative effects on socio-emotional well-being in school year one.
3. There is evidence that the use of some individual ECEC (childminders, friends, relatives) mitigates the negative socio-emotional effects of high formal group ECEC use.
4. Starting age is important and interacts with level of disadvantage. For the 40% most disadvantaged children, starting to use a minimum of ten hours per week formal group ECEC no later than age two, combined with a mean use of over twenty hours per week of formal group ECEC between age two and the start of school, increases the chances of children achieving the expected level on EYFSP measures in school reception year and also improves children's verbal ability in school year one.
5. There was a positive association between formal group ECEC use (in nursery classes, nursery schools etc.) and better verbal ability during school year one, but only for children from families in the lowest quartile of home learning environment score (i.e. children with the least enhancing home learning environments).
6. There was no clear evidence of associations between the quality of ECEC which children had attended between ages two and four and their developmental outcomes during reception year / school year one: though these findings may relate to the relatively small sample of settings for the SEED quality study and the similarities in ECEC quality across the sample.

It remains to be seen how persistent these new findings are. This will be assessed in the report on the later waves of SEED data collection.

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