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

Research Brief

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**Study of Early Education
& Development**



Social Science in Government

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Summary

Aims and Methods

This report presents findings for a sample of 3,930 families who took part in the Study of Early Education and Development (SEED) longitudinal study. Parent interviews at ages two, three and four asked questions about early childhood education and care (ECEC) attended and characteristics of the home environment. Child development at age four was assessed through parent reported socio-emotional development and direct assessments of cognitive development. ECEC quality was measured through observations carried out in 1,000 settings attended by a subsample of children in the study. This report explores whether child development at age four is associated with:

- The amount of differing types of ECEC that children receive aged two to four years
- The home environment and the parent/child relationship at age two to three
- The quality of the ECEC settings that children have attended at age two to four

Key Findings

- Cognitive and socio-emotional developmental benefits were seen to be associated with use of ECEC between ages two and age four. Benefits of ECEC were similar for the most and least disadvantaged families.
 - Increased hours/week in formal group ECEC (e.g. day nursery, nursery/school, playgroup) between ages two and four was associated with non-verbal development and some better socio-emotional outcomes (more prosocial behaviour and behavioural self-regulation and fewer peer problems) at age four. Benefits for child development were seen across private, voluntary and independent (PVI) and maintained settings.
 - Increased hours spent in informal individual ECEC (e.g. relatives, friends) between ages two and four was associated with improved language development at age four, but also with slightly increased levels of SDQ total difficulties for a small group (n=203) of children who received >20 hours/week of informal individual care.
- Attending higher quality formal group ECEC settings was associated benefits for increased non-verbal cognitive development and reduced conduct problems at age four.
- Characteristics of the home environment, including the home learning environment and the parent-child relationship, were associated with cognitive and socio-emotional development at age four. The relationships between ECEC and outcomes were largely independent of the advantages of a rich home learning environment.

Introduction

Research over several decades has accumulated indicating that early years education can have a positive effect on children's educational, cognitive, behavioural and social outcomes, in the short and long term, particularly if the quality is good (Sylva et al., 2010; Melhuish et al., 2015). From September 2004 all three- and four-year-olds in England have been entitled to some 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 was 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 a week¹.

Research has also shown the benefits of high quality early education exist when it starts as young as two-years of age (Smith et al., 2009; Sammons et al., 2002). In 2013 the UK government expanded the funded entitlement to two-year-old children living in disadvantaged households in England. This included two-year-olds looked after by the Local Authority (LA) and those from families in receipt of 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, commissioned in 2012, includes a major longitudinal study designed to help the Department for Education (DfE) by providing evidence on the effectiveness of early years education and by identifying any short- and longer-term benefits from this investment. 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. SEED aims to study children at age two, three, four, five and seven to seek information on how variation in early childhood education and care (ECEC) experience may be associated with cognitive and socio-emotional development. This report is part of SEED, and focuses on exploring how ECEC may be related to children's development at age four. This report addresses three main objectives:

1. To study the associations between the amount of differing types of ECEC that children receive aged two to four years and child development at age four.

¹ 30 hours childcare is 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 equivalent of 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/>.

2. To investigate the relevance of the home environment and the quality of the parent/child relationship on child development at age four.
3. To study the associations between the quality of the ECEC settings that children have attended and child development at age four.

Sample

For this Study on Early Education Use and Child Outcomes up to age four years, the participants were 3,930 children and their families with data collected at Waves 1, 2 and 3, when children were two, three and four years old, respectively.

Children were sampled to come, in approximately equal numbers, from three levels of family disadvantage defined by family income and benefits received³:

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

Early Childhood Education & Care (ECEC)

Children in SEED may attend any form of ECEC, although only those settings referred to as ‘formal’ are eligible for government funding. Settings classified in this report as ‘group’ based are those that are in a non-domestic group setting; those classified as ‘individual’ are in a domestic (i.e. home) setting. A three-way classification of ECEC was 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 nannies⁴)

A further breakdown of formal group ECEC was used in later analysis to compare **Private, Voluntary and Independent** settings (i.e. ECEC which is funded privately or by

³ These categories of family disadvantage were defined based on eligibility criteria for 15 hours funded childcare for disadvantaged two-year olds. The proportion of families in each group is approximately in line with the population distribution at the time.

⁴ The DfE Survey of Parents indicates that grandparents are by far the largest informal provider of ECEC in England (DfE, 2017)

voluntary / charitable organisations) with **maintained** settings (i.e. nursery classes, nursery schools, Local Authority nurseries or children’s centres).

Measures

The measures used in this report are summarised below, further details are in Chapter 2.

Child Development

Child development was assessed when children were aged four through both direct assessments by research staff and by parent ratings.

Direct Child Assessment: cognitive development

Cognitive development was measured using the British Ability Scales (BAS).

1. Naming Vocabulary (verbal ability i.e. language development).
2. Picture Similarities (non-verbal ability).

Direct Child Assessment: self-regulation

1. The HTKS task (“head-toes-knees-shoulders”), a measure of children’s self-regulation. Note: the study also collected self-regulation measures based on parent ratings – see below.

Child Assessment from parent ratings: Socio-emotional and self-regulation development

Socio-emotional development was assessed by parent interview at age four (Wave 3) using the Strengths and Difficulties Questionnaire (SDQ) as well as additional subscales for positive aspects of development.

1. SDQ Hyperactivity (e.g. restless, fidgets, easily distracted)
2. SDQ Emotional Symptoms (e.g. worries, unhappy, nervous)
3. SDQ Conduct Problems (e.g. loses temper, aggressive, takes other children’s things)
4. SDQ Peer Problems (e.g. often alone, poor sociability)
5. SDQ Total Difficulties (the combined total of Hyperactivity, Emotional Symptoms, Conduct Problems and Peer Problems)
6. SDQ Prosocial Behaviour (e.g. shares toys, shows empathy)
7. Behavioural Self-regulation (e.g. thinks before acting, persistent)
8. Emotional Self-regulation (e.g. even mood, not impulsive, calm)
9. Co-operation (e.g. plays easily with others, waits turn).

Home environment and demographics

Home environment measures

Home environment measures were completed at ages two and three (Waves 1 and 2).

1. Home Learning Environment (exposure to learning activities in the home such as reading, nursery rhymes)
2. Household disorder (CHAOS scale)
3. Parent's Psychological Distress score (e.g. symptoms of depression or anxiety)
4. Limit Setting score (e.g. time out, telling off)
5. MORS Warmth score (a measure of parent/child closeness)⁵
6. MORS Invasiveness score (a measure of parent/child conflict)

Demographic measures

Demographic information was collected at age three (Wave 2).

1. Child's sex
2. Child's ethnic group
3. Child's birth weight
4. Child's birth order
5. Maternal age at birth of child
6. Number of siblings living in the same household as child
7. Whether child is living in a couple or lone parent household
8. Whether child is living in a workless or working household
9. Household income
10. Area deprivation (Index of Multiple Deprivation, IMD)⁶
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

Quality measures

The quality of 1000 settings was assessed using observational ratings: 402 settings for children at age two (Wave 1), and 598 settings for children at age three (Wave 2).

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

⁵ The MORS warmth and invasiveness scales were measured at Wave 2 only.

⁶ A ranking of small areas in England based on income deprivation, employment deprivation, education, skills and training deprivation, health deprivation and disability, crime, barriers to housing and services, living environment deprivation.

1. Sustained Shared Thinking and Emotional Well-being (SSTEWE) 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 these measures:

1. SSTEWE – measuring the quality of staff / child interaction
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 several aspects of educational learning opportunities

Results

This is an overview of findings, further details of which are available in the research report. Key findings are also summarised at the beginning of the relevant chapters.

Are variations in ECEC use associated with child development?

Results by the amount of ECEC use

When controlling for home environment and demographic factors, the average number of hours per week in ECEC between ages two and four years was associated with differences in cognitive and socio-emotional outcomes at age four years (see Table 1).

Results are given as the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC usage covariate. Using standardized outcomes, that is outcomes measured in units of the standard deviation, allows the size of effects to be compared between the different outcomes.⁷

⁷ Effects between 0.02 and 0.05 units may be considered small; effects between 0.05 and 0.1 may be considered to be of medium size. Effects over 0.1 units would be considered large.

Table 1: Summary of the statistically significant⁸ associations between children's time in ECEC from two to four years (mean hours per week) and children's outcomes at age four.

Child outcome	Type of early education and care (ECEC)		
	Formal ECEC		Informal ECEC
	Group	Childminders	Relatives, friends, nannies
<i>Cognitive development</i>			
Naming Vocabulary (verbal)	+0.014	+0.053	+0.048*
Picture Similarities (non-	+0.044*	+0.048	+0.010
HTKS Task	+0.018	+0.045	+0.007
<i>Socio-emotional problems</i>			
SDQ Total Difficulties	-0.009	-0.014	+0.039*
Hyperactivity	+0.001	+0.005	+0.036
Emotional Symptoms	-0.005	-0.055	+0.013
Conduct Problems	+0.044[‡]	+0.032	+0.036
Peer Problems	-0.087***	-0.043	+0.021
<i>Socio-emotional strengths</i>			
Prosocial Behaviour	+0.041*	+0.048	-0.012
Behavioural Self-regulation	+0.056**	+0.047	+0.008
Emotional Self-regulation	-0.018	-0.028	-0.020
Co-operation	+0.018	+0.014	-0.010

Sample size = 3,930.

The table displays coefficients for associations between hours of each type of ECEC and each outcome. Statistically significant coefficients are in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Coefficients give the change in the standardized outcome corresponding to a 10 hour per week change in the ECEC use covariate.

For cognitive development and socio-emotional strengths, higher scores indicate a positive outcome, and a positive association (+) indicate that more hours in ECEC are associated with a better score in this outcome. For socio-emotional problems, lower scores are a positive outcome, and a negative association (-) indicates that more hours in ECEC are associated with a better score for this outcome.

[‡] In later analysis, this negative association was significant only for children with high formal group ECEC use, i.e. greater than 35 hours per week over the 38 weeks of the school terms (2.98% of the sample).

In most cases ECEC use has a positive benefit regardless of household income disadvantage level. Positive impacts were observed for use of formal and informal ECEC:

- More hours spent in informal individual ECEC (e.g. with friends and relatives) was associated with better language development. However, for a small group of children (N=203), who received >20 hours/week of informal individual ECEC (e.g. relatives, friends, neighbours) from two to four years of age there was a slightly increased level of SDQ total difficulties. A statistically significant association is one that is unlikely to be due to chance.

- Better non-verbal reasoning ability was associated with more hours spent in formal group ECEC (e.g. nursery classes, nursery schools, day nurseries and playgroups).
- Better socio-emotional outcomes were associated with more hours spent in formal group ECEC settings, specifically higher levels of Prosocial Behaviour and Behavioural Self-regulation and lower levels of Peer Problems.
- More hours spent in formal group ECEC was also associated with children having higher levels of Conduct Problems. Subgroup analysis found that this effect was limited to a small group of children (N = 117) who spent over 35 hours per week of formal group ECEC from age two to four. Findings suggest, however, that the behaviour of these children was in fact no different to that of the majority of children using fewer hours in ECEC. Rather, these high ECEC use children failed to show the lower levels of Conduct Problems that would have been expected given their demographic characteristics and home environment (generally coming from higher qualified families with lower levels of household disorder in comparison with lower ECEC use children). Comparison with the SEED results at age three also suggests that this negative impact has lessened over time.

The associations between ECEC and child outcomes were consistent across SEED disadvantage groups, regions⁹ and area disadvantage (using the Index of Multiple Deprivation).

Given the timing of measurement, and because an extensive number of factors are controlled for in the analyses, the relationships between ECEC and child outcome may be assumed to be causal and therefore the associations identified in this report are referred to as evidence of 'impact' based on this assumption.¹⁰

Results by specific levels of ECEC use

The findings presented above indicate a number of relationships where more hours in ECEC per week are associated with better child cognitive and socio-emotional development. Analyses of the specific levels of ECEC use (in categories of average hours spent in ECEC per week) generally also indicate increasing benefits associated with more hours spent in ECEC. However, given that associations vary across different outcomes and for each type of provision, because the number of hours is an average across a two-year period and because the number of children within some of the time

⁹ The nine government office regions were aggregated into five geographical regions (The North, The Midlands, East of England, London, The South), see Technical Report for further detail.

¹⁰ Further discussion of the causal relationships is given in the associated Technical Report.

categories is quite small, it is not possible to specify a number of hours in ECEC that would be optimum for child development.

Are there differences between the effects of different formal group ECEC settings?

Previous SEED research (Melhuish and Gardiner, 2017) has shown that the characteristics of settings within the category of formal group ECEC differ. Further analysis was undertaken in which children's formal ECEC usage aged two to four was considered separately for private / voluntary / independent (PVI) ECEC group settings, and maintained ECEC in government funded group settings e.g. nursery classes in schools or maintained nursery schools.

2,511 children had used PVI ECEC, 645 had used maintained ECEC and 251 had used both types.

- For non-verbal cognitive outcomes there were statistically significant effects of both PVI and maintained ECEC usage.
- For the socio-emotional outcomes Peer Problems, Prosocial Scale and Behavioural Self-regulation there was evidence of a significant beneficial effect of PVI ECEC usage.
- Although there was no statistically significant effect of maintained ECEC usage on socio-emotional outcomes, comparison with PVI ECEC suggests there were no differences between the two types of provision in terms of their benefit¹¹. The evidence was therefore inconclusive as to whether there were also socio-emotional benefits of time spent in maintained ECEC. The uncertainty of the conclusions concerning maintained ECEC use can in part be attributed to the relatively small number of children in the sample using this type of ECEC.

¹¹ See Chapter 3 for a note on statistical significance and further detail to support interpretation of this finding

Table 2: Summary of associations between children’s time (hours per week) in ECEC aged two to four and children’s outcomes at age four; models with separate effects for PVI and maintained formal ECEC

Outcome	PVI	Maintained	Maintained compared with PVI
<i>Cognitive development</i>			
Naming Vocabulary (verbal)	+0.005	+0.033	+0.028
Picture Similarities (non-verbal)	+0.043 *	+0.082 *	+0.039
HTKS Task	+0.024	+0.052	+0.028
<i>Socio-emotional problems</i>			
SDQ Total Difficulties	+0.004	-0.013	-0.017
Hyperactivity	-0.013	+0.003	+0.016
Emotional Symptoms	-0.006	-0.004	+0.002
Conduct Problems	+0.031	+0.038	+0.006
Peer Problems	-0.100 ***	-0.058	+0.043
<i>Socio-emotional strengths</i>			
Prosocial Behaviour	+0.049 *	+0.025	-0.024
Behavioural Self-regulation	+0.057 **	+0.029	-0.028
Emotional Self-regulation	+0.003	-0.036	-0.039
Co-operation	+0.022	-0.025	-0.047

Sample size = 3,462.

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

Model coefficients give the change in the standardized outcome for a 10 hour per week change in the ECEC covariate, controlling for all other covariates.

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

Are variations in the quality of formal group ECEC settings attended associated with children’s outcomes at age four?

Given that previous SEED research (Melhuish and Gardiner, 2017) has shown that the quality of settings differ, analysis was undertaken to look at the variation in quality of formal group ECEC setting attendance and outcomes. Because quality observations were only carried out in a subsample of settings (Melhuish & Gardiner, 2017), this analysis included 644 children with quality scores at age two, 766 children with quality scores at age three, and 354 children with quality scores at both age two and three.

Having attended higher quality formal group ECEC settings was associated with better cognitive and socio-emotional outcomes at age four in models controlling for the amount of ECEC used between ages two and four, home environment at ages two and three and demographic factors at age three (see Table 3).

- Higher quality of formal group ECEC attended at age three (measured by the SSTEW measure of staff child interaction quality, ECERS-R measure of setting quality as well as a composite overall quality measure) was associated with better **non-verbal cognitive ability** at age four.
- Attending higher quality formal group ECEC at age two and three (measured by composite overall quality) was associated with lower levels of **Conduct Problems** at age four.
- There was no significant relationship between formal group ECEC quality and verbal cognitive development, or between ECEC quality and any other measure of socio-emotional development.

Table 3: Summary of associations between the quality of the ECEC settings which children attended and children’s outcomes at age four.

Quality measure	Child outcome	
	SDQ Conduct Problems	BAS Picture Similarities
Children with Wave 1 quality data, sample size N = 644		
SSTEW	-0.077	+0.021
ITERS-R	-0.116	+0.021
Overall quality (Wave 1)	-0.099	+0.021
Children with Wave 2 quality data, sample size N = 766		
SSTEW	-0.052	+0.150*
ECERS-R	-0.104	+0.219**
ECERS-E	-0.034	+0.139
Overall quality (Wave 2)	-0.066	+0.178*
Children with Wave 1 and Wave 2 quality data, sample size N = 354		
Overall quality (Wave 1 / Wave 2)	-0.211*	+0.189

The table displays coefficients for the associations between the quality of settings attended and each outcome. Only outcomes with a significant association with quality are presented. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the quality covariate.

A larger value is indicative of a stronger association between the two variables. Analyses controlled for hours spent in ECEC, home environment and demographic characteristics.

For BAS picture similarities, higher scores indicate a positive outcome, and a positive association (+) indicates that higher quality of ECEC is associated with improvement in this outcome. For conduct problems, lower scores indicate a positive outcome, and a negative association (-) indicates that more hours in ECEC is associated with improvement in this outcome. The samples consist of children with setting quality data and a mean of at least 10 hours per week formal group ECEC between ages two and four.

The effects of the quality of the ECEC received appear to be less wide-ranging than those of usage although direct comparison of effects is not possible across the models due to different sample sizes. It should be noted that the smaller sample size available for assessing the quality of the ECEC¹² means that these analyses have less power to detect significant effects than the analyses involving type and quantity, where larger sample size applies. It is possible that there are further effects of ECEC quality on child

¹² Of a total sample of 3,930, the quality analysis included 644 children with quality scores at age 2, 766 children with quality scores at age three, and 354 children with quality scores at both age two and three.

outcomes that could not be detected with the smaller sample size. The reduced relative impact of quality in relation to previous findings such as those of EPPE may also be related to the increase in quality over time as indicated in the SEED: Study of Quality of Early Years Provision in England (Melhuish & Gardiner, 2017). This has meant the spread of quality (and therefore statistical variation) may have narrowed, reducing the potential impact of variation in quality on outcomes.

Are variations in the home environment associated with child development?

Several cognitive and socio-emotional outcomes at age four were associated with variations in the home environment¹³ when controlling for demographic factors¹⁴ and amount and type of ECEC use between age two and age four (see Table 4):

- Children from families with a more stimulating Home Learning Environment (HLE) had better cognitive outcomes (verbal and non-verbal ability), and higher levels of Prosocial Behaviour and self-regulation (both HTKS task and parent ratings of Behavioural Self-regulation). In an unexpected finding, a higher HLE score was also associated with lower levels of children's Emotional Self-regulation.
- Children from families reporting a higher level of household disorder (as measured by the CHAOS scale) had poorer outcomes on all socio-emotional measures.
- A higher level of parent's psychological distress was associated with lower child self-regulation (measured by poorer performance on the HTKS task), higher levels of socio-emotional problems and lower levels of child Emotional Self-regulation.
- Mixed findings occur for parents setting limits around behaviour. Where parents set more limits for behaviour children had better cognitive outcomes and Behavioural Self-regulation, less Emotional Symptoms and Peer Problems.
- Where parents set more limits around behaviour also had higher levels of Hyperactivity and Conduct Problems and lower levels of Emotional Self-regulation and Co-operation.
- Children from families with a higher parent/child conflict (measured by MORS Invasiveness) had poorer cognitive and socio-emotional outcomes overall.
- Children from families with a higher parent/child closeness (measured by MORS Warmth) had better cognitive and socio-emotional outcomes on all measures.

¹³ Averaged from age two and three

¹⁴ Measured at age three

Table 4: Summary of the associations between home environment variables at ages two and three and children's outcomes at age four.

Child outcome	Home environment variables					
	Home Learning Environment	Household chaos	Parent's psychological distress	Limit setting	MORS invasiveness	MORS warmth
<i>Cognitive development</i>						
Naming Vocabulary	+0.260***	+0.051	-0.028	+0.228***	-0.132***	+0.158***
Picture Similarities	+0.161***	+0.003	-0.011	+0.123***	-0.084*	+0.070*
HTKS Task	+0.178***	+0.010	-0.073*	+0.121**	-0.104**	+0.082*
<i>Socio-emotional problems</i>						
SDQ Total Difficulties	+0.023	+0.247***	+0.242***	+0.054	+0.609***	-0.266***
Hyperactivity	-0.016	+0.234***	+0.147***	+0.128***	+0.431***	-0.187***
Emotional Symptoms	+0.035	+0.120***	+0.303***	-0.081*	+0.402***	-0.098**
Conduct Problems	+0.043	+0.249***	+0.129***	+0.203***	+0.596***	-0.161***
Peer Problems	+0.020	+0.074*	+0.148***	-0.196***	+0.324***	-0.356***
<i>Socio-emotional strengths</i>						
Prosocial Behaviour	+0.139***	-0.174***	-0.043	+0.008	-0.238***	+0.513***
Behavioural Self-	+0.179***	-0.094**	-0.046	+0.124***	-0.299***	+0.285***
Emotional Self-	-0.075*	-0.251***	-0.136***	-0.089**	-0.607***	+0.136***
Co-operation	+0.059	-0.185***	-0.051	-0.098**	-0.415***	+0.414***

Sample size = 3,930

The table displays coefficients for the associations between the home environment variables and each outcome. Statistically significant coefficients are shown in bold italics, the level of significance is indicated by stars: * = $p < .05$, ** = $p < .01$, *** = $p < .001$. Coefficients give the change in the standardized outcome corresponding to a 2 standard deviation change in the home environment variable.

For cognitive development and socio-emotional strengths, higher scores indicate a positive outcome, and a positive association (+) indicates that a higher level of the home environment covariate is associated with improvement in this outcome. For socio-emotional problems, lower scores are a positive outcome, and a negative association (-) indicates that a higher level of the home environment covariate is associated with a better (i.e. lower) score on this outcome.

Relative effects of ECEC, home environment and demographics

Although hours spent in ECEC is associated with a number of child outcomes, demographic characteristics (particularly maternal education), the parent-child relationship (particularly warmth and invasiveness) and the quality of the home learning environment have a greater influence on children's cognitive development and on socio-emotional development than hours spent in ECEC.

Interactions between ECEC and HLE

Analyses found that the beneficial effects of ECEC use and of a rich Home Learning Environment (HLE) are largely independent of each other. This indicates that even children having very stimulating home environments still benefit from hours in ECEC.

Conclusions

The amount and type of ECEC attended between ages two and four are both associated with a number of cognitive and socio-emotional outcomes at age four. Many findings are in line with those observed in the previous report of outcomes at age three (Melhuish, Gardiner & Morris, 2017). A key difference is additional gains in non-verbal development at age four that have been found for children spending time in group settings. Taken together, these findings indicate the wide ranging benefits of attending ECEC between ages two and age four. These results correspond, in part, with previous research¹⁵ that has frequently found beneficial effects associated with more hours in formal group ECEC for aspects of cognitive development as well as socio-emotional development, such as Peer Problems, Prosocial Behaviour and Self-regulation.

Specifically, the study found that more hours spent in informal individual ECEC settings (e.g. with relatives, friends, neighbours) was associated with better language development at age four. However, for a small group of children (N=203), who received >20 hours/week of informal individual ECEC (e.g. relatives, neighbours, friends) between the ages of two and four years there were slightly increased levels of SDQ total difficulties score.

Verbal development was not associated with hours spent in formal group ECEC settings, which is inconsistent with findings from EPPE which suggested long-term language and literacy outcomes relating to attending group ECEC (Sylva et al., 2004). Although short-term language benefits of group settings have not been found in SEED, language outcomes in the longer term once children start school will be considered in future SEED reports. Given the importance of language development in longer term outcomes (Blanden, 2006), future research should consider ways in which practice can be enhanced to increase language development in children attending group ECEC settings.

Although benefits of group ECEC for language development are not yet seen in SEED, a number of areas of socio-emotional and cognitive development, which are also important for longer term outcomes, are shown to benefit from group ECEC. More hours spent in formal group ECEC (e.g. day nurseries, nursery classes or schools and playgroups) was associated with better cognitive non-verbal reasoning ability at age four. More hours spent in formal group ECEC was also associated with several aspects of socio-emotional

¹⁵ This research is reviewed comprehensively in Melhuish et al. (2015).

development; more Prosocial Behaviour, better Behavioural Self-regulation and fewer Peer Problems.

A small association was observed between hours spent in formal group ECEC and higher conduct problems; further analysis showed that this effect was restricted to children spending over 35 hours per week in formal group settings. This negative impact of high formal group ECEC use on conduct problems was reduced in comparison with the effect found at age three;¹⁶ this is in line with findings from EPPE that such negative impacts are reduced over time (Melhuish et al., 2010).

Increased time spent in ECEC in both PVI and maintained settings was associated with cognitive benefits, and ECEC received in PVI settings was also associated with socio-emotional benefits. The evidence was inconclusive as to whether there were also socio-emotional benefits of time spent in maintained ECEC. The uncertainty of the conclusions concerning maintained ECEC use can in part be attributed to the relatively small number of children in the sample using this type of ECEC.

Associations between ECEC and child development were identified across the whole range of disadvantage in the SEED sample, suggesting that use of ECEC has a largely positive benefit on cognitive and socio-emotional outcomes at age four for children across the advantage-disadvantage spectrum. However, given the lower starting point among disadvantaged children (Speight et al., 2015), and reduced likelihood to take up childcare (DfE, 2017), ECEC may be of particular importance for the most disadvantaged children.

Further, this report presents associations between the quality of childcare attended and child outcomes. The study found evidence that attending better quality childcare settings between ages two and four had a positive impact on some aspects of children's cognitive and socio-emotional outcomes measured at age four. This indicates the value of high quality ECEC provision, and suggests that efforts to further improve the quality of provision may be expected to lead to further improved child outcomes. The recently published SEED quality report (Melhuish & Gardiner, 2017) indicates a number of structural characteristics of settings, including staff qualifications and training, which may be instrumental in achieving the high quality provision that is seen to be associated with the best child outcomes.

The study also found that several cognitive and socio-emotional outcomes at age four were significantly associated with variations in the home environment, particularly the quality of the parent/child relationship, maternal qualifications and the Home Learning Environment. Findings also suggest that outcomes are generally more strongly associated with demographics and home environment than they are with time spent in ECEC settings. Nevertheless, in line with findings from the same sample at age three (Melhuish et al., 2017), the advantages of a more stimulating and responsive Home

¹⁶ Reported in an earlier SEED report (Melhuish et al., 2017).

Learning Environment and the beneficial effects of time in ECEC are largely independent. This suggests that even children with the most stimulating home learning environments still stand to benefit from spending time in ECEC.

Whether the pattern of outcomes observed at age four continues in the longer term will be addressed in future SEED reports.

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