Department for Education

Study of Early Education and Development (SEED): Developing alternative quality scales for Early Childhood Education and Care (ECEC) using exploratory analysis.

Research Brief

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Key Point Summary

- The Study of Early Education and Development (SEED) is a major longitudinal study of the impact of children's pre-school education and care, and other early experience, on their subsequent development and educational attainment.

- As part of the SEED study, the quality of 598 Early Childhood Education and Care (ECEC) settings which children in the SEED study attended at age 3 was assessed.

- These childcare settings were assessed using three well-established quality scales; the Early Childhood Environment Rating Scale – Revised (ECERS-R), the Early Childhood Environment Rating Scale – Extended (ECERS-E) and the Sustained Shared Thinking and Emotional Well-being scale (SSTEW). This entailed collecting data on 56 individual quality items.

- This report aims to use exploratory analyses to answer the following two questions:

    - Do the ECERS-R, ECERS-E and SSTEW scales provide the best predictors of children's cognitive and self-regulation development that can be derived from the underlying quality data?

    - Could effective predictors of the effects of ECEC quality on children's development be derived from a smaller collection of individual quality items?

- New quality scales were derived using factor analysis of the item level quality data and also using a novel method based on regression modelling of the cognitive and self-regulation outcomes in terms of individual quality items. The new quality scales comprised between 10 and 35 individual quality items.

- Analysis of children's cognitive and self-regulation outcomes at age 5 in terms of the new and existing quality scales gave evidence that the new scales could be at least as effective as the established ones, including scales comprising as few as 10 to 15 individual quality items.

- This work is exploratory in nature. The results will need to be tested in future studies in order to confirm these findings.

Introduction

Overview

The Study of Early Education and Development (SEED) is a major longitudinal study of the impact of children's pre-school education and care, and other early experience, on their subsequent development and educational attainment. The study sample consists of 5,642 children born in England in 2010 to 2012. Full details of this study can be found at https://seed.natcen.ac.uk/.

As part of the SEED study, the quality of 1000 Early Childhood Education and Care (ECEC) settings was assessed: 402 settings that children in the SEED study attended at age 2, and 598 that children attended at age 3. This report focusses on the quality of the settings that SEED children attended at age 3 and the possible impact that differences in ECEC quality may have on children's cognitive and self-regulation development at age 5. In particular, the aim is to explore whether scales can be derived from the raw quality data that have better predictive power than the established quality scales used in SEED.

ECEC settings quality data

The childcare settings that children attended at age 3 were assessed using three well-established quality scales: the Early Childhood Environment Rating Scale – Revised[1] (ECERS-R), the Early Childhood Environment Rating Scale – Extended[2] (ECERS-E) and the Sustained Shared Thinking and Emotional Well-being scale[3] (SSTEW).

The Early Childhood Environment Rating Scale - Revised (ECERS-R) is an overall measure of the quality of childcare settings for the over-threes. Settings were assessed across five domains:

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

The individual quality items that were assessed in each domain are shown in Table 1.

The Extension to the Early Childhood Environment Rating Scale (ECERS-E) was designed to focus on the educational aspects of experience for the over-threes. Settings for the over-threes were assessed across 3 domains:

I. Literacy
II. Mathematics
III. Diversity

[1] Harms, Cryer & Clifford, 2005.

[2] Sylva, Siraj-Blatchford & Taggart, 2011.

[3] Siraj, Kingston & Melhuish, 2015.

The individual quality items that were assessed are shown in Table 2.

The SSTEW scale focuses on the quality of interactions between staff and children. Settings were assessed 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

The quality items assessed are shown in Table 3.

Table 1: Breakdown of the ECERS-R scale into domains and individual items.

Personal Care Routines
Greeting and departing
Meals/snacks
Nap and rest
Toilet/diapering
Health practices
Safety practices
Language Reasoning
Books and pictures
Encouraging children to communicate
Using language to develop reasoning skills
Informal use of language
Activities
Fine motor
Art
Music/movement
Blocks
Sand/water
Dramatic play
Nature/science
Math/number
Use of TV, video, and/or computers
Promoting acceptance of diversity
Interaction
Supervision of gross motor activities
General supervision of children
Discipline
Staff-child interactions
Interactions amongst children
Programme Structure
Schedule
Free play
Group time
Provisions for children with disabilities

Table 2: Breakdown of the ECERS-E scale into domains and individual items.

Literacy,
Environment print: letters and words
Book and literacy areas
Adult reading with children
Sounds in words
Emergent writing/mark making
Talking and listening
Mathematics
Counting and the application of counting
Reading and writing simple numbers
Mathematical activities: shape and space
Mathematical activities: sorting, matching and comparing
Diversity
Planning for individual learning needs
Gender equality and awareness
Race equality and awareness

Table 3: Breakdown of the SSTEW scale into domains and individual items.

Building Trust, Confidence and Independence
Self-regulation and social development
Encouraging choices and independent play
Planning for small group and individual interactions/adult deployment
Supporting and Extending Language and Communication
Encouraging children to talk with others
Staff actively listen to children and encourage children to listen
Staff support children's language use
Sensitive responsiveness
Supporting Emotional Well-being
Supporting socio-emotional well-being
Supporting Learning and Critical Thinking
Supporting curiosity and problem solving
Encouraging sustained, shared thinking during story telling
Encouraging sustained, shared thinking in investigation and exploration
Supporting concept development and higher order thinking
Assessing Learning and Language
Using assessment to support and extend learning and critical thinking
Assessing language development

Overall quality was defined as a weighted sum of the three quality scales derived using factor analysis; see Appendix A.

Developing new quality scales

Collecting the data for the ECERS-R, ECERS-E and SSTTEW scales involved assessing 56 individual quality items by research consultants who had been thoroughly trained in the quality assessment techniques. This research document addresses two related questions:

1. Do the ECERS-R, ECERS-E and SSTEW scales provide the best predictors of children's cognitive and self-regulation development that can be derived from the underlying quality data?

2. Could effective predictors of the effects of ECEC quality on children's development be derived from a smaller collection of individual quality items?

Method

Introduction

Two approaches were used to derive potential new quality scales from the available quality data.

1. Exploratory factor analysis of the item level quality data

Exploratory factor analysis is a statistical method which seeks to identify a small number of underlying latent variables which explain the variation in a collection of observed variables. In this instance, the aim is to identify groups of quality items which are closely related to each other and which reflect the underlying pattern of quality variation between settings. Potentially, quality scales derived from these underlying (latent) quality variables may be effective predictors of the outcome variables.

2. Identifying the quality items which best predict the child outcomes using regression analysis

The relationship between individual quality items and child outcomes was explored using linear regression models to find which quality items were the best predictors of child cognitive and self-regulation outcomes. Potentially, quality scales based on collections of these “best predictor” items may also prove effective.

The child sample consisted of the 1302 children who were part of the SEED study, and who had attended those ECEC settings for which quality data had been collected around the time that the children were aged 3. Of these 1302 children, there were 919 for whom measures of cognitive development (naming vocabulary and picture similarities subscales from the British Ability Scales; BAS[4]) were available at age 5, and 762 for whom there were self-regulation measures (from the Child Self-regulation and Behaviour Questionnaire; CSBQ[5]) available at age 5.

Quality scales derived from factor analysis

Exploratory factor analysis of the item level quality data was carried out. There were three items which were not applicable to all of the settings:[6]

1. ECERS-R, Personal Care Routines, Nap and rest
2. ECERS-R, Activities, Use of TV, video, and/or computers
3. ECERS-R, Programme Structure, Provisions for children with disabilities

These items were available for fewer than 80% of the settings and were omitted from the factor analysis.

[4] See Elliott, Smith & McCullough, 2011

[5] See Howard & Melhuish, 2017

[6] E.g. provisions for naps were not applicable where settings took children for half-day sessions only. Use of TV / Video / Computers was not applicable to settings which did not have these facilities.

The exploratory factor analysis supported adopting a two factor model. Further details are given in Appendix B. For each of the two factors, the items that had a factor loading of greater than 0.5 were selected and the mean of these items was adopted as a new quality scale.

Quality scales derived from regression analysis

It was decided on theoretical grounds to focus on the cognitive and self-regulation outcomes at the start of school as previous research indicated that these aspects of development have generally been found to be amongst the most predictive of longer-term child outcomes (Bleses, Makransky, Dale, Højen, & Ari, B., 2016; Robson, Allen, & Howard, 2020).

Cognitive outcomes

Children's cognitive development was assessed directly in the first term of school year one using two British Ability Scales (BAS) measures: BAS verbal ability ("naming vocabulary") and BAS non-verbal ability ("picture similarities").[7] The BAS scores were age adjusted.

Socio-emotional outcomes

Children's socio-emotional development was assessed using the Children's Social Behaviour Questionnaire (CSBQ).[8] As part of the SEED 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 a series of socio-emotional problems and socio-emotional strengths scales.

The following cognitive and self-regulation outcomes were analysed:

1. BAS verbal ability.
2. BAS non-verbal ability.
3. Teacher assessed CSBQ behavioural self-regulation.
4. Teacher assessed CSBQ cognitive self-regulation.
5. Teacher assessed CSBQ emotional self-regulation.

Each outcome variable was regressed on each individual quality item. The quality items that were missing for more than 20% of settings were omitted (see previous section). Models controlled for nine home environment variables:

1. Home Learning Environment (HLE) index (learning activities in home: e.g. parents read with child, take child to library etc.)
2. Household Disorder (CHAOS scale: e.g. house is noisy, house is disorganised).

[7] Elliot 2011.

[8] Howard and Melhuish, 2017.

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. MORS Warmth (closeness in the parent/child relationship: e.g. relationship is affectionate, parent and child do things together).
6. MORS Invasiveness (conflict in the parent/child relationship: e.g. parent finds child annoying).
7. PSD Authoritative parenting, characterized by high demands / high responsiveness.
8. PSD Authoritarian parenting, characterized by high demands / low responsiveness.
9. PSD Permissive parenting, characterized by low demands / high responsiveness.

Models also controlled for 15 demographic variables:

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).
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. Father's highest academic qualification.
15. Highest parental socio-economic status.

Models also controlled for mean weekly Early Childhood Education and Care (ECEC) usage between age 2 and the start of school, in three categories:

1. Formal group ECEC use in nursery classes, nursery schools and playgroups.
2. Formal individual ECEC use with childminders.
3. Informal individual ECEC use with friends, relatives and neighbours.

Models were fitted to complete cases data for these preliminary analyses.

The quality items that best predicted the outcome variables were identified. This was done in such a way as to give equal weight to the cognitive and socio-emotional (self-regulation) outcomes. New quality scales were defined as the mean of the N quality items which were the best predictors of the outcomes, where N = 10, 15, 20, 25, 30 and 35. As far as we are aware, this outcome based approach to deriving quality scales has not been used before. Further details of the method used are given in Appendix C.

Assessing the new quality scales

Models of the following five outcome variables were fitted in terms of the new quality scales derived via factor analysis and regression analysis, as described in the previous two sections. The outcome variables used in regressions were:

1. BAS verbal ability.
2. BAS non-verbal ability.
3. CSBQ behavioural self-regulation.
4. CSBQ cognitive self-regulation.
5. CSBQ emotional self-regulation.

Models controlled for the home environment variables, demographic variables and ECEC use variables as listed above. To take account of the clustering in the SEED data, mixed-effects regression models were fitted, with random effects for government region, for stratum within government region and for primary sampling unit within stratum.

Models were fitted to multiply imputed data for these analyses involving the potential new quality scales. Further details of the multiple imputation process are given in Appendix D.

The sample size was 919 (BAS outcomes) and 762 (CSBQ outcomes).

The results for the new quality scales were compared with those from the established quality scales described in the Introduction:

1. ECERS-R
2. ECERS-E
3. SSTEW
4. Overall quality measure derived from ECERS-R, ECERS-E and SSTEW[9]

[9] See Appendix A.

Results

The new quality scales

The items in the new quality scales derived from regression analysis are given in Table 4.

The items in the new quality scales derived using factor analysis are shown in Table 5.

The first factor focusses on items related to interactions between staff and children and between children. It may be broadly characterised as a Communication Factor.

The second factor focusses on specific activities, both play-based and more specifically educational. It may be broadly characterised as an Activities Factor.

Table 4: Items in new quality scales derived using regression analysis

Quality item	No. of items					
	10	15	20	25	30	35
ECERS-R, Personal Care Routines, Greeting and departing					X	X
ECERS-R, Personal Care Routines, Meals/snacks	X	X	X	X	X	X
ECERS-R, Personal Care Routines, Toilet/diapering	X	X	X	X	X	X
ECERS-R, Personal Care Routines, Health practices			X	X	X	X
ECERS-R, Personal Care Routines, Safety practices		X	X	X	X	X
ECERS-R, Language Reasoning, Books and pictures				X	X	X
ECERS-R, Language Reasoning, Encouraging children to communicate		X	X	X	X	X
ECERS-R, Language Reasoning, Using language to develop reasoning skills				X	X	X
ECERS-R, Language Reasoning, Informal use of language						
ECERS-R, Activities, Fine motor	X	X	X	X	X	X
ECERS-R, Activities, Art		X	X	X	X	X
ECERS-R, Activities, Music/movement		X	X	X	X	X
ECERS-R, Activities, Blocks	X	X	X	X	X	X
ECERS-R, Activities, Sand/water						
ECERS-R, Activities, Dramatic play			X	X	X	X
ECERS-R, Activities, Nature/science						
ECERS-R, Activities, Math/number	X	X	X	X	X	X
ECERS-R, Activities, Promoting acceptance of diversity						
ECERS-R, Interaction, Supervision of gross motor activities	X	X	X	X	X	X
ECERS-R, Interaction, General supervision of children	X	X	X	X	X	X
ECERS-R, Interaction, Discipline						X
ECERS-R, Interaction, Staff-child interactions				X	X	X
ECERS-R, Interaction, Interactions amongst children				X	X	X
ECERS-R, Programme Structure, Schedule	X	X	X	X	X	X
ECERS-R, Programme Structure, Free play			X	X	X	X
ECERS-R, Programme Structure, Group time						
ECERS-E, Literacy, Environment print: letters and words	X	X	X	X	X	X

Quality item	No. of items					
	10	15	20	25	30	35
ECERS-E, Literacy, Book and literacy areas	X	X	X	X	X	X
ECERS-E, Literacy, Adult reading with children						
ECERS-E, Literacy, Sounds in words		X	X	X	X	X
ECERS-E, Literacy, Emergent writing/mark making						
ECERS-E, Literacy, Talking and listening						
ECERS-E, Mathematics, Counting and the application of counting			X	X	X	X
ECERS-E, Mathematics, Reading and writing simple numbers				X	X	X
ECERS-E, Mathematics, Mathematical activities: shape and space					X	X
ECERS-E, Mathematics, Mathematical activities: sorting, matching and comparing					X	X
ECERS-E, Diversity, Planning for individual learning needs						
ECERS-E, Diversity, Gender equality and awareness			X	X	X	X
ECERS-E, Diversity, Race equality and awareness						X
SSTEW age 3, Building Trust, Confidence and Independence, Self-regulation and social development						X
SSTEW age 3, Building Trust, Confidence and Independence, Encouraging choices and independent play						
SSTEW age 3, Building Trust, Confidence and Independence, Planning for small group and individual interactions/adult deployment						X
SSTEW age 3, Supporting and Extending Language and Communication, Encouraging children to talk with others						
SSTEW age 3, Supporting and Extending Language and Communication, Staff actively listen to children and encourage children to listen						
SSTEW age 3, Supporting and Extending Language and Communication, Staff support children's language use						
SSTEW age 3, Supporting and Extending Language and Communication, Sensitive responsiveness					X	X
SSTEW age 3, Supporting Emotional Well-being, Supporting socio-emotional well-being						
SSTEW age 3, Supporting Learning and Critical Thinking, Supporting curiosity and problem solving						

Quality item	No. of items					
	10	15	20	25	30	35
SSTEW age 3, Supporting Learning and Critical Thinking, Encouraging sustained, shared thinking during story telling					X	X
SSTEW age 3, Supporting Learning and Critical Thinking, Encouraging sustained, shared thinking in investigation and exploration						
SSTEW age 3, Supporting Learning and Critical Thinking, Supporting concept development and higher order thinking						
SSTEW age 3, Assessing Learning and Language, Using assessment to support and extend learning and critical thinking						X
SSTEW age 3, Assessing Learning and Language, Assessing language development						

Table 5: Items in quality scales derived from factor analysis

Quality items	Factor 1 “Communication”	Factor 2 “Activities”
ERS-R, Personal Care Routines, Greeting and departing		
ECERS-R, Personal Care Routines, Meals/snacks		
ECERS-R, Personal Care Routines, Toilet/diapering		
ECERS-R, Personal Care Routines, Health practices		
ECERS-R, Personal Care Routines, Safety practices	X	
ECERS-R, Language Reasoning, Books and pictures		X
ECERS-R, Language Reasoning, Encouraging children to communicate	X	
ECERS-R, Language Reasoning, Using language to develop reasoning skills		X
ECERS-R, Language Reasoning, Informal use of language	X	
ECERS-R, Activities, Fine motor	X	
ECERS-R, Activities, Art		
ECERS-R, Activities, Music/movement		X
ECERS-R, Activities, Blocks		
ECERS-R, Activities, Sand/water		X
ECERS-R, Activities, Dramatic play		X
ECERS-R, Activities, Nature/science		X
ECERS-R, Activities, Math/number		X
ECERS-R, Activities, Promoting acceptance of diversity		X
ECERS-R, Interaction, Supervision of gross motor activities	X	
ECERS-R, Interaction, General supervision of children	X	
ECERS-R, Interaction, Discipline	X	
ECERS-R, Interaction, Staff-child interactions	X	
ECERS-R, Interaction, Interactions amongst children	X	
ECERS-R, Programme Structure, Schedule	X	
ECERS-R, Programme Structure, Free play	X	
ECERS-R, Programme Structure, Group time	X	

Quality items	Factor 1 “Communication”	Factor 2 “Activities”
ECERS-E, Literacy, Environment print: letters and words		X
ECERS-E, Literacy, Book and literacy areas		X
ECERS-E, Literacy, Adult reading with children		X
ECERS-E, Literacy, Sounds in words		X
ECERS-E, Literacy, Emergent writing/mark making		X
ECERS-E, Literacy, Talking and listening	X	
ECERS-E, Mathematics, Counting and the application of counting		X
ECERS-E, Mathematics, Reading and writing simple numbers		X
ECERS-E, Mathematics, Mathematical activities: shape and space		X
ECERS-E, Mathematics, Mathematical activities: sorting, matching and comparing		X
ECERS-E, Diversity, Planning for individual learning needs		X
ECERS-E, Diversity, Gender equality and awareness		X
ECERS-E, Diversity, Race equality and awareness		X
SSTEW age 3, Building Trust, Confidence and Independence, Self-regulation and social development	X	
SSTEW age 3, Building Trust, Confidence and Independence, Encouraging choices and independent play	X	
SSTEW age 3, Building Trust, Confidence and Independence, Planning for small group and individual interactions/adult deployment	X	
SSTEW age 3, Supporting and Extending Language and Communication, Encouraging children to talk with others	X	
SSTEW age 3, Supporting and Extending Language and Communication, Staff actively listen to children and encourage children to listen	X	
SSTEW age 3, Supporting and Extending Language and Communication, Staff support children’s language use	X	
SSTEW age 3, Supporting and Extending Language and Communication, Sensitive responsiveness	X	

Quality items	Factor 1 “Communication”	Factor 2 “Activities”
SSTEW age 3, Supporting Emotional Well-being, Supporting socio-emotional well-being	X	
SSTEW age 3, Supporting Learning and Critical Thinking, Supporting curiosity and problem solving	X	X
SSTEW age 3, Supporting Learning and Critical Thinking, Encouraging sustained, shared thinking during story telling		X
SSTEW age 3, Supporting Learning and Critical Thinking, Encouraging sustained, shared thinking in investigation and exploration		X
SSTEW age 3, Supporting Learning and Critical Thinking, Supporting concept development and higher order thinking		X
SSTEW age 3, Assessing Learning and Language, Using assessment to support and extend learning and critical thinking	X	X
SSTEW age 3, Assessing Learning and Language, Assessing language development	X	X

Assessing the new quality scales

The results of the regression models of the outcome variables in terms of the new quality scales are shown in Table 6. The results of the regression models of the outcome variables in terms of the established quality scales are shown in Table 7.

Table 6: Results of models of outcome variables in terms of new quality scales.

	Quality scales derived from regression models of BAS and Self-regulation outcomes						**Quality scales derived from factor analysis**	
							1st Factor: Communication	**2nd Factor: Activities**
Number of items in scale:	10	15	20	25	30	35	24	26
BAS Verbal ability age 5	+0.127*	+0.104	+0.097	+0.074	+0.064	+0.068	+0.067	+0.026
BAS Non-verbal ability age 5	+0.101	+0.111	+0.099	+0.093	+0.096	+0.084	+0.037	+0.066
CSBQ Behaviour self-regulation	+0.190*	+0.194*	+0.184*	+0.189*	+0.175*	+0.161*	+0.103	+0.120
CSBQ Cognitive self-regulation	+0.159*	+0.161*	+0.151*	+0.151*	+0.143(*)	+0.136(*)	+0.090	+0.123(*)
CSBQ Emotional self-regulation	+0.126	+0.138(*)	+0.131	+0.141(*)	+0.132(*)	+0.114	+0.055	+0.087

Results are given as standardized model coefficients.
Statistically significant coefficients are marked: (*) = $p < 0.1$, * = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$.
Sample size = 919 (BAS outcomes), = 762 (CSBQ outcomes)

Table 7: Results of models of outcome variables in terms of established quality scales

	ECERS-R	ECERS-E	SSTEW	Combined quality scale
Number of items in scale:	**29**	**13**	**14**	**56**
BAS Verbal ability age 5	+0.080	+0.000	+0.067	+0.049
BAS Non-verbal ability age 5	+0.058	+0.079	+0.031	+0.058
CSBQ Behaviour self-regulation	+0.161*	+0.123	+0.044	+0.109
CSBQ Cognitive self-regulation	+0.146*	+0.113	+0.051	+0.106
CSBQ Emotional self-regulation	+0.119	+0.077	-0.001	+0.065

Results are given as standardized model coefficients.
Statistically significant coefficients are marked: (*) = p < 0.1, * = p < 0.05, ** = p < 0.01, *** = p < 0.001.
Sample size = 919 (BAS outcomes), = 762 (CSBQ outcomes)

All the quality scales derived using regression analysis of the BAS and Self-regulation outcomes had some success in predicting the outcome variables (Table 6). The general pattern of results indicates that the scales using smaller numbers of quality items predict the outcomes at least as well as those using larger numbers of items.

The scales derived using factor analysis were relatively unsuccessful (Table 6), with the only significant result being the association between the “Activities” factor and CSBQ Cognitive self-regulation.

The most successful of the established quality scales was ECERS-R (Table 7). There were significant associations between ECERS-R and both CSBQ Behavioural self-regulation and CSBQ Cognitive self-regulation.

The quality items that best predict the outcome variables

The scales derived using regression modelling which incorporate 10 or 15 quality items appear to be the most effective in predicting the outcome variables.

The ten quality items in the “10 item” scale are:

1. ECERS-R, Personal Care Routines, Meals/snacks
2. ECERS-R, Personal Care Routines, Toilet/diapering
3. ECERS-R, Activities, Fine motor
4. ECERS-R, Activities, Blocks
5. ECERS-R, Activities, Math/number
6. ECERS-R, Interaction, Supervision of gross motor activities
7. ECERS-R, Interaction, General supervision of children
8. ECERS-R, Programme Structure, Schedule
9. ECERS-E, Literacy, Environment print: letters and words
10. ECERS-E, Literacy, Book and literacy areas

The five additional items in the “15 item” scale are:

11. ECERS-R, Personal Care Routines, Safety practices
12. ECERS-R, Language Reasoning, Encouraging children to communicate
13. ECERS-R, Activities, Art
14. ECERS-R, Activities, Music/movement
15. ECERS-E, Literacy, Sounds in words

These items appear to focus on three related areas:

1. Staff care for children’s needs.
2. Child activities.
3. Staff supervision of child activities.

It is notable that items from the SSTEW scale do not appear among these “best predictor” items.

Discussion

Comparison of the results for the new quality scales in Table 6 with those for the established quality scales in Table 7 suggest that the new quality scales may be at least as effective as the established ones in predicting children's cognitive and self-regulation outcomes. Generally, the scales derived from factor analysis were less successful in predicting child outcomes that those derived from regression analysis. This may reflect the fact that factor analysis is only using associations amongst the quality items only, without reference to child outcomes, in the derivation of the scales, whereas the regression analysis uses associations between quality items and child outcomes in the derivation of quality scales. Hence, regression analysis gives more weight to those items with demonstrated associations with child outcomes. It is also possible that scales with as few as 10 quality items may be as effective, or more so, as scales with a much larger number of items: the ECERS-R scale, which is the most effective of the established scales in this analysis, has 29 individual quality items.

This work must be regarded as exploratory. One notable limitation is that the data used to select the items for the new quality scales was also used to assess the effectiveness of the scales. This may cause the effectiveness of the new scales to be somewhat overestimated, and this caveat may apply particularly to the scales with smaller numbers of quality items. To confirm the effectiveness of these new scales will require them to be tested with additional data that is independent of that used in the derivation of the scales.

However, this work confirms that the quality of the ECEC that children attend at age 3 does have a significant association with children's later cognitive and self-regulation development, even once home environment and demographic factors, as well as the amount of ECEC used, have been taken into account.

It is possible that these associations are partly due to residual confounding, for example, between aspects of the home environment and parents' choice of high quality child care. However, it is likely that these associations are at least partly causal, with attending high quality ECEC having a significant positive impact on children's development to age 5.

Conclusion

In this report, we addressed the following questions:

1. Do the ECERS-R, ECERS-E and SSTEW scales provide the best predictors of children's cognitive and self-regulation development that can be derived from the underlying quality data?

2. Could effective predictors of the effects of ECEC quality on children's development be derived from a smaller collection of individual quality items?

The analyses examined here suggest that it may be possible to derive scales which are better predictors of children's developmental outcomes than the existing ECERS-R, ECERS-E and SSTEW scales, and that it may also be possible for these scales to use fewer quality items than used in the existing scales.

The advantages of scales using smaller number of items, if such scales can be confirmed to be effective through further research, are considerable. Quality assessments using fewer items would be quicker to conduct, which would produce significant cost savings. Reduced assessment time would also reduce the burden on the children and staff in childcare settings, which might make the managers of childcare settings more willing for their establishments to participate in future research.

These conclusions must remain tentative, however, until these newly proposed scales have been thoroughly assessed in future studies.

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Appendix A: Deriving an overall quality measure from the ECERS-R, ECERS-E and SSTEW scales

For children with Wave 2 quality data, a common factor was extracted from the ECERS-R, ECERS-E and SSTEW scales.

The correlations between the Wave 2 quality measures are shown in Table 8.

Table 8: Correlations between Wave 2 quality measures.

	ECERS-R	ECERS-E	SSTEW
ECERS-R	1.000	0.804	0.883
ECERS-E	0.804	1.000	0.832
SSTEW	0.883	0.832	1.000

The loadings of the Wave 2 quality measures onto a single common factor are shown in Table 9.

Table 9: Factor loadings for factor analysis of Wave 2 quality data.

Variable	Loading
ECERS-R	0.924
ECERS-E	0.870
SSTEW	0.956

Using this factor analysis, overall quality was defined as:

$$Overall\ quality = 0.924 \times ECERS\text{–}R + 0.870 \times ECERS\text{–}E + 0.956 \times SSTEW$$

Appendix B: Factor analysis of item level quality data

Exploratory factor analysis of the quality items from the age 3 setting was carried out with from 1 to 8 factors. Analysis was applied to complete cases. Items that were missing for more than 20% of settings were omitted. Complete quality data was available for 570 of the 598 settings (95.3%).

The proportion of variance explained by each factor and the total proportion of variance explained by all factors is shown in Table 10.

Table 10: Proportion of variance explained by factor analysis of age 3 settings item level quality data. Analyses with 1 to 8 factors.

No. of	Fac1	Fac2	Fac3	Fac4	Fac5	Fac6	Fac7	Fac8	Cumulative
1	0.487								0.487
2	0.282	0.262							0.544
3	0.241	0.239	0.089						0.568
4	0.232	0.191	0.088	0.075					0.585
5	0.236	0.185	0.081	0.057	0.041				0.599
6	0.240	0.190	0.069	0.054	0.046	0.016			0.615
7	0.238	0.160	0.064	0.058	0.052	0.035	0.020		0.627
8	0.232	0.158	0.064	0.056	0.052	0.035	0.024	0.017	0.638

The two factor model explains 54.4% of the total variance, with additional factors beyond 2 explaining very little additional variance. For this reason, the two factor model was adopted to generate new quality scales.

Appendix C: Regression models of item level quality data

Each of the outcome variables:

1. BAS verbal ability.
2. BAS non-verbal ability.
3. Teacher assessed CSBQ behavioural self-regulation.
4. Teacher assessed CSBQ cognitive self-regulation.
5. Teacher assessed CSBQ emotional self-regulation.

was regressed on each of the quality items. The regression models controlled for home environment, demographic and ECEC use covariates. Standardized model coefficients were calculated. These show the strength of the relationship between each quality item and each outcome variable. The quality items with the highest standardized model coefficients for a given outcome were the best predictors of that outcome. In order to find the quality items which were the best available predictors of all the outcome variables taken together, for each quality item a weighted mean of the model coefficients for all the outcomes was calculated. This was done so as to give equal weight to the BAS cognitive outcomes and the CSBQ self-regulation outcomes.[10]

Six sets of quality items were identified:

1. The 10 quality items with the highest weighted mean model coefficients.
2. The 15 quality items with the highest weighted mean model coefficients.
3. The 20 quality items with the highest weighted mean model coefficients.
4. The 25 quality items with the highest weighted mean model coefficients.
5. The 30 quality items with the highest weighted mean model coefficients.
6. The 35 quality items with the highest weighted mean model coefficients.

Each of these sets of quality items was used to define a new quality scale, the quality scale being the mean of the quality items in the set.

[10] Specifically, the two cognitive outcomes were given weight 0.5 and the three socio-emotional outcomes were given weight 0.333.

Appendix D: Multiple imputation

Children in the SEED study have incomplete data for two reasons. Firstly, some children in the original sample were lost to follow up and do not have data from later waves of the study; see Table 11.

Table 11: Number of children with data from each wave of the SEED study.

	Number of children	Percentage of original sample
Wave 1	5642	100.0%
Wave 2	4583	81.2%
Wave 3	3930	69.7%
Wave 4	3218	57.0%

Secondly, children in the study may have missing data on a particular variable (so called “item missing data”). Both types of missingness can be corrected for using multiple imputation. This approach avoids the potential bias which may result from analysing only those children with complete data.

The analyses in this report use multiple imputation to control for missing data in the covariates only, and not for outcome or quality measures. The imputation model included all outcome variables, home environment variables, demographic covariates and ECEC usage data. Ten imputed data sets were generated. All statistical models were fitted to each of the imputed data sets and the results were combined.

Note that outcome variables and quality data were not imputed.

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