

Capturing quality in early childhood through environmental rating scales

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Abstract

This paper explores the relationship between ‘process’ quality characteristics in English pre-school centres and the developmental progress made by children between the ages of 3–5 years. A nationally representative sample of 141 English pre-schools participated in this study with longitudinal pre- and post-test measures taken from 2857 children at ages 3 and 5. Centre quality was assessed using two observational instruments, the revised version of the Early Childhood Environment Rating Scale [Harms, T., Clifford, M., & Cryer, D. (1998). *Early Childhood Environment Rating Scale, Revised Edition (ECERS-R)*. Vermont: Teachers College Press] and a new English curriculum extension to it [Sylva, K., Siraj-Blatchford, I., & Taggart, B. (2003). *Assessing quality in the early years: Early Childhood Environment Rating Scale-Extension (ECERS-E): Four curricular subscales*. Stoke-on Trent: Trentham Books]. This new instrument was developed specifically for assessing the curricular aspects of quality, including pedagogy, in pre-school centres subject to the English national Early Childhood Curriculum. Multi-level statistical analyses revealed that quality of centre-based provision as measured by the ECERS-E was a significant predictor of children’s development at entry to school after controlling for pre-test, child characteristics and family background. This study demonstrated that the ECERS-E is a reliable instrument for assessing the educational aspects of process quality and is a significant predictor of children’s cognitive/linguistic progress. In contrast, the ECERS-R had a stronger relationship with children’s socio-behavioural progress in the pre-school period. © 2006 Elsevier Inc. All rights reserved.

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1. Introduction

Since 1997, early years’ education policy in England focused on expanding its services to support young children and their families. The main aim has been to provide good quality early education, especially for disadvantaged children, so they can make a good start to school at the age of 5 (Sylva & Pugh, 2005). These initiatives build upon a considerable body of research, which has shown that the quality of early education is a significant factor in enhancing children’s development. It is an established view among child care researchers that higher quality of care relates to

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better developmental outcomes, and lower quality to lower developmental outcomes (Besky, 2001; Peisner-Feinberg et al., 2000; Vandell & Wolfe, 2000) and that this is particularly true for children from disadvantaged backgrounds “who would otherwise experience impoverished and relatively unstimulating home environments” (Lamb, 1998, p. 14). Some go as far as arguing that quality of care *only* affects disadvantaged children (Scarr, 1997).

The most compelling evidence for the potential of pre-school education and care comes from intervention programmes, often carried out and evaluated as randomised control trials. For example, large gains in cognitive and academic development were found by the evaluation of the Carolina Abecedarian Project (last follow-up at age 21 years; Campbell, Pungello, Miller-Johnson, Burchinal, & Ramey, 2001), and the High/Scope pre-school educational intervention (Schweinhart, 2002). In addition to increased educational attainment, the long-term benefits of the High/Scope programme also included decreased criminality, increased income and economic status. A well-known cost-benefit analysis conducted on outcomes at age 27 concluded that for every public dollar spent on the intervention, the public benefited from a net return of 7.16 dollars. This cost-effectiveness of intervention programmes is believed to come about because of their high-quality content and targeted delivery to disadvantaged children (Barnett, 2000).

Unfortunately the findings from non-experimental studies have been somewhat more mixed. This has in part been attributed to the failings of previous research to simultaneously take account of quantity, quality and childcare type (Vandell, Dadisman, & Gallagher, 2000). Generally, where quality has been considered, it has emerged as a weak but significant predictor of children’s developmental progress, particularly on cognitive outcomes (Clarke-Stewart, Gruber, & Fitzgerald, 1994; Kwan, Sylva, & Reeves, 1998; McCartney, 1984; McCartney & Scarr, 1984). In a recent comprehensive literature review, Vandell (2004) concluded that findings are more conclusive when child care quality and child outcomes are related concurrently (e.g., Loeb, Fuller, Kagan, & Carrol, 2004; Love et al., 2003), rather than longitudinally (see Committee on Family and Work Policies, 2003). In longitudinal studies, relations are less evident when findings rely on a single assessment of quality (e.g., Deater-Deckhart, Pinkerton, & Scarr, 1996) than when relying on multiple assessments of quality (Burchinal et al., 2000). Two notable recent large-scale longitudinal studies which have assessed quantity, quality and care type simultaneously have shown convincing evidence of the importance of child care quality for children’s cognitive development (The Cost Quality and Outcomes study; Peisner-Feinberg & Burchinal, 1997; the NICHD Early Child Care Research Network Study; NICHD, 2000, 2002).

The Cost Quality and Outcomes Study followed a sample of over 800 preschoolers for 5 years up to the second grade of elementary school. High-quality pre-school provisions and close relationship to the teachers predicted better subsequent language and maths skills, independent of children’s school experiences (Peisner-Feinberg et al., 2000). The NICHD Early Child Care Research Network study assessed the quality of childcare experienced by over 1000 children at 6, 15, 24, 36, and 54 months. After controlling for a wide range of background factors, early childcare quality emerged as a positive predictor of children’s subsequent general cognitive abilities, their expressive and receptive language development and their school readiness (NICHD, 2005). Moreover, the consortium has new data revealing that the cognitive gains persist throughout the first three grades of school, i.e., up to age 8 (NICHD Early Childcare Research Network, 2005).

Generally, research regarding associations between quality of pre-school care and children’s socio-emotional outcomes is less conclusive. However, both the Cost Quality and Outcomes Study and the NICHD provided evidence for longitudinal associations. The former found that, at second grade, children were more socially competent if had been in better quality care programmes when they were younger. The latter produced evidence that quality of care related to socio-emotional outcomes across different time points (between age 2 and 4 1/2): higher quality care predicted fewer problem behaviours, higher social competence, positive skilled peer interaction, and lower levels of impulsiveness (NICHD, 2005).

Until recently, the impact of British pre-school provision on children’s development has not been studied in a systematic way through a large-sample prospective study, despite the fact that early childhood education is now government policy in England intended to redress inequality and raising attainment (Inter-departmental Childcare Review, 2002; Sylva & Pugh, 2005).

The only large-scale study in the United Kingdom, the Child Health and Education study, followed 8400 children to the age of 10 years. It was found that those who attended pre-school centres showed higher educational and social outcomes compared to those who did not (Osborn & Milbank, 1987). However, caution must be exercised in interpreting their results, since the limited background information used as statistical control was collected post hoc (Sylva, 1994; Sylva & Wiltshire, 1993).

The Effective Provision of Pre-school Education (EPPE) is the first British large-scale prospective longitudinal study on the effects of pre-school provision, with more than 3000 children followed longitudinally. Using an ‘educational effectiveness’ design, EPPE set out to explore the effects of individual pre-school centres on children’s attainment and their social/behavioural development at entry to primary school at age 5 and any continuing effects to the age of 7 at the end of Key Stage 1 (Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004). The combination of multivariate quantitative analyses (multi-level modelling) along with qualitative techniques (in-depth case studies) has enabled EPPE researchers to identify the structural characteristics and dynamic processes of the most effective pre-schools. The use of multi-level models in statistical analyses allowed researchers to investigate the impact of the characteristics of pre-school provision as well as individual centre effects, after controlling for a large number of child and family characteristics (e.g., SES, education, family structure and size, birth weight, language, poverty).

Results revealed that English children who attended pre-school centres had larger vocabularies, increased linguistic skills and more numerical skill at entry to primary school. The age of pre-school entry was found to be an important factor in the EPPE study, with children starting pre-school earlier (before 3 years) showing better cognitive and linguistic outcomes than those who start later (Sylva et al., 2004). A major aim of the EPPE research was to investigate the contribution of centre quality to children’s developmental progress.

In the EPPE study, the quality of pre-school education and care has been measured in different ways, including data collection on two elements of quality: *structural elements*, including adult-child ratio, or teacher education and training; and *process elements*, including the nature of adult-child interactions, or the nature of activities and learning opportunities available to the children (Phillipsen, Burchinal, Cryer, & Howes, 1997). A main research issue facing investigations into process quality is the question of measurement. Some process quality measures focus strongly on specific aspects of the adult child interaction (e.g., Caregiver Interaction Scale, CIS; Arnett, 1989); other more global process quality measures focus on multiple processes (e.g., Early Childhood Environment Ratings Scale, ECERS-R; Harms, Clifford, & Cryer, 1998). Both these instruments have been widely used in research assessing childcare quality (Burchinal, Howes, & Kontos, 2002; De Kruif, McWilliam, Ridley, & Wakely, 2000; Gilliam, 2000; Jaeger & Funk, 2001; Phillipsen, Burchinal, Cryer, & Howes, 1997; Whitebook, Howes, & Phillips, 1989).

In order to assess pre-school quality, the EPPE project focused particularly on process elements. The main measurements employed were the observational rating scales ECERS-R (Harms et al., 1998) and a newly developed extension supplementing the ECERS-R, called the ECERS-E (Sylva, Siraj-Blatchford, & Taggart, 2003).

The ECERS-R consists of 43 items, which assess 7 aspects of centre-based care and education for children aged 2 1/2 to 5. These areas are measured by the following subscales: *Space and Furnishing* (e.g., indoor space, room arrangement for play, child-related display), *Personal Care Routines* (e.g., greeting/departing, meals/snacks), *Language-Reasoning* (e.g., books/pictures, encouraging children to communicate), *Activities* (e.g., dramatic play, nature/science), *Interaction* (e.g., supervision of children, staff-child interactions, interactions among children), *Program Structure* (e.g., free play, group time), and *Parents and Staff* (e.g., provisions for parents, staff interaction). Detailed descriptions are provided for each item; item scores are 1 (inadequate) through 7 (excellent). The ratings are based on a minimum of a 2-h observation in one classroom or with one group and a limited number of interview questions.

In England, the ECERS has been used in early childhood centres (e.g., Moss & Melhuish, 1991). However, the original ECERS (Harms & Clifford, 1980) was broadly based on the notions of Developmentally Appropriate Practice (DAP; Bredekamp, 1987; Bredekamp & Copple, 1977) and adopted a “light touch” on assessing early education related to children’s ‘academic’ development, e.g., their literacy, numeracy, or scientific thinking (Sylva et al., 2003, p. 7). Yet, the new English curriculum (DfEE/QCA, 2000) is based on the view that precursors to academic skills should be encouraged in pre-school education through play-based activities, which are often adult-led (Whitehurst & Lonigan, 1998). The curriculum includes Physical Development, Creative Development, Personal and Social Education, along with Language, Numeracy and Understanding of the World. Because of this new curriculum, the ECERS-R was felt to be insufficiently ‘cognitive’ in its assessment of play-based learning environments, and not sufficiently sensitive to important pedagogical processes conducive to children’s intellectual and social progress in England. Furthermore, the ECERS-R was thought to be insufficient in assessing pre-school practice aimed at cultural and intellectual diversity.

As a result the ECERS-Extension (ECERS-E; Sylva et al., 2003) was developed by the EPPE team to supplement the ECERS-R. It has four separate subscales (consisting of 18 items). Following the format of the ECERS-R, detailed descriptions are provided for each item; items are scored 1 (inadequate) through 7 (excellent). Appendix A presents an example item from the ECERS-E. The ECERS-E authors recommend basing the ratings on observations of a full session (1/2 day to 1 day) in each classroom or group and using the ECERS-E in conjunction with the ECERS-R.

The four subscales of the ECERS-E are: *Literacy* (e.g., adult reading with child, sounds in words), *Mathematics* (e.g., counting, shape/space), *Science/Environment* (e.g., science resources, food preparation), and *Diversity* (e.g., planning for individual needs, race and gender equality). The subscales are derived from Curriculum Guidance for the Foundation Stage (DfEE/QCA, 2000), a document specifying national ‘learning goals’ (statutory curriculum objectives) and some ‘stepping stones’ (developmental steps which children take before reaching each goal) for children aged 3 to 5+. The ECERS-E aimed to reflect the changing notions of Developmentally Appropriate Practice to include ‘emerging’ literacy, numeracy and scientific understanding. Thus, the ECERS-E is specifically tailored to tap the dimensions of quality as defined by the new curriculum in England and by notions of emergent academic skills.

For example, consider the ECERS-E Literacy subscale item ‘Sounds in Words’ (item 4). In it, high scores are given to centres where staff explicitly highlights rhyme, alliteration and syllabification in everyday activities such as nursery rhymes and clapping games. This relates closely to the curricular learning goal ‘Linking Sounds and Letters’ where caregivers are asked to teach children rhyming songs and to encourage children to imitate sounds. Another example of the link between the national curriculum and the ECERS-E is the ECERS-E Mathematics subscale item ‘Shape and Space’ (item 3). Here, high scores are given to centres where many activities and materials are available which encourage children to generalise shape across a variety of contexts (e.g., art activities, construction activities, role play). This item is closely linked to the curricular learning goal ‘Shape, Space and Measures’ where caregivers are asked to provide a range of materials for construction or to describe the properties of shapes using their mathematical names. The ECERS-E Science and Environment subscale item ‘Living processes and the world around us’ (item 4) is scored as high in centres where children are encouraged to ask questions and to record results. This is closely related to the curricular learning goal ‘Exploration and Investigation’ where caregivers are asked to facilitate children’s talk about findings or their speculations on reasons. To give a final example, the ECERS-E Diversity item ‘Race Equality’ (item 3) is given high scores if staff draw children’s attention specifically to books, pictures or dolls that show black and ethnic minority people in non-stereotypical roles and familiar situations. This is related to the curricular learning goals for cultures and beliefs where caregivers are asked to look at pictures and videos of the cultures of the children within the centre and other cultures outside the children’s experience (see DfEE/QCA, 2000).

The goal of this paper is to introduce the newly developed English scale by exploring its relationship to well established measures of quality and investigating its ability to predict specific child outcomes during the pre-school period in England.

2. Method

2.1. Overview

The Effective Provision of Pre-school Education (EPPE) is a British large-scale prospective longitudinal study on the effects of pre-school provision, with more than 3000 children from 141 pre-school centres who were followed from age 3 to age 7 (Sylva et al., 2004). Assessments of children’s cognitive abilities, and their social/behavioural competences were collected at several time-points: at age 3 (or slightly later if the child entered pre-school after age 3), and at age 5 (at entry to primary school). This paper reports the findings related to children’s developmental outcomes at age 5; follow up at ages 7 and 11 will be reported later. Main data on the quality of pre-school were obtained through two observational ratings while the child was 3–4 years (Sylva et al., 1999).

2.2. Sample of centres

Five regions in England were strategically sampled to include areas with social and ethnic diversity in urban, suburban and rural areas. In each region, about 25 centres were randomly selected from the most common types of early childhood provision (playgroups or parent cooperatives, nursery classes in state primary schools, free-standing nursery education schools, private day nurseries, social services day care centres and state nursery schools combining care and education). In total, 141 randomly selected centres participated in the EPPE study; data were collected between May 1998 and June 1999. Table 1 provides more detailed information about the types of centres.

More than 3000 children participated in the EPPE research; 2857 were randomly selected in their pre-schools, 310 children had no pre-school experience and established the control group. For the purposes of the present paper, only the 2857 children attending pre-school centres provided information for study of quality. Results on the ‘home’ group

Table 1
 Characteristics of the 141 day care centres of the EPPE study

Type of provision	No. of centres	No. of children	Adult: Child Ratio	Staff qualifications	Hours of care
Local education authority nursery classes in primary schools	25	588	1:13	Each classroom led by a qualified teacher (4-year graduate) supported by a qualified staff member with 2-year childcare qualifications	Half-day sessions, 5 days/week, term time only
Voluntary playgroups, parent governed	34	609	1:8	Variable training: none to graduate level	Half-day sessions, 5 or less days/week, term time only
Private day nurseries	31	516	1:8	Variable training: most with 2-year childcare qualifications	Full-day care
Local authority/state day care centres	24	433	1:8	Mostly 2-year childcare training, occasional 4-year graduate qualified teacher per centre	Full-day care
Local education authority nursery schools	20	519	1:10	Head teacher: 4-year graduate qualified teachers, some staff with 2-year childcare qualifications	5–10 sessions/week, term time only
Local education authority nursery schools combining education with care and family support	7	192	1:10	Head teacher: 4-year graduate qualified teachers, some staff with 2-year childcare qualifications	Full-day care with education

are not included here as this paper focuses on pre-school quality. The sample of children was broadly representative of the U.K. census at the time, although socio-economic disadvantage was slightly over-sampled to study ethnic minority groups (see Sammons et al., 1999). The sample included 47.9% girls and 52.1% boys from a wide range of ethnic groups (74.5% White UK heritage, 6.5% mixed heritage, 4.1% White European heritage, 4.1% Black Caribbean heritage, 2.6% Pakistani heritage, 2.2% Black African heritage and 5.9% other heritage). 22.5% of children received free school meals, for 8.7% English was their second language and for 18.1% the mother had no formal qualification (Sammons et al., 2002, 2003). At the time of entry into the EPPE study (Sammons et al., 1999), the children ranged in their age from 35 to 52 months with a mean of 3 years and 4 months. The majority of children who attended pre-school, experienced a maximum of 20 h per week (71.5%) and only few (12.2%) experienced more than 30 h.

2.3. Procedures

To measure child care quality, two observational rating scales (ECERS-R and ECERS-E) were administered when the child was around 3 (and again, if the child changed a pre-school centre). The administration of the rating scales was carried out on the same day by one trained researcher who had familiarised herself with the centre. Certain items on the ECERS-R and ECERS-E were completed by interview and by consulting centre records.

Child assessments were administered at several time points: relevant for this paper are assessments at the beginning of pre-school (age 3) and at entry to the kindergarten/reception year at primary school (age 5). All cognitive assessments were administered to children on a one-to-one basis by a trained researcher; for socio-behavioural assessments, questionnaires were completed by a member of the centre's staff who was most familiar with the child.

2.4. Measures

2.4.1. Quality of pre-school environment

Two environmental rating scales were administered: (1) the Early Childhood Environment Rating Scale (ECERS-R; Harms et al., 1998); (2) the ECERS-Extension (ECERS-E; Sylva et al., 2003).

2.4.1.1. ECERS-R. The ECERS-R consists of 43 items across seven subscales (see Introduction) and has been shown to possess good psychometric properties and good predictive validity in significantly relating to children's developmental outcomes (De Kruijff et al., 2000; Gilliam, 2000; Jaeger & Funk, 2001; Peisner-Feinberg & Burchinal, 1997; Phillips,

McCartney, & Scarr, 1987). In terms of its structure, some research has identified two subscales (for the original ECERS as well as the revised version ECERS-R), one relating to items addressing the interaction between caregivers and children and one relating to items addressing the developmental appropriateness of activities and facilities (Scarr, Eisenberg, & Deater-Deckhart, 1994; Sylva et al., 1999). However, the subscales have been shown to be highly correlated; furthermore they differ when being used with different samples in different countries. As a result, and on the basis of their conceptual design, analyses are often carried out separately for each subscale and it has sometimes been argued that the ECERS-R would be better used to indicate *one* overall quality score (Essa & Burnham, 2001). For the current paper, analyses were carried out on the total scores as well as on the separate subscale scores; yet, it should be noted that the total score may be the most valid measure.

2.4.1.2. ECERS-E. The newly developed ECERS-Extension (ECERS-E; Sylva et al., 2003) consists of 15 items on four subscales: Literacy, Mathematics, Science and Environment, Diversity. In the same way as the ECERS-R, analyses were carried out in terms of the total score as well as in terms of the separate subscale scores. To validate the ECERS-E, the EPPE study related ECERS-E scores to scores on the ECERS-R and the Child Caregiver Interaction Scale (CIS; Arnett, 1989) (Sammons et al., 2002; Sylva et al., 2003). The CIS is an observational rating scale of adult-child interaction with 26 items across four subscales: Positive Relationship (e.g., ‘seems enthusiastic about the children’s activities and efforts’), Punitiveness (e.g. ‘seems unnecessarily harsh when scolding or prohibiting children’), Permissiveness (e.g., ‘expects the children to exercise self-control’), Detachment (e.g., ‘spends considerable time in activity not involving interventions with the children’). On each item the extent to which the statement is characteristic for the caregiver is rated from 1 (not at all) to 4 (very much).

Based on data from all 141 pre-school centres, a significant strong relationship was found between the ECERS-E and the ECERS-R total scores ($r = 0.78, p < .01$). Significant moderate relationships were found between the ECERS-E total and two CIS subscales: Positive Relationship ($r = 0.59, p < .01$) and Detachment ($r = -0.45, p < .01$). The other two subscales of the CIS (Punitiveness, Permissiveness) were also significantly related to the ECERS-E total in the expected direction, but these relations were less strong ($-0.18, -0.32, p < .05$) (Sammons et al., 2002).

The strong correlation between the ECERS-E and -R total scores demonstrates that the scales are picking up similar but not identical aspects of quality. The ECERS-R was designed to detect curricular quality and we believe it does—although in less detail than the English instrument. The lower correlation between the ECERS-E and the CIS is in line with the fact that the CIS focuses strongly on ‘relationship’ aspects, which caregivers establish with the children, while the ECERS-E assesses curriculum as well as relationship. Because the ECERS-E indicators assess the warmth and sensitivity of curriculum activities, it was expected that the ECERS-E would relate moderately with the CIS. Overall these findings support the construct validity of the ECERS-E, with higher correlations with the ECERS-R and lower (but still significant) correlations with the CIS.

Inter-rater reliability was calculated for the two environmental scales on 25 randomly chosen centres throughout the regions (Sylva et al., 1999). It was calculated in two ways: (a) as the percentage of exact agreement between the two observers and (b) as a kappa coefficient (Cohen, 1968). The analysis was done separately for each region and showed that on the ECERS-R, the percentage of exact agreement ranged from 78.2 to 91.4 while the kappas ranged from 0.75 to 0.90. The range of the percentages of exact agreement on the ECERS-E was 85.2 to 97.6 and the range of kappas was 0.83 to 0.97. These results indicate good to excellent inter-observer reliability across centres and regions.

2.4.1.3. Overall scores on pre-school quality in England. The mean total score from 141 centres on the ECERS-R was 4.34 (S.D. = 1.00) and 3.07 (S.D. = 1.01) on the ECERS-E. The ECERS-R mean score is in the ‘adequate to good’ range while the ECERS-E indicates ‘adequate’ quality. Table 2 presents the mean total and subscale scores on both scales from 141 centres.

2.4.2. Child measures

Data on children’s cognitive and language abilities were collected at 3 and 5 years through the British Ability Scales II (BAS II; Elliot, Smith, & McCulloch, 1996). At age 5, children were also administered the Letter Recognition Test (Clay, 1993) and subscales on the Phonological Awareness assessment (Bryant & Bradley, 1985). Data on children’s social/behavioural competences were collected through the Adaptive Social Behaviour Inventory (ASBI; Hogan, Scott, & Bauer, 1992) at age 3 and, at age 5, an extension of the ASBI developed by the EPPE team, the Child Social Behaviour Questionnaire (CSBQ; Sammons et al., 2003).

Table 2
Mean total and subscale score on ECERS-R and ECERS-E from 141 pre-school centres

	Mean	S.D.
ECERS-R		
1. Space and furnishings	4.85	1.04
2. Personal care routines	3.81	1.36
3. Language and reasoning	4.32	1.33
4. Activities	3.83	1.16
5. Interaction	4.82	1.31
6. Program structure	4.70	1.47
7. Parents and staff	4.07	1.28
Mean total ECERS-R	4.34	1.00
ECERS-E		
1. Literacy	3.96	1.06
2. Mathematics	2.95	1.19
3. Science and environment	2.98	1.52
4. Diversity	2.38	1.11
Mean total ECERS-E	3.07	1.01

2.4.3. Cognitive and language assessments

2.4.3.1. *BAS II*. Theoretical foundations of the British Ability Scales II's (Elliot et al., 1996) lie with the Horn–Cattell theory of structural intelligence, and the premise that human ability stems from a range of distinct but interrelated information processing subsystems. The test provides a range of highly specified subscale scores, which can be collapsed and summed into more generalised 'cluster' scores, plus an overall 'General Conceptual Ability' (GCA) score. On each subscale, children receive a number of items and a raw score for the number of items passed. Depending on their age and difficulties with the items, they receive items of varying difficulty.

During the process of the development of the BAS II, extensive scale testing was scheduled to ensure the reliability of the scales. Good internal consistency and test-retest reliability were achieved. Furthermore, the validity was supported by the fact that the measure correlated well with the Wechsler Pre-school and Primary Scale of Intelligence—Revised (WPPSI-R; Wechsler, 1989) and the Wechsler Intelligence Scale for Children—Third Edition (WISC-III; Wechsler, 1991). (See the BAS-II technical manual [Elliot et al., 1996] for more details on concurrent validity, and Hill [2005] for a historical review).

2.4.3.2. *Age 3*. At the beginning of pre-school, four BAS-II subscales were administered as baseline measures: Block Building (perceptual-motor ability: copying a design with wooden blocks), Verbal Comprehension (receptive verbal knowledge: e.g., pointing at different features the administrator names), Naming Vocabulary (expressive verbal knowledge: naming pictures), and Picture Similarities (non-verbal reasoning: e.g., matching and sequencing pictures). These scales were combined to form two composite measures: a total verbal score (combining Verbal Comprehension and Naming Vocabulary) and a total non-verbal score (combining Block Building and Picture Similarities).

2.4.3.3. *Age 5*. At entry to primary school, five BAS II subscales were administered: Verbal Comprehension, Picture Similarities, Naming Vocabulary, Pattern Construction (spatial awareness: constructing patterns with foam squares) and Early Number Concepts (General Mathematical Concepts: e.g., counting, or matching and classifying by number). Children were also administered the Letter Recognition Test (Clay, 1993) and the subscales Rhyme and Alliteration from the Phonological Awareness assessment (Bryant & Bradley, 1985). On the basis of the scores on these tests, five cognitive outcome variables were computed: Language (combining Naming Vocabulary and Verbal Comprehension), Pre-reading (combining Letter Recognition and Phonological Awareness), General Mathematical Concepts (Early Number Concepts), Non-verbal Reasoning (Picture Similarities), Spatial Awareness (Pattern Construction). The intercorrelations between these five indices were moderate, ranging from 0.41 to 0.60, with Pre-reading and General Mathematical Concepts showing the closest relationship.

2.4.3.4. *Cognitive measures—EPPE study.* The scores obtained by 2857 children at age 3 and 5 on the cognitive assessments are presented in Table 3.

2.4.4. *Social/behavioural assessment*

2.4.4.1. *Age 3.* The Adaptive Social Behaviour Inventory (ASBI; Hogan et al., 1992) is a general measure of the social and behavioural development of pre-school children. It was completed by a member of staff who was familiar with the child. It is a 30 item questionnaire; the caregiver is asked to rate the child's behaviour on a three-point scale (e.g., 'Is helpful to other children', 'Follows rules in games', 'Gets upset when you don't pay enough attention'; with 1 indicating rarely or never, and 3 indicating almost always).

An earlier paper (Melhuish, Sylva, Sammons, Siraj-Blatchford, & Taggart, 2001) reports on a factor analysis carried out after the first assessment on the ASBI, revealing a 5-factor solution: Co-operation/Conformity, Peer Sociability, Confidence, Antisocial, and Worried/Upset. This structure was used for the current paper's analysis (see Tables 3 and 4).

2.4.4.2. *Age 5.* The Child Social Behaviour Questionnaire (CSBQ) was developed by the EPPE researchers to assess children's socio-behavioural development at entry to primary school (Sammons et al., 2003). The CSBQ consists of the 30 ASBI items used at pre-test, plus an additional 15 items selected to describe behaviours emerging in 5-year-old children, including independence, concentration, empathy and adherence to classroom routines. Of the additional 15 items, 5 were derived from the Strengths and Difficulties Questionnaire (Goodman, 1997), 5 from the Prosocial Behaviour Questionnaire (Weir, Stevenson, & Graham, 1980; Weir & Duveen, 1981), and the remaining 5 from an unpublished instrument developed by Peter Blatchford at the Institute of Education, University of London. The CSBQ also differs from the ASBI at age 3 in that the items are rated on a five-point scale.

Factor analysis carried out previously by the EPPE team (Sammons et al., 2003) identified a number of factors, which reflect patterns of associations among the questionnaire items. The four main factors accounted for 52% of variance in the ratings. They were: Independence and Concentration, Co-operation and Conformity, Peer Sociability and Anti-social/Worried. For the current paper, these factors were used as outcome variables on children's social behavioural development (see Tables 3, 5 and 6).

2.4.4.3. *Social behavioural measures—EPPE study.* The scores obtained by 2857 children at age 3 and 5 on the socio-emotional assessments are presented in Table 3.

Table 3
Mean scores on children's measures taken at both assessments

	<i>N</i>	Mean	S.D.	Range
At the beginning of pre-school				
Perceptual motor-ability	2816	4.94	3.38	0–16
Non-verbal reasoning	2817	14.86	4.67	0–30
Receptive verbal knowledge	2771	14.22	4.74	0–34
Expressive verbal knowledge	2769	16.48	4.89	0–29
Co-operation and conformity	2842	2.44	0.43	1–3
Peer sociability	2843	2.28	0.48	1–3
Confidence	2843	2.42	0.48	1–3
Antisocial	2839	1.30	0.38	1–3
Worried/upset	2842	1.48	0.43	1–3
At entry to primary school				
Pre-reading	2705	21.57	12.67	0–46
General mathematical concepts	2711	18.5	5.66	0–32
Language	2725	42.13	7.68	0–68
Non-verbal reasoning	2733	22.38	4.54	0–33
Spatial awareness	2585	11.6	7.27	0–41
Independence and concentration	2562	3.54	0.83	1–5
Co-operation and conformity	2570	3.92	0.68	1.33–5
Peer sociability	2568	3.65	0.71	1–5
Anti-social/worried	2567	1.74	0.66	1–4.57

2.4.5. *Child and family characteristics*

Through interviews with a family member (the mother in the majority of cases), information was obtained on: parental characteristics (socio-economic status, mother and father's educational level, employment, age and marital status), family characteristics (lone parent family, family size and child's first language), child characteristics (birth weight, ethnicity, perinatal difficulties, developmental or behaviour problems before age 3), health, home characteristics (home learning environment, bedtime rules, TV rules, time watching TV, play with friends at home and elsewhere), and childcare history.

3. Analysis

3.1. *Multi-level modelling*

Multi-level modelling allows for child-level and centre-level data (i.e. pre-schools) to be combined. Multi-level analysis was carried out due to the nested nature of the data, which was collected from more than 2800 children at two time points across 141 centres (with approximately 20 children in each centre). MLwiN (Rasbach et al., 2000) was used to analyse the association between pre-school quality and children's cognitive and socio-emotional development, while simultaneously taking into account intra-correlation within centres, children's prior attainment, family characteristics, parental care and children's home learning environment.

3.2. *Analysis strategy*

Multi-level models were created for nine outcome variables: five cognitive (Pre-reading, General Mathematical Concepts, Language, Non-verbal Reasoning, Spatial Awareness) and four socio-behavioural (Independence and Concentration, Co-operation and Conformity, Peer Sociability, Anti-social/Worried). In all models, coefficients were treated as fixed constants or parameters.

For each outcome, 2-level models were constructed, with child at level 1 and centre at level 2. Variables included as predictors in the analysis included children's age and pre-test scores, along with many additional child, family, and home environment measures. ECERS-R and ECERS-E scores were entered separately into the models, so that the effect of centre quality could be assessed uniquely for each instrument after controlling for possible confounding background factors. For each outcome, separate multi-level models were constructed for both the ECERS-R and the ECERS-E scores. This was to permit comparison of the predictive power of each quality measure in terms of the various cognitive and socio-behavioural progress indicators. A summary of all variables entered into the complex value-added models is presented in Table 4.

Note that all outcome variables collected at age 3 were age-standardised to compensate for variations in age at assessment across the sample. Age standardisation was conducted according to the procedure described in Schagen (1991). Age standardisation was not carried out at school entry because age was one of the predictive variables in the post-test analyses.

4. Results

4.1. *Predicting cognitive progress*

Coefficient estimates for the ECERS-E and ECERS-R scores in relation to the five cognitive outcomes are presented in Table 5. These models demonstrate that after taking age, prior attainment, and child and family background characteristics into account, the ECERS-E (both total and subscales), was a significant predictor of children's scores on Pre-reading, General Mathematical Concepts and Non-verbal Reasoning. There was no relationship with Spatial Awareness and Language.

In contrast, the ECERS-R was less related to children's cognitive outcomes. The total ECERS-R score was not significant; only one of the subscales (Interaction) was significantly associated with one of the outcomes: children's scores on General Mathematical Concepts. The subscales Language and Reasoning, and Parents and Staff fell just outside the 5% cut-off with the Spatial Awareness and Pre-reading outcomes, respectively. Thus, children's cognitive progress and their 'academic' development were more related to the ECERS-E than to the ECERS-R.

Table 4
Child, family and home environment variables

	Categorical predictors
Child measures	Ethnicity Birthweight (very low, low vs. normal) Gender Non-English language Number of siblings (1–2, 3+ vs. none) English
Family variables	Family SES Mother's education Free School Meal eligibility (poverty)
Home environment	Frequency parent teachers alphabet sounds
Measures	Frequency parent teaches letters/numbers Frequency child paints/draws at home
Other measures	Child changed his/her pre-school (maternal report) Developmental problems before age 3
	Continuous predictors
Prior attainment at age 3	Verbal attainment (cognitive outcome models only) Non-verbal attainment (cognitive outcome models only) Co-operation and conformity (socio-behavioural outcome models only) Peer Sociability (socio-behavioural outcome models only) Confidence (socio-behavioural outcome models only) Anti-social (socio-behavioural outcome models only) Worried/upset (socio-behavioural outcome models only)
Other measures	Child's age in months at outcome assessment (age 5) Percentage of mothers in centre who have a degree or higher Duration in pre-school during EPPE study (in months) Duration in reception class before assessment was completed (in weeks) Percentage of children at centre and whose scores were 1 S.D. lower than the mean BAS-II General Cognitive Ability
	Continuous quality measures
ECERS-E	Average total score Literacy subscale score Mathematics subscale score Science/environment subscale score Diversity subscale score
ECERS-R	Average total score Space and furnishings subscale score Personal care routines subscale score Language and reasoning subscale score Activities subscale score Interaction subscale score Program structure subscale score Parents and staff subscale score

4.2. Predicting social and behavioural development

As shown in Table 5, children's scores on Co-operation and Conformity were significantly predicted by the ECERS-R total, along with the ECERS-R subscales Language and Reasoning, and Interaction. The Interaction subscale also predicted the Independence and Concentration outcome. In contrast, no significant relations between the ECERS-E and children's socio-behavioural outcomes were found, although there were a few positive trends. Thus, the ECERS-E was not a strong predictor of social and behavioural development, which is not surprising, given its specific curricular emphasis.

Table 5
The effect of pre-school quality on children cognitive and social/behavioural development: Multi-level estimates and standard deviations from complex value-added models

	Cognitive					Socio-behavioural			
	Pre-reading	General Mathematical Concepts	Language	Non-verbal Reasoning	Spatial Awareness	Independence & Concentration	Co-operation & Conformity	Peer Sociability	Anti-social/ Worried
ECERS-E									
Average total	0.731 (0.33) ^{a,*}	0.327 (0.13) [*]	0.177 (0.14)	0.326 (0.10) [*]	−0.670 (0.34)	0.042 (0.02) [#]	0.036 (0.02) [#]	0.023 (0.02)	−0.011 (0.02)
Literacy	0.723 (0.31) [*]	0.269 (0.13) [*]	0.130 (0.13)	0.180 (0.10)	−0.076 (0.16)	0.036 (0.02)	0.034 (0.02) [#]	0.023 (0.02)	−0.011 (0.02)
Maths	0.481 (0.26)	0.174 (0.11)	0.084 (0.11)	0.220 (0.08) [*]	−0.101 (0.14)	0.025 (0.01)	0.019 (0.01)	0.024 (0.02)	0.007 (0.01)
Science/environment	0.033 (0.21)	0.137 (0.09)	0.137 (0.09)	0.315 (0.09) [#]	−0.105 (0.11)	0.016 (0.02) [#]	0.015 (0.01)	0.007 (0.01)	−0.011 (0.01)
Diversity	0.555 (0.29) [#]	0.302 (0.12) [*]	0.070 (0.12)	0.132 (0.07) [*]	−0.048 (0.15)	0.032 (0.02) [#]	0.031 (0.02) [#]	0.006 (0.02)	−0.012 (0.02)
ECERS-R									
Average total	0.375 (0.33)	0.174 (0.13)	0.193 (0.14)	0.076 (0.11)	−0.216 (0.17)	0.031 (0.020)	0.038 (0.02) [*]	0.003 (0.02)	−0.027 (0.02)
Space and furnishings	0.291(0.31)	0.015 (0.13)	0.147 (0.13)	0.038 (0.10)	−0.053 (0.16)	0.003 (0.02)	0.029 (0.02)	0.010 (0.02)	−0.030 (0.02)
Personal care	−0.078 (0.22)	0.041 (0.09)	0.141 (0.09)	−0.075 (0.07)	0.088 (0.11)	0.014 (0.01)	0.005 (0.01)	−0.006 (0.01)	−0.018 (0.01)
Language and reasoning	0.344 (0.24)	0.135 (0.10)	0.117 (0.10)	0.072 (0.08)	−0.233 (0.12) [#]	0.025 (0.02)	0.032 (0.01) [*]	0.007 (0.01)	−0.014 (0.01)
Activities	0.057 (0.30)	0.109 (0.12)	0.150 (0.12)	0.098 (0.09)	−0.163 (0.15)	0.014 (0.02)	0.017 (0.02)	−0.008 (0.02)	−0.007 (0.02)
Interaction	0.272 (0.24)	0.307 (0.09) [*]	0.095 (0.10)	0.102 (0.08)	−0.082 (0.12)	0.036 (0.02) [*]	0.040 (0.01) [*]	0.028 (0.015) [#]	−0.013 (0.01)
Program structure	0.194 (0.22)	0.049 (0.09)	0.067 (0.09)	0.047 (0.07)	−0.129 (0.12)	0.008 (0.01)	0.013 (0.01)	−0.004 (0.01)	−0.010 (0.01)
Parents and staff	0.505 (0.26) [#]	0.022 (0.11)	0.082 (0.11)	0.064 (0.08)	0.019 (0.14)	0.015 (0.02)	0.020 (0.01)	−0.003 (0.02)	−0.017 (0.01)

^a When change of centre is not included in the model.

^{*} $p < .05$.

[#] $p < .08$.

4.3. Effect sizes

Effect sizes provide a useful supplement to statistical significance testing in interpreting the strength of the relationship between different predictors and an outcome measure. They describe the change on the children's outcome that is produced by a change of a standard deviation—multiplied by 2—in the predictor variable. Effect size thus corresponds to the difference between predicted scores one standard deviation above and one standard deviation below the mean. Traditionally, effect sizes around 0.2 are interpreted as small, 0.5 as medium and 0.8 as large (Cohen, 1988). Ways to adapt effect size formulae to assist in the interpretation of the results of multi-level analysis have only recently been developed (see Elliot & Sammons, 2004 for details). In order to see the relative contribution of the ECERS-E and ECERS-R scores in the prediction of children's cognitive and social/behavioural outcomes, effect sizes were calculated following the method developed by Tymms, Merrell, & Henderson (1997). Results are presented in Table 6.

5. Discussion

This paper introduced the ECERS-E and described its relationship to child outcomes in the EPPE study. The ECERS-E supplementary scales were developed for the EPPE research project specifically to tap the educational/curricular aspects of 'quality', which are assessed more lightly in the ECERS-R. Using a nationally representative sample of 141 randomly selected pre-school centres, the predictive validity of the ECERS-E and ECERS-R rating scales was demonstrated. The extent to which these measures predicted children's language, cognitive and social/behavioural development provides an indication of their usefulness in assessing centre-care quality which might underpin children's outcomes within a national context.

The significant and moderately strong relationship between the ECERS-E and children's cognitive development suggests that the extension scales capture important elements of the educational/curricular environment. This in turn validates this instrument as a measure of quality related to 'emerging' academic skills.

The ECERS-R was found to be more related to social-behavioural development than to cognitive progress over the pre-school period. This indicated that the ECERS-R is more sensitive to aspects of quality related to children's social development than their cognitive development. The authors therefore hypothesise that similar results would be obtained in educational contexts outside the UK which also place a premium on 'emerging' literacy, numeracy and science. Specifically, in such educational contexts, if the ECERS-E and ECERS-R were applied in the same centre, the ECERS-E would be the stronger predictor of children's academic progress.

Previous research has shown that the ECERS-R predicts children's cognitive development (e.g., Peisner-Feinberg & Burchinal, 1997), a finding not replicated here. This may be due to a different outcome assessments used in this English study. For example, the phonological awareness is a challenging 'academic' test and the non-verbal abilities measured by the BAS-II (spatial awareness, non-verbal reasoning) measure higher order cognitive processes.

The strong correlation between ECERS-R and ECERS-E is an indication that certain process characteristics of quality are perceived and operationalised in similar ways in the two rating scales. On the other hand, the instruments' differential ability to predict cognitive and social progress over the pre-school period suggests that different aspects of children's development are related to different aspects of quality in everyday practice.

The findings of this study support the claim that pre-school quality is significantly related to language development, cognitive progress and social development, even after taking into account the effects of many family and child factors (Dunn, 1993; NICHD, 2000; Peisner-Feinberg & Burchinal, 1997; Whitebook et al., 1989). In terms of the quality discourse, the present study supports the cultural specification of quality as a theoretical concept. Countries with different curricula and differing expectations of child profiles at school entry may have varying definitions of quality. Conceptions of quality depend on national curricula and cultural priorities (Sylva, 2001). If academic achievement is valued at the start of school, then the ECERS-E is a good measure of quality related to children's readiness for school (here 'readiness' refers to language, numeracy and literacy skills). In a cultural context where the development of social skills is considered most important, then the ECERS-R is a better predictor of a good start at school. Put simply, the two scales are sensitive to different aspects of quality practice.

The EPPE study demonstrates the relationship between developmental outcomes and process characteristics of pre-school quality, but also emphasises the importance of structural aspects of quality. Staff qualifications had a strong association with children's Pre-reading progress (Sammons et al., 2002; Sylva et al., 2004) and children's social development. In centres which employed more staff with higher-level qualifications, children made more progress in

Table 6

Effect sizes of ECERS-R and ECERS-E total and subscale scores on cognitive and social/behavioural progress after controlling for child, family and home environment characteristics

	Cognitive					Socio-behavioural			
	Pre-reading	General Mathematical Concepts	Language	Non-verbal Reasoning	Spatial Awareness	Independence & Concentration	Co-operation & Conformity	Peer Sociability	Anti-social/ Worried
ECERS-E									
Average total	0.166 ^{a,*}	0.163 [*]	0.076	0.108 [*]	0.023	0.120 [#]	0.124 [#]	0.073	−0.038
Literacy	0.174 [*]	0.142 [*]	0.059	0.105	−0.028	0.097	0.124 [#]	0.077	−0.040
Maths	0.127	0.102	0.042	0.142 [*]	−0.041	0.054	0.077	0.090	0.028
Science/environment	0.012	0.105	0.091	0.109 [#]	−0.056	0.111 [#]	0.079	0.034	−0.059
Diversity	0.138 [#]	0.165 [*]	0.033	0.191 [*]	−0.018	0.113 [#]	0.117 [#]	0.021	−0.046
ECERS-R									
Average total	0.085	0.087	0.083	0.042	−0.044	0.089	0.131 [*]	0.009	−0.094
Space and furnishings	0.068	0.008	0.065	0.022	−0.019	0.009	0.103	−0.033	−0.108
Personal care	−0.024	0.028	0.083	−0.057	0.042	0.055	0.128	0.026	−0.086
Language and reasoning	0.104	0.090	0.067	0.053	−0.108 [#]	0.096	0.148 [*]	0.030	−0.065
Activities	0.015	0.062	0.074	0.062	−0.065	0.046	0.067	−0.029	−0.028
Interaction	0.080	0.199 [*]	0.053	0.073	−0.037	0.134 [*]	0.180 [*]	0.116 [#]	−0.059
Program structure	0.063	0.035	0.041	0.037	−0.064	0.033	0.064	−0.018	−0.049
Parents and staff	0.144 [#]	0.014	0.045	0.045	0.008	0.054	0.087	−0.012	−0.071

^a When change of centre is not included in the model.^{*} $p < .05$.[#] $p < .08$.

co-operation and conformity and scored lower on antisocial/worried behaviour measure. Similarly, in centres with greater proportions of low qualified staff, poorer outcomes were observed for peer sociability and co-operation and conformity (Sammons et al., 2003). The adult-child ratios in pre-schools in the EPPE study were found to vary systematically according mainly to centre-type and centre-quality (range of ratios: 1:18 to 1:13). After controlling for these two aspects, adult-child ratios were rarely significant predictors of children's progress (Sammons et al., 2002). Note, however, that the range of staff-child ratios was limited.

Consensus is emerging on the beneficial effects of pre-school quality on children's development. However, quality in pre-school practice must be contextualized in a way relevant to the values of a particular society (Dahlberg, Moss, & Pence, 1999). Large-scale, descriptive studies such as the one presented here have traditionally relied on children's outcomes to validate quality measurements on environmental scales. However, this is only one way of approaching the whole issue quality. The conceptual framework suggested by Munton, Mooney, and Rowland (1995) refers to six dimensions of quality, of which 'effectiveness' is only one. The analyses presented here refer to quality mainly in relation to its effectiveness in enhancing children's development. However, quality should not be assessed solely on the basis of effectiveness or at the expense of other aspects of quality, namely acceptability, efficiency, access, equity and relevance. These are important as well.

In conclusion, this study demonstrates the impact of the process characteristics of quality in English pre-schools on children's cognitive and social development at the start of primary school. Results indicated that the ECERS-R is a more sensitive measure of quality related to children's social-behavioural development, while ECERS-E is a more sensitive measure of quality related to children's cognitive progress and their 'academic' skills.

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Appendix A. An example of an ECERS-E item

Item 5. Science activities: Science processes: Food preparation

1	2	3	4	5	6	7
1.1 No preparation of food or drink is undertaken in front of the children.		3.1 Food preparation is undertaken by adults in front of the children.		5.1 Food preparation/cooking activities are provided regularly.		7.1 A variety of cooking activities in which all children have the opportunity to take part are provided regularly.
		3.2 Some children can choose to participate in food preparation.		5.2 Most of the children have the opportunity to participate in food preparation.		7.2 The ingredients are attractive and the end result is reasonable and appreciated. Ex. eaten by children, taken home.
		3.3 Staff discuss with the children routine food that has been prepared by adults, where appropriate, e.g., burnt toast or new biscuits or food brought in by children because of special events.		5.3 The staff lead discussion about the food involved and use appropriate terminology Ex. melt, dissolve.		7.3 The staff lead and encourage discussion on the process of food preparation such as what needs to be done to cause ingredients to set or melt.
				5.4 Children are encouraged to use more than one sense (feel, smell, taste) to explore raw ingredients.		7.4 Staff draw attention to changes in food and question children about it. Ex. what did it look like before, what does it look like now, what has happened to it?

N.B. Scores 2, 4, 6 are mid-way between 1, 3, 5, 7.

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