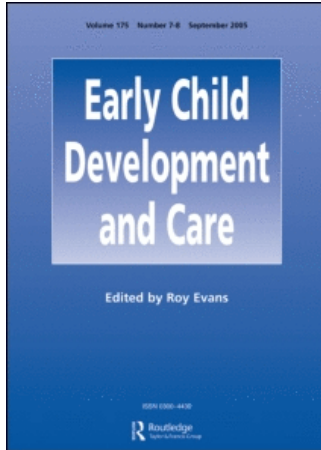


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# Quality of family context or sibling status? Influences on cognitive development

Enrique B. Arranz Freijo<sup>a\*</sup>, Alfredo Oliva<sup>b</sup>, Fernando Olabarrieta<sup>a</sup>, Juan Luis Martín<sup>a</sup>, Ainhoa Manzano<sup>a</sup> and Martin P. M. Richards<sup>c</sup>

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This study analyzes the influence of socioeconomic status, quality of family context and sibling status on cognitive development in a sample of 551 five-year-old children. The regression analyses confirmed the predictive value of socioeconomic status and quality of family context on cognitive development. The quality of family context mediates the relation between socioeconomic status and cognitive development. None of the variables relating to the sibling group showed a significant relationship with cognitive development.

Keywords: *Cognitive development; Family context; Sibling status*

## Introduction

Researchers have focused on the relationship between family context and children's cognitive development, measuring the effect of diverse variables such as the family's socioeconomic status, the social support received by the family during child-rearing, the quality of the physical family environment and the materials provided by parents to stimulate development (Wade, 2004). Sibling status has also been investigated as a variable related to children's cognitive development (Dunn, 2002; Brody, 2004). The authors of this study will focus on the relationship between the quality of the family context, sibling status, socioeconomic status and cognitive development.

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High scores on the HOME scale developed by Caldwell and Bradley (1984) to assess the quality of the home environment were associated with high scores in intelligence tests in children aged between six and eight years (Baharudin & Luster, 1998), and with higher levels of cognitive, linguistic, social and motor development in children aged between four and six assessed using the Development and Maturity Inventory for Preschool Children (DMPI) (Terrise & Dansereau, 1992). High scores on the HOME scale are also associated with more advanced cognitive development in children aged between three and six, assessed using the Stanford–Binet scale (Espy *et al.*, 2001). This association was confirmed by the data obtained by the National Institute of Child Health and Human Development (NICHD, 2002) during an assessment of a group of children under the age of three, using the Bailey Scale of Infant Development II (Bayley, 1993). In general, researchers have found a strong relationship between quality of family context and children’s cognitive development (Grigorenko & Sternberg, 2001).

There is a close relationship between high quality of family context and high socioeconomic status, and between low quality of family context and low socioeconomic status (Terrise *et al.*, 1998; Bornstein & Bradley, 2003). Researchers have also found a relationship between high levels of socioeconomic status and high levels of cognitive development (Bradley & Corwyn, 2002).

Within the field of the relationship between sibling interactions and cognitive development, a number of studies have been carried out that show the importance of these relationships in the development of perspective-taking skills and the understanding of others’ emotional and mental states (Dunn, 2002; Brody, 2004). Other authors have provided data that support the hypothesis that children with older siblings develop *theory of mind* skills at an earlier age (Ruffnam *et al.*, 1998; Das & Babu, 2004). Another group of researchers have focused on the relationship between birth order, intellectual development and academic performance. According to the *confluence model* designed by Zajonc and Markus (1975), as the number of siblings in the family increases, the richness of the stimuli for cognitive development received in family interactions gradually decreases, due to the fact that siblings are not such effective, complex role models as adult parents. The relation between the number of siblings and cognitive development is therefore inversely proportional. According to Zajonc (2001), this theory is corroborated by over 50 empirical studies.

A theory that complements the *confluence model* in explaining the inverse relation between the number of siblings and cognitive development is the *resource dilution theory*. This theory has recently been the focus of attention by researchers who have provided some support. It is based on the work of Blake (1981), who claimed that parents’ material, educational and interactive resources are limited, and that therefore an increase in the number of siblings results in their progressive dilution. The *confluence model* and the *resource dilution theory* are complementary since the *theory of confluence* supports the hypothesis that an increase in the number of siblings is detrimental due to the impoverishment of the family stimulation environment, and the *resource dilution theory* qualifies this by suggesting that this impoverishment is caused by the dilution of parental resources.

A study by Downey (1995) confirms the inverse association, linked to the dilution of resources, between the number of siblings and the educational level reached by a sample of 24,559 eighth-grade students. The author confirms that the availability of parental resources (both economic and interactive) decreases as the number of siblings increases. This fact explains why children belonging to large families have access to less resources than those belonging to smaller families, something that has negative repercussions regarding their future educational level. While there are some researchers supporting this hypothesis (Downey, 2001), others challenge it (Arranz *et al.*, 2001). Authors who are critical of the *resource dilution theory*, such as Rodgers (2001), point out that the effects of family size are spurious and the result of a failure to consider other associations such as that between low socioeconomic status and large family size.

The criticism received has served to qualify some aspects of the resource dilution hypothesis. Schmid and Keller (1998) and Powell and Steelman (1993) have observed that a large age gap between siblings counteracted the negative effects of resource dilution. While Marjoribanks (1997) have evidence that supports the hypothesis that resource dilution mainly affects younger siblings, who receive less interactive, educational and economic resources, and so on, than first-born children or middle siblings. He also observed that the effects of resource dilution are more accentuated in families with middle or low socioeconomic status, in which the dilution of limited resources is more noticeable than in families with a high socioeconomic level.

The fundamental aim of the present study is to carry out an assessment (using the same subject group) of the influence on cognitive development of variables relating to the sibling group and variables relating to the quality of the family context. The authors believe that the variables related to the quality of family context will have a greater influence on cognitive development than those related to the sibling group. In accordance with this approach, the following hypotheses were formulated:

1. A positive association will be found between measures of the quality of the family context and children's cognitive development.
2. An inverse relationship will be found between birth order and sibling number variables and cognitive development.
3. A positive association will be found between socioeconomic status, family context and cognitive development. The quality of family context will mediate the relations between socioeconomic status and cognitive development.

## Method

### *Sample*

The study sample was obtained using a random representational sampling of the population of Basque Country (Spain), conducted in accordance with the census of children born during 1995. The population studied enabled the authors to obtain representative proportions of gender, age (five years) and type of school.

A total of 551 children were assessed: 54.3% boys and 45.7% girls. The mean age was 69.6 months with a standard deviation of  $\pm 3.5$ . The age range was 64–78 months.

Of the sample families, 20.2% were low socioeconomic status, 29.2% were middle to low, 30.5% were middle, 13.5% were middle to high, and 6.7% were high socioeconomic status (Bradley & Corwyn, 2002). The criteria include educational level, profession and income level. The mean number of siblings per family was 1.81 with a standard deviation of  $\pm 0.67$  (minimum, one child; maximum, eight children). One hundred and sixty-three participants (29.9%) were only children; 332 (60.9%) had one sibling, 45 (8.3%) had two siblings, four (0.7%) had three siblings and, finally, one participant (0.2%) had seven siblings. As regards birth order, in addition to 29.9% who were only children, 35.2% were oldest siblings and 31.2% were youngest siblings. The remaining 3.7% were middle children (the majority second or third children).

### *Procedures*

After the first five interviews with the children and their families, each interviewer contacted the research team to clarify criteria regarding the procedure and data assessment process. Throughout the entire data collection process, contact was maintained between the interviewers and the research team. Each interviewer contacted 40 families in order to arrange a date for the family interview, and scheduled the dates of the children's interviews directly with the schools. Interviewers met in groups of five to assess each interview, following the consensus agreement format proposed by Gilbert and Christensen (1985).

### *Measures*

*Quality of family context.* The scale developed by Pettit *et al.* (1997), Developmental History (DH), was chosen because this instrument is designed to collect information about the family context diachronically. It seemed more appropriate to obtain information regarding the family context throughout the child's life. A careful analysis of the DH enabled the research team to verify that the interviewers would assess the diverse family environment quality categories on the basis of objective and quantifiable records obtained during the parental interview, during which very little information would be gathered on the basis of subjective evaluations made by the parents themselves.

The DH consists of a semi-structured interview using 36 questions. The interview is administered individually in the presence of the both the parents and the child. It is designed for parents of school children and has a variable duration of approximately one hour. Interviewers assessed the families on a scale of 1 (very poor) to 5 (very good) in relation to the following categories:

1. *General family situation:* stability of partners' relationship, their jobs and their income level. Existence of diverse problems: medical, legal, birth of a sibling, and so no. Conflict level both within and outside the home.
2. *Impact of the child on the family:* their adjustment to the baby independent of other family stressors.

3. *Quality of non-parental care*: quality and consistency (time-wise) of the non-parental care provided.
4. *Peer stability*: potential for friendship, stability and familiarity of the child's relationships with his/her peers.
5. *Parents' expressed interest in their child's social development*: involvement, efforts to encourage and monitor the child's relationship with his/her peers.
6. *Punitive discipline*: parents' use of physical punishments and severe disciplinary methods.
7. *Physical harm*: objective possibility that the child has suffered some form of physical harm from parents.
8. *Conflict between partners*: frequency, intensity and child's exposure to such conflicts.
9. *Other in-home conflicts*: frequency, intensity and child's exposure to conflicts with other people: ex-spouse, siblings, other relations, home help, and so on.
10. *Exposure to conflict or violence outside the home*: frequency, intensity and child's exposure to conflicts in the neighborhood, at school, and so on.
11. *Social contact*: parents' perceptions of support and contact with a social network of family and friends during the rearing period.
12. *Stressors*: frequency and number of stressors during rearing, such as moving house, medical, legal or financial problems, death of a relative, and so on.
13. *Parents' sense of control*: ability to resolve and adapt positively to the challenges faced during the child-rearing.
14. *Global assessment*: the sum of the scores obtained in each of the above categories (mean = 50.28; standard deviation = 6.07). Scores in categories 6, 7, 8, 9, 10 and 12 were reversed. The assessment of the quality of non-parental care (category 3) was excluded from this overall score, due to high number of missing values and its low correlation with the other categories (between 0.01 and 0.14). The internal consistency of the total scale (excluded category 3) was  $\alpha = 0.80$ .

*Cognitive development. The Batelle Development Inventory (1984, 1988; Spanish version, 1989)*. The inventory is an individual administration assessment method for evaluating fundamental skills in children's development from birth up until the age of eight, which has been standardized for the Spanish population. Information is obtained by means of a structured test situation, reports by parents and teachers regarding specific items and observation of the child in his/her natural environment.

*The Wechsler Intelligence Scale for Children (Wechsler, 1949)*. This test has been standardized for the Spanish population. The Wechsler subscales were applied in order to obtain an assessment of the application of cognitive abilities to everyday problems and situations, and to compare the results with those obtained using the cognitive subscale of the Batelle Development Inventory.

## Results

The descriptive statistics of the variables used are presented in Table 1. Those relating to the categories included in DH are presented in Table 2.

Table 1. Descriptive statistics of cognitive variables and global assessment in DH

	Mean	Standard deviation	Range
Global assessment in DH	46.98	5.46	28–57
Batelle cognitive scale	89.80	6.61	38–98
Batelle language scale	96.00	7.06	62–108
Wechsler similarities scale	14.27	4.03	0–22
Wechsler comprehension scale	17.87	5.12	0–30

*Hypothesis 1: a positive association will be found between measures of the quality of the family context and children's cognitive development*

In order to study this association, a correlation analysis was carried out between the variables related to family context (i.e. the categories of DH) and those measuring cognitive development. Given the high correlation (between 0.49 and 0.69) between the scores obtained in the tests used to assess cognitive development (similarities and comprehension Wechsler scales, and cognitive and language Batelle scales), a principal components analysis was carried out. A single factor, *cognitive development*, was identified that explained 66.8% of the variance observed. The overall score on the DH scale presented a significant relationship with the score obtained in cognitive development ( $r(508) = .29, p < 0.001$ ). Most of the correlations between cognitive development and the initial categories on the DH scale were also significant, ranging from 0.08 to 0.21 (Table 2).

Table 2. Titles of the DH categories and correlations with cognitive development

	Mean	Standard deviation	r value
General family situation	4.08	0.85	0.18***
Child's impact on the family	4.09	0.83	0.21***
Quality of non-parental care	3.66	1.52	0.18***
Peer stability and potential for friendship	3.95	0.83	0.13**
Parents' interest in their child's social development	4.29	0.72	0.10*
Punitive discipline	1.73	0.84	0.20***
Physical harm	4.69	0.78	0.11*
Conflict between partners	4.31	1.00	0.08
Other in-home conflicts	4.47	0.90	0.19***
Conflicts outside the home	4.52	0.90	0.19***
Level of social contact	3.53	0.99	0.16***
Stressors	3.81	1.19	0.14**
Parents' sense of control	4.18	1.00	0.20***
Global assessment <sup>a</sup>	50.28	6.07	0.31***

\*\*\* $p < 0.001$ , \*\* $p < 0.01$ , \* $p < 0.05$ . <sup>a</sup>Does not include quality of non-parental care.

*Hypothesis 2: an inverse relationship will be found between birth order and sibling number variables and cognitive development*

The relationships between the variables relating to sibling group and cognitive development or quality of family context were studied through correlation analyses. None of the variables relating to the sibling group showed a significant relationship with the level of cognitive development ( $r(530) = -0.04$ , not significant, for birth order; and  $r(530) = 0.20$ , not significant, for number of siblings). Correlations of birth order and number of sibling with quality of context as measured by DH were also non-significant. It should also be noted that when a differentiated analysis was carried out for families with a low, middle and high socioeconomic status, it was observed that correlations between birth order or sibling number and cognitive development were non significant for every group.

*Hypothesis 3: a positive association will be found between socioeconomic status, family context and cognitive development. Quality of family context will mediate the relations between socioeconomic status and cognitive development*

In order to compare the cognitive development and quality of family environment of children belonging to families with a low, medium and high socioeconomic status, the corresponding analyses of variance were carried out. The family's socioeconomic status did present significant differences in relation to the overall score for the DH scale ( $F(2, 509) = 8.66, p < 0.001$ ). It was generally families with the lowest socioeconomic status that presented the least favorable development contexts.

As regards the relationship between socioeconomic status and cognitive development, the differences found were significant, since children of parents with a high socioeconomic status obtained higher scores than those with parents of a medium socioeconomic status, who in turn obtained higher scores than children from families with a low socioeconomic status ( $F(2, 523) = 19.93, p < 0.001$ ).

In order to test the mediating effect of the quality of family context on the relation between socioeconomic status and cognitive development, we followed the procedure proposed by Baron and Kenny (1986). According to these authors, a variable may be considered a mediator between a predictor or independent variable and an outcome or dependent variable when it carries the influence from the predictor to the outcome. Mediating can be considered to occur when the association between the predictor and the outcome is significant, the predictor and the mediator are significantly related, the association between the mediator and the outcome remains significant after controlling for the effect of the predictor, and the relationships between the predictor and the outcome decreases significantly after the mediator has been controlled for in the model. The four conditions can be tested using three multiple regression analyses.

The regression analysis indicated that the socioeconomic status was significantly related to cognitive development ( $F(1, 519) = 57.71, p = 0.000, R_2 = 0.10$ ). In the second step, socioeconomic status had a significant relation with total score on the DH scale ( $F(1, 502) = 14.02, p = 0.000, R_2 = 0.03$ ). Finally, cognitive development

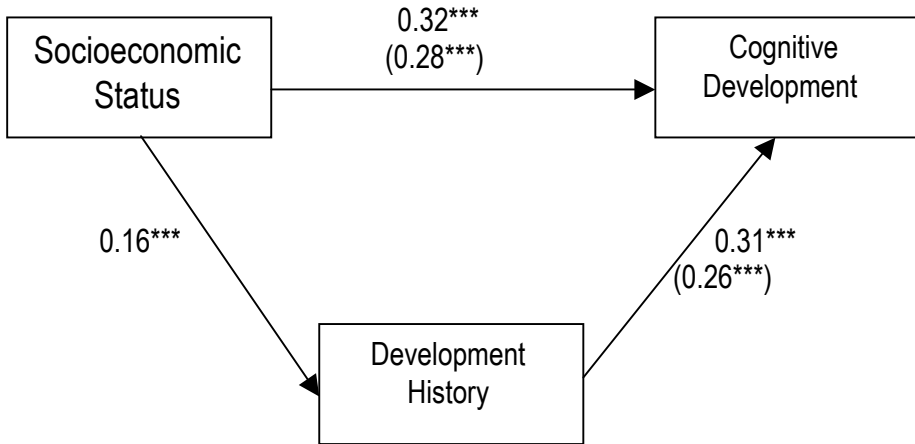


Figure 1. Mediation model for associations between socioeconomic status and cognitive development as mediated by DH. Path coefficients outside parentheses are zero-order correlations ( $r$  values). Path coefficients in parentheses are standardized partial regression coefficients from equations that include the other variable with a direct effect on the criterion. \*\*\*  $p < 0.001$ . Sobel test,  $z = 3.20, p < 0.01$

was regressed on socioeconomic status and total score on DH, and both variables contributed significantly to predict values of the criterion variable ( $F(2, 500) = 51.07, p = 0.000, R_2 = 0.17$ ). The attenuation of  $\beta$  coefficients for socioeconomic status from 0.32 to 0.28 indicated that the quality of family context as measured by DH scale was partially mediating the relationships between socioeconomic status and cognitive development (Figure 1). The Sobel test (Sobel, 1988) indicated a weak but significant partial mediation effect ( $z = 3.20, p = 0.001$ ). The direct or non-mediated relationship was also significant, a finding that points to the possible mediation of other variables not included in DH.

**Discussion**

Associations were found between children’s cognitive development and 12 of the 13 categories that comprise the DH scale. The results of this study can therefore be said to highlight the positive and significant relationship between family context and children’s intellectual development. Nevertheless, it is important to point out that the correlations between the scores for the DH scale and for cognitive development were significant, although moderate (0.29), which leaves open the possibility of the influence of other environmental (school context, peers) and genetic factors.

The results of this study may be added to the body of research that offers evidence regarding the influence of family context on children’s cognitive development, since they indicate that the cognitive development of the children studied was greater when they were reared in a stable, stimulating and non-conflictive family environment (Espy *et al.*, 2001; Borkowsky *et al.*, 2002; NICHD, 2002). The use of an instrument

that assesses not only the current family context, but also the prior history of family influences, lends a special interest to this study. The variability observed with regard to the global quality category highlights the usefulness of this instrument for discerning the quality of the family context of development.

These results do not support the *resource dilution theory*, which is why it is worth asking the question as to how exactly birth order influences cognitive development if this influence is not connected to the quality of the family context. The answer probably lies in the fact that the method for measuring the quality of the family context used in this study (DH) is first and foremost an ecological approach. Perhaps resource dilution refers to family interaction resources, such as parents' motivation in connection with the rearing process (which may decrease in proportion to the birth order), the time dedicated by parents to diverse *scaffolding* activities, modifications in their ideas about parenting as the number of children increases and changes in their personality, and so on. It is therefore necessary to use other instruments capable of measuring such interactive variables. There are many family context dimensions that influence children's cognitive development, but only a few of these seem to be related to birth order.

The influence of birth order on personal and cognitive development continues to be a controversial area of research, subject to much methodological criticism. In this sense, a study by Michalsky and Shakelford (2001) suggests that differences in the psychological variables associated with birth order only appear when individuals from different families are compared, and are not found in comparisons of individuals from the same family. Differences between siblings are the result of different intra-family interactions rather than their position in the sibling group. These differences contribute to generating interactive spaces that behavioral genetics theorists have labeled *non-shared environments* (Howe, 1994; Rowe, 2002).

A higher socioeconomic status was generally linked to higher overall scores for the DH scale. Similarly, a significant association was found between socioeconomic status and the scores obtained in cognitive development. The association between socioeconomic status and cognitive development does not appear to be due solely to the better quality of the family context in families with a higher status, since the association remains significant even when factors referring to the quality of the family context are considered also in the regression analysis. The regression analysis carried out confirmed the existence of a relationship between socioeconomic status and cognitive development that is not mediated by the quality of family context measured by DH.

One possible explanation for this phenomenon is that, although high socioeconomic status is associated with a high-quality family context, it may also have a significant association with other factors linked to the quality of family interactions that are not measured by the DH. The existence of these other factors—among which could be mentioned decontextualization, play, linguistic scaffolding, authoritative parenting, positive parental expectations, quality of attachment, and so on (Borkowsky *et al.*, 2002; Arranz, 2005)—serve to explain the significant association found between high socioeconomic status and more advanced cognitive development.

Similarly, the association observed in some studies between high scores on the HOME scale (Caldwell & Bradley, 1984) and high socioeconomic status (Terrise *et al.*, 1998) seems to lend weight to this proposed explanation, since the HOME scale gathers a great deal of information about some of the interactive processes that take place within the family context, which are not analyzed in the DH scale. In any case, it should be noted that families with a higher socioeconomic status have a better chance of converting economic resources into quality parenting and interactive resources. In general, the data obtained confirmed a close relationship between high socioeconomic status and a high level of cognitive development, a relationship that has been extensively documented in scientific literature (Bradley & Corwyn, 2002).

The most significant conclusion that can be drawn from the results obtained refers to the need for measurements to include a wider group of instruments and variables encompassing information about both the ecological aspects of the family context and factors relating to intra-family interaction. The measurement of these intra-family interactions should not refer solely to parent-child interactions, but also to interactions between siblings. In this way, much progression may be made in the joint or differential consideration of the influence of variables related to the quality of family context and family interactions on children's cognitive development. Cognitive development itself should also be measured both qualitatively and quantitatively, in order to extend our knowledge of the differential impact of diverse ecological and interactive aspects on this process.

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