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Home Literacy Environments and Young Hispanic Children's English and Spanish Oral Language

A Communality Analysis

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The authors examine dimensions of the home literacy environment relative to oral language outcomes for high-risk Hispanic children. They also illustrate the use of commonality analysis for understanding the contribution of home literacy to oral language outcomes. Forty-eight children and their families participated in the study. Commonality analysis was used to determine what percentage of the explained variance in both English and Spanish oral language was associated with variance uniquely and commonly accounted for by five subscales of the Familia Inventory, a questionnaire that examines home literacy environments. Library Use accounted for the greatest amount of unique variance in English oral language proficiency, and Extended Family accounted for the greatest amount of unique variance in Spanish oral language proficiency. Significant positive relationships were also noted between several of the Familia Inventory subscales. A discussion on the use of commonality analysis is followed by limitations and suggestions for future research.

Keywords: *preschool children's literacy; bilingual preschoolers; commonality analysis*

Reading with children, opportunity for verbal interactions, value placed on literacy, and experiences with print are some key ways in which the home environment influences children's early literacy development (National Research Council, 1998). Although the majority of children experience a supportive home literacy environment with access to rich language experiences, far too many children do not (Bennet, Weigel, & Martin, 2002). Environments poor in language stimulation and conversation not only compromise language development but also inhibit vocabulary acquisition and other readiness skills (National Institute of Child Health and Human Development [NICHD] Early Child Care Research Network, 2005). The cost of such disadvantage manifests itself in meaningful differences in language and literacy development (Gunn, Simmons, & Kameenui, 1998; Hart & Risley, 2003). These costs are far greater for those who are English-language learners (ELL), have low family incomes, have poorly educated parents, and/or reside in struggling communities (Snow, Burns, & Griffin, 1998). Regrettably, the greatest opportunities to acquire and enhance oral language skills come very early in children; once wasted, they may be permanently lost (Hirsch, 2006; Karoly, Kilburn, & Cannon, 2005). The primary aim of this study was to evaluate the relationship and relative importance of unique and

common aspects of home literacy environment and young immigrant and migrant Hispanic children's oral language in English and Spanish. A second aim of this study was to describe the use of commonality analysis and to demonstrate how it could be used to address the first aim posed above.

The critical years for developing a strong foundation of language acquisition are the early ones (Hirsch, 2006). Well-established research shows that children's early literacy development occurs chiefly through listening and talking experiences, not through reading and writing (Dickinson & Tabors, 2001; Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005). During this period, children's literacy development relies on a steady buildup of vocabulary mediated through interactions with significant others. As children mature, opportunities for including them in more complex literacy experiences evolve and increase dramatically. Unfortunately, some families employ fewer of these opportunities, ultimately disadvantaging their children at school entry (Wasik & Hendrickson, 2004). Children's preparedness at school entry, often referred to as "school readiness," is powerfully related to the literacy they acquire during these early formative years (Lonigan & Whitehurst, 2001; NICHD Early Child Care Research Network, 2005). Early exposure to literacy experiences provides a vital source of linguistic stimulation for children that promotes their successful literacy development (Bus, 2003).

Language skills during the preschool years exert a strong influence on later reading acquisition (NICHD Early Child Care Research Network, 2005; Storch & Whitehurst, 2002). These skills include the capacity to use and understand vocabulary, stringing of words together in grammatically appropriate phrases and sentences, use of words to convey meaning, and flexibility in the use of language to meet the demands of varying social contexts (Landry & Smith, 2006). From age 3 and on, children's familiarity with words, amount of talk, and vocabulary levels are securely in place and often indicative of widening gaps to come (Biemiller, 2003; Hart & Risley, 2003). Children who lag behind in oral language proficiency often read less than other children, miss opportunities to develop reading and comprehension strategies, often encounter reading material far too advanced for their skills, and develop negative attitudes about reading (Lonigan & Whitehurst, 2001; National Research Council, 1998; NICHD Early Child Care Research Network, 2005).

The precise role of oral language proficiency as it relates to early reading is not fully understood. Oral language has been shown to have both direct and indirect effects on phonological skills late in the preschool period, accounting for up to 17% to 25% of the variance (Lonigan, Burgess, & Anthony, 2002). Other studies show the relationship between oral language and code-related skills to be strong in the preschool years, with oral language predicting 48% of the variance in code-related skills. Evidence also demonstrates longitudinal continuity in oral language development, with 90% of the variance in kindergarten language ability accounted for by preschool ability and 96% of the variance in Grades 1 and 2 accounted for by kindergarten ability. Individual differences in oral language skills appear to be a critical influence on later literacy skills important to development of children's early reading skills (Foorman, Anthony, Seals & Mouzaki, 2002; Roth, Speece, & Cooper, 2002). These "strands" should be coordinated and woven together to allow children to acquire literacy even before formal reading instruction begins (Scarborough, 2003).

An understanding of the relationship between oral language and reading requires examining the role of children's background variables, however (Roth et al., 2002). For example,

studies show that at least half of the achievement gaps between poor and nonpoor children are already evident at entry to kindergarten (Wertheimer & Croan, 2003). The cumulative effect of background risk factors (e.g., impoverished home literacy environments) can heighten some young children's vulnerability to experiential deficits (Justice & Pullen, 2003). For many of these children, vulnerability can translate to increased risk for a learning disability (Stanton-Chapman, Chapman, Kaiser, & Hancock, 2005). It is important not only to identify these variables but also to describe the contexts through which their influence operates (Brooks-Gunn & Duncan, 1997).

Established research has shown that numerous risk factors can negatively influence children's language development and later school readiness (National Research Council, 1998). These risk factors can be generally divided into two areas: *group specific* and *individual specific*. A number of group-specific risk factors have predicted poor performances in school because children in these groups are affected by one or all of those conditions. Research has shown that family's socioeconomic status (SES) and parent level of education are both strong predictors of children's early language development (Foster et al., 2005; McLoyd, 1998; Snow et al., 1998). For example, before entry into kindergarten, differences in cognitive skills between high-SES students and their low-SES peers are, on average, 60% (Lee & Burkman, 2002). Other group-specific risk factors include limited English proficiency (LEP), speaking a different dialect of English, residing in low-income communities, and attending low-achieving schools (NICHD, 2000; National Research Council, 1998).

A number of individual-specific risk factors have also been shown to predict children's language development and school readiness. Research shows that individual children, whether or not exposed to group-based adversity, may be at greater risk than otherwise comparable children for achievement difficulties for any number of reasons (National Research Council, 1998). For instance, families differ tremendously in the level to which they provide supportive language environments for children's literacy development (Foster et al., 2005). The home literacy environment has been well documented as an influence on children's early literacy development (Wasik & Hendrickson, 2004; Van Kleeck, 2004). Researchers have shown that optimal outcomes are associated with home environments that provide children with many multiple and varied opportunities to interact with caring adults around meaningful age-appropriate materials (e.g., Hart & Risley, 1992). Numerous aspects of the home environment are relevant to children's normal development, including the availability of learning materials, interactions between children and adults, and physical conditions of the home (Ryan, Fauth, & Brooks-Gunn, 2006).

Although family income and SES have been used as predictor variables, they are more often marker rather than process variables (Payne, Whitehurst, & Angell, 1994). Researchers have long sought to identify characteristics of families and the home environment subsumed by SES or family income that relate to child literacy development. These practices include parent–child interactions; shared book reading; early literacy experiences that occur around games, nursery rhymes, songs, and conversations; shared trips to the library; parents' own personal reading habits; availability of resources that provide cognitive stimulation; interactions with individuals other than parents; caregiver enjoyment of reading; and number of picture books in the home (Landry & Smith, 2007; Payne et al., 1994). The quality of these practices has been shown to be critical to the learning process and later reading and comprehension (Wasik & Hendrickson, 2004). Researchers have also shown

that children with special language and literacy needs may not fully acquire the abilities thought to come from exposure to home literacy experiences identified above. These indicator deficiencies increase dramatically during preschool and are linked to significant delays in expressive language and receptive vocabulary (Snow et al., 1998; Vernon-Feagans, Miccio, & Yont, 2003). Other individual-specific risk factors include the presence of a reading disability in the family, the presence of a hearing impairment in the child, and the presence of language impairment in the child (Snow et al., 1998). These factors, when combined with group-specific risk factors, can have a deleterious impact on the educational trajectories of young children and can make them vulnerable to widening deficits in critical language and literacy foundations.

Environments, including home contexts, exert a large influence on cognitive development (National Research Council, 2001). It is well known that children who are exposed to multiple group- and individual-specific risk factors are at an even greater risk for poor language development and poor school performance. Children who present multiple risk factors prior to formal schooling are much more likely to experience school problems than children exposed to only one or two risk factors (Sameroff, Seifer, Barocas, Zax, & Greenspan, 1987). Language and literacy disparities of these children include, but are not limited to, (a) significant receptive and expressive vocabulary and language gaps (Hart & Risley, 1995), (b) limited background knowledge of concepts necessary for sufficient depth of processing (Hirsch, 2006), (c) lack of well-developed oral language skills that lay a foundation for literacy skills (Catts, Fey, Zhang & Tomblin, 1999), and (d) less exposure to print media (Neumann & Roskos, 1993). Thus, it is important to examine specific groups of children who may experience multiple risk factors in the home and who are at great risk for deficits in language development and school failure. In the past two decades, much has been learned from prediction studies relative to the antecedents of reading difficulties, yet far less is known about what causes or influences them (McCardle, Scarborough, & Catts, 2001).

Although an extensive literature review on children's home language and literacy environments is beyond the scope of this study, there is growing awareness that research has focused primarily on children from White middle-class families (Hammer, Miccio, & Wagstaff, 2003). A source of urgency, however, is the growing numbers of children of Hispanic decent who are ELLs and who live in poverty. The number of ELL students has grown dramatically in the past decade. Many of these children have poorly educated parents, come from low-income families and communities, and attend schools that are predominantly minority and low achieving (NICHD, 2000; National Research Council, 1998). Mostly Spanish speaking, these children are almost twice as likely as non-Hispanic Whites to read below their age levels in English (National Research Council, 1998). Although it is clear that Hispanic children are failing to reach their potential in schools, their home environments remain poorly understood (Farver, Yiyuan, Eppe, & Lonigan, 2006).

Immigrant and migrant ELLs are among the most educationally vulnerable groups of children in the nation (Gibson & Bejinez, 2002; Gonzalez, Reid, Synhorst, O'Kane, & Tostado, 2006). These children are likely to experience educational problems because of impoverished literacy environments, high rates of mobility, and likelihood of frequent school and community changes (Ezell, Gonzales, & Randolph, 2000; Gibson & Bejinez, 2002). In particular, immigrant and migrant children often move from school district to school district and receive limited or no formal schooling for extended periods of time (Gonzalez et al., 2006).

Language minority students enter U.S. schools needing to acquire oral language in a second language, and they need to do so with efficiency to "catch up" with their monolingual English peers (Lesaux & Geva, 2006). The transition for children whose home literacy experiences and interactions differ substantially from what goes on in the English classroom can be very difficult (Snow et al., 1998). Because many of these children will attend primarily English-only schools, it is important to examine the home literacy environments that support the foundation for increasingly sophisticated literacy skills (Hammer et al., 2003). Examining the home literacy environment may provide an indication of children's degrees of vulnerability to future reading difficulties. To assess the home literacy environment and English and Spanish oral language skills of Hispanic children, the authors administered the Familia Inventory (Taylor, 2000) and the Pre-Literacy Language Assessment Scales 2000 English and Spanish (PreLAS 2000; DeAvila & Duncan, 2000). The questions of interest in the present study are as follows:

1. What percentage of the explained variance in both English and Spanish oral language proficiency is associated with variance uniquely accounted for by subscales E (Support by Extended Family), F (Shared Work and Play by Family), L (Library Use by Family), M (Parental Modeling of Reading), and P (Practical Reading in Home) of the Familia Inventory?
2. What proportion of variance is associated with a combination of two or more subscales?
3. Which dimensions of the home literacy environment are most important? and
4. What is the relationship between the multidimensional aspects of family literacy and English and Spanish preschooler oral language?

Method

Setting

Children and their families were drawn from an early childhood center in a small city in a midwestern state as part of a larger study examining the effects of an Even Start program. The Even Start project was colocated in a facility representing the collaborative partnership of 10 social service agencies. These agencies were focused on meeting the needs of migrant and immigrant Hispanic Spanish-speaking families. This region has experienced large-scale Hispanic migrant and immigrant settlement because of employment opportunities at local meatpacking plants and other agribusinesses. The population is largely composed of low- and middle-income Hispanic families who speak limited or no English, with a large percentage of adults demonstrating English literacy skills in the lowest proficiency level defined by the Adult Basic Literacy Survey (National Center for Education Statistics, 1992).

Participants

Participants were preschool children from Hispanic Spanish-speaking migrant and immigrant families enrolled in an Even Start program. Even Start is an education program for low-income families that is designed to improve the academic achievement of parents and their young children, especially in the area of reading. Even Start recruits families most in need of services, as indicated by a low level of income, a low level of adult literacy or English language proficiency of the eligible parent or parents, and other need-related indicators. For

purposes of this study, we used the federal definition of migrant: a person or family who in the preceding 3 years has moved from one school district or from one administrative area to another within or between states to obtain temporary or seasonal employment in agricultural activities as a principle means of income (Office of Migrant Education, 1998).

All 48 participants were preschool children from Hispanic Spanish-speaking families. The children ranged in ages from 3.4 to 4.8 years, with an average age of 4.3 years. Approximately 51% of the participants were female. Approximately 92% of the preschoolers spoke Spanish only, with 8% speaking Spanish and some English. Approximately 69% of the families were two-parent families, 25% were single-parent families, and the remaining children were living with extended family members or had other living arrangements. Of those interviewed for this study, 75% were the mother, and 25% were another adult caretaker (e.g., father, grandparent). When asked about literacy-related activities including shared reading, 54% of the interviewees indicated reading only in Spanish, 40% read in Spanish and some in English, and 6% reported reading mostly in English. Approximately 3% percent of the interviews reported no shared reading activities during any given week, 23% reported reading at least once a week, 40% reported reading at least twice a week, 33% reported reading at least three times a week, and 1% reported reading four or more times a week. When asked about their children's television viewing habits, on average, preschoolers watched 3 hours of television, with 34% viewing in Spanish and 66% viewing in English. Table 1 presents selected demographic variables.

Measures

The Familia Inventory (Taylor, 2000). The Familia Inventory is a 57-item diagnostic questionnaire in Forms A and B (for pretesting and posttesting) designed to assess the multidimensional aspects of family and home literacy by family literacy programs. The questionnaire is not timed but generally takes about 20 minutes. It can be used with both literate parents as well as parents who are low-level readers. The inventory is available in both English and Spanish and can be filled out by one or both parents or in the presence of a family specialist or other trained individual. In this study, a trained bilingual specialist interviewed parents. The scoring software for the Familia Inventory generates an interpretive "family profile" to be used by parent educators or other personnel working with families.

Scoring of the Familia Inventory is straightforward. The Familia Inventory provides norms for the total standardization sample, Euro-American families, African American families, and Hispanic American families as well as for families with children ages 0 to 5, 6 to 9, and 10 to 12 and children of combination ages. Items are rated on a Likert-type scale ranging from 0 (*never*) to 5 (*daily*). The questionnaire yields 10 discrete types of family interactions, which are related to home literacy. The subscales are (a) Subscale F, Family Work and Play, which assesses levels of family interaction in shared labor and recreation (e.g., "We go on family outings together, walks, trips to the park"); (b) Subscale T, Use of Television, which assesses the regularity and levels of television viewing in a family (e.g., "Our family has favorite TV programs that we watch together"); (c) Subscale V, Verbal Interactions at Home, which assesses the importance a family places on talking with children (e.g., "We talk with our children as we play, work, and carry out our daily routine"); (d) Subscale M, Parental Modeling and Reading, which assesses levels of parental modeling

Table 1
Selected Demographic Characteristics

Variable	Mean	Standard Deviation	Median	Range
Mother's age	30	6	29	21-49
Mother's years education	9	3	9	3-14
Father's age	33	7	32	22-51
Father's years education	8	3	9	0-15
Total number of children	3	1	3	1-6
Total children's books	14	15	10	0-50
Total adults' books	4	5	2	0-30
Household size	5	2	5	2-10
Household income	$28,000	$16,000	$23,000	$4,000-$60,000

of literacy via activities aimed at shaping child reading behavior (e.g., "Our children see us read books, newspaper, and other materials"); (e) Subscale P, Practical Reading in the Home, which measures the family's use of reading for applied purposes (e.g., "We look up how to do things in books and magazines when we make things at home"); (f) Subscale R, Shared Reading by the Family, which assesses how frequently the family reads together (e.g., "The older children and/or relatives read to the younger children"); (g) Subscale W, Shared Writing by the Family, which looks at the extent to which writing skills and activities are used in the family (e.g., "Our children use puzzles, mazes, dot-to-dot, or other writing games"); (h) Subscale E, Support by Extended Family, which assesses interaction with extended family like grandparents and other relatives (e.g., "Our children spend time with their grandparents"); (i) Subscale L, Library Use by Family, which measures frequency of use of school or community library resources by family members (e.g., "We go to the library with our children"); and (j) Subscale S, Parental Support of School, which assesses how parents interact with children and school around homework and other school activities (e.g., "We make sure our children complete and understand their school work"). More globally, the 10 subscales of the Familia Inventory are part of a taxonomy of home and family literacy components that involve distinct components of family interactions. Research has shown that families are involved in language and literacy activities in four basic ways: (a) shared family activities within daily family routines, (b) shared family activities around reading and writing, (c) shared family utilization of external resources out of the home, and (d) combinations of two or more of the above (Taylor, 2000).

The Familia Inventory yields raw scores that range from 0 to 30 for each of the 10 subscales. Percentile rank scores are available for Euro-American, African American, and Hispanic American families. The Cronbach's alpha coefficient reliability estimates for the Familia Inventory subscales from a sample of 48 families in 2002-2003 Wyoming Even Start programs for Forms A and B ($n = 48$) were as follows: Subscale E, .78; Subscale F, .89; Subscale L, .89; Subscale M, .88; Subscale P, .89; Subscale, R, .91; Subscale S, .93; Subscale T, .86; Subscale V, .90; and Subscale W, .89. Cronbach's alphas for Forms A ($n = 97$) and B ($n = 50$) for a sample from Iowa Even Start programs were .95 and .90, respectively. Cronbach's alphas for the Infant Forms A and B ($n = 29$) were as follows: Subscale E, .85; Subscale F, .92; Subscale L, .86; Subscale M, .95; Subscale P, .93; Subscale, R, .88;

Subscale S, .94; (T subscale not included in infant form); Subscale V, .88; and Subscale W, .82. Cronbach's alphas in using Form A in the present study were as follows: Subscale E, .65; Subscale F, .76; Subscale L, .91; Subscale M, .70, and Subscale P, .64. All Cronbach's alphas were within acceptable limits. No other information is provided by the author of the Familia Inventory, nor to our knowledge are there any other extant findings published on the psychometric properties of the Familia Inventory in the literature.

PreLAS 2000 (DeAvila & Duncan, 2000). The PreLAS2000 is designed to assess English and Spanish language proficiency in children ages 4 to 6. The PreLAS 2000 tests are part of the Language Assessment Scales (Duncan & DeAvila, 1991) family of measures used for placement and annual evaluation decisions of ELLs for bilingual or English as a Second Language (ESL) placements. The PreLAS 2000 has been used across a spectrum of research, including the cross-linguistic transfer of phonological skills of Hispanic preschoolers (Lopez & Greenfield, 2004), phonological acquisition of preschoolers learning English (Anderson, 2004), effects of tutoring programs on language skills (Denton, Anthony, Parker & Hasbrouck, 2004; Troia, 2004), and large longitudinal studies, such as the Early Childhood Longitudinal Study.

This PreLAS2000 assesses both oral language and emergent literacy skills. The administration of the assessment is relatively simple. The test is administered individually and takes about 10 to 15 minutes to complete. It provides for both receptive (i.e., comprehension of the processes involved in apprehending the meaning of words, phrases) and expressive language (i.e., linguistic output) information based on a total score computed from oral and preliteracy subtests. Various aspects of language are assessed by individual subtests. Subtest scores are then weighted and summed into a total composite score. The five subtests of the oral language component include Simons Says, a measure of receptive vocabulary assessed via listening comprehension and following directions tasks; Art Show and Human Body, both measures of expressive vocabulary and semantics; Say What You Hear, a measure of expressive and receptive language emphasizing morphological and syntactic dimensions; and Let's Tell Stories, a measure of receptive and expressive vocabulary with an emphasis on story retelling, natural language production, event sequencing, and syntax.

For children 5 to 6 years old, the PreLAS2000 English and Spanish tests provide a Pre-Literacy subscale that assesses letter recognition, number recognition and concepts, color recognition, shapes and space, reading, and writing. A combination of discrete-point (right or wrong) items and holistically scored natural speech samples provides multiple measures of assessment. Total PreLAS2000 raw scores fall within a range of 0 to 100, with percentiles used for descriptive purposes. On the basis of their total score, children are assigned to proficiency bands (in English or Spanish) ranging from Proficiency Level 1 (*non-English*) to Proficiency Level 5 (*fluent*). The test was standardized on a group of 960 children from 17 schools, representing the four major regions of the United States. Of the norming sample, 251 spoke English only and 712 spoke a language other than English. Twenty-six other languages were collapsed into a "language minority" category, with Spanish being the dominant other language. Males and females were equally represented in the sample.

The PreLas 2000 was reviewed extensively by the Buros Institute (Pratt, 2003). Based on the results of the review, the reliability of the PreLAS 2000 is moderate to high. Internal

consistency reliability for the total standardization sample as measured by interform correlations for total score and proficiency assignment is .99 and .95 for the oral sections and .97 and .87 for preliteracy sections, respectively. Subscale-to-total-score correlations were .79 and above for both forms of the instrument. Additionally, the subtest and item descriptive statistics are highly consistent across the two forms of the instrument for the total sample. The reliability coefficients reported were consistent with the previously published version of the PreLAS 2000.

The validity of the PreLas2000 was also reviewed by the Buros Institute (Pratt, 2003). From the results of the review, it is evident that the instrument is consistent with its intended use and valid for its intended purpose. The oral and preliteracy sections of the test separated the sample children on the basis of home-language background (i.e., primary language spoken in the home), age, and grade variables but did not separate children by gender, indicating that the instrument discriminates between children on expected variables. Scores for children from minority-language backgrounds were significantly lower than for children from English-only backgrounds. Younger children scored consistently lower than older children and were less proficient across test sections. Finally, scores and proficiency levels of children increased significantly by grade level. It should be noted the PreLas2000 lacks external and peer-reviewed measures of validity (e.g., concurrent validity) and more research is needed in this area.

Sociodemographic questionnaire. A researcher-developed questionnaire was designed to collect basic demographic information such as child- and family-specific information for the Even Start project. The questionnaire is partitioned into five parts. Part 1 consists of questions pertaining to general information, such as childbirth history, developmental information, and child medical and health histories. Part 2 questions pertain to temperament during infancy and toddler years and childhood history of mental or physical problems. Part 3 questions cover general family history. Part 4 is a series of questions on migrant status. Part 5 is designed to assess various aspects of the home literacy environment (e.g., number of children's books, number of shared readings during the week). For this study, only questions from Parts 3, 4, and 5 were used.

Design and Procedures

Data collection. Data were collected in August 2004 by a trained bilingual data specialist and doctoral-level special education university students. Data in this study were part of a larger Even Start evaluation designed to evaluate the effectiveness of four components of Even Start, namely, interactive literacy activities between parents and their children, training of parents on how to be their child's primary teacher and partners in their child's education, parent literacy training, and age-appropriate instruction and education for children. For purposes of this study, four half-day preschool classes of immigrant and migrant preschoolers were invited to participate.[1] Prior to data collection, the data collector participated in an intensive 4-day training workshop, where she was trained on standardized test administration, rapport building, and scoring. University doctoral special education students with extensive experience in assessing diverse students conducted the training workshop and participated in the data collection. The training workshop consisted of standardized

test administration, computer scoring of instrument protocols, confidentiality, and proper data storage. Training was done to a mastery basis. The bilingual data collector and doctoral students were required to reach an 85% accuracy criterion on three separate fidelity observations by specially trained doctoral students in special education.

Data Analysis

To assess the literacy characteristics of the home environment and their relative importance in explaining total variance in preschool children's oral language proficiency in Spanish and English, the Familia Inventory subscales, uniquely and in combination with each other, were examined using a regression commonality analysis. In the commonality analysis, five subscales of the Familia Inventory were employed as predictors of both English and Spanish oral language as measured by the PreLAS2000 preschool oral language test: Extended Family (E), Family Work and Play (F), Library Use (L), Parental Modeling (M), and Practical Reading (P). These five subscales were selected because they met the specific goals of the *Guide to Quality Even Start Family Literacy Programs* parent–child interaction and parenting education components (Dwyer, 2001).

Commonality analysis, a variance-partitioning method, designed to determine the "true" effects of independent variables on the dependent variable (Rowell, 1996; Thompson, 2000), was especially applicable in this study. Commonality analysis decomposes the squared multiple correlation (R^2) to determine both the unique and nonunique explained variance of the dependent variable with each independent variable (Pedhazur, 1982). As recommended in Seibold and McPhee (1979) and Rowell (1996), variance partitioning is generally limited to five predictor variables. Because the number of nonoverlapping and overlapping components in a commonality analysis (e.g., home dimensions of literacy) is exponentially determined, six or more predictors render analyses extremely cumbersome and complicated to interpret. The difficulty in unraveling higher order interactions (i.e., fourth order and beyond) in commonality analysis is analogous to the difficulty in disentangling four-way interaction effects in ANOVA (Seibold & McPhee, 1979). Statistically, the number of potential combinations of unique and commonality components can be determined by $2^k - 1$, where k is the number of predictors in the model. The unique contribution of each predictor in a model is defined as the partition of variance attributed to it when entered last in a regression analysis. Commonality analysis also takes into account the joint or common explanatory powers of predictors in all their possible permutations (Thompson, 2000).

In commonality analysis, every possible R^2 value for all predictor variable combinations (e.g., Shared Work and Play by Family; Shared Reading by the Family; Family Work and Play) is computed using repeated regression runs. The obtained R^2s are subsequently subjected to the appropriate arithmetic computations. The procedure for calculating the computational formulas for the unique and common commonality components of the model are reasonably straightforward using spreadsheet software such as Microsoft Excel. The formulas for the five-variable model in this study are depicted in the appendix. Pedhazur (1982), Rowell (1996), Thompson (2006), and others elaborate on the procedure for writing commonality analysis formulas for any number of k predictor variables, and Seibold and McPhee (1979) and Amado (1999) cogently illustrate the formula writing process.

Table 2
Descriptive Statistics (n = 48)

Scale	Minimum	Maximum	Mean	Standard Deviation
E: Extended Family	4	27	14.02	5.1
F: Family Work and Play	11	30	23.44	4.5
L: Library Use	0	22	6.04	6.5
M: Parental Modeling	1	29	20.00	6.7
P: Practical Reading	7	28	18.00	5.5
PreLAS2000 English	0	85	25.67	27.3
PreLAS2000 Spanish	20	82	52.19	16.5

Note: PreLAS2000 = Pre-Literacy Language Assessment Scales 2000 (DeAvila & Duncan, 2000).

Once the unique and common variance components have been calculated, results can be illustrated and interpreted in tabular form. A commonality analysis table permits a check on the arithmetic, with row entries depicting the unique and commonality effects of each predictor variable in the model. Column totals equal the R^2 value of the predictor variable in the regression model in which it was the only variable entered in the model (Rowell, 1996). Reading down each predictor variable column, it is easy to see how the proportion of variance accounted for by a specific predictor variable in the model is partitioned into various combinations (Pedhazur, 1982). As a final check of the arithmetic in the tables, the sum of unique and commonality values for the complete set of variables in the model should equal the R^2 when every predictor variable is entered into the model.

Results

Table 2 presents the means and standard deviations for the five subscales and English and Spanish oral language scores. Table 3 presents the Pearson zero-order correlations between the variables. Several significant and positive relationships were derived:

1. Extended Family and Family Work and Play,
2. Extended Family and PreLAS2000 Spanish,
3. Family Work and Play and Parental Modeling,
4. Family Work and Play and Practical Reading,
5. Library Use and PreLAS2000 English, and
6. Parental Modeling and Practical Reading.

Tables 4 and 5 present the unique and common components of shared variance (R^2) of the English and Spanish PreLAS2000 oral language scores on the five subscales of the Familia Inventory. The commonality summary table presented in Table 4 (English) indicates that the unique predicted variance contribution of the predictor, Library Use, was approximately 14%, and its total commonality variance with one or more of the other subscales was approximately 1%. In the commonality analysis of the five Familia subscales, it appeared that Library Use was the dominant factor in predicting English oral language and

Table 3
Correlations Between Familia Inventory Subscales and PreLAS2000 Language Scores

Scale	1	2	3	4	5	6	7
1. E: Extended Family	—	.30*	.28	–.02	.14	.15	.32*
2. F: Family Work and Play		—	.17	.38*	.40*	–.11	.14
3. L: Library Use			—	.00	.10	.39**	.08
4. M: Parental Modeling				—	.71**	.05	–.03
5. P: Practical Reading					—	.08	.24
6. PreLAS2000 English						—	.01
7. PreLAS2000 Spanish							—

Note: PreLAS2000 = Pre-Literacy Language Assessment Scales 2000 (DeAvila & Duncan, 2000)
*$p < .05$. **$p < .01$

alone accounted for about 15% (14% + 1%) of the variance in English oral language and about 69% (.151/.216) of all the explained variance in preschool PreLAS2000 English oral language scores. Furthermore, Parental Modeling and Practical Reading did not seem to be useful predictors at all of English oral language scores. Both their unique contributions and commonality elements were very small.

The commonality summary table presented in Table 5 (Spanish) shows that the unique predicted variance contribution of Extended Family (.054) in combination with the commonality variance shared with one or more of the other subscales (.048) accounted for the dominant factor (.102) predicting preschool oral language scores. Examination of Table 5 shows that the Extended Family component of the total variance was also shared with Parental Modeling (.023) and Practical Reading (.027). Additionally, it accounted for approximately 51% (.102/.201) of all the variance in preschool Spanish PreLAS2000 oral language scores. The other variables offered little unique contribution to explaining the variance uniquely or in combination.

Overall, the data indicated that for the most part, with the exception of Extended Family in predicting Spanish oral language, what is unique to the subscales of the Familia is more important in terms of predicting English and Spanish oral language score variance than what is shared with other subscales. Finally, it should be noted that there were instances of negative commonalities. As Thompson (1985) explains, this result can seem "counterintuitive since the result could be taken to mean that . . . predictor variables have in common the ability to explain less than 0% of the variance" (p. 54). The presence of negative commonalities can typically be attributable to "suppressor" effects and more likely with more fine-grained partitions such as commonality analysis (Parrila, Kirby, & McQuarrie, 2004; Rowell, 1996).

Discussion

The first 5 years of life are critical to a child's lifelong development, and young children's earliest experiences set the stage for future success in school. Families play a critical role in

Table 4
Unique and Common Components of Shared Variance (R^2) English

	Predictor					
Predictor	E	F	L	M	P	Cumulation
Unique E	0.013					0.013
Unique F		0.059				0.059
Unique L			0.145			0.145
Unique M				0.010		0.010
Unique P					0.000	0.000
Common E,F	–0.011	–0.011				–0.011
Common E,L	0.029		0.029			0.029
Common E,M	–0.004			–0.004		–0.004
Common E,P	0.001				0.001	0.001
Common F,L		–0.015	–0.015			–0.015
Common F,M		–0.008		–0.008		–0.008
Common F,P		0.000			0.000	0.000
Common L,M			–0.004	–0.004		–0.004
Common L,P			0.001		0.001	0.001
Common M,P				0.011	0.011	0.011
Common E,F,L	–0.010	–0.010	–0.010			–0.010
Common E,F,M	0.003	0.003		0.003		0.003
Common E,F,P	–0.001	–0.001			–0.001	–0.001
Common E,L,M	–0.001		–0.001	–0.001		–0.001
Common E,L,P	0.003		0.003		0.003	0.003
Common E,M,P	–0.001			–0.001	–0.001	–0.001
Common F,L,M		0.003	0.003	0.003		0.003
Common F,L,P		–0.002	–0.002		–0.002	–0.002
Common F,M,P		–0.011		–0.011	–0.011	–0.011
Common L,M,P			0.001	0.001	0.001	0.001
Common E,F,L,M	0.001	0.001	0.001	0.001		0.001
Common E,F,L,P	–0.001	–0.001	–0.001		–0.001	–0.001
Common E,F,M,P	0.001	0.001		0.001	0.001	0.001
Common E,L,M,P	–0.003		–0.003	–0.003	–0.003	–0.003
Common F,L,M,P		0.001	0.001	0.001	0.001	0.001
CommonE,F,L,M,P,	0.002	0.002	0.002	0.002	0.002	0.002
Total Cumulation						**0.216**[a]
Total	0.024[b]	0.013[b]	**0.151**[b]	0.003[b]	0.005[b]	
Unique	0.013	0.059	0.145	0.010	0.000	
Common	0.010	–0.047	**0.007**	–0.007	0.004	

Note: E = Extended Family; F = Family Work and Play; L = Library Use; M = Parental Modeling; P = Practical Reading.

a. Equivalent to multiple R^2, sum of all unique values for complete set of predictors in model.

b. Individual values of R^2 that sum to multiple R^2 (with rounding error).

Table 5
Unique and Common Components of Shared Variance (R^2) Spanish

	Predictor					
Predictor	E	F	L	M	P	Cumulation
Unique E	.054					.054
Unique F		.001				.001
Unique L			.002			.002
Unique M				.056		.056
Unique P					.095	.095
Common E, F	.006	.006				.006
Common E, L	–.002		–.002			–.002
Common E, M	.027			.027		.027
Common E, P	.023				.023	.023
Common F, L		–.001	–.001			–.001
Common F, M		0		0		0
Common F, P		.003			.003	.003
Common L, M			–.001	–.001		–.001
Common L, P			–.001		–.001	–.001
Common M, P				–.054	–.054	–.054
Common E, F, L	.002	.002	.002			.002
Common E, F, M	–.006	–.006		–.006		–.006
Common E, F, P	.012	.012			.012	.012
Common E, L, M	.004		.004	.004		.004
Common E, L, P	.004		.004		.004	.004
Common E, M, P	–.022			–.022	–.022	–.022
Common F, L, M		.001	.001	.001		.001
Common F, L, P		0	0		0	0
Common F, M, P		–.002		–.002	–.002	–.002
Common L, M, P			0	0	0	0
Common E, F, L, M	–.002	–.002	–.002	–.002		–.002
Common E, F, L, P	.002	.002	.002		.002	.002
Common E, F, M, P	.002	.002		.002	.002	.002
Common E, L, M, P	–.003		–.003	–.003	–.003	–.003
Common F, L, M, P		0	0	0	0	0
Common E, F, L, M, P	.001	.001	.001	.001	.001	.001
Total cumulation						.201[a]
Unique	.054[b]	.001[b]	.002[b]	.056[b]	.095[b]	
Common	.048	.018	.004	–.055	–.035	
Total	.102	.019	.006	.001	.06	

Note: E = Extended Family; F = Family Work and Play; L = Library Use; M = Parental Modeling; P = Practical Reading.
a. Equivalent to multiple R^2, sum of all unique values for complete set of predictors in model.
b. Individual values of R^2 that sum to multiple R^2 (with rounding error).

helping children get ready for school. Young children thrive when families are able to surround them with rich literacy experiences and opportunities. Thus, efforts to improve school readiness are most effective when they address the capacity of families and communities to provide developmentally enhancing opportunities for their young children. One such effort is Even Start. The stated purpose of Even Start literacy programs is to help "break the cycle of poverty and illiteracy by improving the educational opportunities of the Nation's low-income families" (Dwyer, 2001, p. 1). In the present study, two notable findings emerged that may serve to inform policy decisions about improving school readiness. In terms of answering the question of which are the most important dimensions of the Familia Inventory, results revealed that for English oral language proficiency, family-reported use of libraries was most useful. For Spanish oral language proficiency, having extended family members was most important.

The Library Use subscale of the Familia Inventory assessed the frequency of use of school or community library resources by the family. Libraries serve as an accessible resource for families not only for print awareness but also for family-driven and child-oriented activities that promote reading (Taylor, 2000). Although mostly in English, classroom and community libraries promote independent reading by allowing children easy access to books and comfortable places to take an interest in, browse, and read books (Christie, Enz, & Vukelich, 2006). This finding is consistent with the work of several early literacy researchers who found that the frequency of library visits is positively related to children's vocabulary, even after controlling for the effects of children's print exposure. Most important, the findings are more robust when the family literacy activities directly involve children (e.g., library visits; Payne et al., 1994; Senechal, LeFevre, Hudson, & Lawson, 1996). Other researchers have noted that library visits and well-designed classroom library corners that appeal to children's play preferences and that meet their literacy needs foster young children's development as emergent readers and writers and promote their interest in prereading activities (Roskos & Neumann, 2003). Finally, the finding that English oral language was related to Library Use was not surprising, given that sources of books in languages other than English (e.g., Spanish) are relatively scarce compared to the availability of books for children whose native language is English (Pucci, 1994). Nascent research on recommendations for providing effective library services to the Spanish-speaking family holds some promise. This research shows that some of the most effective methods libraries can employ to address the literacy needs of Spanish-speaking populations are to (a) become knowledgeable about the characteristics, values, and cultural needs of the immigrant population; (b) design libraries that "mirror" the community's profile; (c) recruit bicultural volunteers; (d) network with local agencies (e.g., churches, community centers); (e) form relationships with community leaders; (f) use bilingual signage wherever possible (e.g., outside, inside); (g) promote library availability to Hispanic groups; (h) provide materials the Hispanic community wants, not just what staff thinks they want; (i) provide culturally competent diversity training to staff; and (j) provide programming (e.g., poetry readings, dance, music) that appeals to Spanish-language populations (e.g., Brown, Lòpez-De Fede, Siegfried, & Patterson, 1998; Castillo et al., 1994).

The Extended Family subscale measures the levels of interaction within a family that includes grandparents and other relatives (Taylor, 2000). The finding that Extended Family was positively related to Spanish oral language among preschoolers is supported by qualitative

and quantitative works across a range of disciplines. To begin with, the present finding was also supported by the strong, cumulative, and empirical evidence that home literacy environments influence later school preparedness and performance (Wasik & Hendrickson, 2004). Research with Mexican American families specifically has shown an expressed preference for extended social networks in which important others (e.g., grandparents, other adults) form clusters of social relations that transmit knowledge, skills, information, norms, and values. This finding was also consistent with the growing body of research on intergenerational literacy programming, which seeks to involve the whole family by targeting adult caretaker strengths as a means of facilitating literacy of children in families (Daisey, 1991; Darling, 1992).

In the present study, to better understand the relative contribution of each dimension of home literacy, a commonality analysis was used as a means of partitioning the variance by which squared multiple correlation (R^2) could be reduced into constituent parts that could then be attributed to the home literacy aspects uniquely and in combination with each other. Commonality analysis is, however, but one method of partitioning variance in regression analyses and is straightforward when five or fewer variables are of interest to the researcher and may be very useful as a supplement to conventional regression analyses. An alternative to commonality analysis is blockwise selection of variables. Blockwise selection is a method of predictor selection in which forward selection is applied to specific "blocks" or sets of predictors with the aim of letting the blocks compete, ignoring other blocks, for entry into the equation using specified criteria (e.g., F-to-enter, increment in R^2). Once the first stage is completed, the selection procedure moves to the predictors in the second block with the restriction that the predictors identified in the first block remain in the equation. Second-block predictors compete for entry into the equation with their usefulness assessed relative to the presence of the first block predictors and will not be considered useful if they correlate highly with one or more predictors from the first block (Pedhazur, 1982).

Considering the pattern of intercorrelations among variables, it is possible that a complete block of variables will not meet entry criteria simply because it was entered late in the process. For this reason, it is often difficult to determine the "true" effects of the independent variables upon the dependent variables. More often, the independent variables are correlated, thus increasing the complexity of assessing the data to make interpretive sense of the results. What is missing is an account of the proportions of variance that can be attributed to various combinations of independent variables. Commonality analysis does not depend on a priori knowledge of the influence of predictors. Commonality analysis considers all possible orders of entry of the predictors in the model without distorting the results, as may occur in stepwise analyses or forced entry methods (Rowell, 1996).

Limitations and Future Research

One purpose of the study was to identify home literacy determinants of English and Spanish oral language for Hispanic preschool children. A second purpose was to illustrate the use of commonality analysis to address the questions posed in the present study. It was hoped that the knowledge of the unique and common home literacy antecedents of oral language for preschoolers will help in identifying which combination of home components are most important for targeted efforts by home-visiting programs and early childhood personnel.

Findings from the present study should, however, be interpreted cautiously, given its limitations. First, although the Library Use and Extended Family subscales of the Familia Inventory were correlated with English and Spanish oral language, respectively, the use of self-report instruments to assess home support for literacy may be subject to bias. For example, it is conceivable that parents' knowledge that they are "supposed" to read to their children may have influenced them such that they overreported the frequency of literacy-related behaviors. Future research should seek to obtain some composite, average, or summative score of socially desirable responding and control for its influence through its treatment as a covariate in analyses (e.g., partial correlations, multiple regression, or analysis of covariance). Second, measurement of children's oral language development relied on the use of only the PreLAS2000, a global measure of expressive and receptive oral language. Clearly, other aspects of children's emergent literacy warrant investigation (e.g., phonological awareness, alphabet knowledge, concepts of print). Future studies should explore the effect of the home environment on other aspects of a child's language development. Third, the present study relied on a highly circumscribed group of preschool children whose adult caretakers primarily worked in meatpacking plants in or around a mid-Western state and were either recent immigrants or agribusiness migrants. Participants may be quite different from other families on a number of complex sociological domains. Future studies should target populations from different regions of the country. Fourth, this study primarily focused on Hispanic children. The Hispanic student population is now the fastest growing segment of school-age children. In 2000, minority students composed 39% of the public school enrollment, with 44% being Hispanic in origin (National Center for Education Statistics, 2003). Although the general school population has grown only 12% since 1990, the predominantly Spanish-speaking, limited-English-proficient population has grown 105% (Kindler, 2002). It is estimated that by the year 2030, Hispanic children will constitute one fourth of the total student enrollment, with large numbers of these students having limited English proficiency (NICHD, 2000). Notwithstanding the numbers of Hispanic students, they, like many other nonnative speakers from other countries, face the daunting challenge of learning to speak, read, and write English while simultaneously learning the content of their core subject areas. Clearly, for all these children, their family serves as the foundation for language and literacy development. Future research should seek to examine the construct of "family literacy," including shifts in how literacy is conceptualized in families, social and cultural elements, and developmental and educational theories within the context of variations in literacy practices in different cultural and linguistic groups. Much more work is needed on how families engage in informal and direct and intentional ways to foster literacy in their children (Wasik & Hendrickson, 2004). Fifth, the results of this study are sample specific. Specifically, R^2 may vary from sample to sample, even though the independent variables remain identical in every sample (Pedhazur, 1982).

Conclusion

The central question of interest in the present study was whether different aspects of the home literacy environment had independent and common relationships with English and Spanish oral language outcomes. In the present study, we illustrated the use of commonality

analysis to decompose R^2 into the proportion of the variance of oral language outcomes associated uniquely with each of the Familia Inventory subscales and with the common effects of each. Much of the recent increased minority enrollments in elementary schools may be attributed to the growth in numbers of language-minority Hispanic students (Llagas & Snyder, 2003). Hispanics have made gains in several key education areas in the past two decades, but despite these gains, gaps between Hispanic and non-Hispanic students remain intractable. The large and ever-growing numbers of language-minority children has thrust upon the educational community extremely important questions and challenges not traditionally addressed within the domains of emergent literacy and reading science (Snow et al., 1998). Demographic trends indicate that the percentage of first-time kindergartners with two or more risk factors was 5 times greater for diverse learners, especially Hispanics (Silliman, Wilkinson, & Brea-Spahn, 2004). Diverse learners, especially those from literacy-impoverished homes, face on a daily basis "the tyranny of time in which the educational clock is ticking," falling further and further behind in their education (Kameenui, 1993, p. 376).

The findings in the present study have implications for practice and research on young children with or at risk of disabilities who are from diverse linguistic populations. Whereas children in the present study were not identified as having a disability, we did look at home correlates of early differences in oral language acquisition—differences known to have predictive relationships with later success, difficulties, and disabilities in reading (National Research Council, 1998). Caregivers may support children's language development through several processes, including reciprocal communication, cognitive stimulation, scaffolding, understanding conventions of print, language input, and understanding how to use words to convey meaning. These activities actively promote the skills that form the critical early foundations of literacy and learning to read (Landry & Smith, 2006). What, then, do educators need to know to better address the literacy issues of Hispanic families? They should (a) recognize that approximately 71% of entering Hispanic kindergarteners have multiple risk factors that harm language outcomes, (b) understand that Hispanic family socialization practices and literacy experiences may differ substantively from the normative expectations of schooling, (c) increase the number of bilingual and monolingual personnel with an understanding of the home literacy experiences of Hispanic families, (d) build sociocultural and linguistic bridges for ELL students and their families, and (e) adopt evidence-based practices that highlight instructional components based on reading research and Hispanic families (Silliman et al., 2004).

This study is of particular importance to "the tyranny of time" in that it adds to research and practice on diverse children who are at risk for school failure and disabilities. First, the home environments of Hispanic families, unfortunately, remain poorly understood—a barrier for translating policy into effective practices at home and at the classroom level (Farver et al., 2006). Many educators do not possess a significant knowledge about the linguistic underpinnings (e.g., home support for literacy, parent–child verbal interactions) of literacy learning (Silliman et al., 2004). We explored important variations in the home literacy environments of Hispanic families and their children regarding literacy and oral language outcomes. Second, we shed some light on the relative importance of literacy practices of Hispanic families and the relationship between those familial routines and important developmental precursors to school readiness. Third, we provided a glimpse into the quality of

Hispanic home environments—strong predictors of young Hispanic children's emergent literacy (Foster et al., 2005).

Finally, whereas it is known that limited-English-proficiency status is a strong indication that a child is at high risk for reading difficulties and that low reading achievement is widespread among Hispanic students, an unexpected finding in the present study was that even when tested in Spanish, the home language, Spanish-speaking preschoolers performed poorly—an indication that linguistic differences alone were not responsible solely for the disparities and degree of risk faced by these preschoolers. This finding leads to an important caveat on the present research: As noted by the National Research Council (1998), the risk factors and oral language outcomes of children are continuous and probabilistic rather than categorical or deterministic. Erroneous and misleading conclusions can be reached if risk variables and findings are not interpreted in this fashion. Comprehensive reviews of research have shown that no single risk, on its very own, is accurate enough to be practically and solely useful in predicting language, literacy, and reading problems. Researchers must look for combinations of various types—individual, familial, and demographic—to provide useful and meaningful predictive estimates of later levels of achievement (National Research Council, 1998, 2001).

Appendix
Formulas for Unique (U) and Common (C) Components of Explained Variance for Two, Three, Four, or Five Predictors

Two Predictor Variables

$U1 = -R^2(2) + R^2(12)$
$U2 = -R^2(1) + R^2(12)$
$C12 = R^2(1) + R^2(2) - R^2(12)$

Three Predictor Variables

$U1 = -R^2(23) + R^2(123)$
$U2 = -R^2(13) + R^2(123)$
$U3 = -R^2(12) + R^2(123)$
$C12 = -R^2(3) + R^2(13) + R^2(23) - R^2(123)$
$C13 = -R^2(2) + R^2(12) + R^2(23) - R^2(123)$
$C23 = -R^2(1) + R^2(12) + R^2(13) - R^2(123)$
$C123 = R^2(1) + R^2(2) + R^2(3) - R^2(12) + R^2(13) - R^2(23) + R^2(123)$

Four Predictor Variables

$U1 = -R^2(234) + R^2(1234)$
$U2 = -R^2(134) + R^2(1234)$
$U3 = -R^2(124) + R^2(1234)$
$U4 = -R^2(123) + R^2(1234)$

(continued)

Appendix (continued)

$C12 = -R^2(34) + R^2(134) + R^2(234) - R^2(1234)$
$C13 = -R^2(24) + R^2(124) + R^2(234) - R^2(1234)$
$C14 = -R^2(23) + R^2(123) + R^2(234) - R^2(1234)$
$C23 = -R^2(14) + R^2(124) + R^2(134) - R^2(1234)$
$C24 = -R^2(13) + R^2(123) + R^2(134) - R^2(1234)$
$C34 = -R^2(12) + R^2(123) + R^2(124) - R^2(1234)$
$C123 = -R^2(4) + R^2(14) + R^2(24) + R^2(34) - R^2(124) - R^2(134) - R^2(234) + R^2(1234)$
$C124 = -R^2(3) + R^2(13) + R^2(23) + R^2(34) - R^2(123) - R^2(134) - R^2(234) + R^2(1234)$
$C134 = -R^2(2) + R^2(12) + R^2(23) + R^2(24) - R^2(123) - R^2(124) - R^2(234) + R^2(1234)$
$C234 = -R^2(1) + R^2(12) + R^2(13) + R^2(14) - R^2(123) - R^2(124) - R^2(134) + R^2(1234)$
$C1234 = R^2(1) + R^2(2) + R^2(3) + R^2(4) + R^2(12) + R^2(13) - R^2(14) - R^2(23) - R^2(24) - R^2(34) + R^2(123) + R^2(124) + R^2(134) + R^2(234) - R^2(1234)$

Five Predictor Variables

$U1 = - R^2(2345) + R^2(12345)$
$U2 = - R^2(1345) + R^2(12345)$
$U3 = -R^2(1245) + R^2(12345)$
$U4 = -R^2(1235) + R^2(12345)$
$U5 = -R^2(1234) + R^2(12345)$
$C12 = R^2(1345) + R^2(2345) - R^2(345) - R^2(12345)$
$C13 = R^2(1245) + R^2(2345) - R^2(245) - R^2(12345)$
$C14 = R^2(1235) + R^2(2345) - R^2(235) - R^2(12345)$
$C15 = R^2(1234) + R^2(2345) - R^2(234) - R^2(12345)$
$C23 = R^2(1245) + R^2(1345) - R^2(145) - R^2(12345)$
$C24 = R^2(1235) + R^2(1345) - R^2(135) - R^2(12345)$
$C25 = R^2(1234) + R^2(1345) - R^2(134) - R^2(12345)$
$C34 = R^2(1235) + R^2(1245) - R^2(125) - R^2(12345)$
$C35 = R^2(1234) + R^2(1245) - R^2(124) - R^2(12345)$
$C45 = R^2(1234) + R^2(1235) - R^2(123) - R^2(12345)$
$C123 = R^2(145) + R^2(245) + R^2(345) - R^2(45) - R^2(1245) - R^2(1345) - R^2(2345) + R^2(12345)$
$C124 = R^2(135) + R^2(235) + R^2(345) - R^2(35) - R^2(1235) - R^2(1345) - R^2(2345) + R^2(12345)$
$C125 = R^2(134) + R^2(234) + R^2(345) - R^2(34) - R^2(1234) - R^2(1345) - R^2(2345) + R^2(12345)$
$C134 = R^2(125) + R^2(235) + R^2(245) - R^2(25) - R^2(1235) - R^2(1245) - R^2(2345) + R^2(12345)$
$C135 = R^2(124) + R^2(234) + R^2(245) - R^2(24) - R^2(1234) - R^2(1245) - R^2(2345) + R^2(12345)$
$C145 = R^2(123) + R^2(234) + R^2(235) - R^2(23) - R^2(1234) - R^2(1235) - R^2(2345) + R^2(12345)$
$C234 = R^2(125) + R^2(135) + R^2(145) - R^2(15) - R^2(1235) - R^2(1245) - R^2(1345) + R^2(12345)$
$C235 = R^2(124) + R^2(134) + R^2(145) - R^2(14) - R^2(1234) - R^2(1245) - R^2(1345) + R^2(12345)$
$C245 = R^2(123) + R^2(134) + R^2(135) - R^2(13) - R^2(1234) - R^2(1235) - R^2(1345) + R^2(12345)$
$C345 = R^2(123) + R^2(124) + R^2(125) - R^2(12) - R^2(1234) - R^2(1235) - R^2(1245) + R^2(12345)$
$C1234 = R^2(15) + R^2(25) + R^2(35) + R^2(45) - R^2(5) - R^2(125) - R^2(135) - R^2(145) - R^2(235) - R^2(245) - R^2(345) + R^2(1235) + R^2(1245) + R^2(1345) + R^2(2345) - R^2(12345)$
$C1235 = R^2(14) + R^2(24) + R^2(34) + R^2(45) - R^2(4) - R^2(124) - R^2(134) - R^2(145) - R^2(234) - R^2(245) - R^2(345) + R^2(1234) + R^2(1245) + R^2(1345) + R^2(2345) - R^2(12345)$

(continued)

Appendix (continued)

$$C1245 = R^2(13) + R^2(23) + R^2(34) + R^2(35) - R^2(3) - R^2(123) - R^2(134) - R^2(135) - R^2(234) - R^2(235) - R^2(345) + R^2(1234) + R^2(1235) + R^2(1345) + R^2(2345) - R^2(12345)$$

$$C1345 = R^2(12) + R^2(23) + R^2(24) + R^2(25) - R^2(2) - R^2(123) - R^2(124) - R^2(125) - R^2(234) - R^2(235) - R^2(245) + R^2(1234) + R^2(1235) + R^2(1245) + R^2(2345) - R^2(12345)$$

$$C2345 = R^2(12) + R^2(13) + R^2(14) + R^2(15) - R^2(1) - R^2(123) - R^2(124) - R^2(125) - R^2(134) - R^2(135) - R^2(145) + R^2(1234) + R^2(1235) + R^2(1245) + R^2(1345) - R^2(12345)$$

$$C12345 = R^2(1) + R^2(2) + R^2(3) + R^2(4) + R^2(5) - R^2(12) - R^2(13) - R^2(14) - R^2(15) - R^2(23) - R^2(24) - R^2(25) - R^2(34) - R^2(35) - R^2(45) + R^2(123) + R^2(124) + R^2(125) + R^2(134) + R^2(135) + R^2(145) + R^2(234) + R^2(235) + R^2(245) + R^2(345) - R^2(1234) - R^2(1235) - R^2(1245) - R^2(1345) - R^2(2345) + R^2(12345)$$

Note

1. There were only two preschool teachers at the center who were designated Even Start teachers. Each teacher taught two half-day classes (morning and afternoon). Both teachers agreed to participate in the Even Start program and this study.

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