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A Longitudinal Assessment of the Home Literacy Environment and Early Language

Sara A. Schmitt[*], **Adrianne M. Simpson**, and **Margaret Friend**

Department of Psychology, San Diego State University, San Diego, CA, USA

Abstract

This longitudinal assessment concentrated on the relation between the Home Literacy Environment (HLE) and early language acquisition during infancy and toddlerhood. In Study 1, after controlling for SES, a broadly-defined HLE predicted language comprehension in 50 infants. In Study 2, 27 children and their primary caregivers returned for further analyses. Findings revealed that the HLE measured in infancy predicted language production in toddlerhood, and maternal redirecting behaviors measured in toddlerhood were negatively associated with expressive language. Results across both studies indicate the importance of a broadly-defined HLE (including joint attention and parent-child conversation) for language development. Taken together, these findings highlight the importance of the HLE in supporting both receptive and expressive vocabulary growth in the second and third years of life.

Keywords

Home Literacy Environment; language development; receptive vocabulary; expressive vocabulary

The factors that underlie early literacy have become an important focus in developmental research. An early indicator of emergent literacy is the pace of early language acquisition. In turn, the Home Literacy Environment (HLE) is a complex of factors thought to support early language. However, conceptualizations of the HLE exist along a continuum from a conservative focus on literacy activities to a broader focus on literacy and joint attention.

On one end of the spectrum, researchers employ a definition of the HLE that focuses exclusively on literacy activities (DeBaryshe, 1993; Deckner, Adamson, & Bakeman, 2006; Fritjers, Barron, & Brunello, 2000; Karrass & Braungart-Rieker, 2005; Payne, Whitehurst, & Angell, 1994; Raikes et al., 2006; Senechal, LeFevre, Hudson, & Lawson, 1996; Senechal, LeFevre, Thomas, & Daley, 1998). Evans and Shaw (2008) review five key skill areas that are supported by activities in the home: phonological awareness, alphabetic knowledge, print concepts, vocabulary development, and word recognition. In each area, they emphasize the importance of shared reading in supporting skill acquisition and development. In contrast, others define the HLE more broadly to include literacy and joint attention activities (Dodici, Draper, & Peterson, 2003; Fish & Pinkerman, 2003; Roberts, Jurgens, & Burchinal, 2005;

[*]Correspondence to: Sara A. Schmitt, Department of Human Development and Family Sciences, Oregon State University, Corvallis, OR 97333, USA. schmitts@onid.orst.edu.

Umek, Podlesek, & Fekonja, 2005). Though they devote particular attention to shared book reading, Evans and Shaw, acknowledge the importance of other parent-child interactions in the home that also contribute to later literacy. This disparity in conceptual scope has led to inconsistent findings regarding the relation between early language and the HLE (DeBaryshe, 1993; Deckner et al., 2006; Dodici et al., 2003; Fish & Pinkerman, 2003; Fritjers et al., 2000; Karrass & Braungart-Rieker, 2005; Payne et al., 1994; Raikes et al., 2006; Roberts et al., 2005; Senechal et al., 1996; Senechal et al., 1998; Umek et al., 2005).

The present paper has two primary goals. First, in Study 1 we assess the concurrent relation between conservatively- vs. broadly-defined measures of the HLE and early vocabulary comprehension. Second, in Study 2 we assess the concurrent and predictive relation between the HLE and language production.

Conservatively-Defined HLE

The HLE can be defined as shared reading activities in the home. For example, a relationship between frequency of parent-child reading episodes, parent knowledge of storybook titles, and language is well-documented in the literature particularly among preschool-aged children (Karrass & Braungart-Rieker, 2005; Raikes et al., 2006; Senechal et al., 1996; Senechal et al., 1998). Frequency of book reading accounts for approximately 8% of variance in language outcomes (Scarborough & Dobrich, 1994; Bus, van IJzendoorn, & Pellegrini, 1995). Similarly, parent's knowledge of storybook titles accounts for between 2 and 7% of the variance in receptive and expressive vocabulary (Senechal et al., 1996; Senechal et al., 1998).

There is a relation between the *quality* of parent-child reading activities and language outcomes (Arnold, Lonigan, Whitehurst, & Epstein, 1994; Deckner et al., 2006; Ortiz, Stowe, & Arnold, 2001; Reese & Cox, 1999; Valdez-Menchaca, & Whitehurst, 1992). For example, Reese and Cox (1999) conducted a study in which parents were trained on facilitative dyadic reading styles. It was found that parents who explain and inquire about pictures in a storybook facilitate receptive vocabulary development in their children. However, a significant interaction was also reported between reading style and initial vocabulary skills: children with lower initial vocabulary experienced the greatest gains when parent reading focused on describing and/or labeling.

Multiple measures of reading activity, taken together, account for substantial variance in early language. Age of onset of shared reading, visits to the library, number of books in the home, and the quality of reading interactions are associated with child language (DeBaryshe, 1993; Deckner et al., 2006; Frijters et al., 2000; Payne et al., 1994). These factors, as a group, account for 21% of unique variance in the receptive language of kindergarteners (Frijters et al., 2000) and 18.5% of combined receptive and expressive vocabulary among preschoolers (Payne et al., 1994). Whereas the majority of research regarding the home literacy environment focuses on preschool children, an emerging literature extends this concept to infants and toddlers. Consistent with the literature on older children, some studies report that book reading activities are related to early comprehension and expressive vocabulary both concurrently and predictively (Deckner et al., 2006; Raikes et al., 2006).

Further, DeBaryshe (1993) reported that shared reading accounted for 35% of the variance in receptive language and age of onset of book reading was the strongest predictor of oral language skills in 2-year olds, paralleling Payne et al.'s (1994) findings in older children.

The role of the onset of shared reading in predicting language outcomes was recently clarified by Karrass and Braungart-Rieker (2005). Shared book reading at 8 months of age, but not at 4 months of age, predicted combined receptive and expressive vocabulary at 12 and 16 months. The beneficial effect of shared reading may be dependent upon the emergence of intentionality and joint attention toward the end of the first year of life (Tomasello, 1999, 2003). Shared reading does not appear to facilitate language acquisition prior to the onset of triadic interactions. Parents who begin reading early to their infants tend to engage in frequent joint attention (Karrass, VanDeventer, & Braungart-Rieker, 2003) and generally provide a stimulating linguistic environment (Bus et al., 1995). While book reading provides one opportunity for joint engagement, joint attention in other contexts of parent-child interactions may contribute to the relation between onset of shared book reading and language acquisition.

Broadly-Defined HLE

A conceptualization of the HLE combining literacy activities and other joint attention activities (e.g., object naming, parent-child conversations) is the focus of recent studies of language outcomes among preschool children (Dodici et al., 2003; Fish & Pinkerman, 2003; Roberts et al., 2005; Umek et al., 2005). Fish and Pinkerman (2003) examined the relative contributions of mother-child interactions (e.g., contingent feedback), contextual variables (e.g., frequency of book reading), and child characteristics (e.g., infant temperament) to the language skills in a sample of low SES rural Appalachian children. Maternal responsiveness predicted language comprehension skills at 15 months, age 4, and prior to kindergarten entry and explained additional variance in preschool language skills above other variables, including literacy activities (11% variance in 4-year-olds and 8% prior to kindergarten entry).

Similarly, Dodici et al. (2003) and Roberts et al. (2005) found evidence that the quality of joint attention episodes and literacy activities differentially predict language outcomes among 3- and 4-year-olds. Neither the frequency nor child's enjoyment of book reading predicted language outcomes; however, maternal sensitivity and book reading strategies were associated with larger vocabularies at 3 years and prior to kindergarten entry (Roberts et al., 2005). Further, the most significant and consistent predictor of language and literacy outcomes was the Home Observation for Measurement of the Environment Inventory (HOME), an observational measure of overall quality of stimulation in the home (Bradley & Caldwell, 1976; Caldwell & Bradley, 1984). This is consistent with Dodici et al.'s finding that parent report of reading activities did not predict language outcomes whereas the overall HLE, as measured through observed parent-child literacy interactions, predicted vocabulary prior to kindergarten entry. Consistent with these findings, Umek et al. (2005) found that the Home Literacy Environment Questionnaire (HLEQ), a parent report measure including items on literacy activities and social interactions, in combination with maternal education, significantly predicted combined vocabulary comprehension and production in 4-year-olds.

In these studies, a broadly-defined HLE better predicted language outcomes from late infancy through approximately 4 years of age than any individual component. Of interest in the present paper is whether a broad measure of the HLE will predict vocabulary comprehension earlier in the acquisition process.

The notion that social interaction provides a foundation for language competence is consistent with approaches that emphasize how social factors direct infant attention to word-referent relationships. Many studies support the link between social interactions and early language (Baldwin, 1991; Baldwin & Markman, 1989; Baldwin et al., 1996; Tomasello, 1999; Tomasello & Farrar, 1986). For example, social-cognitive skills, particularly intention-reading, emerge as fundamental to language acquisition in infancy (Baldwin et al., 1996; Tomasello, 2001), and language and literacy development are highly associated (Arnold et al., 1994; Deckner et al., 2006; Karrass & Braungart-Rieker, 2005; Ninio, 1983; Reese & Cox, 1999; Roberts et al., 2005; Senechal et al., 1998; Umek et al., 2005; Whitehurst et al., 1988). Thus, social pragmatic factors, such as joint attention and intentional inference, might be a foundation of emergent literacy. However, because early interactions may be modulated by Social Economic Status (SES), we now consider the evidence for SES effects on mother-child interactions and on language acquisition.

The Influence of Socio-Economic Factors on Early Literacy

Factors such as low income and maternal education may have broad consequences for language acquisition and literacy. Mothers from lower socio-economic strata have been shown to engage in speech toward their children that is more directive and includes fewer questions relative to mothers from higher SES backgrounds. These mothers also tend to talk less to their children and use smaller vocabularies (Hoff, Laursen, & Tardif, 2002). Hart and Risley (1995) report that children from lower SES families hear about 62,000 words a week in contrast to children from working class families who hear about 125,000 words and children from professional upper SES backgrounds who hear 215,000 words. In turn, these SES differences in language input have significant effects on development: both maternal vocabulary and length of utterance are positively associated with child language acquisition (Hoff & Tian, 2005). These findings are consistent with a growing literature that reports SES influences on parent-child interaction and child language outcomes (Beitchman et al., 2008; Vernon-Feagans et al., 2008; see Hoff, 2006 for a review). Scarborough and Dobrich (1994) argue that SES is a stronger predictor of emergent literacy in preschoolers than shared reading activities. These findings suggest that SES may influence language development through its effects on opportunities for interaction and input.

Nevertheless, considerable variability exists in parent report of book reading activities within lower SES samples (Payne et al., 1994; Raikes et al., 2006) as well as within middle- and upper-SES samples (Bee et al., 1982; Deckner et al., 2006; Dodici et al., 2003; Hoff, 2003; Olson, Bates, & Kaskie, 1992; Senechal et al., 1996). In mixed SES samples, Olson et al. (1992) and Bee et al. (1982) found that adult-infant interaction explained unique variance in early language skills after SES had been controlled. Of interest in the present paper is to investigate the effects of the HLE on language development in a sample representative of the

local community. We present two studies exploring the concurrent and predictive relationships between the HLE and language development in infancy and toddlerhood.

Study 1

Study 1 evaluated the relative efficacy of conservative and broad measures of the HLE for predicting language comprehension prior to the second birthday. One conceptualization of the HLE is characterized by a specific emphasis on *literacy qua literacy*: activities that are directly associated with reading (e.g., shared book reading and print concepts). Another, broader HLE is characterized by a focus on activities that provide the scaffolding that *leads to literacy*: key social factors (e.g., shared attention and expansion of child utterances) that emerge in multiple contexts of adult-infant interaction including shared book reading. We hypothesize that a broadly-defined HLE will account for significantly greater variance in language comprehension relative to a conservatively-defined HLE. We also expect that the HLE will predict scores on both parent report and behavioral measures of language comprehension, and further, that the HLE will explain unique variance in language acquisition beyond that explained by SES.

Method

Participants—The final sample consisted of 50 typically-developing infants (24 males and 26 females) following the exclusion of seven subjects due to parental interference (2), technical failure (2), and infant fussiness (3). Infants ranged from 16 to 21 months of age (M = 18;23, range 16;2 to 21;4). The demographic characteristics of the sample were similar to the census data on the English-speaking population of the local county. The distribution of socio-demographic characteristics can be found in Table 1. Selection criteria for infant participation were: full-term pregnancy, normal hearing and vision, and parent report of English language exposure greater than or equal to 75% of total weekly exposure.

To address hypotheses related to SES, we screened participants on parent education and occupation and endeavored to recruit those parents most representative of the local population. Whereas income levels, ethnicity, and second language exposure reflected the local population, the educational attainment of the final sample was relatively high. Nevertheless, Hollingshead Four Factor Index scores indicated that the sample represented a wide range of SES. The Four Factor Index of Social Status (Hollingshead, 1975) takes both education and occupation into account, providing a more sensitive estimate of SES than either education or income alone. Middle-class status is associated with scores ranging from 40 to 54. The distribution of scores for the present sample was relatively normal with a slight negative skew (M = 44.70, SD = 12.90, *skew* = −.40, range = 11 to 66). Thirty-four percent of the current sample had scores less than 40, 38% between 40 and 54, and 28% greater than 54.

Participants were recruited through advertisements in local parenting magazines, community-based internet resources, a local free weekly newspaper, and flyers distributed at local libraries, daycare facilities, and low-income nutrition centers. Parents received a $10 gift certificate to a local store to compensate for travel to the lab and infants received a small gift for their participation.

Measures

Children's Title Checklist (CTC): The CTC assesses parents' knowledge of children's storybooks as a measure of the HLE (Senechal et al., 1996, 1998) and, thus, constitutes a conservative measure of the HLE. Slight modifications were made based on the local availability of books. The modified checklist consisted of 54 total items, 36 titles and 18 foils. Following Senechal et al. (1998), a score was derived by subtracting the proportion of false positives from the proportion of correct responses to correct for responses based on social desirability.

Home Literacy Environment Questionnaire (HLEQ): The HLEQ assesses multiple facets of the HLE (Umek et al., 2005), including book reading and conversational behaviors and, in this sense, constitutes a broad measure of the HLE. The questionnaire consists of 33 items. Parents indicate the frequency of each parent-child activity on a 1 to 6 point Likert-scale (1–2 = never or rarely, 3–4 = frequently, 5–6 = very frequently or always). A final score is assigned based on the mean of all items, ranging from 1 to 6, in order to preserve the original scale.

Hollingshead Four Factor Index of Social Status (SES): A value is assigned to represent social class based on the education and occupation of each employed parent in the home (Hollingshead, 1975). The SES value ranges from 8 to 66 and is determined by weighting and summing scores on two scales: highest level of education and occupation. In dual-parent homes, the SES scores of both parents are averaged to calculate one score per household. The scale has been recommended for use in developmental psychology because it can be used with unmarried individuals, heads of household, and families and has been found to be both reliable and valid (Gottfried, 1985).

MacArthur-Bates Communicative Development Inventory: Words and Gestures (CDI: WG): A parent checklist designed to measure infant receptive and productive vocabulary, the CDI: WG consists of words, phrases, and gestures (Fenson et al., 1993). Parents indicate whether infants understand or understand and produce the items listed. The full comprehension vocabulary score is a dependent measure in the present study.

The Computerized Comprehension Task (CCT): The CCT is a behavioral measure of language comprehension appropriate for infants in the second year of life (Friend & Keplinger, 2003, 2008). Items include nouns, verbs, and adjectives that vary in difficulty. Pairs of images appear on a touch-screen in a forced-choice format. Infants are prompted to touch a target image and receive auditory reinforcement for correct responses. The target image is counter-balanced across participants resulting in two equivalent forms. Responses are coded as correct if the child touches or points to the target image; incorrect if the child touches or points to the distractor image; ambiguous if the child's response is uninterpretable (i.e. a touch to the center of the screen or both images touched simultaneously); or missing if the child looked but failed to respond to the prompt. The testing session consists of 4 training trials, 41 test trials, and 13 reliability trials. The total number of test trials on which children chose the target image serves as a behavioral measure of language comprehension in the present study.

Procedure—Participants initiated contact with the lab through telephone or email. Those who met the screening criteria set up an appointment to come to the lab. Approximately 1 week prior to the appointment, a basic information sheet and CDI: WG were sent to the parents. Upon arrival in the lab, infants participated in a warm-up period with toys in the lobby while parents completed the CTC. Parents were instructed that the list contained both actual and fake titles, to indicate only the titles that they recognized, and to avoid guessing. Completion of the HLEQ followed. Parents were instructed that families typically engage in a wide range of activities with their infants and that it is unlikely that any family regularly participates in all of the listed behaviors. They were told that the purpose of the questionnaire was to get an accurate picture of their individual environment, including the activities that they engage in the most and the least. Next, infants were shown how to "finger paint" on a portable touch-sensitive computer screen using a wide brush setting in Microsoft Paint™ to become familiar with the technology used in the CCT. All infants participated in this familiarization.

Infants and their parents were escorted into a dimly lit testing room to complete the CCT. Infants were seated in front of the computer kiosk with parents seated behind. Parents wore opaque glasses so that the infants could not use parents' gaze to guide their responses. Parents were instructed not to repeat the experimenters' questions and encouraged not to interact with their child during the task unless the child became upset in which case, the parent was asked to comfort the child. If the child could not be consoled then the testing session was terminated.

At the beginning of each trial, the experimenter prompted the infant. The prompt was dependent upon word class: for nouns the experimenter said, "Where's the ___? Touch ___;" for verbs, "Who's ___? Touch ___;" and for adjectives, "Which one is ___? Touch ___." Next, target and distractor images appeared on the touch-sensitive screen. Each pair of images was presented for 7 sec based on pilot data and previous studies indicating that the majority of 16–20-month-old infants execute a touch to the screen within this window. To sustain attention, if a child failed to respond on 2 consecutive trials, the experimenter touched the target image to reintroduce the contingency between a correct response and an auditory reinforcement. If a child attempted to touch the target image but failed to do so within the 7 sec window, the image pair was re-presented; however, this rarely occurred. Following the presentation of the test trials, 13 picture pairs were re-presented in the opposite left-right orientation to assess reliability. Only infants who remained alert and attentive throughout the testing session participated in the reliability assessment (N=31).

Results and Discussion

Scores on the CTC ranged from .08 to .64 (M = .30, σ = .14). Similar to Senechal et al. (1998), we found that foil titles were rarely checked by parents (mean = 2.0%, median and mode = 0) suggesting that responses were not driven by social desirability. Titles on the CTC were correctly identified at a rate of 32.1%, lower than reported by Senechal et al. (46.55%). However, endorsements were higher for books that were considered popular by local librarians (62%) and for books identified as classics (53.2%).

On the HLEQ, the full range of scores (*M*s ranged from 1.50 to 5.82) was utilized on the majority of items in the questionnaire. However, the distribution of HLEQ total scores was negatively skewed ($M = 4.10$, $SD = .64$, $skew = -.86$). The reliability coefficient for the instrument was high ($\alpha = .86$) showing good internal consistency. Although both the CTC and HLEQ purport to measure the home literacy environment, they were not significantly correlated, $r(50) = .010$, $p > .05$.

Assessment of test-retest reliability on the CCT revealed one outlier at 3 standard deviations from the mean. Test-retest reliability was significant with and without this outlier, $r(34) = 69$, $p < .01$ and $r(33) = .77$, $p < .01$, respectively (see Figure 1). Both, test-retest reliability and convergence with parent report on the CDI: WG ($r(50) = .44$, $p < .01$; see Figure 2), replicated the findings reported by Friend and Keplinger (2003, 2008). Preliminary analyses revealed no significant sex or form differences on either vocabulary measure. The average comprehension score was 226.74 out of 396 items ($\sigma = 100.62$) on the CDI: WG and 17.34 out of 41 items ($\sigma = 7.76$) on the CCT.

Zero-order correlations were evaluated to explore the association between all predictor and dependent variables. Contrary to expectation, neither SES nor the CTC correlated with either vocabulary measure. As expected, the correlations between the HLEQ and both vocabulary measures were medium to large and significant. For the CDI: WG, $r(50) = .55$, $p < .01$, and for the CCT, $r(50) = .35$, $p = .01$. Results suggested that only the HLEQ, not SES or the CTC, would contribute to the models of the relationship between HLE and early language comprehension.

This was confirmed by a planned series of fixed-order hierarchical multiple regressions. In order to control for SES effects, this variable was entered on the first step. Then the CTC and HLEQ were alternated on subsequent steps. First, predictors were regressed onto the CDI: WG. Two multivariate outliers were identified. Analyses run with and without these participants yielded a consistent pattern of significance. Therefore, results are presented on the full data set. The model predicting CDI: WG scores was significant only after the addition of the HLEQ on step 3, $F(3, 46) = 6.72$, $p < .01$, $R^2 = .31$. Neither SES nor the CTC accounted for significant variance; however, HLEQ scores did account for a significant increase in explained variance, $F(1, 46) = 19.82$, $p < .01$, $\Delta R^2 = .30$, and were significantly associated with CDI: WG scores, ß = .55, $p < .01$. In support of our hypothesis, this result shows that the HLEQ accounts for 30% of the variance in receptive vocabulary above and beyond that explained by a conservative measure of the HLE and after controlling for SES.

Identical fixed-order hierarchical regressions were run with the CCT as the dependent measure. The model predicting CCT scores was not significant when all predictors were included. However, the HLEQ did account for a significant increase in explained variance beyond the CTC and SES, $F(1, 46) = 5.81$, $p = .02$, $\Delta R^2 = .11$, and was significantly associated with CCT scores, ß = .33, $p = .02$. The CTC did not add significantly to the total variance in infant comprehension. Together, these findings indicate that the HLEQ better predicted language comprehension across measures than did the CTC.

These results reveal the efficacy of a broadly-defined HLE in predicting receptive vocabulary prior to the second birthday. In order to produce the most accurate model of this relationship, regressions were rerun to include only relevant predictors as indicated by the zero-order correlations. HLEQ scores were first regressed on CDI: WG. Four multivariate outliers were identified; however, the pattern of significance obtained across regressions was such that results are presented on the full data set. HLEQ scores were next regressed on CCT. As expected, the HLEQ predicted word comprehension on both the parent report and infant performance measures. HLEQ scores accounted for significant variance in the CDI: WG, $F(1, 48) = 20.56$, $p < .01$, $R^2 = .30$, and the CCT, $F(1, 48) = 6.48$, $p = .01$, $R^2 = .119$ (see Figures 3 and 4). Further, the regression coefficients relating the HLEQ to vocabulary comprehension were medium to large and significant, $\beta = .55$, $p < .01$ and $\beta = .35$, $p = .01$, respectively. The home literacy environment, as assessed by the HLEQ, explains 12–30% of the variance in infant receptive vocabulary, depending on the method of assessment.

The HLEQ includes statements to evaluate multiple characteristics of the home environment, incorporating both social-pragmatic factors and specific book reading activities. Umek et al. (2005) identified five factors comprised in the HLEQ: (a) stimulation to use language, explanation, (b) reading books, visiting the library and puppet theater, (c) joint activities and conversation, (d) interactive reading, and (e) zone-of-proximal development stimulation. Of interest was whether the parental behaviors that are most associated with language development vary with the age of the children studied. Since the present, smaller sample precluded factor analysis, the inter-correlations between HLEQ items were evaluated to address this question. Large and moderately large effect sizes, rs > .4, were used to identify sets of related items. Items that did not exhibit a large correlation with at least two other items were excluded. There were 20 items in the final set.

Three distinct sets of items were identified. The first set represents engagement in joint attention, conversations, and triadic activities. The second set represents the quantity and quality of shared book reading. The final set includes items that indicate formal skill learning. This analysis suggests a slightly different underlying structure in the present, younger sample than found in Umek et al. (2005), although sizable overlap exists.

The intra-class correlations for these item sets were high (Cronbach's alpha = .87, .77, and .82, respectively) and the correlation between each set and the full HLEQ was large and significant, rs between .57 and .88, $ps < .01$. CDI: WG scores are significantly correlated with joint attention and shared book reading items, $rs = .49$ and .42, $ps < .01$, respectively whereas CCT scores are associated only with joint attention items, $r = .35$, $p = .01$. A correlation matrix is presented in Table 2. Across measures, reported parent-child conversation, shared book reading, and formal skill learning accounted for 12–24% of variance in infant language comprehension.

To summarize, contrary to expectation, SES did not account for significant variance in language comprehension. As expected, a broad measure of the HLE that combines social-pragmatic factors such as maternal responsiveness and joint attention with literacy behaviors was successful in predicting early comprehension vocabulary. Measures of the HLE that rely strictly on literacy behaviors do not appear to predict language development in the second

year of life. This finding, in conjunction with the analysis of distinct item sets within the HLEQ, suggests that early language development relies primarily on social interaction and general language stimulation. Of interest in Study 2 is whether the relation between the HLE and early comprehension extends to later language production and whether parent reports and observation yield converging portraits of the HLE.

Study 2

Several studies report a predictive relationship between the HLE and language in preschool-aged children, however, there is a dearth of literature exploring this relationship in younger children. Study 2 builds upon the work of Dodici and Draper (2001). Dodici, Draper, and Peterson (2003) conducted a longitudinal study on parent-toddler home literacy interactions and language and literacy development in preschool. Parent-child interactions at 14, 24, and 36 months were videotaped and coded using the Parent-Infant/Toddler Interaction Coding System (PICS; Dodici & Draper, 2001) to obtain a measure of the HLE. Prior to entering kindergarten, parent-reported reading behaviors in the home, parent-child interactions, and children's language and literacy were assessed. Observed interactions better predicted literacy and language skills in preschoolers than did parent reports of reading in the home; however the sample did not include low-income families, and developmental outcomes were not assessed during the toddler period.

Study 2 assesses the predictive validity of the HLE in late infancy to language development in toddlerhood. We hypothesize that the HLE at 16–21 months (time 1) will predict expressive language in toddlers at 24–40 months (time 2). We further hypothesize a concurrent relationship between the HLE and toddlers' expressive language. Finally, we extend Dodici et al. (2003) by evaluating the prediction from observed interactions to language development during the toddler period in families from a broader demographic. We expect that observed interactions will better predict expressive language development in toddlers than parent reports on the HLEQ.

Method

Participants—Of our original sample in Study 1, 27 children (male = 12, female = 15) between the ages of 24–40 months (M = 29 months) and their primary caregivers returned to participate in Study 2. The distribution of socio-demographic characteristics can be found in Table 3.

Procedure—Participants were contacted by telephone. Parent-child dyads were mailed the HLEQ to complete at home and an appointment in the lab was scheduled one month later to reduce the possibility of carry-over effects from the HLEQ to the laboratory observation. Approximately 1 week prior to this visit, parents were mailed the CDI: WS to complete at home, and were asked to bring it to the lab on the day of the appointment. The researcher and dyads engaged in a "warm-up" period of 10 minutes in a comfortable playroom. Dyads were guided into an adjacent room equipped with a Sony Digital Handycam video camera, a Digital Audio Tape (DAT) Recorder, an Audio Technica AT898 Subminiature Recorder equipped with a Cardioid Condenser microphone, and a one-way mirror for observation.

Dyads were observed for 20 minutes. For the first 10 minutes of observation, caregivers were asked to play with their child as they would at home with a complex toy (a Fisher-Price interactive farm set) provided by the experimenter. For the second 10 minutes, caregivers were asked to read one to three age-appropriate picture books with their child just as they would at home. Pilot testing revealed that children were more alert and compliant when play preceded shared book reading. Consequently, in all sessions, free play with the toy preceded shared book reading. The picture books included: "Clifford: Where is the Big Red Doggie?" by Norman Bridwell; "Biscuit's Picnic" by Alyssa Satin Capucilli; and "Mighty Tugboats" by Gina Phillips and Noeline Cassettari. The interactions were audio- and video-taped for later coding.

Measures

Home Literacy Environment Questionnaire: The HLEQ (Umek et al., 2005) was completed one month prior to the laboratory visit.

Maternal Responsiveness Coding System: A modified version of Bornstein, Tamis-LeMonda, Hahn, & Haynes' (2008) maternal responsiveness coding system was used to code the 10-minute videotaped observation of toy play interactions. Maternal responses were coded into one of the following mutually-exclusive categories: 1) affirmations (e.g., "Great job," That's correct!" or "That's where that goes."); 2) imitations/expansions/repetitions (for example, the child says, "This is the horse." Mother replies, "This is the horse that says nay!"); 3) description of an object, event, or activity (e.g., "The cow belongs in the barn.); 4) question about an object, event, or activity (e.g., "Who are you playing with?" or "Can you milk the cow?"); 5) exploratory prompt (e.g., "What is this over here?"). The frequency of maternal responses in each category was coded. The first author coded all participant interactions, and an inter-rater reliability of >= .80 was reached with a second coder on one-third of the sessions.

Reading Style Scale: A modified version of a reading style scale (Whitehurst et al., 1988) was used to code parent-child shared book reading. Seven categories were coded: 1) simple *what* questions (e.g., "What is that?"); 2) imitative directives/modeling (e.g., "There are one, two, three boats. Now, can you count to three?"); 3) praise/confirmation (e.g., "Good job! You answered that correctly!"); 4) open-ended questions (e.g., "What's on this page?" or "What do you think will happen next?"); 5) repetition (For example, the child says, "Red boat." Mother responds, "Boat."); 6) expansion (For example, the child says, "Dog." Mother responds, "Big dog."); 7) function/attribute question (e.g., "What is it doing?" or "What color is Clifford?"). The frequencies of maternal behaviors were coded. The first author coded all participants, and an inter-rater reliability of >= .80 was reached with a second coder on one-third of the sessions.

MacArthur-Bates Communicative Development Inventory: Words and Sentences (CDI: WS): Parents completed the CDI: WS (Fenson et al., 1993) as a measure of expressive language. In particular, we were interested in parent reports of vocabulary production for comparison with reports of vocabulary comprehension in Study 1. Typically,

this measure is used for children 24–30 months of age, however, of the 8 participants older than 30 months, only 4 were at ceiling, and none were statistical outliers.

Results and Discussion

Both the HLEQ at time 1 (M = 4.08, SD = .54, *skew = .07)* and at time 2 (M = 4.58, SD = .44, *skew = .10)* were normally distributed and utilized the full range of scores. Scores on the CDI: WS ranged from 102 to 677 out of 680 (M = 459.38, SD = 148.33).

The mutually exclusive items in the modified version of Bornstein et al.'s (2008) maternal responsiveness coding system were generally not correlated with a single exception: affirmations and exploratory prompts were related at r = .41,p = .04. In contrast, on the dialogic reading scale developed by Whitehurst et al. (1988), the majority of items were correlated with at least two other items in the scale. This measure demonstrated good internal consistency (α = .68).

To investigate consistency in the reporting of the HLE across time, and the predictive relationship between the HLE and expressive language, two regression analyses were conducted. Preliminary analyses revealed two multivariate outliers (> 2 SD from the mean). When these outliers were included, results did not reach significance. Further analyses are reported with these outliers excluded.

The HLEQ at time 1 significantly predicted the HLEQ at time 2, $F(1, 24) = 14.57$, p =.01, R^2 = .39. Further, the HLEQ at time 1 predicted expressive vocabulary at time 2 on the CDI: WS, $F(1, 22) = 7.41$, p = .01., R^2 = .26. Parent report of the HLE appears to be consistent over time and parent reports of the HLE late in the second year of life predict CDI: WS vocabulary production scores in the third year of life.

Next, two sets of regression analyses were conducted to understand the concurrent relationship between the HLE and toddler's expressive language at 24–40 months (time 2). One outlier due to a CDI: WS score more than 2 standard deviations below the mean was identified. When this outlier was included, results did not reach significance. The following analyses are reported with this outlier excluded.

In the first analysis, CDI: WS vocabulary production scores were regressed first on to the HLEQ and then on the observed HLE interaction scores. Surprisingly, there was no effect of reported HLEQ scores or of the maternal responsivity and dialogic reading scores on vocabulary production.

Although parent report of HLE at time 2 did not emerge as a significant predictor of reported expressive language in toddlers, we were interested in whether the same item structure would emerge on the HLEQ for parents of children in their third year. The driving question here was whether the construct of the HLE changes for parents as their children achieve new developmental milestones. Recall that in Study 1, we identified item sets that overlapped somewhat with those identified by Umek et al. (2005) in a sample of parents of 4-year-olds. However there were also important differences. We sought to discover whether the items reported on in the HLEQ clustered differently over time.

As in Study 1, a careful examination of inter-correlations was conducted on all items on the HLEQ. Item sets were identified using a Cronbach's alpha cutoff of .7. Due to the smaller sample size in Study 2, items that correlated at *rs* > .3 with at least two other items were retained whereas those that did not conceptually fit into a construct were deleted, resulting in the deletion of 14 items and 19 remaining items.

Three item sets were identified. With the exception of a few items, the same basic item sets identified in Study 1 were also found in Study 2: joint attention activities and parent-child conversation; shared book reading activities; and formal skill learning. These distinct item sets were internally consistent (Cronbach's alpha = .79, .76, and .70). The item sets and the HLEQ at time 2 are significantly correlated, *rs* = .81, .69, and .54, $p < .01$. Further, the joint attention item set shows a moderate correlation with the CDI: WS, $r = .47$, $p = 03$. Formal skill learning and shared book reading were not significantly related to CDI: WS scores.

A second correlation matrix was generated to explore the relation of the variables on the maternal responsivity scale and expressive language. The only variable associated with children's expressive language was maternal redirecting behavior (r = −.49, p = .02). This is consistent with an established negative relationship between maternal redirecting behaviors and early language (Carpenter, Nagell, & Tomasello., 1998; Baldwin & Markman, 1989).

To follow up on this finding, a hierarchical regression was conducted in which production scores were regressed on to the HLEQ and maternal redirecting prompts. The HLEQ was entered on the first step and maternal prompts that redirected the child's activity were entered on the second step. Parent reported HLEQ scores at 24–40 months were not a significant predictor of language production. However, there was a significant increment in R^2 when maternal redirecting prompts were entered into the equation, (r =.51, $R^2 = .26$, $R^{\Delta} = .20$, $p = .03$). As predicted, observed parent-child interactions accounted for variance above that accounted for by parent reports of the HLE. Interestingly, and consistent with previous literature (Carpenter et al., 1998; Baldwin & Markman, 1989), the frequency of maternal redirecting prompts was negatively related to parent reports of vocabulary production on the CDI: WG (t (20) = −2.37, partial r = −.46, $p = .03$). In contrast with these positive findings regarding the relation of specific factors on the HLEQ and specific maternal behaviors with reported vocabulary production, there were no significant relations between items on the dialogic reading measure and expressive language.

Three important findings emerge from Study 2. First, a broad measure of the HLE in the second year, defined by joint attention and book reading activities, predicts later language development in toddlers. Second, observed interactions better predict language production than parent reports of the HLE. Consistent with the literature, parental behaviors that redirect a child's interest were negatively associated with total vocabulary production. Interestingly, other maternal behaviors in the responsitivity scale were not related with language production. Of particular interest, maternal following behaviors did not predict language development. Previous findings suggest a relationship between following behaviors and language in infancy (Tamis-LeMonda, Bornstein, & Caldwell, 2001). Results from Study 2 reveal that children in the third year of life benefit less than younger children from extensive maternal scaffolding. Perhaps vocabulary development at this stage benefits more

from opportunities for expression than from maternal scaffolding of that expression. Finally, replicating the findings of Study 1, joint attention and parent-child conversation emerged as the only factors associated with language development in the third year.

General Discussion

Previous research on the relationship between the HLE and language development has employed an inconsistent conceptualization of the HLE and focused primarily on children of preschool age and beyond. In Study 1, we sought to clarify these findings by evaluating the relative efficacy of a conservatively- versus broadly-defined HLE for predicting early word learning in the second year. Parent report of a broadly-defined HLE accounted for 12–30% of variance in scores of early language comprehension. The effect size was similar to other studies utilizing aggregate measures of the HLE to predict language in preschool aged children (18.5–21%; Payne et al., 1994; Frijters et al., 2000). Further, the variance explained by the HLEQ is greater than that explained by a more conservative parent report measure focused exclusively on storybook titles as a proxy for shared reading activity.

Significant relations between checklists (e.g., CTC) and vocabulary measures that have previously been found have been in samples of older children, typically four to five years of age, were not found in Study 1. This may indicate that the utility of title checklists as an indirect measure of the HLE may not extend to younger infants. Perhaps children at the early stages of language acquisition benefit most from the communicative engagement that underlies shared book reading, not the activity of shared book reading per se. Karrass et al. (2003) found that behaviors of parents of 8-month-olds in a laboratory play setting were not associated with reported frequency of shared reading. The authors suggest that might reflect the exclusion of joint attention from the measured parental behaviors. The HLEQ includes behaviors that reflect joint attention in addition to other parent-child interactions and, in contrast to Karrass et al., a significant relation was found between joint attention/conversation and shared reading. However, only joint attention/conversation was significantly correlated to both parent report and behavioral assessments of receptive vocabulary. Consistent with this finding, parent's knowledge of storybook titles did not predict vocabulary knowledge in the present sample.

In Study 2, we introduced an observational measure of the HLE in addition to parent report. We were interested in whether the early HLE predicts subsequent language production and whether parent reports and observational measures converge in their portrayal of the HLE. Parent report of the HLE was consistent from the second to the third year. This may indicate that parents engage in similar literacy activities with their children from infancy to toddlerhood. In addition, parent report of the HLE predicted subsequent reports of expressive language. Parents who reported frequent facilitative HLE behaviors during infancy reported larger vocabularies for their children in toddlerhood relative to parents who reported less frequent HLE activities. This is consistent with previous studies (Deckner et al., 2006; Dodici et al., 2003; Rodriquez et al., 2009). Our findings highlight the utility of facilitative parental behaviors in infants as young as 16 months for vocabulary development. The rich social interactions that provide support for early comprehension also support children's vocabulary production.

In Study 1, we found that those parental behaviors on the HLEQ reflecting joint attention and conversation were the most important for predicting comprehension in infancy. This relationship remained consistent across age groups. In Study 2, only those behaviors representing joint attention and conversation were moderately associated with language production. The current research adds to the large body of literature demonstrating the significant role these activities play in many facets of development, including language, emotion, and cognition (Baldwin & Markman, 1989; Carpenter et al., 1998; Tomasello & Farrar, 1986).

In Study 2, we also sought to explain concurrent variance in children's expressive language. Consistent with previous literature (Carpenter et al., 1998; Baldwin & Markman, 1989), the only significant predictor of expressive language that emerged in toddlerhood was maternal redirecting responses. The more frequently mothers redirected their child's attention during observed toy play, the lower the reported vocabulary production score. Redirecting behaviors place high demands on children's attention; thus, avoiding redirection behaviors could play a supportive role in the development of children's attention regulation. In a recent study by Landry, Smith, Swank, and Guttentag (2008), avoiding maternal redirecting (part of a larger parenting intervention) was associated with increases in language outcomes. Moreover, avoidance of redirecting of children's interests mediated the effect of a parenting intervention on social engagement, suggesting impacts of redirecting on other aspects of development.

Surprisingly, shared reading style was not a significant predictor of expressive language in our sample. Whitehurst et al. (1988) created a dialogic reading scale to measure the frequency with which parents utilized a set of book reading strategies offered to them through a training program. They found that after a 1-month intervention, parents who were engaging in this style of reading had children with larger expressive vocabularies than a control group. Parents in the present studies were not trained in reading strategies. Perhaps the lack of an effect of reading style on expressive language reflects this methodological difference. Alternatively, and consistent with Study 1, reading activities may not play as large of a role as the social factors that underlie those activities in the third year.

In Study 1, we sought to explore the relationship between the HLE and early vocabulary across social class through the recruitment of a relatively diverse sample representative of the local community. Variability in the HLE and language skills as a function of SES has been noted throughout the literature. In light of evidence that parental linguistic input is a stronger predictor of language than SES (Hart & Risley, 1995), we hypothesized that the HLE would account for significant variance beyond that explained by SES. This hypothesis was supported. Surprisingly, however, SES was neither associated with measures of the HLE, nor a significant predictor in the model relating HLE to receptive vocabulary.

Similar null results have been found between SES and expressive vocabulary in 17- through 19-month-olds (Westerlund & Lagerberg, 2008) and 24-month-olds (Pan, Rowe, Spier, & Tamis-LeMonda, 2004) and between SES and receptive vocabulary in 18-month-olds (Berglund, Eriksson, & Westerlund, 2005) and in 18- through 32-month-olds (Rodrigue, 2001). Collectively, this suggests that the early stages of language acquisition may be less

susceptible to SES effects than later language development. Vocabulary scores have been found to diverge with development as a function of SES (Hart & Risley, 1995; Hoff-Ginsberg, 1998). This divergence suggests that the consequences associated with lower SES may accumulate across time and may not be detectable in the first three years of life.

Taken together, the current studies emphasize the importance of the HLE, particularly those aspects associated with joint attention and parent-child conversation, for children's early language development. Importantly, this finding extends to both early word comprehension and later word production. These findings were further clarified by observational data which indicate that, although parent-child conversation is essential for language growth, parent input has to be calibrated to the child's linguistic competence such that, with development, children take more responsibility as conversational partners. These findings highlight the importance of these early conversations in supporting both receptive and expressive vocabulary growth in the second and third years of life.

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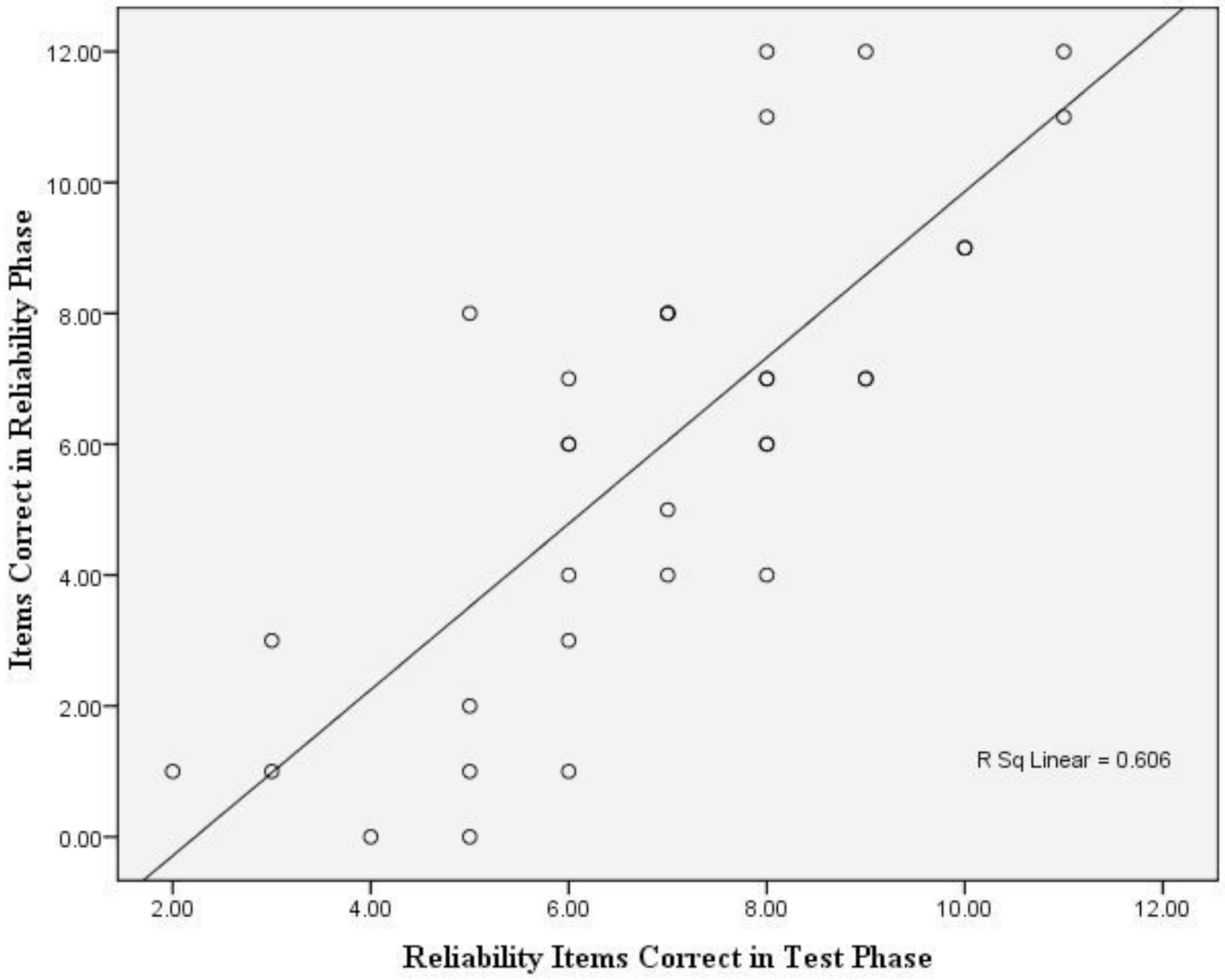

Figure 1.
Test-Retest Reliability of the CCT

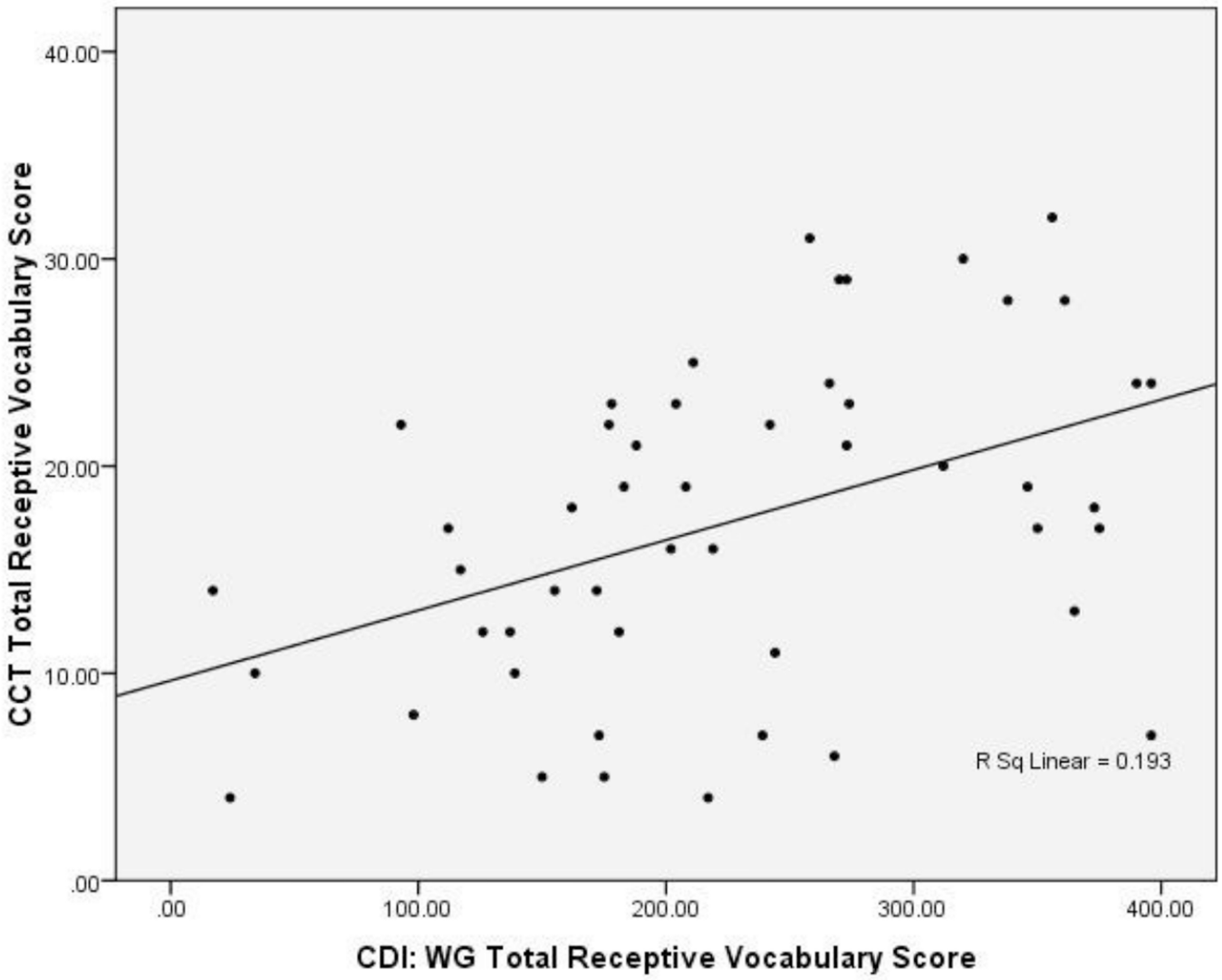

Figure 2.
Convergent Validity of the CDI: WG and the CCT

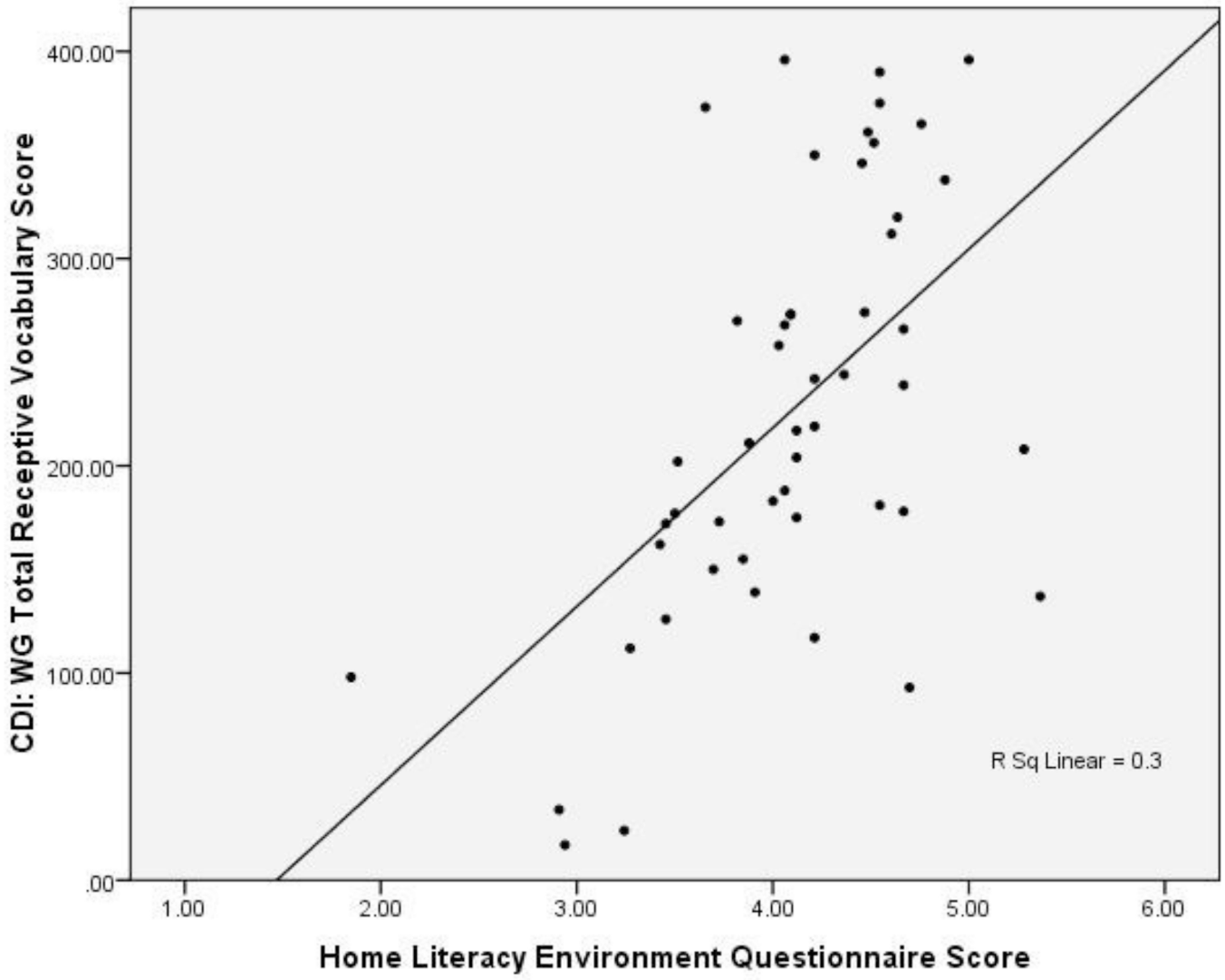

Figure 3.
Relationship between HLEQ scores and CDI: WG scores

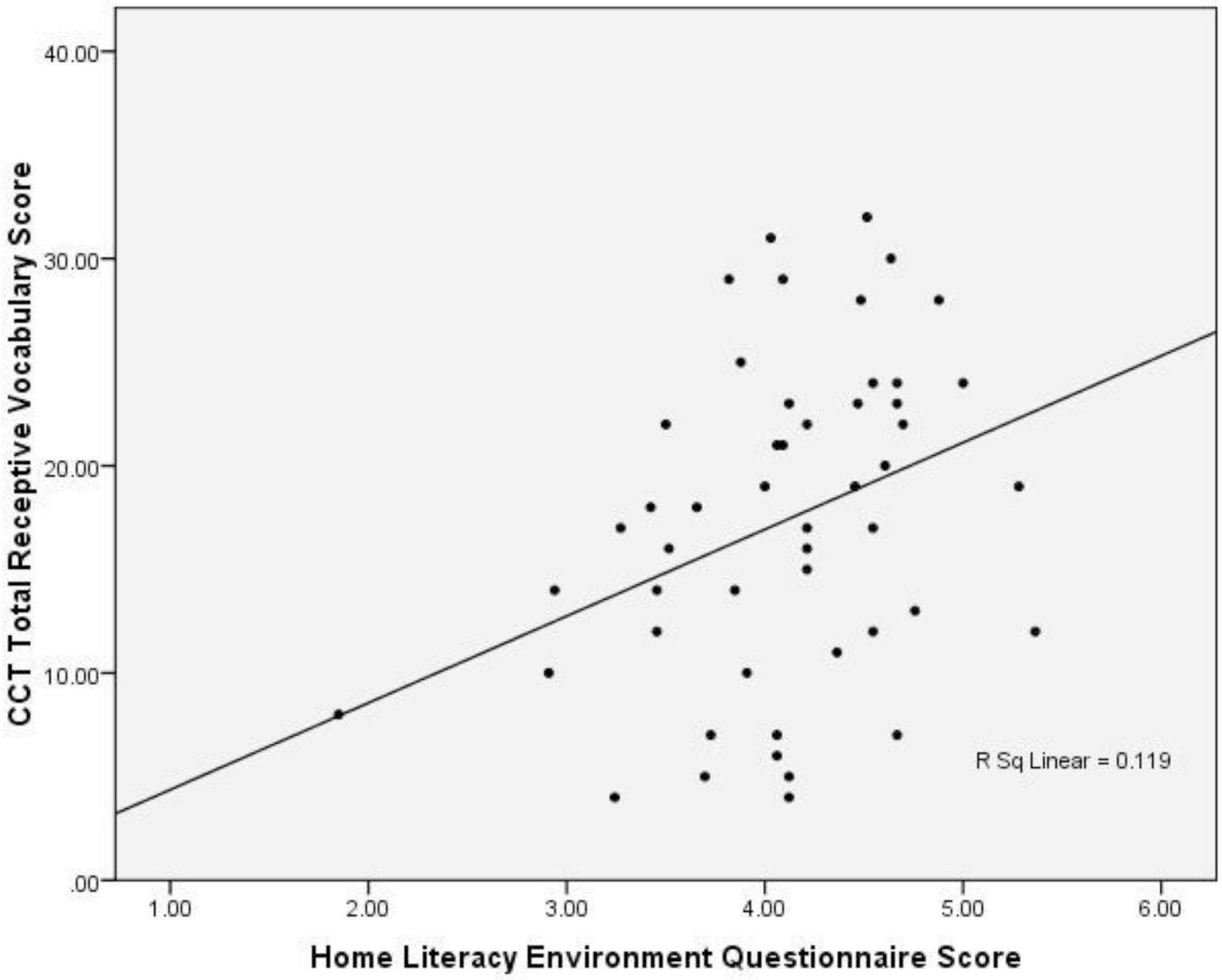

Figure 4.
Relationship between HLEQ scores and CCT scores

Table 1

Distribution of Selected Demographic Characteristics of Participants in Study 1

Characteristic	Boys (N=24)	Girls (N=26)	Total (N=50)	% in County [a]
	Number (%) of participants			
Maternal education				
High School or Less	2 (8.33)	5 (19.23)	7 (14.00)	(34.0)
Some College	3 (12.50)	5 (19.23)	8 (16.00)	(31.0)
College Graduate	10 (41.67)	6 (23.08)	16 (32.00)	(21.1)
Post-Baccalaureate	9 (37.50)	10 (38.46)	19 (38.00)	(12.7)
Approximate Income				
15,000–24,999	1 (4.17)	4 (15.38)	5 (10.00)	(8.7)
25,000–34,999	-	-	-	(8.8)
35,000–49,999	2 (8.33)	4 (15.38)	6 (12.00)	(12.9)
50,000–74,999	4 (16.67)	4 (15.38)	8 (16.00)	(17.8)
75,000–99,999	5 (20.83)	7 (26.92)	12 (24.00)	(13.8)
100,000–150,000	8 (33.33)	2 (7.69)	10 (20.00)	(15.7)
150,000–199,999	0	1 (3.85)	1 (2.00)	(6.8)
>200,000	1 (4.17)	1 (3.85)	2 (4.00)	(6.4)
Maternal Ethnicity [b]				
Asian	1 (4.17)	1 (3.85)	2 (4.00)	(4.9)
Black/not Hispanic	1 (4.17)	1 (3.85)	2 (4.00)	(5.0)
Hispanic [c]	2 (8.33)	5 (19.23)	7 (14.00)	(15.5)
White/not Hispanic	18 (75.00)	18 (69.23)	36 (72.00)	(71.2)
Mixed Race	2 (8.33)	1 (3.85)	3 (6.00)	(3.8)
Second Language				
No	16 (66.67)	15 (57.69)	31 (62.00)	(64.8)
Yes	7 (29.17)	5 (19.23)	18 (38.00)	(35.2)

Note.

[a] Source is U.S. Census Bureau, 2006–2008 American Community Survey at http://factfinder.census.gov/

[b] For Asian and Hispanic categories, county values are corrected to reflect the proportion of adults who “speak English very well.”

[c] Hispanic ethnicity is not independent from race.

Table 2

Correlation Matrix for HLEQ, Item Sets, and Vocabulary Measures (Study 1)

	1	2	3	4	5	6
1. HLEQ		.88**	.57**	.63**	.55**	.35*
2. Joint attention/conversation			.60**	.42**	.50**	.35*
3. Shared book reading				.23	.27	.16
4. Formal skill learning					.42**	.18
5. CDI: WG						.44**
6. CCT						

Note.

*$p < .05$

**$p < .01$.

Table 3

Distribution of Selected Demographic Characteristics of Participants in Study 2

Characteristic	Boys (N=12)	Girls (N=15)	Total (N=27)	% in County [a]
	Number (%) of participants			
Maternal education				
High School or Less	1 (9.09)	2 (13.33)	3 (11.54)	(34.0)
Some College	1 (9.09)	4 (26.67)	5 (19.23)	(31.0)
College Graduate	5 (45.45)	3 (20.00)	8 (30.77)	(21.1)
Post-Baccalaureate	4 (36.36)	6 (40.00)	10 (38.46)	(12.7)
Approximate Income				
18,000–40,000	0	3 (23.08)	3 (12.50)	(8.7)
41,000–60,000	0	5 (38.46)	5 (20.83)	(8.8)
61,000–80,000	4 (36.36)	1 (7.69)	5 (20.83)	(12.9)
81,000–100,000	4 (36.36)	2 (15.38)	6 (25.00)	(17.8)
>100,000	3 (27.27)	2 (15.38)	5 (20.83)	(13.8)
Maternal Ethnicity [b]				
Asian	0	1 (6.67)	1 (3.70)	(4.9)
Hispanic [c]	0	2 (13.33)	2 (7.41)	(15.5)
White/not Hispanic	9 (75.00)	11 (73.33)	20 (74.07)	(71.2)
Mixed Race	3 (25.00)	1 (6.67)	4 (14.81)	(3.8)
Second Language				
No	9 (75.00)	8 (53.33)	17 (62.96)	(64.8)
Yes	3 (25.00)	7 (46.67)	10 (37.04)	(35.2)

Note. Maternal education demographics reported for 26 subjects (male = 11, female = 15). Income data reported for 24 subjects (male = 11, female = 13).

[a] Source is U.S. Census Bureau, 2006–2008 American Community Survey at http://factfinder.census.gov/

[b] For Asian and Hispanic categories, county values are corrected to reflect the proportion of adults who “speak English very well.”

[c] Hispanic ethnicity is not independent from race.