The Effects of Rurality on Parents' Engagement in Children's Early Literacy

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Abstract Investigations of urban-rural context on children's educational experiences have produced somewhat inconsistent findings, but one thing is clear, parent engagement in children's early learning positively impacts academic outcomes. Research identifying conditions that uniquely influence parents' early engagement in learning and literacy in rural settings are needed. An illustrative example of a study investigating the effects of rurality on parent engagement and children's literacy using a nationally representative dataset (Early Childhood Longitudinal Study, Birth Cohort, ECLS-B; n = 6550) is discussed. Contextual differences in parents' use of technology and community resources and children's reading scores were revealed. The important role of technology and structural characteristics of rural communities in young children's early literacy development was demonstrated; however, further research is needed to better understand the impact of these and other contextual influences. A proposed agenda for future research in this area is discussed.

Keywords Parent engagement · Early language and literacy · Rural contexts · Preschool · Literacy resources · Home environments

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1 Parent Engagement, Reading Readiness and Rural Settings

Reading skills are critical to children's academic success (Duncan et al. 2007), and the effects of poor early reading are compounded over time (Arnold and Doctoroff 2003). Language skills that influence reading abilities are formed in the beginning stages of life; children's early language experiences not only set the stage for their learning potential, but they also greatly influence their academic trajectory (Heckman 2006; Whitehurst and Lonigan 2001). Thus, the effects of undermined language and literacy development can be seen early on and have lasting consequences. Specifically, poor language and literacy skills at the time of school entry have been linked to increased remedial education and school dropout (Dickinson and Tabors 2001).

High quality early experiences in childcare and preschool settings significantly impact children's skill development, and as children's first teachers, parents play a critical role in establishing a stimulating learning environment that will optimize their overall development (National Institute of Child Health and Human Development Early Child Care Research Network 2006). Early parent engagement in language and literacy activities is important for young children's overall learning and school readiness (Sheridan et al. 2011; Weigel et al. 2006) and has been linked to children's increased vocabulary and language skills (Hart and Risley 1995; Hindman and Morrison 2012), alphabet knowledge (Hindman et al. 2008; Sénéchal 2006), and learning behaviors, such as self-regulation, cooperation and compliance (Hindman and Morrison 2012). Furthermore, early reading experiences in the home have been shown to predict later language and literacy readiness in kindergarten and reading skills in early elementary school, demonstrating longitudinal effects of early parent engagement (Forget-Dubois et al. 2009).

Parent engagement, as defined here, refers to practices and provisions that support early language and literacy skills for preschoolers. Establishing a home learning environment that provides accessible language and literacy resources for children, both material and relational, is an important method by which parents support early learning (Bradley 2002). Interactive shared book-reading experiences between parents and children are among the most influential methods for expanding vocabulary (Fielding-Barnsley and Purdie 2003; Jordan et al. 2000). A language rich environment includes other forms of language-based interaction, such as telling stories, singing songs, and reciting nursery rhymes, which support oral narrative skills linked to later reading comprehension (Hester 2010), reading fluency (Reese et al. 2010), vocabulary development (Hart and Risley 1995), and phonological awareness (Tabors et al. 2001). Providing access to print materials in the home, especially children's books, creates a literacy environment conducive to vocabulary development (Burgess et al. 2002; Dever and Burts 2002). Access to computers has also been shown to positively influence children's early literacy skills (Macaruso and Rodman 2011; Shamir et al. 2012). Additionally, accessing community resources, such as libraries or museums, expand cultural experiences and provide

opportunities for engagement in language- and literacy-based activities, promoting early reading skills (Neuman and Celano 2001, 2004).

Several factors influence parent engagement in language and literacy interactions, such as socioeconomic status and education. One level of influence on early parental literacy engagement that deserves more attention is geographical location. Structural characteristics within one's neighborhood or community have been shown to influence parenting behavior and children's literacy outcomes (Froiland 2011). For example, exposure to community-based resources, including libraries, zoos, museums, parks and/or playgrounds fosters children's positive early learning outcomes (Froiland et al. 2014). However, more research is needed to understand the unique determinants of setting conditions on early parent-child literacy interactions. Specifically, little is currently known about the similarities or differences between rural and urban settings in the manner by which parents engage in language and literacy activities with their young children and the effect of their engagement on children's reading readiness.

Conditions in rural settings may differentially impact the ways in which parents are engaged in early learning activities and the degree to which parents' behaviors impact later academic skill development. Some have argued that the diminished resources and income potential in rural communities may negatively influence parents' educational aspirations for their children and in turn depress their efforts to promote learning in the home (Durham and Smith 2006; Roscigno and Crowley 2001). Although some research indicates that parents in rural communities place less emphasis on academic achievement (Lampard et al. 2000) and invest and engage less in educational experiences (Roscigno et al. 2006) than their urban counterparts, others have demonstrated that parent involvement in children's education in rural settings produces similar benefits for student achievement for children in rural schools as it does for children in urban and suburban settings (Keith et al. 1996). Specifically, rural parent involvement in school-based literacy activities has been shown to positively affect kindergarten children's reading skills (Porter DeCusati and Johnson 2004). Yet, more research is needed to better understand the effects of geographic locale on parent engagement in early literacy and children's academic development.

2 An Investigation of Geographical Context on Parent Engagement in Early Literacy

Rigorous methodological investigations of setting conditions impacting family engagement in children's education are lacking (Arnold et al. 2005; Coladarci 2007). Most studies that claim to study a rural phenomenon do not include comparison conditions that explain differences of rural relevance (Coladarci 2007; Semke and Sheridan 2012). Previous examinations of parents' engagement in early language and literacy activities have included rural samples (Barnyak 2011; Dever

and Burts 2002); however, they have not included urban comparison groups, thereby making it difficult to draw conclusions about the unique impact of the different settings. Thus, our current understanding of the effects of rural setting on parents' language and literacy behaviors is based on speculation and conjecture about presumed universal practices or influences and their relationship to children's outcomes, based largely on research conducted in urban or nonspecified settings. An additional challenge with conducting research in rural communities is obtaining large enough samples to allow for robust analyses of contextual variability. Conducting a generalizable evaluation of the effects of geographic setting on parental behavior and child literacy outcomes requires a large, representative sample from each locale. Studies of this magnitude would demand significant resources; fortunately, large-scale secondary datasets allow for such evaluations.

Few studies have explored the extent to which parents' engagement and children's early literacy vary across geographic contexts. To partially fill this void, we conducted a study that examined variation in engagement and literacy between rural settings and city, suburban, and town settings. Specifically, we examined the relationships among rurality, parents' early language and literacy engagement behaviors, and children's kindergarten literacy. Our primary research question concerned the total effect of geographical context on parents' literacy engagement in preschool and children's literacy in kindergarten. Second, we investigated whether parent engagement mediated the pathway between context and child outcomes. The specific research questions examined in this study were:

1. What is the effect of geographic setting—living in a rural setting versus city, suburban, or town setting—on (a) children's kindergarten literacy, and (b) parents' preschool literacy engagement?
2. Does parent literacy engagement during preschool mediate the relationship between geographic setting and children's kindergarten literacy?

As demonstrated in previous research (Froiland 2011), we hypothesized that setting would have a unique effect on parents' preschool literacy engagement and children's kindergarten literacy. Given the differences in community resources (i.e., libraries) in urban and rural communities, it was expected that rural families would access these resources less frequently during preschool than their urban counterparts, which may negatively impact their kindergarten literacy scores. However, we hypothesized that parent literacy behavior during preschool (i.e., reading, singing, story-telling, providing access to literacy materials [books and computers] in the home) would look similar across settings, which may address some of the gaps in resources and support later reading skill development.

This study was conducted via a secondary data analysis of the Early Childhood Longitudinal Study, Birth Cohort (ECLS-B) study sponsored by the National Center for Education Statistics (NCES), U.S. Department of Education. The ECLS-B was designed to examine the systemic interactions of the child, family, childcare, health care, educational system, and community on children's overall health, social-emotional development, and intellectual capacity that influence

children's school readiness (Andreassen and West 2007). The longitudinal information provided by the ECLS-B database made it possible to examine temporal relations between parent engagement and child literacy; no other studies of this magnitude have allowed for such longitudinal investigations. Studies that have collected longitudinal data tend to be based on relatively small samples, whereas the ECLS-B provided a large, nationally representative sample across various geographical contexts and time points that allowed us to conduct a statistically powerful and generalizable evaluation of the effects of setting on parent engagement and child literacy using sophisticated analytic methods.

3 Methods

Participants and selection procedure. A stratified, multistage sampling design involving unequal selection probabilities was used by ECLS-B researchers to obtain the sample of eligible children (Snow et al. 2009). See Bethel et al. (2005) for information regarding the ECLS-B sampling design. Information was obtained from approximately 10,700[1] children and their parents, early child care providers, and kindergarten teachers, across five waves of data collection. The present study utilized data collected during the preschool (Wave 3; 2005–2006) and kindergarten waves (Waves 4 and 5; 2006–2007 and 2007–2008, respectively) (Snow et al. 2009). The second wave of kindergarten data collection was necessary to gather information about children who were not yet in kindergarten in 2006 (Wave 4) or who repeated kindergarten. For the present study, Waves 4 and 5 were combined into a single kindergarten wave so that inferences could be made about children in their kindergarten year. Data were obtained from Wave 4 for children first entering kindergarten in 2006 (including children who first entered kindergarten in 2006 but repeated kindergarten in 2007) and from Wave 5 for children first entering kindergarten in 2007.

Home-schooled children, children in ungraded programs, children with no kindergarten experience, and children for whom grade was unknown, were excluded from the analyses. Furthermore, children reported as Native Hawaiian or other Pacific Islander/non-Hispanic, were excluded from the analyses due to the very small sample size which resulted in non-convergence of the models when child race/ethnicity was included as a covariate. Upon excluding all ineligible cases, the effective sample size for this study was $n = 6550$, although missing item-level data resulted in some variation in sample size across analyses. Weighted descriptive statistics for this sample are provided in Table 1.

Study Variables and Measures. Parent interview data were collected by ECLS-B field staff via a structured computer-assisted personal interviewing (CAPI)

[1]To protect confidentiality of the data, all sample sizes have been rounded to the nearest 50 per Institute of Education Sciences reporting requirements.

Table 1 Weighted descriptive statistics[a] for the reduced sample (n = 6550)

Study variable	Statistic
Child	
Male	51.340 %
Race/ethnicity	
White	53.448 %
Black	14.000 %
Hispanic	25.523 %
Asian	2.536 %
American Indian or Alaska Native	0.498 %
More than 1 race	3.995 %
Kindergarten assessment age in months	68.163 (4.420)
Parent[b]	
Primary respondent is biological mother[c]	95.593 %
Family[b]	
Highest parent education level	
Less than a high school degree	10.985 %
High school degree or equivalent	23.177 %
Vocational or technical program degree	5.833 %
Some college	27.550 %
Bachelor's degree	16.614 %
Advanced schooling beyond Bachelor's	15.840 %
At or above 100 % poverty threshold	75.638 %
2 or more adults[d] in the home	86.644 %
Primary language in home is English	81.411 %

[a]Percentages for categorical variables and means (SD) for continuous variables
[b]Statistics are based on Wave 3 data
[c]Remaining respondents included biological fathers, other mother and father types, non-parent relatives, and non-relatives
[d]Individuals 18 years of age or older. Percentages may not sum to 100 due to rounding error

program (Snow et al. 2009). See Snow et al. (2009) for a detailed description of interview procedures.

Geographic Setting. Household ZIP codes from the Wave 3 parent interview were combined with data from the American Community Survey to create a composite location variable based on the Urban-Centric Locale Codes defined by the National Center for Education Statistics (Snow et al. 2009). The 12 locations included large city, mid-size city, small city, large suburban area, mid-size suburban area, small suburban area, fringe town, distant town, remote town, rural fringe, distant rural, and remote rural. For this study, locations were collapsed into four groups, city (n = 1950), suburban (n = 2550), town (n = 850), and rural (n = 1100). The Urban-Centric Locale Codes take into account locations' population size and proximity to urban areas (i.e., principal cities, urbanized areas, and

urban clusters). Urban areas are classified based on population size and density, and economic and social integration and prominence. We chose this classification system because it provides a finer discrimination than a simple urban versus rural designation. Furthermore, it utilizes information about proximity to urban areas, which is likely to be more related to parent engagement and child literacy than population size alone.

The Urban-Centric Locale Codes were applied at the level of household ZIP codes. Thus, all rural inferences generated by this study exist, by definition, at the level of ZIP codes. It is important to bear in mind that rural, as defined by this study, cannot explain differences in parent engagement and child literacy within ZIP codes, because all households within a ZIP code were assigned the same location code.

Parental Preschool Literacy Engagement. Parent-reported literacy engagement variables were obtained from the Home Environment section of the Wave 3 parent interview. Four parental engagement characteristics were selected: home literacy materials, access to computer technology, children's exposure to the library, and parental language and literacy behaviors.

Home Literacy Materials. Home literacy materials were assessed via access to children's books in the home. A one-item measure, "About how many children's books does [child] have in your home now, including library books?" was used to determine number of books in the home. Unweighted statistics computed for our sample indicated that households had an average of 68.021 (SD = 86.317) children's books, with a minimum of 0 and a maximum of 900 books. Due to the highly skewed nature of this variable, a log-transformed version was used for all analyses.[2]

Access to Computer Technology. Children's use of computers was measured via the question, "In a typical week, how often does [child] use the computer?" with possible response options 1 = *Never*, 2 = *Once or twice a week*, 3 = *Three to six times a week*, and 4 = *Every day*. The unweighted average response was 1.843 (SD = 0.947).

Exposure to the Library. Four dichotomous (*No* = 0, *Yes* = 1) questions on library use were summed to create a composite score of children's library exposure. These questions were (a) "In the past month, has anyone in your family visited a public library with [child]?" and (b) "In the past month, did you use the public library to…Borrow books to read aloud to [child] or for [him/her] to read? (c) Borrow materials other than books, such as cassettes, CDs, videos, or toys, to share with [child]? (d) Take [child] to a story hour or program?" Parents who responded "No" to the first question did not complete the remaining three questions; in these cases, the remaining three questions were scored as '0'. The unweighted Kuder–Richardson 20 (KR20) coefficient for the four items was 0.861. Sample composite scores ranged from 0 to 4 with higher scores representing greater exposure. The unweighted average composite score was 1.122 (SD = 1.470).

[2]A value of one was added to all observations prior to the transformation in order to avoid taking the log of zero, which equals infinity.

Parent Behaviors. Three questions measured parent language and literacy behaviors: "In a typical week, how often do you or any other family member… (a) Read books to your child? (b) Tell stories to your child? (c) Sing songs with your child?" The four possible response options were *Not at all*, *Once or twice*, *3 to 6 times*, and *Everyday* with higher scores representing more frequent behaviors. Unweighted Cronbach's alpha for the three items was 0.576. Parent language and literacy behavior trait scores were computed using confirmatory factor analysis (CFA) as described in the Sects. 4 and 5. The unweighted average trait score was 0.003 (SD = 0.535) with a minimum score of −1.451 and a maximum score of 0.848.

Children's Kindergarten Literacy. Children's early literacy was evaluated by the early reading assessment of the direct child assessment. Most of the 85 items that comprised the assessment came from the *PreLAS 2000* (Duncan and De Avila 1998), PPVT-III (Dunn and Dunn 1997), or Preschool Comprehensive Test of Phonological and Print Processing (Pre-CTOPPP; Lonigan et al. 2002), but some items were created specifically for the ECLS-B (Najarian et al. 2010).

Child scores and item parameters were estimated according to the three-parameter logistic (3PL) model commonly used in item response theory (Najarian et al. 2010). The unweighted average kindergarten theta score for the reduced sample was 0.647 (SD = 0.803) with a minimum theta score of −2.115 and a maximum theta score of 3.086. Reliability of the kindergarten theta scores as reported in the ECLS-B kindergarten 2006 and 2007 Data File User's Manual was 0.920 for Wave 4 (2006) and 0.930 for Wave 5 (2007) (Snow et al. 2009). See page 56 of Snow et al. (2009) for more information on the reliability calculations.

Child and Family Covariates. Three child covariates were included in the analyses: race/ethnicity (also used as a proxy for family race/ethnicity), age at kindergarten assessment, and sex. Child race/ethnicity and sex were obtained through parent report. The present study used a single, mutually-exclusive composite variable that classified children into one of eight categories: White, non-Hispanic; Black or African American, non-Hispanic; Hispanic, race specified; Hispanic, no race specified; Asian, non-Hispanic; Native Hawaiian or other Pacific Islander, non-Hispanic; American Indian or Alaska Native, non-Hispanic; or More than one race, non-Hispanic (Snow et al. 2009). The categories of "Hispanic, race specified" and "Hispanic, no race specified" were collapsed into a single category. Child age at kindergarten assessment was computed as the difference, in months, between the date of the kindergarten direct child assessment and the child's birthdate as recorded on the child's birth certificate.

One family covariate, socioeconomic status, was also included in the analyses. The SES standardized composite variable available in the ECLS-B restricted datafile is comprised of five parent/household variables, including father/male guardian's education and occupation prestige, mother/female guardian's education and occupation prestige, and household income (Snow et al. 2009). The Wave 3

SES composite scores were used in the present analyses. The unweighted average SES for the present sample was −0.003 (SD = 0.847) with a minimum SES of −2.250 and a maximum SES of 2.090.

4 Data Analysis

All data were analyzed in M*plus* Version 6.1 (Muthén and Muthén 1998–2010) using full-information maximum likelihood estimation to account for item-level missing data. A design-based approach was used to account for the ECLS-B complex sampling design. Specifically, parameter estimates were weighted by the WKR0 weight appropriate for longitudinal analyses involving child assessment data and/or parent interview data obtained from the wave in which the child first entered kindergarten (Snow et al. 2009), and variance estimation was performed using a paired jackknife replication method (Wolter 1985).

Confirmatory factor analysis (CFA) was performed to evaluate the hypothesized structure of the parent behavior construct. Three parent-reported indicators of parent language and literacy behavior—reads books to child, tells stories to child, and sings songs with child—were specified to measure a single latent factor. The indicators were deemed to be good measures of the latent construct (i.e., unstandardized factor loadings were significant at the $\alpha = 0.050$ level and all standardized factor loadings were greater than 0.400). Expected a priori estimation was used to obtain latent trait scores based on the CFA model. These scores were then used in the primary analyses.

Structural equation modeling (SEM) was used to evaluate the primary research questions. Model fit was evaluated according to the root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR), with the joint criteria of RMSEA < 0.060 and SRMR < 0.090 indicating good model fit (Hu and Bentler 1999). Standardized path coefficients were provided as measures of effect size with absolute values of $\beta < 0.10$ suggesting a "small" effect, near 0.30 suggesting a "medium" effect, and at or above 0.50 suggesting a "large" effect. Coefficients of determination (R^2 values) were provided with R^2 values less than 0.01, near 0.06, and at or above 0.14 suggesting small, medium, and large effects, respectively (Cohen 1988).

The total effect of geographic setting on children's early literacy was first examined by evaluating an SEM without the hypothesized mediating parental literacy engagement variables. The indirect effect of geographic setting on children's early literacy was then examined by evaluating an SEM with the hypothesized mediating parental literacy engagement variables. Sobel's (1982) test was used to evaluate the significance of the indirect effect. Geographic setting was represented by three dummy variables (city, suburban, and town) with the rural setting as the reference group. Thus, negative coefficients indicated that rural individuals were higher on the endogenous (dependent) variable. Child race/ethnicity, kindergarten assessment age, gender, and family SES variables were included in both models as covariates.

5 Results

Preliminary analysis. Item parameter estimates from the CFA of the parent behaviors construct are presented in Table 2. With only three indicators, the model was fully saturated so absolute model fit could not be established. However, all unstandardized factor loadings were significant at the $\alpha = 0.001$ level, and all standardized factor loadings were greater than 0.400 ($\hat{\lambda} = 0.565$, 0.724, and 0.448 for read books to child, tell stories to child, and sing songs with child, respectively) suggesting that each of the indicators adequately reflects the latent construct.

Primary analyses. Table 3 provides the weighted descriptive statistics, by geographic setting, for all study variables used in the primary analyses.

Table 2 Item parameter estimates from a confirmatory factor analysis of the parent language and literacy behaviors construct

Item	Unstandardized factor loading	Standardized factor loading	R^2
Read books to child	0.489***	0.565	0.320
Tell stories to child	0.668***	0.724	0.524
Sing songs with child	0.399***	0.448	0.200

Note $n = 6550$. Estimates were weighted using the WKR0 longitudinal weight. Standard errors were computed using a paired jackknife replication method
***$p < 0.001$

Table 3 Weighted descriptive statistics[a] by geographic setting

Study variable	City	Suburban	Town	Rural
Child sex				
Male (%)	51.8	51.1	52.4	50.5
Female (%)	48.2	48.9	47.6	49.5
Child race/ethnicity				
White (%)	38.5	51.7	61.4	78.2
Black (%)	20.5	13.0	9.1	8.2
Hispanic (%)	33.5	28.8	21.6	6.5
Asian (%)	3.2	3.5	0.8	0.4
American Indian or Alaska Native (%)	0.3	0.2	1.3	1.2
More than 1 race (%)	4.0	2.9	5.7	5.5
Child age in months[b]	68.136 (4.365)	68.123 (4.387)	68.086 (4.419)	68.354 (4.646)
Family SES[c]	−0.220 (0.838)	0.075 (0.783)	−0.221 (0.771)	−0.149 (0.706)
Number of children's books[c]	58.611 (76.292)	71.724 (81.462)	70.344 (88.832)	81.021 (91.977)
Child computer use[c]	1.764 (0.932)	1.938 (0.940)	1.767 (0.907)	1.766 (0.902)
Child library exposure[c]	1.060 (1.434)	1.147 (1.466)	0.951 (1.406)	0.836 (1.308)
Parent lang/lit behaviors[c]	−0.021 (0.541)	0.009 (0.527)	−0.015 (0.522)	0.034 (0.557)
Child reading score[b]	0.544 (0.809)	0.743 (0.760)	0.561 (0.744)	0.588 (0.738)

Percentages may not sum to 100 due to rounding error. Estimates were weighted using the WKR0 longitudinal weight. Standard errors were computed using a paired jackknife replication method
[a]Percentages for categorical variables and means (SD) for continuous variables
[b]Statistics are based on kindergarten Wave data
[c]Statistics are based on Wave 3 data

Research Question 1a: What Is the Effect of Setting on Children's Kindergarten Literacy? Parameter estimates for the model containing the total effect of setting on children's early literacy controlling for the effects of child race/ethnicity, kindergarten assessment age, and gender, and family SES are displayed in Table 4. The model is fully saturated, so absolute model fit could not be assessed. Together, the predictors accounted for approximately 26 % of the variance in children's early literacy. Holding the other variables in the model constant, child reading scores significantly differed across suburban and rural settings such that suburban children had higher reading scores in kindergarten than rural children ($\hat{\beta} = 0.072$, $p = 0.013$). There were no differences in reading scores between rural settings and city and town settings.

Research Question 1b: What Is the Effect of Setting on Parents' Preschool Literacy Engagement? The full model including the parental literacy engagement variables demonstrated acceptable model fit, RMSEA = 0.030 (90 % CI = 0.023–0.038), SRMR = 0.008. Parameter estimates are given in Table 5. Together, the predictors accounted for 39.6 % of the variance in the number of children's books in the home, 6.2 % of the variance in child library exposure, 7.7 % in parent language/literacy behaviors, 7.4 % in children's computer use, and 28.1 % of the variance in child reading scores. Holding the other variables in the model constant, city and suburban children were exposed to the library significantly more than rural children ($\hat{\beta} = 0.105$, $p < 0.001$ and $\hat{\beta} = 0.102$, $p < 0.001$, respectively). There was no significant difference between town and rural children's library exposure. In addition, suburban children had significantly greater computer access in the home

Table 4 Parameter estimates from a structural equation model examining the total effect of rurality on children's early literacy

Parameter	Unstandardized estimate	Standardized estimate	R^2
Child reading score *regressed on*			0.261
City	0.023	0.014	
Suburban	0.113*	0.072	
Town	0.037	0.015	
Black	−0.012	−0.006	
Hispanic	−0.125**	−0.070	
Asian	0.238***	0.049	
American Indian or Alaska Native	−0.258**	−0.023	
Multiple races	−0.016	−0.004	
SES	0.341***	0.351	
Child age	0.052***	0.300	
Child gender	0.119***	0.077	

Note $n = 6350$. Rural was the reference group for the geographic setting variable. White/non-Hispanic was the reference group for the child race/ethnicity variable. Estimates were weighted using the WKR0 longitudinal weight. Standard errors were computed using a paired jackknife replication method

***$p < 0.001$; **$p < 0.010$; *$p < 0.050$

Table 5 Parameter estimates from a structural equation model examining the indirect effect of rurality on children's early literacy through parental language and literacy engagement

Parameter	Unstandardized estimate	Standardized estimate	R^2
Number of books[a,b,c] (log transformed) *regressed on*			0.396
City	−0.061	−0.025	
Suburban	−0.046	−0.020	
Town	−0.022	−0.006	
Black	−0.852***	−0.261	
Hispanic	−0.872***	−0.336	
Asian	−1.019***	−0.142	
American Indian or Alaska Native	−0.713***	−0.044	
Multiple races	−0.215***	−0.037	
SES	0.536***	0.379	
Child computer use[a,d,e] *regressed on*			0.074
City	0.057	0.028	
Suburban	0.139**	0.074	
Town	0.039	0.014	
Black	−0.107*	−0.040	
Hispanic	−0.131**	−0.062	
Asian	0.148**	0.025	
American Indian or Alaska Native	−0.273**	−0.021	
Multiple races	−0.047	−0.010	
SES	0.259***	0.222	
Child library exposure[b,d,f] *regressed on*			0.062
City	0.329***	0.105	
Suburban	0.295***	0.102	
Town	0.181	0.041	
Black	−0.102	−0.025	
Hispanic	−0.278**	−0.085	
Asian	0.248*	0.027	
American Indian or Alaska Native	−0.069	−0.003	
Multiple races	0.062	0.009	
SES	0.339***	0.190	
Parent language/literacy[c,e,f] behaviors *regressed on*			0.077
City	0.021	0.018	
Suburban	−0.006	−0.006	
Town	−0.013	−0.008	
Black	−0.171***	−0.110	
Hispanic	−0.169***	−0.137	
Asian	−0.124**	−0.036	
American Indian or Alaska Native	−0.179***	−0.023	

(continued)

Table 5 (continued)

Parameter	Unstandardized estimate	Standardized estimate	R^2
Multiple races	−0.035	−0.013	
SES	0.122***	0.182	
Child early literacy *regressed on*			0.281
City	0.014	0.008	
Suburban	0.101*	0.064	
Town	0.032	0.013	
Number of books (log transformed)	0.057***	0.083	
Children's computer use	0.057***	0.068	
Child library exposure	0.019^	0.035	
Parent language/literacy involvement	0.094***	0.065	
Black	0.062	0.028	
Hispanic	−0.047	−0.026	
Asian	0.294***	0.060	
American Indian or Alaska Native	−0.184*	−0.017	
Multiple races	0.001	0.000	
SES	0.278***	0.287	
Child age	0.053***	0.302	
Child gender	0.105***	0.068	

Note n = 6450. Residual correlations = [a]0.070; [b]0.112; [c]0.258; [d]0.073; [e]0.119; [f]0.170
Rural was the reference group for the geographic setting variable. White/non-Hispanic was the reference group for the child race/ethnicity variable. Estimates were weighted using the WKR0 longitudinal weight. Standard errors were computed using a paired jackknife replication method
***$p < 0.001$; **$p < 0.010$; *$p < 0.050$; ^$p = 0.053$

than rural children ($\hat{\beta} = 0.074$, $p = 0.001$). Living in a rural community did not significantly influence number of children's books in the home nor parent behaviors.

Research Question 2: Does Parental Literacy Engagement in Preschool Mediate the Relationship Between Setting and Children's Kindergarten Literacy? Indirect effects of setting on children's kindergarten literacy through parental literacy engagement in preschool were examined for combinations of variables in which both sets of pathways—parental preschool literacy engagement regressed on setting and children's kindergarten literacy regressed on parental preschool literacy engagement—were significant. Children's computer access, parent behaviors, and number of children's books in the home significantly predicted child reading scores in kindergarten ($\hat{\beta} = 0.068$, $p < 0.001$; $\hat{\beta} = 0.065$, $p < 0.001$; and $\hat{\beta} = 0.083$, $p < 0.001$, respectively), and children's library exposure marginally significantly predicted children's reading scores ($\hat{\beta} = 0.035$, $p = 0.053$). However, only library exposure and computer access were predicted by setting. Thus, only two sets of indirect effects were evaluated: (1) the effect of setting on children's kindergarten literacy through children's preschool exposure to the

library, and (2) the effect of setting on children's kindergarten literacy through children's preschool computer access. There was a small but marginally significant indirect effect of setting, city versus rural ($\hat{\beta} = 0.004$, $p = 0.091$) and suburban versus rural ($\hat{\beta} = 0.004$, $p = 0.070$), on children's kindergarten reading scores through children's preschool exposure to the library. There was also a small but significant indirect effect of setting, suburban versus rural ($\hat{\beta} = 0.005$, $p = 0.016$), on children's kindergarten reading scores through children's preschool computer access. These results indicate that setting indirectly impacts children's kindergarten reading scores by limiting access to libraries and computers, which in turn negatively impacts reading scores (see Fig. 1).

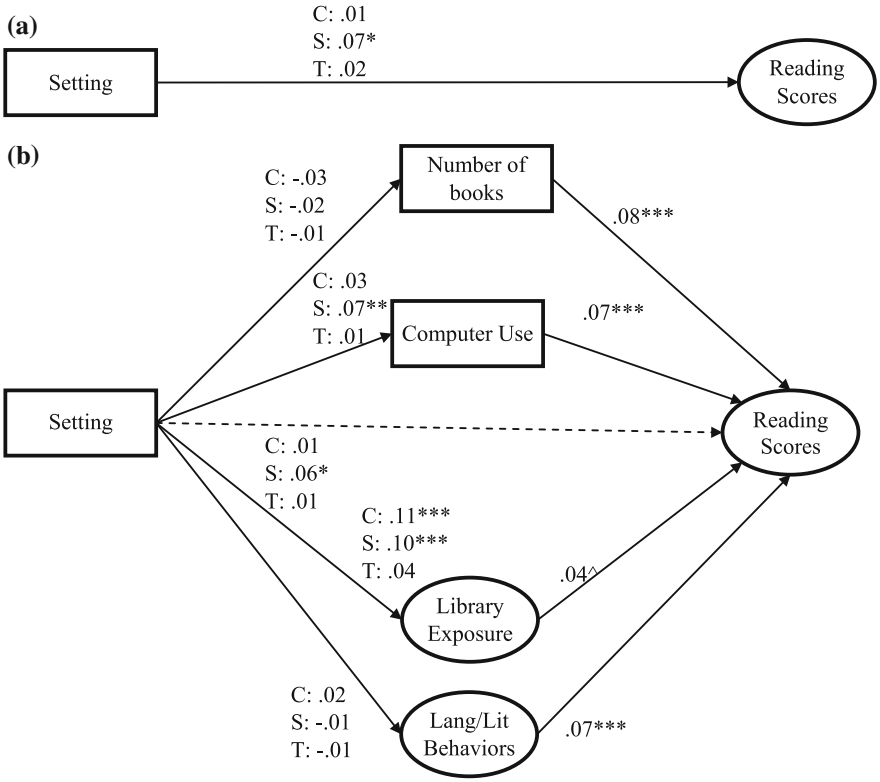

Fig. 1 Path diagrams illustrating the total effect of geographic setting on children's kindergarten literacy (**a**) and indirect effect of geographic setting on children's kindergarten literacy through parents' preschool literacy engagement (**b**). Rural was the reference group for the geographic setting variable. *C* city versus rural, *S* suburban versus rural, *T* town versus rural. Residual correlations and covariate effects are not shown for sake of simplicity. *Rectangles* indicate manifest variables and *ovals* indicate latent variables. *Values* represent standardized coefficients. ***$p < 0.001$; **$p < 0.010$; *$p < 0.050$; ^$p = 0.053$

6 Discussion

The primary aim of this study was to examine the effect of setting (as defined by population, density, and proximity to urban areas) on parent engagement in language and literacy during preschool, and children's early literacy as measured by their kindergarten reading scores. This study was conducted via a secondary analysis of the ECLS-B dataset which represents an extensive nationally-representative sample. Findings from this study revealed that living in a rural community influences some parenting variables that are important in predicting language and literacy in kindergarten entry, but not others. Specifically, residing in a rural community did not appear to influence the number of children's books in the home nor parent-child language and literacy interactions during preschool. Stated in another way, being in close proximity to urban areas or resources did not make a difference regarding parents' provision of children's literacy materials or their verbal interactions (i.e., reading, singing, telling stories) with their young children. Thus, beliefs that rural conditions may depress parents' engagement in learning activities are not supported by these findings, as parents in rural settings appear to be equally engaged in stimulating parent-child interactions as parents in urban communities.

Not surprisingly, however, given the structural context of small, distal communities, the variables affected by setting appear to be those related to access to resources (i.e., library and home computer access). Preschoolers in rural settings used computers in the home less frequently than those in suburban areas and had lower kindergarten reading scores. Results also showed that living in rural settings limits parents' access to resources in the community (i.e., libraries) during the preschool years, which negatively impacted children's kindergarten literacy. Specifically, preschool children in rural areas were exposed to the library less than preschool children in city and suburban areas, which negatively influenced rural children's kindergarten reading scores.

As was demonstrated in previous research, this study supports the notion that structural characteristics of the community in which one lives may play an important role in young children's early literacy development. Cognitively stimulating resources, such as libraries and museums, may be limited in rural communities due to financial resources, population scarcity, and lack of proximity to metropolitan areas. Institutions, such as libraries, operate on property taxes and other public funds that may be restricted in some rural communities relative to other (e.g., city, suburban) communities. Furthermore, geographic isolation may prohibit families from accessing public resources in rural communities. Community resources that stimulate language and literacy have been shown to impact children's early skill development and preparedness for school (Froiland 2011; Lareau 2000).

However, as technology advances, learning tools such as e-readers and iPads may play a larger role in supporting the learning of young children (Macaruso and Rodma 2011; Shamir et al. 2012). Increasing access to and use of these learning tools in home settings may compensate for the lack of other resources found in rural communities. As of yet, few studies have specifically explored the use of these

types of technology in rural homes and its impact on early learning. Such research will have important implications for the fields of early intervention and education in understanding the systemic variables that influence child learning and methods to support rural children to achieve optimal learning outcomes.

Our findings also suggest that other mediating factors need to be considered. Interestingly, when attempting to understand the role of setting on parent engagement and children's reading, there was no difference in rural and city children's reading scores, despite the differences in their library and computer exposure. Hence, it appears likely that there are additional mediator variables for which rural children are advantaged over city children, compensating for their limited exposure to the library and home computers. For example, children in rural communities may have greater access to safe, green spaces (e.g., yards, parks, and fields) that afford young children safe opportunities for outdoor play and discovery, providing a unique context for cognitively stimulating experiences. This may help to offset their limited access to community libraries or technological resources.

Similarly, it appears that there are additional mediating variables not included in our model that would explain why suburban children have higher kindergarten entry reading scores than rural children, even after controlling for computer use, library exposure and other demographic variables (i.e., race/ethnicity, age, sex, and SES). Families in suburban areas often have access to both technology and community resources, as well as green space (e.g., yards and parks). Collectively, suburban areas may have the best of both urban and rural communities, which may play a role in the overall differences in kindergarten reading scores.

Structural factors unique to geographic settings, such as social organization, also warrant further exploration. Community identity and social relatedness may uniquely differ across setting conditions and play a role in children's early learning outcomes. Families in urban neighborhoods with lower levels of social organization interact less with others in their community as a means of protection from potential negative influences (APA 2005). Families in other areas (i.e., suburban, small town, or rural communities) may experience a closer sense of social community and more frequent, positive social interactions (van den Berg et al. 2007). Levels of social disorder and strong social networks have been shown to influence parent engagement in learning activities and children's early academic skill development (Froiland et al. 2014). Thus, further investigation is needed to determine what structural factors unique to setting conditions, such as social organization or natural environments, serve to support early parent engagement in stimulating language and literacy interaction and young children's overall reading development.

7 Limitations

It is important to consider these findings in light of how rural was defined. Population, density and proximity to urban areas do not fully define rural communities and any inferences drawn about rural settings are limited to our use of the

Urban-Centric Locale Codes to define rural locations. More sensitive, comprehensive locale definitions may have produced different findings, and may also explain the lack of differences seen between rural and town settings.

Furthermore, this study focused on only a select number of parent language and literacy engagement variables during preschool that impact children's reading scores. Although the variables included in this study have been used across various studies as indications of parent language and literacy behaviors (Burgess et al. 2002; Dever 2001; Dever and Burts 2002), other possible mediating factors need to be considered. Social organization may be an important consideration, especially for rural communities (Froiland 2011). The social structures within rural communities may serve to buffer the effects of limited resources associated with rural settings and should be further explored. A related limitation is the exclusive use of self-report data to measure parent engagement rather than observational ratings. Although the ECLS-B datafile includes observational ratings of parents' literacy engagement, these ratings are only available for approximately 11 % of cases (Najarian et al. 2010). Retaining the direct observations would have reduced the sample by approximately 89 %. Nevertheless, relying on parents' reports of their engagement activities and behaviors may have produced an upward bias in our measures of parent language and literacy engagement due to socially desirable responding. Finally, parent engagement data were collected in 2005–2006; therefore, interpretations must be made in terms of resources that were available and parenting practices that were reflective of that time period. Certain indicators of parental preschool literacy engagement may have changed since the time these data were collected in both rural and non-rural contexts. Again, this is an area in need of further study.

8 Conclusions and Future Research Directions

This study provides a unique look into the influence of geographic setting on early parent engagement and children's kindergarten language and literacy development. Findings suggest that parents across rural and urban settings are equally engaged in establishing interactive home literacy environments during the preschool period. However, preschool children's access to resources (i.e., libraries and computers) is limited in rural areas compared to children in urban areas, which in turn negatively impacts rural children's kindergarten reading scores.

Yet, as demonstrated by the lack of differences in kindergarten scores for children in rural and city settings and overall higher scores for children in suburban communities, it is likely that other variables may uniquely serve to enhance early literacy skill development in both rural and suburban settings that were not accounted for in this model and warrant further study. These findings have important implications for future research examining the effects of geographic settings on parent engagement in home learning activities. Conditions in rural settings need to be better understood to determine factors that promote strong

literacy skills and ultimately, academic success for rural children. Future studies need to include rigorous evaluations of distinctive features of rural contexts to better explain setting differences and identify important mediating factors influencing academic outcomes for children in rural education systems.

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