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Characteristics Related to Parent-Child Literacy and Numeracy Practices in Preschool

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Despite evidence suggesting that home literacy and numeracy environments are related to children's school readiness skills, little research has examined the child and family characteristics that relate to the home literacy and numeracy environments within the same sample. These factors are important to investigate in order to determine what may foster or prevent parent-child engagement. The primary purpose of this study was to examine the shared and unique parent-reported child and parent variables that are related to the frequency of parent-child literacy and numeracy practices. The 199 preschoolers included in the study ranged in age from 3.00 to 5.17^oyears ($M = 4.16$, $SD = 0.57$). Parents reported on child and family characteristics. Two multiple regression analyses were conducted (one each for home literacy and numeracy environments). Results indicated that parent education and children's age were positively related to the frequency of both literacy and numeracy practices. However, parents' beliefs of the importance of numeracy were positively associated with the frequency of parent-reported numeracy practices, whereas beliefs of the importance of literacy were not related to the frequency of literacy practices. In line with other research, parents reported finding literacy development to be more important than numeracy development and engaging in parent-child literacy practices more frequently than numeracy practices. Understanding factors that are related to the home literacy and numeracy environments may be an important step in identifying how to best encourage parents to engage their children in these practices at home.

Keywords: parents, mathematics, literacy, preschool, home learning environment, home numeracy environment, home literacy environment

INTRODUCTION

Early academic skills—literacy and numeracy skills in particular—are important for the development of later skills and are predictive of long-term academic achievement (Pagani et al., 2010; Nguyen et al., 2016). Despite the importance of these early skills, children enter the school setting with varying literacy and numeracy abilities (Starkey et al., 2004; Klibanoff et al., 2006). Children who enter school with less-developed numeracy and literacy skills often experience difficulties in later reading and mathematics (Claessens et al., 2009). Parents' support of preschool children's learning is related to a number of school readiness skills (Parker et al., 1999); specifically, parent-child literacy

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and numeracy practices are related to the development of children's literacy and numeracy skills (Kleemans et al., 2012; Baker, 2014). However, there are significant differences in the home learning environments that parents provide for their children (Young-Loveridge, 1989) and there are likely various parent and child factors that are related to these differences. Unfortunately, it is unclear which factors are related to the frequency of parent-child practices. Though researchers have some understanding of factors that are related to the home literacy and numeracy environments (e.g., socioeconomic status; Hoff et al., 2002), there is little research examining all of these factors within the same sample. Additionally, researchers often focus on either the home literacy or home numeracy environment, or a broader construct of the general home learning environment (cf. Sonnenschein et al., 2016). Thus, additional research that examines factors related to literacy and numeracy practices within the same sample is critical to researchers' and practitioners' understanding of how to best aid parents in providing a supportive home literacy environment (HLE) and home numeracy environment (HNE) for preschool children.

The aim of the current study is to determine the shared and unique parent and child characteristics that relate to the frequency of parent-child literacy and numeracy practices. Specifically, we explored whether parental educational attainment, child's sex and age, the number of children living in the home, and parents' beliefs of the importance of literacy and numeracy development are related to parent-reported HLE and HNE. An additional aim was to compare the frequency of parent-child literacy and numeracy practices, as well as parents' beliefs of the importance of literacy and numeracy.

BACKGROUND

The Home Learning Environment

The home learning environment is comprised of factors in the home, such as activities and access to learning materials, that contribute to children's learning and development of academic skills. Literacy and numeracy are two specific domains among many that comprise the home learning environment. Parent-child literacy practices, such as joint reading (Wood, 2002), and numeracy practices, such as teaching the counting sequence and the names of numerals (Anders et al., 2012), are important for children's developing academic skills (Melhuish et al., 2008). Similar to the extant literature emphasizing the role of the HLE in children's literacy development, emerging evidence emphasizes a strong relation between the HNE and children's numeracy development (Hart et al., 2016; Napoli and Purpura, 2018).

Home Literacy Environment

The HLE is comprised of characteristics of the home environment that contribute to the development of children's emergent literacy skills (Foster et al., 2005). The HLE is categorized into two types of parent-child practices: code-related interactions (e.g., pointing out alphabet letters and

sounds) which are related to children's print-based skills, and meaning-related interactions (e.g., shared reading) which are related to children's language and vocabulary skills (Sénéchal and LeFevre, 2002; Sénéchal, 2015). Unsupportive early HLEs are related to difficulties in developing reading skills, and these difficulties persist years later (Sonnenschein et al., 2010; Schmitt et al., 2011).

Home Numeracy Environment

In the past decade, researchers have shown an increased interest in the HNE. The HNE has been found to predict children's numeracy abilities in preschool (Anders et al., 2012) and kindergarten (Kleemans et al., 2012). The HNE is comprised of direct (e.g., teaching numeral names, counting objects, learning simple sums) and indirect (e.g., playing store, playing board games that involve counting) parent-child practices that are thought to contribute to the development of children's early mathematics skills (Niklas and Schneider, 2013; Skwarchuk et al., 2014). Positive relations between direct practices and child outcomes have been more consistently found (LeFevre et al., 2010). Thus, the present study includes only direct practices.

Factors Related to the Home Learning Environment

It is important to understand which factors predict parent-child literacy and numeracy practices, especially given the relations between these practices and the development of children's early academic skills. Notably, certain characteristics of children, such as birth order, are related to the HLE (Raikes et al., 2006). Despite emerging evidence on the importance of the HNE, there are marked differences in parents' reports of their literacy and numeracy practices with their children. Parents report valuing literacy over numeracy and engaging their children in literacy practices more frequently than numeracy practices (Blevins-Knabe et al., 2000; Cannon and Ginsburg, 2008). Given that the HLE and HNE have been shown to be distinct domains of the overall home learning environment, and that parents often place greater emphasis on literacy practices than numeracy practices, different parent and child characteristics may predict practices in each domain. Understanding the relations between child and parent characteristics and the HLE and HNE may inform subsequent targeting of interventions. Several key child and parent variables have been linked to the frequency of HLE and HNE activities. However, these variables are often studied separately, and have typically been examined in the context of either the HLE or HNE or the general home learning environment, but not both the HLE and HNE in the same sample. These variables include: child's age and sex, parent education, the number of children living in the home, and parental beliefs about the importance of attaining early academic milestones.

Child's Age

The relation between children's age and the home learning environment is important to understand given persistent

evidence from longitudinal studies showing that the effects of the home learning environment may be strongest during the preschool years (Bradley et al., 2001). Children's age is related to the quality of stimulation in the home learning environment (Bradley et al., 2001) in that parents often improve the quality of both the HNE and HLE as children get older and approach school entry (Son and Morrison, 2010). However, there is considerable variation in the HLE that parents provide as children approach school entry (Rodriguez and Tamis-LeMonda, 2011). Findings on the HNE trajectory are more consistent. Parent reports indicate that the HNE differs for children of different ages, often indicating that older children are engaged in more advanced activities and younger children are engaged in more basic activities (LeFevre et al., 2002; Sonnenschein et al., 2012). Importantly, this is true for children even within the same age group (i.e., preschool-aged children). For example, Thompson et al. (2016) found that parents engage older preschool children (i.e., 4-year-olds) in more frequent HNE activities than younger preschool children (i.e., 3-year-olds).

Child's Sex

In addition to children's age, children's sex is another factor that may be related to differences in the HLE and HNE. Some research indicates that there are sex-based differences in parents' reports of children's interest in literacy favoring girls (Baroody and Diamond, 2013), but these sex-based differences are not always seen in the HLE (Sénéchal and LeFevre, 2014). There is also evidence that parents have sex-based biases toward their children's mathematics abilities. Compared to parents of girls, parents of boys typically report having higher expectations for their sons' mathematics achievement and believe they will be more successful in mathematics-related careers (Gunderson et al., 2012). Additionally, there is evidence that parents include mathematics-related language in interactions with boys more frequently than in interactions with girls (Chang et al., 2011).

Parent Education

Variability in children's early cognitive outcomes are related to differences in socioeconomic status (SES), and these SES-based differences can be seen in children as young as 18 months (Fernald et al., 2013; Larson et al., 2015). One reason for SES-based differences may be the home learning environment. Parents with lower levels of education tend to provide less complex academic experiences at home (Saxe et al., 1987; Hoff et al., 2002) and a lower quality home learning environment overall (e.g., the frequency of reading, teaching numbers and letters, and parent-child play; Davis-Kean, 2005; Hoff et al., 2002). There is also evidence that children's numeracy skills are related to parent education (Anders et al., 2012), and one factor that may explain this relation is the HNE.

Children in the Home

Evidence suggests that the number of children living in the home is negatively related to the quality of the broad home learning environment (Baharudin and Luster, 1998). Downey (1995) found evidence that the more children there are living in the home, the more divided resources are (e.g., time and money).

Another explanation is that parents are less likely to use activities (e.g., playing board games) as learning opportunities when more than one child is involved (Benigno and Ellis, 2004). Although there are relations between the quality of the home environment and the number of children living in the home, it is unclear whether the number of children living in the home is related to the frequency of parent-child literacy and numeracy practices.

Parents' Beliefs

Parents' decisions to involve themselves in educational practices with their children at home is informed by their beliefs about child development, what they should be doing to raise their children, and how they can help their children succeed academically (Hoover-Dempsey et al., 2005). Researchers have examined the importance of parents' beliefs about a range of topics related to literacy, such as best practices for teaching children in the home (DeBaryshe, 1995) and how children develop skills (Bingham, 2007). Additionally, research demonstrates that parents' beliefs regarding the importance of academic development is related to the HLE (Sénéchal and LeFevre, 2002; Martini and Sénéchal, 2012). In the domain of numeracy, this research has focused on parents' opinions about numeracy (Blevins-Knabe et al., 2000; Missall et al., 2015), including the importance of reaching specific academic milestones in early elementary school (LeFevre et al., 2009; Skwarchuk et al., 2014). Less research has focused on the importance of numeracy as a predictor for parents of preschoolers. This relation is important to understand because children are more likely to be exposed to numeracy practices at home when their parents believe that home numeracy practices are important (Sonnenschein et al., 2012). These findings indicate that parents' beliefs may be related to their practices and are an important step in determining the importance of beliefs for practices. However, the sample examined by Sonnenschein and colleagues included children ranging from preschool to fourth grade. It is critical to determine if these relations are consistent specifically for preschool-aged children.

Parents' Beliefs of the Importance of Literacy and Numeracy

In addition to understanding how parents' beliefs of the importance of literacy and numeracy development relate to the HLE and HNE, it is important to understand how these beliefs relate to each other. Parents often report believing that literacy development is more important than numeracy development (Blevins-Knabe et al., 2000; Cannon and Ginsburg, 2008). Additionally, parents report feeling less comfortable with numeracy than with literacy (Warren and Young, 2002), and often are unaware of numeracy practices beyond counting (Coates and Thompson, 1999), which may contribute to their beliefs that these skills are not as important as literacy skills. Parents' beliefs of the importance of skills is related to the frequency of their practices of those skills (LeFevre et al., 2002). As such, considering whether parents' beliefs in the importance of literacy and numeracy development differ, and the frequency of literacy and numeracy practices, may help researchers to understand whether promoting the importance of specific activities may also promote the frequency of those activities.

Present Study

The primary purpose of the present study was to identify parent-reported parent and child characteristics that are related to the HLE and HNE in a sample of preschool children. Specifically, we hypothesized that parent education and children's age would positively relate to the HLE and HNE, and the number of children in the home would negatively relate to the HLE and HNE. Additionally, we hypothesized that parents' beliefs of the importance of literacy would be positively related to the HLE and importance of numeracy would be positively related to the HNE. Due to evidence that parents have sex-based biases towards children's numeracy development, we hypothesized that parents would report more frequent HNE activities with boys than girls, but that sex-based differences would not be observed for the HLE. An additional goal was to examine differences in parents' views of literacy and numeracy. Specifically, we expected that parents would report believing literacy development to be more important than numeracy development and report more frequent literacy than numeracy practices.

METHOD

Participants

Participants were recruited from 16 preschools as a part of two larger studies examining the development of school readiness skills in preschoolers in the Midwestern United States. All parents of 3 to 5-year-old children attending these schools were invited to participate in the studies given that they were comfortable enough with English to complete the questionnaire. Parents of 210 students completed both the background questionnaire and permission forms. Of those children, 11 were excluded from analyses because the child was in kindergarten (some preschools were located within elementary schools). The 199 preschoolers included in the analyses are 52% female, 56% white, 11% Latino, 7% Asian, 7% Black, and 19% other or multiracial. Children ranged in age from 3.00 to 5.17 years ($M = 4.16$, $SD = 0.57$) at the time of parental consent. Parents' highest education ranged from eighth grade or less to attainment of a graduate degree: 32% had a graduate degree, 25% had an Associate's or Bachelor's degree, and 43% had less than a college degree.

Measures

Participating parents completed a researcher-created background questionnaire modified from previous research (LeFevre et al., 2009). They provided information regarding their educational attainment, and characteristics of the family and home environment.

Parent Education

SES has been measured in a variety of ways, and parental educational attainment is considered a central component of SES (National Center for Educational Statistics, 2012; National Forum on Education Statistics, 2015). As such, parent education is used as a proxy for SES in this study. Parental education was categorized as follows: eighth grade education or less (1), some high school (2), GED (3), high school diploma (4), some college

(5), Associate's degree (6), Bachelor's degree (7), Master's degree (8), and PhD or postgraduate degree (9). If education was reported for two parents in the household, the highest level of education was included in models.

Home Literacy and Numeracy Practices

Parents also reported the frequency of practicing specific literacy and numeracy activities in the home with their children, on a six-point scale ranging from *never* (0) to *multiple times a day* (5). Four questions regarding the frequency of parents' practices were used to create a composite variable of the HLE ($\alpha = 0.73$): reading storybooks, printing letters, identifying letters, and identifying letter sounds. Eight questions regarding the frequency of parents' numeracy practices were used to create a composite variable of the HNE ($\alpha = 0.79$): counting objects, printing numbers, reading number storybooks, using number activity books, using the terms *more than* and *less than*, counting down, learning simple sums, and identifying written numbers.

Parents' Beliefs of the Importance of Literacy and Numeracy

In addition to home practices, parents rated how important they believed it was for their children to meet specific literacy and numeracy milestones by kindergarten entry, on a scale from *not important* (0) to *very important* (4). Five questions regarding parents' views of the importance of their children reaching specific literacy milestones by kindergarten entry were used to create a composite variable of parents' views of the importance of literacy ($\alpha = 0.77$): identifying/recognizing alphabet letters, printing name, rehearsing the alphabet, sounding out three letter words, and printing alphabet letters. Seven questions regarding parents' views of the importance of their children reaching specific numeracy milestones by kindergarten entry were used to create a composite variable of parents' views of the importance of numeracy ($\alpha = 0.86$): calculating simple sums, using the terms *more than* and *less than*, solving basic word problems, verbally counting to 40, accurately counting 1 to 15 objects, reading numerals 1 to 10, and counting out 1 to 5 objects from a larger group.

Analytic Strategy

Two multiple regression analyses were conducted to determine the predictors of parents' literacy and numeracy practices. We controlled for race/ethnicity in regression analyses by entering dummy coded variables for Black, Asian, Latino, and multiracial, using white as the reference group. Dependent variables included HLE and HNE composites and independent variables included child's age and sex, number of children in the home, parent education, and parents' beliefs of the importance of the domain (i.e., literacy or numeracy). Of parents who completed the background questionnaire, 4 (2%) were missing all of the HLE and HNE items and 13 (6.5%) were missing between one and three of the HLE or HNE items. Results from Little's missing completely at random (MCAR) test indicate that data were missing at random for both the HLE ($\chi^2 = 3.47$, $df = 6$, $p = 0.748$) and HNE ($\chi^2 = 71.60$, $df = 68$, $p = 0.359$) variables. Missing values function in SPSS was used to impute missing items using linear interpolation.

TABLE 1 | Descriptive statistics of covariates, child outcomes, and home environment.

Variable	M	SD	Range	Min	Max	Skew	Kurtosis
Child age	4.16	0.57	2.17	3.00	5.17	-0.21	-0.79
Children in the home	2.01	0.95	5.00	1.00	6.00	1.06	1.59
Importance of literacy	3.52	0.60	3.00	1.00	4.00	-1.65	3.16
Importance of numeracy	3.22	0.76	3.86	0.14	4.00	-1.11	1.13
Home literacy environment	3.00	1.00	4.50	0.50	5.00	-0.27	-0.54
Home numeracy environment	2.20	0.87	4.75	0.13	4.88	0.25	0.03

N = 199.

TABLE 2 | Correlations between parent and child characteristics and the home literacy and numeracy environments.

	1	2	3	4	5	6	7	8
1. Child age	—							
2. Child sex	0.13	—						
3. Parent education	-0.18**	-0.03	—					
4. Children in the home	0.22**	0.10	-0.16*	—				
5. Importance of literacy	0.20**	-0.03	-0.06	0.00	—			
6. Importance of numeracy	0.17**	-0.02	0.00	0.08	0.77**	—		
7. Home literacy environment	0.17*	-0.13	0.31**	-0.11	0.10	0.10	—	
8. Home numeracy environment	0.23**	-0.01	0.13	0.00	0.15*	0.23**	0.71**	—

*p < 0.05; **p < 0.01.
N = 199.

TABLE 3 | Multiple regression analysis predicting home literacy environment controlling for race/ethnicity.

Variable	B	SE	B	R ²
				0.20
Child age	0.45	0.12	0.26***	
Child sex	-0.33	0.13	-0.17*	
Parent education	0.15	0.04	0.31***	
Children in home	-0.14	0.07	-0.13	
Importance of literacy	0.08	0.12	0.05	

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.

TABLE 4 | Multiple regression analysis predicting home numeracy environment controlling for race/ethnicity.

Variable	B	SE	B	R ²
				0.15
Child age	0.37	0.11	0.24***	
Child sex	-0.07	0.12	-0.04	
Parent education	0.09	0.04	0.21*	
Children in the home	-0.06	0.07	-0.07	
Importance of math	0.24	0.08	0.21**	

*p ≤ 0.05; **p ≤ 0.01; ***p ≤ 0.001.

Predicting the Home Learning Environment Home Literacy Environment

A multiple regression analysis was conducted to determine which factors predicted home literacy practices (see **Table 3**). As expected, parents of older children ($\beta = 0.26, SE = 0.12, p < 0.001$) and parents with greater education attainment ($\beta = 0.31, SE = 0.04, p < 0.001$) engaged children in literacy practices more frequently than parents of younger children and those with lower educational attainment, respectively. Contrary to our hypothesis, the HLE score was also greater for female children ($\beta = -0.17, SE = 0.13, p = 0.012$). The number of children in the home and parents' beliefs of the importance of literacy were not significantly related to the HLE.

Home Numeracy Environment

A separate multiple regression analysis was conducted to determine which factors predict home numeracy practices (see **Table 4**). As expected, parents engaged older children in numeracy practices more frequently than younger children ($\beta = 0.24, SE = 0.11, p = 0.001$). Additionally, as hypothesized, parents with greater educational attainment reported more frequent numeracy practices than those with lower educational attainment ($\beta = 0.21, SE = 0.04, p = 0.013$). Finally, as expected, parents who reported believing mathematics skills to be more important reported more frequent parent-child numeracy practices ($\beta = 0.21, SE = 0.08, p = 0.004$). Contrary to expectations, children's sex and the number of children in the home were not related to the frequency of HNE practices.

RESULTS

Descriptive Statistics

Means, standard deviations, skew, and kurtosis are presented in **Table 1**. Parents reported reading storybooks with their children almost daily ($M = 3.76, SD = 1.10$) and reading number storybooks with their children about once per week ($M = 2.47, SD = 1.27$). Parents reported printing letters ($M = 2.48, SD = 1.43$) and numbers ($M = 1.91, SD = 1.38$) less frequently. Of the numeracy practices, parents reported practicing simple sums with their children least; on average, parents practiced simple sums with their children only one to three times per month ($M = 1.43, SD = 1.32$). The most common numeracy practice was counting objects, which parents reported doing with their children almost daily ($M = 3.50, SD = 0.95$). Correlations are presented in **Table 2**.

Differences Between Literacy and Numeracy

Paired samples t-tests were conducted to analyze differences between parents' beliefs of the importance of literacy and numeracy, as well as the HLE and HNE. There was a significant difference between parents' beliefs of the importance of literacy ($M = 3.52$, $SD = 0.60$) and the importance of numeracy ($M = 3.22$, $SD = 0.76$), $t(198) = 8.74$, $p < 0.001$, Cohen's $d = 0.62$, indicating that parents believed literacy to be more important than numeracy. There was also a significant difference between the HLE ($M = 3.00$, $SD = 1.00$) and the HNE ($M = 2.20$, $SD = 0.87$), $t(198) = -15.58$, $p < 0.001$, Cohen's $d = 1.11$, indicating that parents reported practicing literacy activities with their children more frequently than numeracy practices. Parents reported engaging in literacy practices two to five times per week and engaging in numeracy practices about once per week.

DISCUSSION

The results of this study suggest that there are key child and parent characteristics that are related to the frequency of parent-child literacy and numeracy practices in the home environment. However, these characteristics may not always be the same across academic domains. Understanding predictors of parent-child literacy and numeracy practices, particularly within the same sample of parents and children, is important for researchers' understanding of how to assist parents in providing an adequate HLE and HNE for their children.

Factors Related to the Home Literacy and Numeracy Environments

Children's Age

As hypothesized, children's age was related to both the HLE and the HNE. On average, compared to younger children, parents reported engaging older children in more frequent literacy and numeracy activities. Research has found that parents adjust home literacy practices as elementary-aged children develop more advanced skills (Sénéchal and LeFevre, 2014), and one way this may be reflected is in more frequent literacy practices. This has also been found for numeracy practices with preschool-aged children; parents tend to engage older preschool children with more complex numeracy activities than younger preschool children (Thompson et al., 2016). A potential explanation for this is that parents do not believe that younger children are developmentally ready to engage in some of the specific practices that were reported (e.g., writing letters or numerals). Further, parents' awareness of the importance of these practices may increase as children grow closer to kindergarten entry.

Children's Sex

In contrast to our hypotheses, children's sex was related to the HLE, but not the HNE. However, it is important to note that sex

was not significantly correlated with either the HLE or HNE (see **Table 2**). There may not have been a difference for the HNE because parents reported infrequent engagement in numeracy practices overall, resulting in limited variability in the HNE variable. Although there is evidence that sex biases for mathematics are present as early as preschool (Gunderson et al., 2012), the current sample may not have been practicing numeracy activities enough for such differences to be apparent. Given that the bivariate correlation was not significant, it is possible that the relation between sex and the HLE was a spurious finding.

Parent Education

As hypothesized, parent education was positively related to both the HLE and the HNE. These findings are in line with previous research that has found that parents with higher educational attainment engage their children in more complex academic activities compared to parents with lower educational attainment (Hoff et al., 2002). Parents with lower educational attainment may be working multiple jobs or have atypical work hours, which may limit their ability to engage their children in academic activities. Additionally, parents with lower educational attainment may undervalue the role they play in helping their children develop early academic skills, or feel that teachers are better suited to teach their children, or may not have the resources to do so (Jones and Prinz, 2005). It is important to identify the barriers that parents face in order to support them in providing a quality HLE and HNE.

Children in the Home

Contrary to expectations, the number of children living in the home was not related to the frequency of HLE or HNE practices. This finding is inconsistent with previous research that has found that the number of children in the home is negatively related to the home learning environment (Baharudin and Luster, 1998). However, previous research showing this relation often measured the general home environment and did not assess specific aspects (e.g., HLE and HNE). There are a few possible explanations for the lack of relation between the number of children in the home and the HLE and HNE. Some practices, such as reading, may be easily done with more than one child. Additionally, if children had older, school-aged siblings, parents may include younger children in academic activities while assisting older children with homework. Future research on the home learning environment should consider the role of siblings in more detail by collecting information on ages of the children (rather than only the number of children) and more specific contexts in which practices are conducted.

Parents' Beliefs

Our hypotheses regarding parents' beliefs were partially supported. Parents' beliefs in the importance of numeracy was significantly related to the HNE, but parents' beliefs in the importance of literacy was not significantly related to the HLE. The findings regarding the HLE are in contrast to other findings that parents' beliefs of the importance of literacy are related to the HLE (Silinskas et al., 2020). The relation between parents' beliefs

and the HNE is aligned with and contributes to previous findings that children are more likely to be exposed to numeracy practices when their parents report believing numeracy development is important (Sonnenschein et al., 2012). The finding that parents' beliefs are related to the HNE but not the HLE may be because parents report differential levels of importance for literacy and numeracy. Whereas literacy exposure is widely recognized as being an important part of development, the importance of exposure to numeracy activities early on is not as widely recognized in the United States (Mazzocco, 2016). As such, parents who hold stronger beliefs regarding numeracy development are more likely to engage their children in numeracy-related activities.

In line with previous research findings and our hypothesis, parents reported believing that literacy development is more important than numeracy development (Blevins-Knabe et al., 2000; Cannon and Ginsburg, 2008). Further, parents reported engaging their children in literacy practices more frequently than numeracy practices. Differences between parents' literacy and numeracy beliefs and practices are likely a result of the widespread public emphasis that is placed on literacy development. In contrast, parents of preschool-aged children rarely receive information on the importance of numeracy development, despite the fact that this development is longitudinally related to children's achievement (Nguyen et al., 2016).

Limitations and Future Directions

A few limitations of this study should be noted. First, there are likely several additional factors that are related to the HLE and HNE that were not measured in this study. Given that the included variables explained only 19% and 12% of the HLE and HNE, respectively, future studies should include additional factors, such as social risk (Foster et al., 2005), to determine their relation to the HLE and HNE and to potentially explain additional variance. Additionally, we only had information on how many children were living in the home and not birth order. Future studies should consider collecting this information as birth order may be related to the home learning environment (Bradley and Caldwell, 1984). Second, the indicators of the HLE and HNE relied on parent report. Although the infrequency of numeracy practices indicates that parents may not have overestimated the frequency of practices, self-report always includes a potential for reporter bias and issues related to social desirability. It is also important to note that our findings may be affected by shared method variance. Researchers may consider the use of daily diary methods, direct observation, or video recording parent-child interactions in future studies. Observations and recordings would also allow researchers to consider the quality of the interactions, rather than being limited to quantity. Third, the measures of the HLE and HNE were not exhaustive, particularly for the HLE measure. Future research should include additional activities that parents may engage in with their children. Fourth, this study was concurrent in nature. Future research should consider assessing how parent and child characteristics are related to the HLE and HNE longitudinally. Finally, children's outcomes were not included in this study. Future research should address the relations between parent and child characteristics related to the HLE and HNE, measures of the HLE and HNE, and children's literacy and numeracy skills.

Implications

Awareness of the characteristics that are related to the HLE and HNE may allow researchers and practitioners to identify characteristics of parents and children who may benefit from additional support in building a higher quality HLE and HNE. Additionally, the findings indicate particular factors that interventions may need to address in order to effectively implement change, such as emphasizing the importance of early numeracy development in order to affect change in the HNE. Additionally, there is a need to support parents in their involvement in HNE activities, such as providing them with suggestions for activities and strategies for incorporating numeracy at home.

The findings may also help researchers better understand the mechanisms underlying parents' choices to engage with their children in various learning activities. Given that HLE and HNE practices have implications for children's outcomes, it may not be that there is a direct relation between child or family factors (e.g., parental education) and children's outcomes, but rather that the HLE and HNE may mediate the relations. Future studies should address whether the HLE and HNE mediate the relation between family factors and preschool children's outcomes, and particularly look at this potential mediation within the same sample of children. Identifying the shared and unique characteristics related to learning experiences in the home, particularly numeracy experiences, may help researchers understand the complex relations between the HLE, HNE, and children's literacy and numeracy skills. Further, the findings that some family and child characteristics predict the HLE or HNE, but not both, support previous research indicating that the HLE and HNE are related but distinct factors of the home environment (Napoli and Purpura, 2018). These differences may indicate that rather than examining the home learning environment as a broad construct, researchers should consider domain-specific aspects of the home environment.

Findings that parents value literacy development over numeracy development may also indicate the need for public dissemination of information regarding the importance of early numeracy development, such as strategies used to circulate information on literacy (Mazzocco, 2016). Educators and practitioners who work with young children and their parents may be helpful resources for distributing this information. If parents continue to receive information regarding the importance of only early literacy skills, and do not receive the same messages about numeracy skills, they will likely continue to prioritize parent-child literacy practices over numeracy practices.

DATA AVAILABILITY STATEMENT

The datasets generated for this study are available on request to the corresponding author.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by the Institutional Review Board, Purdue University. The patients/participants provided their written informed consent to participate in this study.

AUTHOR CONTRIBUTIONS

AN made substantial contributions to the conception and drafting of the manuscript. IK made substantial contributions

to the conception and drafting of the manuscript. JL made substantial contributions to analyses and revisions. SS made substantial contributions to the conception and revisions. DP made substantial contributions to the conception and revisions.

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Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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