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Using Alphabet Knowledge to Track the Emergent Literacy Skills of Children in Head Start

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Abstract

Having strong alphabet knowledge early in life is a powerful predictor of long-term reading and academic outcomes. Upon tracking the alphabet knowledge of 172 children enrolled in their first year of Head Start, we identified that most of the children could name fewer than 10 letters at the beginning of the academic year. Approximately, one third of the children with low alphabet knowledge in fall made significant progress and demonstrated mastery of 10 or more letters in spring. For the children who started the year knowing fewer than 10 letters, receptive vocabulary was the best predictor of who would make gains in alphabet knowledge throughout the year. In addition, most children who entered Head Start knowing fewer than 10 letters knew

letters from their first names and the letters A, B, or O. Implications for the management of emergent literacy skills for children at-risk for academic difficulties are discussed.

Keywords literacy, assessment, at risk for developmental delays/disabilities, disability populations, early identification, emergent literacy, Head Start, prevention

Emergent literacy consists of a combination of print-related and language-based skills that provide a foundation for children's later transition into reading (Teale & Sulzby, 1986). One component of emergent literacy surrounds children's awareness of print and its importance in everyday life (van Kleeck, 1998). A second set of skills surrounds children's oral language ability, including vocabulary knowledge and narrative competence, which assist children in understanding the content of print (Westby, 1991). The final set of skills includes knowledge of print concepts, such as alphabet knowledge and phonological awareness, which provide the building blocks for being able to decode words in later reading (Lonigan, Burgess, & Anthony, 2000).

While each aspect of emergent literacy provides its own contribution to children's later literacy acquisition, knowledge of the alphabet is a particularly important skill for children to acquire. The ability to name letters is considered to be one of the best early predictors of children's later reading achievement (Piasta, Petscher, & Justice, 2012; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). When following children from preschool through the early elementary years, alphabet knowledge has consistently provided unique prediction of children's long-term reading outcomes, both in monolingual children (e.g., McBride-Chang, 1999; Storch & Whitehurst, 2002) and children learning English as a second language (e.g., Solari et al., 2014). This result, which has been observed in numerous individual studies, has been further confirmed through large-scale meta-analyses (Hammill, 2004; National Early Literacy Panel, 2008; Scarborough, 1998).

Alphabet knowledge could be a strong predictor of reading outcomes simply because it is a correlate of broader reading or academic ability. However, multiple studies and theoretical accounts have outlined how this skill has a likely causal relationship with later reading (Evans, Bell, Shaw, Moretti, & Page, 2006; Foulin, 2005; Piasta & Wagner, 2010; Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998; Walsh, Price, & Gillingham, 1988). Having strong knowledge of letter shapes allows children to identify them efficiently when encountered in text, assisting with the acquisition of decoding skills (Walsh et al., 1988). In addition, children's engagement with letters promotes better understanding of sound–letter relationships. Multiple studies have demonstrated that when children know a letter's name, they are more likely to demonstrate mastery of sound–letter relationships for that letter (Evans et al., 2006; Piasta & Wagner, 2010; Treiman et al., 1998). This is likely because most English letters contain the associated phoneme as consonant vowel (e.g., d, t) or vowel consonant (e.g., f, s) combinations. Thus, alphabet knowledge itself plays an important role in children's literacy acquisition.

Children's acquisition of alphabet knowledge is influenced by multiple internal and external factors. Internally, children's cognitive ability, as measured by receptive vocabulary and a number of reasoning and processing tasks, is one of the strongest predictors of concurrent alphabet knowledge (Evans et al., 2006). Externally, children's alphabet knowledge can be influenced by the amount of engagement in emergent literacy activities during the preschool years (Sénéchal, 2006).

Alphabet Knowledge in Children at Risk for Reading Difficulties

A disproportionately high number of children from families with low socioeconomic status (SES) have significantly delayed alphabet knowledge when compared with their mainstream peers (Bowey, 1995; Duncan & Seymour, 2000; Elbro & Petersen, 2004; Justice, Invernizzi, Geller, Sullivan, & Welsch, 2005; Snowling, Gallagher, & Frith, 2003). These early delays are a likely contributor to the later achievement gap observed in children from families with low SES (National Early Literacy Panel, 2008). Therefore, regular screening of children's emergent literacy skills, including alphabet knowledge, has been recommended as a best practice in Head Start programs (Office of Head Start, 2015). Once children with emergent literacy delays are identified, intensive interventions can be used to promote significant gains in their foundational knowledge, including interventions directly targeting alphabet knowledge (e.g., Button, Johnson, & Furgerson, 1996; Lonigan, Purpura, Wilson, Walker, & Clancy-Menchetti, 2013).

When implementing screening of alphabet knowledge, educators need to know what levels of performance are considered adequate and what puts a child at risk for later literacy difficulties. Piasta and colleagues (2012) reviewed the available alphabet knowledge benchmarks provided by each state in the United States to identify recommended benchmarks for identifying children who are at risk for later academic and literacy difficulties. Although benchmarks for letter naming varied across states, most states specified that children should be able to name 10 uppercase letters by the end of preschool. This 10-letter benchmark was also an early recommendation of the National Head Start Association (U.S. Department of Health and Human Services, Administration on Children, Youth Families/Head Start Bureau, 2003).

Piasta et al. (2012) noted that they could not find justification for letter-naming benchmarks in any state standards, nor could they find any empirical research investigating the ability of these benchmarks to identify children at risk for later reading delays. Piasta et al. then measured preschool children's alphabet knowledge using the *Phonological Awareness Literacy Screening–PreK* assessment (PALS-PreK; Invernizzi, Landrum, Teichman, & Townsend, 2010; Invernizzi, Sullivan, Meier, & Swank, 2004), an emergent literacy screening measure that features an alphabet knowledge subtest. The examiners prompted the children to name all 26 letters of the alphabet and then examined which letter-naming benchmarks (10, 13, 16, 18, 19, 20, or 26 letters named) were effective in predicting children's reading skills in first grade. Piasta et al. documented that the 10-letter benchmark had strong specificity, meaning that most children who had normal reading skills in first grade knew at least 10 letters in preschool. The team found that sensitivity could be increased using a benchmark of 18 letters, meaning that most children who were having reading difficulties in first grade knew fewer than 18 letters in preschool. This 18-letter benchmark has been recently adopted as a recommendation by the Office of Head Start (2015).

Most preschool-age children in the United States are meeting both the 10- and 18-letter benchmarks described above (Invernizzi et al., 2004; Piasta et al., 2012). When asked to name the 26 letters in the alphabet during the administration of the PALS-PreK, a group of 734 preschool-age children were able to name 17 to 19 letters on average (Invernizzi et al., 2004). However, children from at-risk backgrounds could name substantially fewer letters than their mainstream peers. Upon testing the alphabet knowledge of 2,161 preschool-age children from at-risk backgrounds using the PALS-PreK, Justice et al. (2005) found that children only knew, on average, 7.2 letters.

The Emergence of Alphabet Knowledge in Young Preschool Children

While Justice et al. (2005) showed that 4- and 5-year-old children from low-income households tend to know fewer letters than their peers when approaching the end of preschool, there are limited data summarizing the emergence of alphabet knowledge in at-risk children who are in their first year of preschool. This is likely because most 3-year-old children are just starting to be able to name letters. Worden and Boettcher (1990) tested the alphabet knowledge of 38 3-year-old children from mainstream backgrounds and found that they could name, on average, four letters. While most children know few letters at 3 years of age, alphabet knowledge is still a powerful predictor in young preschool-age children. Lyytinen et al. (2004) found that children who knew at least four letters at 3.5 years of age had a high probability of becoming strong readers, while children who did not know any letters at that same age were at a much greater risk for later reading difficulties. The new Head Start standards are consistent with these developmental expectations, recommending that children 36 to 48 months of age be able to name “some letters that are encountered often” (Office of Head Start, 2015, p. 47).

Knowing expectations for the early acquisition of alphabet knowledge in young children may assist with early identification of reading difficulties. Early identification is a particular challenge when working with children from lower socioeconomic backgrounds, who enter early childhood programs such as Head Start with varied home literacy experiences (Roseberry-McKibbin, 2013). Some children may initially present as delayed primarily due to lack of exposure to literacy-rich environments, but then spontaneously recover once exposed to the content. Other children also initially present as delayed, but will have continued difficulty with literacy acquisition despite regular instruction. By tracking the emergence of alphabet knowledge in children enrolled in Head Start, we may better understand how the skill changes over time. In addition, we may have the ability to better predict those children who have continued difficulty with alphabet knowledge by testing how letter acquisition relates to other aspects of emergent literacy.

In addition to examining the raw numbers of letters that fledgling letter learners acquire, it is important to examine the types of strategies that young children in Head Start use to learn letters. One of the first letters that most children learn is the first initial of their first name, given that most children have frequent exposure to this letter (Justice, Pence, Bowles, & Wiggins, 2006; Phillips, Piasta, Anthony, Lonigan, & Francis, 2012; Treiman, Kessler, & Pollo, 2006). Children also have an advantage for the additional letters in their names, though the first initial is the most likely letter known (Justice et al., 2006; Share, 2004). A final group of letters that tend to be early developing include the letters “A, B, and O.” “A” and “B” have the advantage of being the first two letters in the alphabet, so they are likely heard with high frequency by children. The “O” advantage is thought to be due to the close similarity to the orthography of the letter and the shape of the lips when producing it (Phillips et al., 2012).

Summary and Rationale

A significant number of 4- and 5-year-old children at-risk for academic difficulties leave Head Start knowing fewer letters than their peers (Justice et al., 2005), yet little is known about the development of alphabet knowledge skills for children who are just beginning their Head Start education. The purpose of this study was to better understand the alphabet knowledge skills of young children from at-risk backgrounds who were enrolled in their first year of Head Start. This study was innovative in that it followed these young children over the span of an entire academic year, which allowed us to track children who made significant gains in their alphabet knowledge and children who continued to know only a few letters after a year of formal schooling. We were particularly interested in examining characteristics of children who learned only a few letters over the course of an academic year. To explore differences between low-growth and high-growth learners, we related children’s alphabet knowledge to additional emergent literacy measures. We further compared the types of letters that children knew across the low-growth and high-growth learners. These data allowed us to better understand the nature of alphabet knowledge development in young at-risk learners by addressing the following questions:

Research Question 1: What are the early alphabet knowledge profiles of 3- and 4-year-old children throughout their first year of Head Start?

Research Question 2: Which emergent literacy measures best predict those children who continue to have limited alphabet knowledge at the end of their first year of Head Start?

Research Question 3: What types of letters are being learned by strong and weak letter learners?

Method

Children were recruited from Head Start programs in a major Midwestern city to participate in an Early Reading First project (N = 172; M_{age} = 42.7 months, SD_{age} = 3.9 months, range = 36–49 months; 44% boys, 56% girls; 100% African American). Each child was monolingual English speaking and enrolled in his or her first year of Head Start. All children had one additional year of Head Start or 4-year-old Kindergarten prior to being age-eligible for 5-year-old Kindergarten. Participants were from 10 different Head Start centers, with a range of two to 75 children per center. Data were collected from 13 additional children who had Individualized Education Plans (IEPs). We did not receive detailed information regarding the nature of the IEPs. Because the range of potential disabilities could be large, we elected to exclude these 13 children from the study.

As part of the project, all students were enrolled in classrooms implementing *Opening the World of Learning* (OWL; Schickedanz, Dickinson, & Charlotte-Mecklenburg Schools, 2005), a language- and literacy-based preschool curriculum. Studies have shown that children whose classrooms implemented the OWL curriculum exhibited significant gains in early literacy skills, including vocabulary, alphabet knowledge, and phonological awareness skills (Edmonds & Algozzine, 2008; Pearson, 2009). The OWL curriculum is organized around six thematic units (e.g., Family, Things that Grow) and is designed to systematically promote the development of emergent literacy skills, including oral language, phonological awareness, social and emotional development, and alphabet knowledge. All OWL units contain teacher-led and child-initiated activities designed to increase children's alphabet knowledge and other early literacy skills. Examples of activities include name writing, alphabet puzzles, songs focusing on letters (e.g., BINGO), and alphabet letter matching. Participating teachers received ongoing professional development (e.g., group workshops, individual literacy coaching) on alphabet knowledge and other aspects of early literacy development and instruction as part of the Early Reading First project. The quality of instruction, fidelity to the OWL curriculum, and focus on alphabet learning varied across classrooms. Factors influencing instructional variation included individual teaching styles and preferences, years of teaching experience, educational background, and length of time teachers had participated in the Early Reading First project.

A subgroup of 34 children received supplementary instruction. Children were enrolled in this supplementary instruction based on their performance in the battery of testing described below. Teacher concern was also taken into account, particularly if children's scores were not uniformly low. These 34 children received additional small-group instruction (30 min, twice per week), focusing primarily on vocabulary and phonological awareness, with minimal direct focus on alphabet knowledge.

The current project followed each child over the course of one academic year. All children completed testing in fall and spring. Fall testing started in September and continued through December, given that children were continually enrolling in Head Start. On average, there were 7.1 months between initial and follow-up testing (SD = 0.8 months, range = 5–8 months). Children who were lost to attrition were excluded from this study, resulting in a complete data set where each participant completed the entire testing protocol at both time points. This battery of testing included the PALS-PreK assessment (Invernizzi et al., 2004), which contains the following six subtests documenting a range of emergent literacy skills:

- Alphabet Knowledge: Students were cued to name the 26 uppercase letters of the alphabet, which were presented randomly. Students who named at least 16 uppercase letters were also cued to name lowercase letters. If at least nine lowercase letters were identified correctly, the letter sounds subtest was administered. Only the results from the uppercase letters subtest were included in the analyses for this study because (a) mastery of uppercase letters emerges prior to lowercase letters, (b) the research documenting the relationship between alphabet knowledge and reading outcomes has found the strongest relationships using uppercase letters, (c) alphabet knowledge benchmarks are based solely on uppercase letters, and (d) only 16 of the children (9% of the sample) named at least 16 uppercase letters in fall and completed the lowercase testing. Scores range from 0 to 26.

- Name Writing: Students were cued to write their own first names. Children's productions were coded with a rubric, with scores ranging from 0 to 7.
- Beginning Sound Awareness: Students were cued to say the first sound of a series of words starting with /s/, /m/, and /b/. Scores range from 0 to 10.
- Print and Word Awareness: Students engaged in shared storybook reading and were tested on their understanding of print concepts, such as differences between text and pictures, text directionality, and so forth. Scores range from 0 to 10.
- Rhyme Awareness: Students were cued to identify two object names that rhymed (e.g., cake, bell, mop, snake). Scores range from 0 to 10.
- Nursery Rhyme Awareness: Students were cued to fill in missing rhyme words from familiar nursery rhymes. Scores range from 0 to 10.

The PALS-PreK is a criterion-referenced assessment that utilizes raw scores. The maximum score for Alphabet Knowledge: Uppercase Letters is 26. The maximum score for Name Writing is 7. For the remaining subtests (Beginning Sound Awareness, Print and Word Awareness, Rhyme Awareness, Nursery Rhyme Awareness), the maximum score is 10 points per subtest. Psychometric information about the PALS-PreK was provided in Invernizzi et al. (2004) and Invernizzi et al. (2010), which reported strong interrater reliability (r = .96–.99), high test–retest reliability estimates (r = .80–.98), and moderate levels of concurrent validity when PALS-PreK scores were compared with measures of phonological awareness, early reading, and general academic development (r = .41–.71). According to Invernizzi and colleagues (2010), the PALS-PreK is among the most commonly used preschool literacy assessments. For example, in the 2008–2009 school year, more than 1,400 preschool teachers administered the PALS-PreK to over 21,000 children.

In addition to the PALS-PreK, each child completed the Peabody Picture Vocabulary Test, Fourth edition (PPVT-4; Dunn & Dunn, 2007) in fall and spring to document his or her receptive vocabulary skills. The PPVT-4 is a well-established assessment of English receptive vocabulary and was required for all funded Early Reading First projects (U.S. Department of Education, 2003). Receptive vocabulary is of interest, given the positive correlations between early oral language skills and later reading achievement (Lonigan et al., 2000). Vocabulary skills have a particularly strong impact on word-decoding skills in the early stages of reading (National Early Literacy Panel, 2008; Storch & Whitehurst, 2002).

While the PPVT-4 directly assesses children's comprehension of words, children's scores are influenced by multiple factors. Children's overall cognition and academic readiness have a direct influence on children's performance as demonstrated by strong correlations between the PPVT-4 and measures of cognition (Campbell, Bell, & Keith, 2001; Evans et al., 2006). In addition, receptive vocabulary scores need to be interpreted carefully with children from at-risk backgrounds as many children have limited exposure to higher level vocabulary (e.g., Hart & Risley, 1995) and tend to have lower receptive vocabulary scores than their mainstream peers (Champion, Hyter, McCabe, & Bland-Stewart, 2003; Washington & Craig, 1999). While children from at-risk backgrounds tend to score lower on the PPVT-4, Washington and Craig argued that it is still a valid test for these children given the normal distribution observed in their sample.

The PPVT-4 consists of two parallel forms (A and B). According to the test manual, alternative form reliability was high (r = .87–.93). Similarly, test–retest reliability of the PPVT-4 was also high (r = .92–.96). Concurrent validity was moderate to high with various tests of vocabulary, language, and reading. Raw scores were converted to standard scores (M = 100, SD = 15) for the analyses.

Selection of Alphabet Knowledge Benchmark

We had to establish which letter-naming benchmark would best capture strong and weak letter learners. While Piasta et al. (2012) demonstrated that an 18-letter benchmark has the strongest sensitivity and specificity, we believed it would set too high a bar for children who were just starting their first year of Head Start. Conversely, we considered using a four-letter benchmark as knowing being able to name four letters at 3.5 years of age is highly predictive of long-term reading outcomes (Lyytinen et al., 2004). However, many of the children turned 4 years old through the study, so we believed a four-letter benchmark would have been too lenient. We concluded that the 10-letter benchmark provided a good middle ground, allowing us to effectively distinguish between strong and weak letter learners. Furthermore, the 10-letter benchmark has a level of validity given its historic use throughout the United States and its strong specificity when used with children in preschool (Piasta et al., 2012).

Results

Research Question 1: What Are the Early Alphabet Knowledge Profiles of 3- and 4-Year-Old Children Throughout Their First Year of Head Start?

The first goal of this study was to identify the percentage of children who entered Head Start with strong alphabet skills, those who started knowing few letters and made rapid gains with a year of instruction, and those who started knowing few letters and continued to have difficulty learning letters despite the instruction. To achieve this goal, the participants were classified into three groups based on whether or not they met the 10-letter benchmark in fall and spring. As observed in Table 1, 15% of the children (n = 26) successfully named at least 10 letters in fall, putting them in the *High Initial* group; each of these children named 10 or more letters in spring as well. Thirty-one percent of the children (n = 54) did not meet the 10-letter benchmark in fall but successfully named at least 10 letters in spring, putting them in the *High Growth* group. Over half of the sample (n = 92) did not meet the 10-letter benchmark in either spring or fall, putting them in the *Low Growth* group.

Table 1. Group Size and Means (*SD*) for Age (in Months) and Alphabet Knowledge in Fall and Spring Across Groups.

Group	N	Age	Fall alphabet knowledge	Spring alphabet knowledge
Low growth	92	41.4(3.7)	0.7(1.3)	2.5(2.6)
High growth	54	43.7(3.5)	2.6(2.5)	18.7(5.7)
High initial	26	44.9(3.6)	17.2(4.4)	23.0(5.3)
Total sample	172	42.7(3.9)	3.8(6.2)	10.6(9.8)

Note. Alphabet knowledge values based on number of uppercase letters named on the PALS-PreK. PALS = Phonological Awareness Literacy Screening

There was a 2- to 3-month difference in average age across the groups (see Table 1). This difference in ages was significant, $F(2, 169) = 11.7$, $p < .001$. Post hoc Scheffé analyses revealed that children in the Low Growth group were significantly younger than the children in High Initial ($p < .001$) and High Growth ($p = .003$) groups. No significant differences in age were observed between the High Initial and the High Growth groups ($p = .34$). We next reviewed the group membership of the 32 children enrolled in tiered instruction. None were in the High Initial group, six children were in the High Growth group, leaving the majority of the children in the Low Growth group (n = 26).

Research Question 2: Which Emergent Literacy Measures Best Predict Those Children Who Continue to Have Limited Alphabet Knowledge at the End of Their First Year of Head Start?

From a practice and prevention perspective, we were interested in better differentiating between the two groups of children who started with low alphabet knowledge values. The High Initial group was the least at risk for further delays because they were meeting the 10-letter benchmark in both fall and spring. Both the Low Growth and High Growth groups were at greater risk for later reading difficulties because they were not meeting this alphabet knowledge benchmark. Of all the children who started Head Start knowing fewer than 10 letters (n = 146), only the 54 children in the High Growth group lowered their risk of long-term reading impairments by learning a substantial number of letters throughout the school year.

Early educators need to identify the best method of predicting which children will make substantial gains with regular schooling (i.e., the High Growth group) and which children will continue to struggle despite a year of instruction (i.e., the Low Growth group). Baseline alphabet knowledge values were not satisfactory on their own to predict which children would grow throughout the year, as both the Low Growth and High Growth groups were near the floor during fall testing (i.e., children knew less than three letters, on average). Being better able to identify those children who will continue to have substantial difficulty learning new letters will allow educational professionals to identify those children requiring more intensive intervention.

To better understand differences between the Low Growth and High Growth groups, we compared baseline measures of emergent literacy collected from the PALS-PreK and the PPVT-4 (see Table 2 for descriptive statistics). Because there was a small, but significant, difference in age between the Low Growth and High Growth groups, we controlled for age in these comparisons. A series of ANCOVA equations were completed using each of the six additional baseline emergent literacy measures as the dependent variable, group (Low Growth vs. High Growth) as the independent variable, and age as the covariate. Eta squared (η^2) values were also calculated as an estimate of the effect size, which summarized the amount of variance explained by group membership. Cohen (1988) provided guidelines for small (η^2 = .01), medium (η^2 = .06), and large (η^2 = .14) effect sizes.

Table 2. Mean (*SD*) Scores From Fall Administration of the PALS-PreK and PPVT-4 Across the Low Growth and High Growth Groups.

Group	Beginning sound awareness	Print awareness	Rhyme awareness	Nursery rhyme awareness	Name writing	PPVT-4
Low growth	1.1(1.7)	1.9(1.9)	2.5(1.7)	1.9(1.5)	1.2(1.1)	86.1(11.7)
High growth	1.7(2.4)	2.6(2.0)	3.0(2.0)	2.6(1.4)	1.8(1.4)	95.5(10.1)

Note. Scores on PALS-PreK subtests range from 0 to 10, with the exception of Name Writing, which ranges from 0 to 7. PALS = Phonological Awareness Literacy Screening; PPVT = Peabody Picture Vocabulary Test

Significant differences were observed between the Low Growth and High Growth groups for the following three measures: the PALS-PreK, Nursery Rhyme Awareness, $F(1, 143) = 5.0$, $p = .03$, $\eta^2 = .03$, and Name Writing, $F(1, 143) = 4.4$, $p = .04$, $\eta^2 = .03$. A significant difference was also observed for the PPVT-4, $F(1, 143) = 23.1$, $p < .01$, $\eta^2 = .14$. No significant differences between the Low Growth and High Growth groups were observed for the following three measures from the PALS-PreK: Beginning Sound Awareness, $F(1, 143) = 1.5$, $p = .22$, $\eta^2 = .01$, Print Awareness, $F(1, 143) = 1.4$, $p = .25$, $\eta^2 < .01$, and Rhyme Awareness, $F(1, 143) = 1.5$, $p = .22$, $\eta^2 = .01$.

Upon comparing the additional baseline emergent literacy measures across the Low Growth and High Growth groups, we identified that there were indeed significant differences for several of the measures at baseline. The effect size for the PPVT-4 was notably larger than the additional emergent literacy measures, suggesting that it may be superior for predicting which children would make the substantial gains in alphabet knowledge across the academic year. To test if PPVT-4 scores were the best unique predictor of group membership, we completed a binary logistic regression analysis to determine if the PPVT-4 and PALS-PreK each explained unique variance in the grouping (low growth vs. high growth). Group (low vs. high growth) was the dependent variable and Age, PPVT-4, and PALS-PreK were the independent variables. With the PALS-PreK, we excluded alphabet knowledge scores as they were used to determine the groupings of the children. The results of the complete model are summarized in Table 3. As observed in the table, only the PPVT-4 was a significant predictor of group membership. While all predictors had similar odds ratios and were all below 1.0, the PPVT-4 was the only predictor that had a confidence interval that did not straddle 1.0, meaning that the PPVT-4 was the only predictor that was significant with a 95% confidence interval.

Table 3. Results of Binary Logistic Regression Predicting Group Membership (Low Growth vs. High Growth).

Predictors	β	Significance	Odds ratio	95 % CI for odds ratio
Age	-.05	.36	.95	[.85, 1.1]
PPVT-4	-.06	<.001	.94	[.91,0.97]
PALS-PreK	-.04	.38	.96	[.88,1.1]

Note. CI = Confidence interval; PPVT = Peabody Picture Vocabulary Test; PALS = Phonological Awareness Literacy Screening

While this initial analysis demonstrated that PPVT-4 was the only measure to significantly predict group membership, it is possible that there could be substantial covariance between the PPVT-4 and the PALS-PREK. To determine if the measures did covary in their ability to predict group membership, we completed two hierarchical logistic regressions and examined changes in effect sizes (using Nagelkerke r^2) as we entered each measure into the equation. For both analyses, we controlled for age differences across the groups by entering age as the first block. Given that we observed a significant difference in age across the groups, it was not surprising that age accounted for 12% of the variability in group membership (Nagelkerke r^2 = .12). After accounting for age in the first block, any subsequent changes in explained variance were due to the respective variable and not by the differences in age across the two groups. In the second block, we added children's PPVT-4 scores, which changed the r^2 estimate from .12 to .29, demonstrating that PPVT-4 scores explained 17% of the unique variance in group membership. We included PALS-PreK scores into the final block, which did not contribute any additional explained variance (r^2 = .29).

To test if the PALS-PreK provided unique explanation of group membership, we completed a second hierarchical logistic regression. After entering age in the first block, we entered PALS-PREK scores in the second block, which changed the r^2 estimate from .12 to .18, demonstrating that PALS-PREK scores explained 6% of the unique variance in group membership after controlling for age. We included PPVT-4 scores into the final block, which changed the r^2 estimate from .18 to .29. Together, these regression equations show that PALS-PREK scores provide some unique ability to predict group membership after controlling for age, but that PPVT-4 explained the majority of the unique variance in group membership.

Research Question 3: What Types of Letters Are Being Learned by Strong and Weak Letter Learners?

We next documented the types of letters that children in the Low Growth and High Growth groups were learning. We limited our analysis to children who were able to name at least one letter as there is no way to describe letter learning strategies in children who demonstrated knowledge of no letters. We further restricted the sample to children who knew no more than three letters so that the two groups were roughly matched on their developmental level, given that there were significant age differences across the groups. Fifteen of the 54 (28%) children in the High Growth group named between four to nine letters, while only three of the 92 (3%) children in the Low Growth group named four to nine letters. Excluding the children who named between four and nine letters ensured that we removed the stronger letter learners from the groups and that the two groups were roughly equivalent. There were roughly the same number of children who knew one to three letters in the Low Growth (n = 29) and High Growth (n = 28) groups. In the Low Growth group, there were 15 children who named one letter, 10 children who named two letters, and four children who named three letters. In the High Growth group, there were 14 children who named one letter, seven who named two letters, and seven who named three letters.

For each group, we determined the percentage of children who produced at least one letter from the following three categories of early developing letters: first initial, letters from first name, and the letters A, B, and O. We excluded children's productions of first initials when calculating the number of letters from the first name, and then excluded letters from the first name when determining if the children produced A, B, or O. So, only productions of A, B, or O were counted if they were not in the child's first name. As observed in Table 4, the majority of the children used at least one of the strategies when producing their early letters (72% of the Low Growth group and 82% of the High Growth group). For the Low Growth group, children were more likely to produce A, B, or O than their first initial or any additional letters from their first name. Children in the High Growth group used these three strategies with roughly equal frequency.

Table 4. Percentage of Children in Low Growth and High Growth Groups Who Could Name at least One Letter From the Three Groups of Letter Types in Fall.

Group	First initial	First name[a]	A, B, or O[b]	Any strategy
Low growth	21%	21%	41%	72%
High growth	36%	36%	39%	82%

Note. Values in each column summarizes the percentage of children who named at least one letter form each respective category. [a]Excludes first initial. [b]Excludes letters from first name.

Discussion

Upon evaluating the alphabet knowledge of a group of children in their first year of Head Start, we observed that the majority of children entered preschool knowing few letters. Eighty-five percent of the children (i.e., 146 of the 172 children) knew fewer than 10 letters upon entering the Head Start program. Of the 146 children who entered Head Start with limited alphabet knowledge, approximately one third of the children made substantial gains in alphabet knowledge and met the 10-letter benchmark at the end of the year. While we cannot know for certain why these children made the gains that they did, the language- and literacy-based curriculum (i.e., OWL; Schickedanz et al., 2005) was likely a positive influence in assisting with the advancement of their general emergent literacy skills. It is also possible that these children (or a subgroup of them) were simply late bloomers who spontaneously improved in their alphabet knowledge or responded to other forms of enrichment outside of the classroom. In addition, other child factors (e.g., oral language skills, cognition) may have influenced the development of alphabet knowledge.

After 1 year of instruction in Head Start, the current sample as a whole was meeting the 10-letter benchmark (spring alphabet knowledge: M = 10.6, SD = 9.8). Children in the present study scored slightly higher than the at-risk children in the study by Justice and colleagues (2005), who could name 7.2 letters on average. Although a sizable number of children in the current study made significant gains throughout the academic year and the group as a whole was meeting the 10-letter benchmark, these group-level data were not painting the full picture. The majority of the children who entered Head Start with limited alphabet knowledge continued to have difficulty with mastery of the alphabet. All told, about half of the children who entered Head Start knowing fewer than 10 letters (92/172) were not meeting this basic benchmark at the end of the year, despite at least 1 year of early education. This limited growth observed across the year put most of the children at an increased risk for long-term reading and academic difficulties.

Predicting Group Membership

Measuring alphabet knowledge alone at the beginning of Head Start would be ineffective for predicting which children would make substantial growth over the course of the year as most of the children who did not enter knowing at least 10 letters were essentially at the floor (knowing only 1–3 letters, on average). We were interested in identifying if any other measures would assist in more accurately predicting which children would make significant growth and which children would continue to struggle. The series of ANCOVAs comparing the remaining PALS-PreK and PPVT-4 scores across the Low Growth and High Growth groups demonstrated that the greatest differences between the two groups were found on the PPVT-4, while smaller group differences were observed for the remaining measures from the PALS-PreK. The subsequent binary logistic regression confirmed that PPVT-4 scores were most effective in predicting which children would make substantial gains across the academic year.

The relatively small differences between the groups on the different PALS-PreK subtests could have been because all of the scores were from the same instrument. There could be an inherent bias in the PALS-PreK that caused all of the children to do poorly on the entire measure. However, there are robust data demonstrating that the PALS-PreK is a valid measure for a wide range of children, including those from culturally and linguistically diverse backgrounds (Invernizzi et al., 2004).

One potential explanation for the superior ability of the PPVT-4 to predict growth in alphabet knowledge relates to psychometrics. Psychometrically, most of the fall PALS-PreK scores were very low in the Low- and High Growth groups, demonstrating that the children entered Head Start with limited emergent literacy skills. As seen in Table 2, children had raw scores of 1, 2, or 3, on average, for each of these subtests, with standard deviations nearly the same value as mean values. These floor effects may not have provided enough variability in performance to assist with predicting who would demonstrate growth in their alphabet knowledge. Conversely, there was a wider range of scores on the PPVT-4. The 146 children in the Low- and High Growth groups had an average raw score of 38.5 (*SD* = 15.4), which was converted to an average standard score of 89.4 (*SD* = 12.0). This wider distribution of scores, which were well above floor levels, provided sufficient variance to sort the children based on their receptive vocabulary, which was a meaningful predictor of growth in alphabet knowledge.

In addition to a simple psychometric explanation, there could be something particularly useful in PPVT-4 scores that assisted with the prediction of growth in alphabet knowledge. Long-term reading outcomes are strongly predicted by both alphabet knowledge (e.g., National Early Literacy Panel, 2008) and vocabulary skill (e.g., Storch & Whitehurst, 2002), so it is not surprising that these two measures are interacting in early childhood. In addition, the PPVT-4 likely captured other aspects of early child development that are related to children's acquisition of alphabet knowledge, including general cognitive ability (Evans et al., 2006) and exposure to vocabulary (Champion et al., 2003).

Types of Letters Known

The majority of the children in the Low Growth and High Growth groups who knew one to three letters upon entering Head Start knew letters that were either in their first name or were A, B, or O. This suggests that the children in our sample were also using the strategies described by Justice et al. (2006), Phillips et al. (2012), and Share (2004). The children in the Low Growth group were slightly less likely to be using these strategies when compared with the children in the High Growth group. This difference was marginal and would not assist in improving prediction of group membership given the modest difference. The results do suggest that the children in the Low Growth group may be slightly less organized in their learning of letters.

Looking across the types of letters known, it was interesting that the A, B, O strategy was used more frequently than the other strategies by the children in the Low Growth group, particularly because we only included the letters if they were not in the child's first name. This result was surprising, as first initials and letters from the first name are some of the earliest letters to be mastered (Justice et al., 2006; Share, 2004). Children in the Low Growth group may have been using the A, B, O strategy more frequently if they had less practice interacting with the letters in their name. That is, the higher likelihood of knowing A, B, or O could have been from exposure to alphabet songs and games.

Educational Implications

The majority of the children in this study knew few letters upon entering Head Start. Even with 1 year of instruction in Head Start, nearly half of the children from this study were still not meeting basic alphabet knowledge benchmarks and were at significant risk for long-term academic and emergent literacy difficulties. This result should reaffirm the need for teachers, administrators, researchers, and other stakeholders to find innovative methods of improving the outcomes of children from at-risk backgrounds. It was promising that a subset of the children responded well to a general language-based curriculum (i.e., the High Growth group). However, more intensive intervention is likely needed for the large number of children who still struggle after a year in Head Start.

This project also reiterates the importance of collecting student data and using that data for individualizing student support plans. The PALS-PreK, which is a clinically feasible and psychometrically robust emergent literacy measure, effectively identified the children who came to school with emergent literacy deficits. Our analyses revealed that the PPVT-4 further assisted in discriminating between those children who were more likely to recover without intensive interventions and those who had continued difficulty. Therefore, it appears that a screening measure that documents both basic emergent literacy (such as alphabet knowledge) and some aspect of language or vocabulary (such as receptive vocabulary) could be used together to help identify those children most in need of more intensive instruction.

Upon examining the types of letters known, most of the children in our sample were using the same strategies described by Justice et al. (2006), Phillips et al. (2012), and Share (2004). However, we were surprised that there was not more universal knowledge of letters from the children's first name, and first initial in particular. If a child is just beginning to learn her or his letters, early education teachers may want to start with targeting the child's first initial or letters in the first name. For children who know a higher number of letters, educators would want to target letters at a more advanced stage. The Alphabet Knowledge measure from the PALS-PreK provides a quick method of getting an inventory of letters known to assist with individualizing the instruction.

Limitations and Future Directions

The present study was a retrospective evaluation of children's alphabet knowledge in a large group of children who were at risk for later academic and reading difficulties. To optimize internal validity, we were strategic in selecting participants who had similar characteristics (i.e., all low SES) and had similar educational experiences (i.e., all in Head Starts in the same metropolitan area and all receiving the same curriculum). However, given that the study occurred in the naturalistic environment of the Head Start classroom, we were unable to control for all possible confounds that may have had an impact on our results. The biggest potential confound was that some of the children received additional tiered instruction. It is possible that the children in the High Growth group who were receiving more intensive instruction (i.e., the six children receiving tiered instruction) made significant gains because of the intervention. We do not believe that the added instruction had a substantial impact on the findings from our study. First, the tiered instruction did not focus explicitly on alphabet knowledge, but rather on global emergent literacy skills. Second, 82% of the children receiving tiered instruction remained in the Low Growth group, demonstrating that there was not an overwhelming advantage for participating in the tiered instruction. Finally, because all of the children in this study were receiving the OWL curriculum, which addressed a range of emergent literacy skills, we believe that there was no major difference in the educational experience concerning alphabet knowledge for the children in tiered instruction and the children in the general classroom.

When completing research in real-life educational environments, some potential confounds are inevitable. In particular, we were unable to withhold available intervention from a group of children who were demonstrating emergent literacy difficulties. While withholding the intervention may have strengthened the internal validity of this particular study, it could have limited the educational outcomes of the children who participated in the study, which was a much greater risk that we were willing to take.

Despite the limitations of our study, our results provide novel insight into the early alphabet knowledge skills of young children in Head Start. Future work could include a prospective study using a discrete criterion of letters known for identifying children for tiered instruction, which would be a more definitive test of whether or not alphabet knowledge measures could be used to identify struggling children and monitor their progress within an early education setting. Such a study could test the results of an intervention focusing directly on the acquisition of alphabet knowledge (e.g., Piasta & Wagner, 2010). Additional research could also examine if alphabet knowledge is a sensitive general outcome measure when implementing other types of emergent literacy interventions or preschool curricula.

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