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Assessment of Young Children's Letter-Sound Knowledge: Initial Validity Evidence for Letter-Sound Short Forms

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Abstract

The *Letter-Sound Short Forms* (LSSFs) were designed to meet criteria for effective progress monitoring tools by exhibiting strong psychometrics, offering multiple equivalent forms, and being brief and easy to administer and score. The present study expands available psychometric information for the LSSFs by providing an initial examination of their validity in assessing young children's emerging letter-sound knowledge. In a sample of 998 preschool-aged children, the LSSFs were sensitive to change over time, showed strong concurrent validity with established letter-sound knowledge and related emergent literacy measures, and demonstrated predictive validity with emergent literacy measures. The LSSFs also predicted kindergarten readiness scores available for a subsample of children. These findings have implications for using the LSSFs to monitor children's alphabet knowledge acquisition and to support differentiated early alphabet instruction.

Keywords

letter-sound knowledge, progress monitoring assessment, emergent literacy

Converging evidence shows that children's knowledge of letter forms, names, and corresponding sounds, collectively termed alphabet knowledge, are critically important emergent literacy skills that uniquely predict children's later reading success (Lonigan, Schatschneider, Westberg, & The National Early Literacy Panel, 2008; Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). Due to differing experiences with and exposure to print, young children exhibit highly variable levels of alphabet knowledge (McBride-Chang, 1999; Piasta, 2014; Schatschneider et al., 2004). Early childhood educators therefore need to accurately measure and monitor children's alphabet knowledge to ensure they are making adequate progress in these foundational skills. The newly developed *Letter-Sound Short Forms* (LSSFs; Piasta, Phillips, Williams, Bowles, & Anthony, 2016) show promise as an ongoing assessment of children's alphabet knowledge. In the current study, we provide further evidence concerning the validity of this measure.

Alphabet Assessment to Inform Instruction

With increased awareness of the importance of alphabet knowledge for success in kindergarten and beyond, many early childhood educators administer some form of assessment to evaluate children's alphabet knowledge. To maximize the relevance of such assessments, educators need instruments that assist them in connecting children's scores to their instructional decision-making to facilitate explicit and systematic differentiated alphabet instruction (Phillips & Piasta, 2013; Piasta, 2014; Piasta & Wagner, 2010a). Such instruction requires ongoing progress monitoring of individual children's learning. Effective progress monitoring tools exhibit strong psychometrics, utilize multiple equivalent forms, show sensitivity to changes over time, and are brief and easy to administer and score (Kelley, Hosp, & Howell, 2008). Research has shown that educators who use the results of progress monitoring to inform their instruction have children who make greater gains (Ketterlin-Geller, Gifford, & Perry, 2015) and may be better able to identify children in need of supplemental instruction.

Although many different alphabet knowledge assessments are available, existing tools are not ideal. Commercially available measures are typically valid and reliable but sometimes costly and may not be feasible for schools to purchase

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(e.g., the *Woodcock–Johnson Tests of Achievement*, which includes alphabet assessment in its Letter-Word Identification, Word Attack, and Spelling of Sounds subtests; Woodcock, McGrew, & Mather, 2001/2007). Moreover, these tools are often lengthy and require a great deal of time to administer to individual children. Conversely, the LSSFs require less than 2 min to administer per child. Available assessments that are brief present further challenges. These are typically designed for children in kindergarten and above, either do not measure letter-sound knowledge or conflate alphabet knowledge with other skills, and include a fluency component, which may not be appropriate for young children who are only just acquiring letter-sound knowledge (e.g., easyCBM, Alonzo, Tindal, Ulmer, & Glasgow, 2006; Dynamic Indicators of Basic Early Literacy Skills [DIBELS], Good, Kaminski, Smith, Laimon, & Dill, 2001). Others require more administration time than the LSSFs and may assess recognition, but not production, of letter sounds (e.g., Individual Growth and Development Indicators [IGDI] Sound Identification, McConnell, Bradfield, Wackerle-Hollman, & Rodriguez, 2012).

In contrast, the LSSFs are specifically designed for use with young children, particularly those not yet in kindergarten; include only letter-sound production items; and are not fluency-based, thereby alleviating floor effects. Finally, although educator-created measures may overcome affordability and administration challenges, these are not necessarily valid or reliable. In particular, letters vary in difficulty (Phillips, Piasta, Anthony, Lonigan, Francis, 2012; Piasta et al. 2016; Drouin, Horner, & Sondergeld, 2012), making it unlikely that letter subsets on educator-created assessments are equivalent or can be used as parallel forms. Thus, we created the LSSFs with multiple equivalent forms as an age-appropriate alphabet knowledge measure for young children.

LSSFs' Development and Initial Psychometrics

The LSSFs consist of multiple, brief forms that measure children's letter-sound knowledge as one important aspect of alphabet knowledge. We developed both three-form (eight letters per form) and four-form (six letters per form) versions of LSSFs using item response theory (IRT; see Piasta et al. 2016, for more details). After establishing that the basic assumptions for IRT analysis were met, we estimated item parameters for each letter. We retained those exhibiting adequate item fit and assigned these letters to forms such that forms represented the full range of letter difficulties. Further analyses on both calibration and validation samples indicated that forms were not only equivalent but also yielded adequate test information and exhibited high reliability (ρ = .89–.93). IRT-based scores from the forms also correlated at .73 or higher with children's scores when assessed with all 26 letters. Thus, the LSSFs meet several of the requirements for effective progress monitoring tools, with strong psychometric characteristics, multiple equivalent forms, and quick and easy administration.

However, additional evidence is necessary to establish the validity of the LSSFs, which was the purpose of the present study. We addressed three specific research aims. Given that the LSSFs are intended as a progress monitoring tool, we first determined the extent to which the LSSFs were sensitive to change over time in children's letter-sound knowledge as they progressed from preschool into the following school year. Second, we determined the extent to which the LSSFs exhibited concurrent validity with an established, long-form measure of letter-sound knowledge as well as other measures of related emergent literacy skills. Third, we determined the extent to which the LSSFs exhibited predictive validity with emergent literacy and kindergarten readiness measures.

Method

Participants

Data for the present study were collected from the final two cohorts of preschool-age children (*n*s = 447 and 551) participating in a larger project (Piasta et al. 2017). These cohorts were combined into a single sample (n = 998; 50% girls) given similar recruitment methods, no differences in initial alphabet or emergent literacy skill scores, few differences in demographic characteristics, and similar results when analyses were conducted by cohort. All children attended early childhood programs, were at least 4 years old at initial assessment (M = 54 months, SD = 4.79 months), exhibited basic English proficiency, were free of profound disabilities such that they could participate in assessments, and had parental consent to participate in the study. Most children were White (70%), 16% were Black, and 11% were of Other races or multiracial (2% unreported). Five percent were Hispanic or Latino (8% unreported). The majority of children's mothers had high school diplomas as the highest degree earned (51%), 4% had no high school diploma, 14% had associate degrees, 15% had bachelor's degrees, and 14% had graduate degrees (3% unreported).

Children were randomly selected from 250 different early childhood classrooms, with one to five children participating per classroom (M = 4). Children's classrooms were distributed among rural (32%), suburban (34%), and urban (24%) areas (11% unreported). Most children were enrolled in classrooms affiliated with public school systems (56%) or early childhood centers (31%), many of which were also affiliated with Head Start (22%). Less than 5% of children were enrolled in family- or home-based care (9% unreported for classroom/care type). Approximately half of children attended classrooms that were enrolled in the state's Quality Rating Improvement System (47%) and

56% attended classrooms utilizing commercially available instructional curricula, with Creative Curriculum most frequently reported.

Procedures and Measures

Trained research staff collected data in the fall and spring of the academic year (2012–2013 or 2013–2014) as well as the fall of the subsequent academic year (fall follow-up); measures and assessment timepoints specific to the current study are described below. Research staff administered direct assessments individually in quiet locations at children's early childhood education programs. In addition, we obtained state kindergarten readiness data for a subsample of children who matriculated to public kindergarten programs in fall follow-up 2013 ($n = 205$).

LSSFs. Research staff administered the LSSFs (Piasta et al. 2016) to assess children's letter-sound knowledge at all three timepoints. For this study, we utilized the four-form, six-letter version of LSSFs and randomly selected the form administered to a given child at each timepoint. Each form consists of six letters, depicted simultaneously in both uppercase and lowercase (e.g., Bb), and presented in a fixed, random order. As previously indicated, forms were equated on difficulty during the development process (Piasta et al. 2016). Children are asked to provide the sound that corresponds to each letter. Because many letters in the English alphabet correspond to more than one sound, any sound commonly associated with a letter was considered correct (e.g., short or long sounds for vowels). Correct responses were tallied and converted to a scale of expected number of letters known (out of 26) to ease interpretation for educators. The latter involved Thissen and Orlando's (2001) approach to derive IRT-based theta scores for each tallied score, and then transform these theta scores to the predicted number of correctly identified letter sounds, had all 26 letters been administered (for more details, see Piasta et al. 2016); each short form provides a table that maps raw scores directly to the converted 0 to 26 scale. Reliabilities calculated from IRT parameters (Raykov, Dimitrov, & Asparouhov, 2010) ranged from .89 to .91. Internal consistency in the current study ranged from .83 to .89 across forms, and no form effects were noted across timepoints.

Phonological Awareness Literacy Screening, PreK (PALS). Research staff administered the Uppercase and Lowercase Letter Recognition subtests from PALS (Invernizzi, Sullivan, Meier, & Swank, 2004) to assess children's letter name knowledge at fall and fall follow-up. Children are presented with all 26 letters in a fixed, random order, first in uppercase and then in lowercase, and asked to provide the name of each letter. Correct responses were tallied and summed across the two subtests (internal consistency = .98). Research staff also administered the Letter-Sounds PALS subtest to a subset of children at fall follow-up ($n = 184$). This subset included all children assessed after the date on which Institutional Review Board (IRB) approved adding this measure to the assessment battery; by chance, these children tended to have higher family income levels compared with the full sample, $t(952) = -3.39$, $p = .001$, but did not significantly differ on any other demographic characteristics or initial emergent literacy skills. Children are presented with 23 uppercase letters plus three digraphs (Sh, Th, Ch) and asked to provide the associated sound. Correct responses were tallied, with scoring paralleling that for the LSSFs (internal consistency = .95).

Pre-Reading Inventory of Phonological Awareness (PIPA). Research staff administered the Rhyme Awareness and Alliteration Awareness subtests of the PIPA (Dodd, Cosbie, McIntosh, Teitzzel, & Ozanne, 2003) to assess children's phonological awareness at fall and fall follow-up. In each subtest, children are presented with 12 sets of four words, also represented pictorially, and asked to select the word within the set that either does not rhyme (Rhyme Awareness) or does not start with the same sound (Alliteration Awareness). Correct responses were tallied and summed across subtests (internal consistency = .82) given theoretical and empirical evidence indicating that phonological awareness is a unidimensional construct (e.g., Anthony & Lonigan, 2004) coupled with results from an exploratory factor analysis (first two eigenvalues: 6.76 and 2.04) and subsequent preliminary parallel analysis.

Kindergarten Readiness Assessment–Literacy (KRAL). We obtained state KRAL data for children in the 2012–2013 cohort who matriculated to public kindergarten at the time of fall follow-up ($n = 205$). Beyond being older, this subsample did not significantly differ from the full sample on demographic characteristics or initial emergent literacy skills. Kindergarten readiness data were unavailable for the 2013–2014 cohort because the state implemented a new kindergarten readiness assessment and declined to release the new data. The KRAL directly assessed children's kindergarten readiness, focusing exclusively on language and literacy skills, and was administered by children's kindergarten teachers between the start of the kindergarten year and November 1. KRAL items included answering when and why questions, repeating sentences, letter identification, rhyming, and alliteration; scores could range from 0 to 29. The KRAL technical report indicates internal consistency of .84 and adequate item-fit statistics (American Institutes for Research, 2004).

Results

Table 1 shows descriptive statistics for all measures. Sample sizes for PALS Letter Sounds and KRAL reflect

Table 1. Descriptive Statistics for Alphabet Knowledge and Other Measures.

Measure	*n*	*M*	*SD*	Minimum	Maximum
LSSFs					
Fall	967	8.77	8.13	1.03	23.53
Spring	886	12.39	8.64	1.03	23.53
Fall follow-up	822	17.59	7.52	1.03	23.53
PALS LR					
Fall	968	26.78	18.25	0	52
Fall follow-up	817	43.42	12.85	0	52
PALS LS					
Fall follow-up	184	20.17	7.81	0	34
PIPA					
Fall	928	7.42	4.60	0	23
Fall follow-up	788	13.09	6.20	0	24
KRAL					
Fall follow-up	205	22.16	6.10	5	29

Note. LSSFs = *Letter-Sound Short Forms*; PALS LR = *Phonological Awareness Literacy Screening, PreK, Letter Recognition*; PALS LS = *Phonological Awareness Literacy Screening, PreK, Letter Sounds*; PIPA = *Pre-Reading Inventory of Phonological Awareness*; KRAL = *Kindergarten Readiness Assessment–Literacy*.

that these were collected for only subsets of the full sample. Sample sizes for other fall follow-up measures reflect attrition over time. Children without fall follow-up data ($n = 176$) were approximately 1 month younger than those remaining in the sample, more likely to be Black and less likely to be White, and less likely to have mothers with advanced degrees. All available data were used in analyses, and all results were consistent when sensitivity to missing data patterns was tested using a saturated correlates approach (Enders, 2010).

LSSF scores were significantly correlated across all timepoints. The correlation between LSSF scores assessed in fall and spring was .70, the correlation between LSSF scores in spring and fall follow-up was .52, and the correlation between LSSF scores in fall and fall follow-up was .43. Notably, although children exhibited the full range of LSSF scores at all timepoints, the average LSSF score increased over time from 8.77 to 17.59.

Sensitivity to Individual Differences in Change Over Time

To examine sensitivity to individual differences in change over time, we conducted a growth curve analysis using HLM 7.0 to determine whether children exhibited significant growth in their scores on the LSSFs and whether the LSSFs captured individual differences in children's growth. Time was coded as months from September 1 of the academic year, and children were nested within classrooms (modeled as a random effect; intraclass correlation [ICC] = .49). The equation for the random-intercept, random-slope model appears below:

$$\text{Predicted LSSF score} = \gamma_{000} + \gamma_{100} \times \text{Time} + r_0 + r_1 \times \text{Time} + \mu_{00} + \mu_{10} \times \text{Time} + e.$$

A significant fixed effect of time ($\gamma_{100} = 0.742$, $p < .001$) indicated that children improved their LSSF scores over time, with an average gain of almost nine letter sounds per year. Moreover, a significant random effect associated with time ($r_1 = .050$, $p = .002$) indicated variation in LSSF slopes ($SD_{\text{slope}} = 0.22$) and signaled that the LSSFs were sensitive to individual differences in rates of growth.

Concurrent Validity

To assess concurrent validity, we examined the extent to which children's LSSF scores correlated with other measures of alphabet knowledge and phonological awareness when assessed at the same timepoint (see Table 2; fall correlations below the diagonal and fall follow-up correlations above the diagonal). Children's LSSF scores were strongly and significantly correlated with their letter recognition scores. Children's LSSF scores were also moderately and significantly correlated with their phonological awareness scores. Finally, children's LSSF scores were strongly and significantly correlated with another measure of letter-sound knowledge, namely, their PALS Letter-Sounds scores.

Predictive Validity

To assess predictive validity, we examined the extent to which children's fall LSSF scores were associated with other emergent literacy skills and kindergarten readiness assessed approximate 1 year later at fall follow-up. Children's fall LSSF scores were moderately and significantly (all *p*s < .01) associated with their letter naming ($r = .45$), phonological awareness ($r = .48$), and KRAL scores ($r = .53$) at fall follow-up. Fall LSSF scores were also moderately and significantly associated with PALS Letter-Sounds scores at fall follow-up ($r = .46$).

Discussion

Educators striving for data-driven instruction of alphabet knowledge require progress monitoring tools that are brief and easy to administer, while still being psychometrically robust and translatable to instructional targets (Piasta, 2014). In the current study, we provide additional evidence that the LSSFs meet these criteria. Findings support the sensitivity of the LSSFs to normative and individual growth across time and their concurrent and predictive validity in a large sample of preschool-aged children.

Table 2. Correlations for LSSF Concurrent Validity at Fall and Fall Follow-Up.

Measure	1	2	3	4
1. LSSFs	—	.71**	.84**	.41**
2. PALS LR	.76**	—	.80**	.43**
3. PALS LS[a]			—	.45**
4. PIPA	.47**	.41**		—

Note. Fall correlations are presented below the diagonal; fall follow-up correlations are presented above the diagonal. Sample sizes varied among the cells due to occasional missing data. LSSFs = *Letter-Sound Short Forms*; PALS LR = *Phonological Awareness Literacy Screening, PreK, Letter Recognition*; PALS LS = *Phonological Awareness Literacy Screening, PreK, Letter Sounds*; PIPA = *Pre-Reading Inventory of Phonological Awareness*.
[a]Sample size for this variable was 184. These data were only collected at fall follow-up; therefore, cells with this variable are blank below the diagonal.
**Correlation is significant at the $p < .01$ level (two-tailed).

The LSSFs demonstrated significant, moderate-to-large concurrent associations with commonly used measures of both alphabet knowledge and phonological awareness; such results indicate the validity of the measure and are notable given the LSSFs' brevity at six items each. These findings are consistent with prior research showing strong associations between children's letter name and sound knowledge (Evans, Bell, Shaw, Moretti, & Page, 2006; McBride-Chang, 1999) and align with both theory and evidence suggesting bidirectional relations between letter-sound knowledge and phonological awareness skills (Ehri et al., 2001; Piasta & Wagner, 2010b). Moreover, the LSSFs demonstrated a significant predictive association with a kindergarten-entry measure of school readiness. Collectively, these findings support the LSSFs' utility for educators interested in efficiently and accurately tracking the progress of their entire class of children and in gauging their academic school readiness across the preschool year. Significant longitudinal correlations with both the KRAL, which is a broad measure of literacy-related school readiness, and the PALS Letter-Sounds subtest, which assesses the same specific construct as the LSSFs, demonstrate that the LSSFs can be an indicator of both school readiness in general and letter-sound knowledge specifically. The moderate predictive correlations compare favorably with those for other very brief screening tools, such as the original *Get Ready to Read!* (e.g., *r*s = .28–.43 with phonological awareness and letter-knowledge measures at 16–37 month intervals; Phillips, Lonigan, & Wyatt, 2009) and IGDIs (e.g., *r*s = .15–.45 with similar measures at 18-month interval; Missall et al., 2007), albeit across a shorter time interval. Further research is needed to determine the LSSFs' accuracy in classifying children truly at risk for decoding difficulties (e.g., Wilson & Lonigan, 2010). As letter-sound knowledge is necessary for children's acquisition of the alphabetic principle and decoding skill in subsequent grades (Ehri, 2015; Phillips & Piasta, 2013), a simple tool that can serve these dual purposes can guide educators' practice without impinging on valuable instructional time.

The LSSFs were developed to provide preschool educators another tool that could validly inform their decisions about alphabet knowledge instruction. The LSSFs can help educators efficiently monitor all children in their classrooms to ascertain those who may not be making progress in learning letter sounds. Correspondingly, this can inform decisions to slow or accelerate the pacing of explicit instruction of alphabet knowledge (e.g., Jones & Reutzel, 2012) and to regroup children for evidence-based small group instruction (e.g., Lonigan & Phillips, 2016). Furthermore, children exhibiting consistently poor performances on the LSSFs may be in need of additional, more intensive instruction, such as provided via supplemental small group instruction or multitiered instructional systems (Bailet, Repper, Murphy, Piasta, & Zettler-Greeley, 2013; Lonigan & Phillips, 2016). For these specific children, educators should complement LSSF results with additional diagnostic letter-sound assessment to determine the specific letters requiring intensive instruction (Piasta, 2014); a single LSSF administration does not provide this information, trading such diagnostic specificity for brevity, efficiency, and multiple equivalent forms. In general, periodic review of LSSF results may enable and encourage those educators not currently engaged in intentional alphabet instruction to enact more systematic practices. More research is needed to investigate how, and how well, educators' use of the LSSFs across the year informs their instructional choices (Busch & Reschly, 2007).

We note several important limitations. Although the current sample was large and relatively diverse, both with regard to settings and child backgrounds, few participants were Hispanic/Latino or dual language learners, none had limited English proficiency, and children whose mothers had higher levels of education were underrepresented. The LSSFs need further validation with these and other key early childhood populations (e.g., children with identified disabilities, learners acquiring alphabet knowledge in two distinct orthographies). Moreover, there should be additional investigation of the LSSFs' short-term test–retest reliability and predictive validity with criterion measures of both alphabet knowledge and broader early literacy constructs, including phonemic awareness and decoding, both during and beyond kindergarten.

Future research is required to identify child and classroom characteristics that influence growth on the LSSFs, including determining whether the measure is sensitive to the amounts and quality of alphabet instruction in early childhood classrooms. It would be particularly beneficial to identify normative benchmarks indicative of optimal growth rates (e.g., Hosp & Fuchs, 2005; Roehrig, Petscher, Nettles, Hudson, & Torgesen, 2008). Descriptive and experimental

studies (e.g., Hasbrouck & Tindal, 2006; Shapiro, 2008) suggest that educators make better instructional decisions when guided by accurate and accessible data. To this end, this article demonstrates the validity and feasibility of the LSSFs as a tool that can support early childhood educators and the alphabet knowledge development of children enrolled in their classrooms.

Authors' Note

Jason L. Anthony is now at the Department of Child and Family Studies and Rightpath Research and Innovation Center at the University of South Florida. The opinions expressed are those of the authors and do not necessarily represent the views of the funding agencies.

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