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A New Screening Tool for the Early Identification of Risk Factors for the Development of Reading Problems in Kindergarten and First Grade Students

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Abstract

Early diagnosis of reading disorders is essential for intervention and later academic success. A tablet-based, group-administered screening measure, Risk Factor Screener for Reading (RiFS-R), identifies students at-risk for Phonics and/or Phonological Awareness difficulties. All students entering kindergarten should have already mastered the skills reflected in the RiFS-R. Students (n=657) in kindergarten or first grade completed the RiFs-R during the school day. Composite scores indicated that 42% of the 384 kindergarten students showed risk factors in Phonics, and 84% had risk factors in Phonological Awareness. Of the 273 1st graders screened, 32% showed risk factors for Phonics, and 70% showed risk factors for Phonological Awareness. Findings suggested that most students in kindergarten and 1st grade were already behind when they started the academic year, indicating that widespread screening would provide important information for early childhood curricula.

Keywords: literacy, early childhood, classroom, assessment, screening, phonological awareness, phonemic awareness, phonics, reading comprehension

1. Introduction

Reading and literacy among school-age children are serious concerns in the US, especially since the abrupt school closures in Spring, 2020 (Domingue et. al., 2022). According to The Nation's Report Card from the National Center for Education Statistics (2024), National Assessment of Educational Progress (NAEP) reading proficiency has dropped from 33% to 31% among fourth graders. Trends suggest that students in the U.S. are reading less proficiently, less frequently, and educators are appropriately concerned about these longitudinal declines.

Clinically, specific reading disorders may occur in as many as 1/4 to 1/5 children, many of whom are not diagnosed until second or third grade (Lyon, 1996; Siegelman et. al., 2022). Hamilton & Glascoe (2002) showed that a child's third grade reading proficiency predicted long-term academic success. They found that 75% of children with reading difficulties who were not identified before 3rd grade continued to show reading disabilities by ninth grade. Fewer than 2% of those with literacy difficulties completed education post-high school. Research has shown the importance of phonological awareness in the development of early reading skills (Milankov et al., 2021). Children who possess weak phonological awareness have trouble accurately sounding out words and have been shown to have trouble catching up with their peers if not addressed by third grade (Hernandez, 2011). Third grade retention is often discussed as a policy option to improve early grade literacy. Thirteen of the 50 states in the US plus the District of Columbia have Third Grade Retention Laws requiring that students must repeat 3rd grade if their test scores do not show grade level reading (Whinnery & Weyer, 2024). Because poor reading ability and literacy negatively impact children's lives (Kame'enui et al., 2021), and successful remediation is much more difficult and costly if intervention is delayed (Schwartz, 2023), it seems reasonable that earlier diagnosis of reading disorders could significantly benefit children's opportunities for the future. However, there are few validated screening instruments available for use in younger children and many take significant time and resources to administer.

The two most common causes of early reading difficulties are thought to be weaknesses in phonics (letter recognition

and letter-sound association) and phonological awareness (including phonemic awareness; Catts et. al., 2002; Milankov et. al., 2021; Torgeson et. al, 2010). Screening for phonological awareness falls into three categories: sound comparison, phoneme segmentation, and phoneme blending (Torgeson, 1998; Torgeson, 1999). Screeners exist for these categories (i.e., the Comprehensive Test of Phonological Processing, Second Edition (CTOPP-2; Wagner et al., 2013) and for one or more of these categories separately (e.g., phonological awareness: Dynamic Indicators of Basic Early Literacy Skills (DIBELS) (Good et. al., 2001), i-Ready (Curriculum Associations, 2019), Measure of Academic Progress (MAP) assessment (Northwest Evaluation Association, 2016), the Phonological Awareness Skills Test, (Kilpatrick, 2016) and the Early Bird Screener (Gaab & Petscher, 2021)). Unfortunately, these screening instruments are delivered individually to students, do not fully capture several important skills, take a long time to administer and score, and are costly.

The Risk Factor Screener for Reading (RiFS-R) differs from other screeners. Intentionally designed as a broad screening device, it does not diagnose reading problems. It focuses exclusively on skills that students entering kindergarten and 1st grade should have mastered (Torgeson, 1998). To minimize the number of false negatives, the algorithms used to define "At Risk" students were intentionally set low with the intention that it would be preferable to reteach a skill rather than miss students who require intervention. An engaging web-based assessment, the RiFS-R is administered on an iPad or Android tablet. Students use child-sized, over-the-ear headphones to prevent disruptions. The game-like tasks are familiar, requiring little student instruction, and the entire screener takes only 10 to 15 minutes to administer. In addition, the screener can be given in a group in a classroom. Instead of requiring training in psychometrics, the proctors only need to be able to troubleshoot internet failure or device malfunction. Most importantly, the results for any individual student or the entire group are available instantly. This allow the school and teacher(s) to quickly develop lesson plans to address sound comparison, phoneme segmentation, and phoneme blending difficulties. The RiFS-R is a cost-effective way to identify children who are at risk for early reading difficulties and who could benefit from educational strategies in phonics and phonological awareness to bring the students up to grade level.

After previous research determined that the RiFS-R screener showed reliability and validity, we undertook a large-scale screening study to assess the frequency of students in kindergarten and first grade who showed risk factors in phonics, phonological awareness, or both. Kindergarten and first grade students were selected because the presumption is that early diagnosis and early intervention will be the simplest, as well as the most cost-effective, way of preventing reading problems in later years while developing proficient readers by third grade. Identifying students while they are young and providing that information to the early childhood teachers, a strong phonics and phonological awareness program could be initiated in kindergarten and/or first grade.

2. Method

2.1 Participants

The sample consisted of 657 students in kindergarten (n=384) and first grade (n=273) attending 5 different schools (2 were faith-based schools; 3 were Charter schools) located in South Florida and Bronx, New York. There were 318 boys and 339 girls in the sample. The sample was comprised of children from Caucasian, African-American or Hispanic racial/ethnic backgrounds (Table 1). Children ranged in age from 5-7 years (M = 5.9 years). Children completed the RiFS-R screener in classroom settings in small groups between October and January in the academic years 2021-22, 2022-23, 2023-24, and 2024-25. No students completed the RiFS-R in both kindergarten and first grade.

Table 1. Background information about schools in the sample

	Kindergarten Students Screened	First Grade Students Screened	Location	Type of School	Predominant Race/Ethnicity of Enrolled Students	Predominant Socioeconomic Status of Enrolled Students
School 1	57	21	Miami, Florida	Charter School	100% AA	Under-resourced
School 2	69	108	South Florida	Faith-Based	9.5% HW, 90.5% NHW	Good resources
School 3	34	0	Miami Gardens, Florida	Charter School	100% AA	Under-resourced
School 4	61	90	South Florida	Faith-Based	95.3% NHW, 4.7% HW	Good resources
School 5	172	54	Bronx, NY	Charter School	39% AA, 61% H	Under-resourced
Total	384	273				

Note. Individual-level information was not available because the sample was deidentified prior to transmittal to the research team. AA=African-American. HW=Hispanic White. NHW=Non-Hispanic White. H=Hispanic.

2.2 Procedure

Data were collected by school personnel as part of classroom activities over 4 academic years. Students were assessed between October and January in order to provide time for children to become accustomed to the school setting and to ensure at least some familiarity with technology, while not waiting too long into the school year. During the tool's early development, we observed that individual headphones were valuable tools for maintaining concentration and as such, all students wore headphones during sessions. Total time to participate was between 10-15 minutes per student.

To make certain that students used the platform correctly, proctors circulated among the students and supervised their progress. The main goal of proctors was to confirm that each tablet was working properly and the students were concentrating. Proctors set up the tablets beforehand to streamline the experience for students. An average of 14 students were tested at once; it is feasible to conduct screening 1:1 or in groups of 10-25 students at a time.

During this study there were no instances of technological failure or internet failure. During tool development, these glitches were common, especially in older school buildings that were not wired for internet. These types of technological glitches are longer an issue.

Training for proctors requires very low commitment. Potential proctors need to understand the basics of using a tablet device and connecting them to the building's Wi-Fi network. Some experience with classroom management strategies of young students is recommended to maintain students' concentration on task. Proctors are tasked with entering student information into each tablet, initiating the task, and collecting tablets when the app indicates that the student has completed the screener.

Data were collected by school personnel with informed consent from parents/guardians at the outset of the school year. The dataset was deidentified and provided to the research team. No identifiable information was available to the research team. According to NIH Guidance, this constitutes an Exempt Study from Human Subjects Institutional Review Board approval, and therefore, no IRB review or additional consent was required for this study. Data were analyzed in Microsoft Excel within the Microsoft 365 Suite (v. 2504).

2.3 Measures

2.3.1 Scale Development

The RiFS-R was designed to evaluate a student's phonics and phonological awareness skills. Phonics is comprised of two subtests: (a) *Letter Recognition*, which assesses a child's knowledge of the letters of the alphabet, and (b) *Letter-Sound Association*, which measures whether a student knows the sound that is associated with each letter of the alphabet. There are 14 items on the *Letter Recognition* subtest. Each student was prompted to select the correct pairing from three different options onscreen. There are 9 items measuring *Letter-sound Association.* The student listens to a sound via earphones and then selects the letter associated with that sound from three options. Letters for the Letter Recognition and Letter–Sound Association subtests were chosen according to their frequency in words from the *Concise Oxford Dictionary* (Baldrick, 1990).

Phonological Awareness tasks were organized into three domains: Sound Comparison, Phoneme Segmentation, and Phoneme Blending (Torgesen, 1998). Following a deductive approach to item construction (Boateng et al., 2018), items were written to align with these domains and designed using one-syllable words of three to four letters to maintain developmental appropriateness for children as young as five years old.

Phonemic awareness was evaluated through three subtests:

1. Sound Comparison, measuring a child's ability to identify the initial sound in a word;
2. Phoneme Segmentation, assessing the capacity to separate a word into its individual sounds; and
3. Phoneme Blending, assessing the ability to synthesize discrete sounds into a whole word.

The Sound Comparison section contained four items. For each, the child viewed a picture of an object and selected another one- or two-syllable word beginning with the same sound (e.g., "Find the word that starts with the same sound as *pen*"), with both images and auditory cues available (e.g., *van*, *pot*, *horse*).

The Phoneme Segmentation subtest consisted of six items in which the child was shown a picture and given its name—a one-syllable, three- to four-letter word (e.g., "The word is *pot*"). The task required choosing from three options the correct sequence of phonemes representing that word (e.g., /p/ /ŏ/ /t/; /p/ /ă/ /t/; /p/ /ŭ/ /p/).

Finally, the Phoneme Blending portion included six items. The student heard a set of three phonemes forming a one-syllable word (e.g., "What word do these sounds make? /b/ /ĕ/ /d/") and then selected from three printed options the correctly blended word (e.g., *bet*, *bad*, *bed*).

Prior to data analysis, two of the six items from both the *Phoneme Segmentation* and *Phoneme Blending* subtests were removed. The final items in each subtest were excluded after evidence of participant fatigue was observed toward the

end of testing, along with intermittent technical issues (e.g., Internet disruptions or programming glitches) that occasionally caused the program to pause or skip items unpredictably. Additional items were also omitted from these subtests because certain response options were difficult to distinguish auditorily. For instance, the narrator's articulation made some words (e.g., *pat* vs. *pet*) sound similar, resulting in confusion among several students.

2.3.2 Scoring the RiFS

On the RiFS-R screener, composite scores were calculated for two domains: Phonics (comprising *Letter Recognition* and *Letter–Sound Association*) and Phonemic Awareness (comprising *Sound Comparison*, *Phoneme Segmentation*, and *Phoneme Blending*). For each composite, the total number of correct responses across the relevant subtests was summed to produce an overall score. Students were classified as "At Risk" in a domain if their composite score fell below 75%, and as "Not At Risk" if their score was 75% or higher. The 75% cutoff was selected to represent below-average performance while accounting for potential variability and minor errors that may occur among younger children.

2.3.3 Reliability and Validity Study

Our previous study examined the reliability and validity of the RiFS-R screener as compared to established measures of phonics and phonological awareness that are delivered individually (Kuttler & Levy, 2024). The RiFS-R showed (a) construct validity (as measured by item evaluation during exploratory factor analysis); (b) good reliability (as measured by Cronbach's alpha); (c) convergent validity (as compared to Comprehensive Test of Phonological Processing, Second Edition (Wagner et al., 2013) and Woodcock-Johnson Test of Achievement, Fourth Edition (WJA-IV) Letter-Word Identification test (Schrank et al., 2014); and (d) discriminant validity (as compared to the Wechsler Individual Achievement Test, Fourth Edition (WIAT-IV) Expressive Vocabulary and Receptive Vocabulary tests (Breaux, 2020). Fifty students (29 boys, 21 girls) between the ages of 5 and 7 years (M = 79.27 months, SD = 6.33 months) participated in the study. In the validation sample, Total RiFS-R scale $\alpha = 0.82$, Sound Comparison subscale, $\alpha = 0.69$, Phoneme Segmenting subscale, $\alpha = 0.76$, and Phoneme Blending subscale, $\alpha = 0.80$.

3. Results

In analyses of the overall sample, there were no differences by gender for students at-risk for Phonics (χ^2 (1) = .26, ns) and Phonological Awareness (χ^2 (1) = .01, ns). As would be expected, kindergarten students were more likely than first grade students to be identified as at risk for Phonics (χ^2 (1) = .48.18, $p < .001$) and Phonological Awareness (χ^2 (1) = 17.53, $p < .001$). Frequency counts and percentages of Kindergarten students who scored within the at-risk range for Phonics and Phonological Awareness by school are reported in Table 2, Figure 1 and Figure 2. Overall, forty-two percent of the sample of kindergarten students scored as at-risk in the phonics category; 84% were identified as at-risk on Phonological Awareness. Forty-seven percent of Kindergarten students were observed to score in the at-risk category for both Phonics and Phonological Awareness (Table 2).

Table 2. RiFS-R Screener Results for Kindergarten Students Scoring in the At-Risk Category for Phonics and Phonological Awareness By School

	Students Screened	At-Risk Phonics	%	At-Risk Phonological Awareness	%	At-Risk for Both Phonics and Phonological Awareness	%	Not At-Risk Both Phonics and Phonological Awareness	%
School 1	57	10	17.54	34	59.65	12	21.05	9	15.79
School 2	69	42	60.87	60	86.96	47	68.12	7	10.14
School 3	25	4	16	14	86.96	3	12.00	3	12.00
School 4	61	15	24.59	50	81.97	15	24.59	32	52.46
School 5	172	91	52.91	164	95.35	109	63.37	1	0.58
Total	384	162	42.19	322	95.35	186	78.15	52	21.85

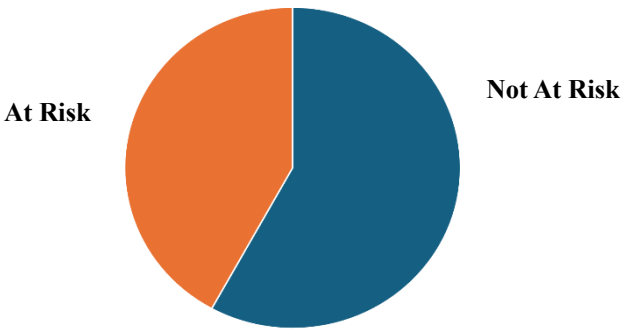

Figure 1. Percent of Kindergarteners Scoring in the At-Risk Category for Phonics

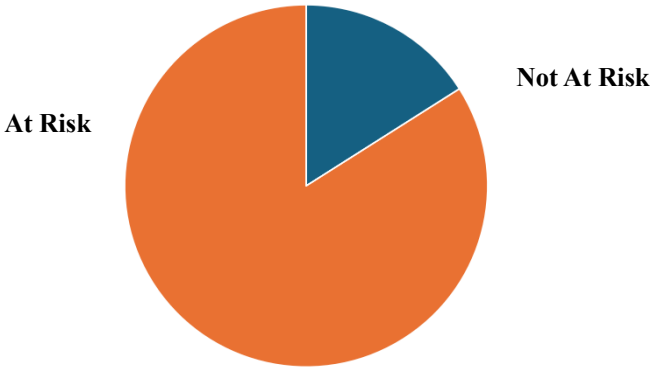

Figure 2. Percent of Kindergarteners Scoring in the At-Risk Category for Phonological Awareness

Table 3, Figure 3, and Figure 4 show the first grade students who scored in the at-risk range in Phonics (32%) and Phonological Awareness (70%). Thirty-two percent of the first grade sample scored in the at-risk range for both Phonics and Phonological Awareness (Table 3).

Table 3. RiFS-R Screener Results for First Grade Students Scoring in the At-Risk Category for Phonics and Phonological Awareness By School

	Students Screened	At-Risk Phonics	%	At-Risk Phonological Awareness	%	At-Risk for Both Phonics and Phonological Awareness	%	Not At-Risk Both Phonics and Phonological Awareness	%
school 1	21	2	7	21	00	21	00	0	0
school 2	08	0	7	68	3	34	1	28	6
school 4	90	8	9	47	2	8	9	14	6
school 5	54	6	8	54	00	24	4	0	0
Total	273	6	2	190	0	87	7.44	42	2.56

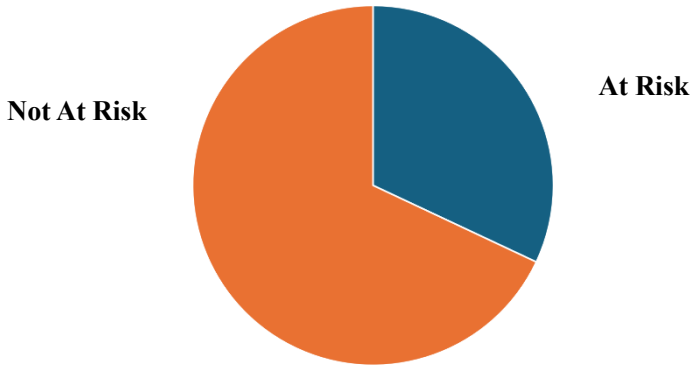

Figure 3. Percent of First Grade Students Scoring in the At-Risk Category for Phonics

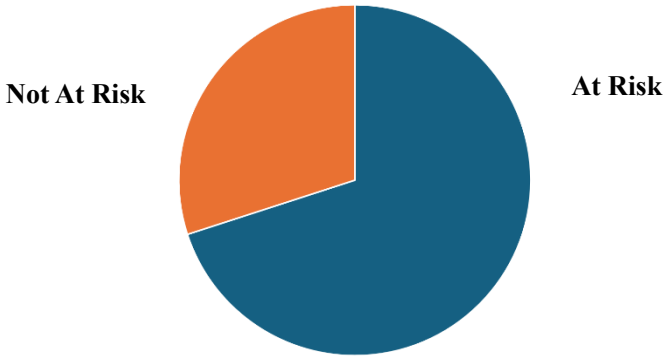

Figure 4. Percent of First Grade Students Scoring in the At-Risk Category for Phonological Awareness

We then examined the Phonics components of Letter Recognition and Letter-Sound Association (Table 4). Seventeen percent of kindergarten students and 14% of first grade students had difficulty with recognizing their letters placing them in the at-risk range of scores. Surprisingly, 44% of kindergarteners and 24% of first grade students showed difficulty in knowing the sound associated with each letter.

Finally, we examined Phonological Awareness components of Sound Comparison, Phoneme Segmentation, and Phoneme Blending (Table 4). Over half the sample of kindergarten students (57.29%) and just over one quarter of first grade students (25.64%) were in the at-risk category for Sound Comparison. Phone Segmentation scores put over three quarters of kindergarten students in the at-risk category (76.30%) and 29.30% of first grade students had difficulty. Seventy percent of kindergarten students exhibited at-risk scores in phoneme blending and 37.36% of first grade students were in the at-risk category as well.

Table 4. Letter Recognition and Letter-Sound Association Scores Among Kindergarten and First Grade Students by School

	# of Students Screened	At Risk Letter Recognition	%	At Risk Letter-Sound Association	%	At Risk Sound Comparison	%	At Risk Phoneme Segmentation	%	At Risk Phoneme Blending	%
Kindergarten											
School 1	57	7	12.28%	9	15.79%	30	53%	30	53%	25	64%
School 2	69	16	23.19%	36	52.17%	52	75%	52	75%	35	51%
School 3	25	1	4.00%	4	16.00%	7	28%	12	48%	12	48%
School 4	61	6	9.84%	15	24.59%	32	52%	42	69%	37	61%
School 5	172	37	21.51%	106	61.63%	99	58%	157	91%	159	92%
Total	384	67	17.45%	170	44.27%	220	57.29%	293	76.30%	268	69.79%
First Grade											
School 1	21	4	19%	10	48%	11	48%	11	52%	13	62%
School 2	108	15	13%	31	29%	31	29%	37	39%	50	46%
School 4	90	6	7%	8	9%	8	9%	1	1%	2	33%
School 5	54	12	22%	20	37%	20	37%	31	57%	37	69%
Total	273	37	13.55	69	25.27	70	25.64	80	29.30	102	37.36

4. Discussion

Research has shown the importance of phonics and phonological awareness in the development of early reading skills (Milankov et al., 2021). Students who possess weak phonics and phonological awareness skills have trouble accurately identifying letters and sounding out words. Importantly, they have been shown to have trouble catching up to their peers if those skills are not developed by third grade (Hernandez, 2011). Because of those observations, it is imperative that teachers and school administrators are aware of a student's proficiency in phonics and phonological awareness when they enter school for the first time, either in kindergarten or in first grade. Using the RiFS-R scale as a screening instrument is one solution to educators' needs for a quick, easy-to-administer, child-centered measure.

The RiFS-R is fun for students, takes very little time away from normal classroom programs, requires very little proctor training to administer, and the results are available instantly. Following the reliability and validity evaluation (Kuttler & Levy, 2024), this screener was administered to 657 students to examine percentages of students who were at-risk for early low literacy skills. Of these students, only 14% of kindergarten students and 15% of first grade students were not-at-risk for difficulties in both phonics or phonological awareness skills; this was both a surprising and alarming finding.

Despite the fact that all children should know the "ABC Song" from home or pre-school, 17% of kindergarten students and 14% of first grade students in our sample did not know the names of all the letters they were shown. A surprising 44% of kindergarten students and 25% of first grade students had difficulty pairing letters with their corresponding sounds. Over half of the sample of kindergarten students and a quarter of the first grade students exhibited difficulty identifying the beginning sounds of words (Sound Comparison). The number of students who were at risk for Phoneme Segmentation difficulties, where students break apart words, was 76% for kindergarten and 29% for first grade students; this subscale showed the poorest achievement of all the RiFs subscales. A large portion of this sample of students was also shown to be at risk in Phoneme Blending, a task in which sounds are combined into words (Kindergarten: 70%; First grade: 37%). These findings are particularly concerning because it signals that there may be delays in foundational literacy skills.

For decades, proponents of early reading skills have long suggested that all entering kindergarten students should be proficient in phonics and phonological awareness skills (Torgeson, 1998). From our findings, most of the students screened were not adequately prepared for kindergarten or even for first grade, although we did observe that fewer first grade students were at-risk in both phonics and phonological awareness. We considered several reasons for those results. Perhaps the students were not mature enough to understand the questions; perhaps some students received no training in Phonics and/or Phonological Awareness in their pre-school programs or at home from their parents or grandparents; perhaps the effects of living in poverty interfered with their learning; perhaps there are more learning disabilities than

teachers suspect; or perhaps there was a combination of issues or other issues not considered.

There were several limitations that warrant discussion. Due to the nature of data collection we do not have individual-level data on language preference, family income and sociodemographic circumstances, or other individual characteristics (other than gender, which does not play a role herein). We did not assess how many of the students did not speak English as their first language or collect information about their language spoken by their family of origin, which may have affected their ability to understand the instructions and certainly could have impacted the student's exposure to English letters and sounds. Students' living conditions and financial resources undoubtedly impact their opportunities for access to reading materials; we also considered levels of parental stress and its effect on their time to read with children. Given these considerations, it will be important for potential users of the RiFS-R to be aware that the measure is not a one-size-fits-all screening instrument, and care must be taken to avoid using the results for high-stakes decisions and labelling students as deficient too early.

We are strongly recommending early screening followed by targeted intervention based on our findings and others (Schlichting et al., 2023). It is critically important to identify students at risk for poor literacy and to initiate programs to teach students phonics and phonological skills early. Although the authors are not career educators, other education professionals have identified evidence-based teaching strategies such as explicit instruction (Ehri et al., 2001), Phonological and Phonemic Awareness Training (Lonigan, Schatschneider, & Westberg, 2013; Torgesen, Wagner, Rashotte, Herron, & Lindamood, 1999), Multisensory Structured Literacy (MSL; Birsh & Carreker 2018; Ritchey & Goeke 2006) and Small-Group and Tiered Intervention (Response to Intervention, RtI; Fletcher & Vaughn, 2009; Gersten et al., 2020).

Decades of research show that delays not only affect self-confidence and motivation, but early intervention can significantly improve future academic outcomes (Hansford et al., 2024). Acknowledging that education unions do not oppose early screening in principle, but have questioned how to best implement universal screening, the RiFS-R contributes one solution to teachers' lack of time to administer the screener and resolves the additional burdens associated with undergoing appropriate training in administering psychometric tests. With the information obtained from the RiFS-R screening, and understanding the importance of phonics and phonological awareness in learning how to read, career educators, principals, districts, and state Boards of Education should mandate screening for difficulties in phonics and phonological awareness skills while refraining from labelling students as having poor literacy until after interventions and further investigation into the possible causes for RiFS-R scores have been completed (i.e., biliteracy, co-occurring disabilities, cultural influences, memory, and attention).

We submit that the U.S.'s low performance on the reading section of the Nation's Report Card could be driven by lack of phonics and phonological awareness mastery in the early grades. These foundational reading skills are critical for students to become proficient readers, and missing those skills prevents them from sounding out (decoding) words as they read, a skill essential for fluency in reading. The data shown in this study should be a "wake-up call" to educators; if our findings are indicative of students in kindergarten and first grade, all schools should evaluate students in kindergarten and first grade for their skills to ensure that the students have early intervention opportunities.

We echo the concerns raised by the Clinton Foundation's initiative Too Small to Fail (Clinton Foundation, 2025), where they state, "Today, almost 60 percent of children in the United States start kindergarten unprepared, lagging behind their peers, in critical language and reading skills." The data presented in this study suggest that the number of students who are unprepared may actually be higher than 60% and may even approach 90%. These data should encourage educators and parents to urge schools to screen all entering students in order to identify those who have risk factors that may prevent them from learning to read proficiently. States should empower schools to teach all students phonics and phonological awareness starting as soon as the student enters school in either kindergarten or first grade. Identifying difficulties at an early age and providing appropriate, timely intervention will be a positive step forward to ameliorating the U.S. literacy crisis.

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

Data sharing statement

No additional data are available.

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