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SCREENING EARLY READING SKILLS IN PRESCHOOL CHILDREN: GET READY TO READ

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This study examined a new screening tool (Get Ready to Read) for assessing early reading skills in 73 three-year-old and 79 four-year-old children from low-income families and relating performance to more extensive assessments of phonological sensitivity and language skills (vocabulary and print knowledge) that have been found to be related to the development of reading skills. GRTR scores correlate with scores on the cognitive assessments, with vocabulary skills most strongly related to performance. Phonological sensitivity accounted for less variance than vocabulary, but both were stronger predictors than environmental print. GRTR is one option for early childhood educators seeking to identify a developmentally appropriate assessment tool to screen preschool children's progress in acquiring reading-related skills. Further research linking GRTR performance with later reading skills is needed.

Research on the development of reading skills has focused on school-aged children with poor reading skills, including dyslexia, but a greater understanding is needed of how research findings with older children relate to the development of reading skills and the prevention of reading disabilities in preschool children. Early reading skills often are denoted by various names in the literature (e.g., "emergent literacy," "pre-reading," and "reading readiness"), but across this literature, as described below, there is evidence that early reading skills are influenced by the same types of cognitive abilities found to influence the development of reading in older children. This paper examines how children's performance on a new screening tool—Get Ready to Read (GRTR; Whitehurst & Lonigan, 2001)—relates to their performance on assessments of the phonological, oral language, and print knowledge skills purported to be indexed by the screening tool to evaluate its validity as a screening measure. The study focuses on skill development in a sample of preschool children from low-income families attending a federally funded preschool. A screening tool

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useful in identifying the status of preschool children on cognitive skills known to be related to word-level reading skills may be helpful for teachers and administrators in preschool education who are charged with preparing children to be ready to learn at kindergarten entry.

Researchers have isolated specific cognitive abilities as underlying the development of reading skills in school-aged children (Catts & Kamhi, 1998; Fletcher, Foorman, Shaywitz, & Shaywitz, 1999; Torgesen & Burgess, 1998). These cognitive abilities characterize children with poor reading skills. Strengths and weaknesses on these cognitive abilities characterize children along the continuum from poor to good reading skills (e.g., Fletcher et al., 1998; Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992). Cognitive abilities that enable the decoding of written material to occur at the single-word level are facilitated by strengths in phonological sensitivity (the ability to attend to and manipulate the sound structure of speech in words) and language skills (especially vocabulary skills). Relative strengths in these same cognitive abilities characterize good and poor readers in languages other than English as well as the reading skills of second-language learners (Avons, Wragg, Cupples, & Lovegrove, 1998; Dufva, Niemi, & Voeten, 2001; Naslund & Schneider, 1996)

Whitehurst and Lonigan (1998) described the development of early reading skills in preschool children as requiring "inside-out" skills or knowledge of how print is translated into sounds and interpreted (e.g., phonological and syntactic sensitivity, letter-sound-name knowledge) and "outside-in" skills or understanding of the context of reading (e.g., language, understanding narrative and print conventions). Studies of specific cognitive abilities in the preschool period have shown clusters of cognitive abilities to be predictive of reading skills at school age. For example, Scarborough (1990) found that school-aged children identified either as reading disabled or as normal readers were characterized early in the preschool period by differences in productive language, vocabulary, phonemic awareness, and letter-sound knowledge. Lonigan and colleagues have found that measures of phonological sensitivity (e.g., rhyme, alliteration, and blending) obtained during the preschool period were predictive of subsequent reading abilities (Lonigan, Burgess, Anthony, & Barker, 1998). Badian (1998) found that measures of verbal memory, orthographic processing (visual matching), and rapid naming during the preschool period discriminated good readers from poor readers in second grade.

The identification of cognitive abilities in the preschool period that predict later reading skills sets the stage for the early detection and remediation of underdeveloped abilities. A common approach to the assessment of reading skills is to use a multi-instrument battery so that the different component parts needed for word-level decoding are assessed. However, batteries often are not feasible with preschool children for a variety of reasons. Limiting factors include the lengthy administration time needed for the application of multi-instrument batteries and the use of standardized tests as reading outcome measures that are not normed for children under 5 years of age (e.g., Wide Range Achievement Test-3, WRAT-3, Wilkinson, 1993). One feasible approach

to early assessment of young children is to use screening scales. Screening scales are designed to be brief assessments for identifying individuals as being at risk for academic delays, and as a means for referring those identified as at risk for further assessment or intervention. One recently developed screening tool designed for use with preschool children is the GRTR (Whitehurst & Lonigan, 2001). Items on GRTR ask children to point to one of four pictures in response to a question or command (e.g., "Find the picture that has letters in it") and include content assessing print knowledge (understanding of books, printed letters, and words), emergent writing (text knowledge), and phonological sensitivity (letter sounds, rhyming, and segmenting words). The skills assessed by GRTR include cognitive abilities that have been found by researchers to relate to subsequent reading skills, with 60% of the items tapping phonological sensitivity skills and 40% tapping either text or print knowledge. One purpose of the present study is to evaluate how children's performance on GRTR relates to their performance on assessments of phonological sensitivity and language skills. Although the GRTR was developed for use with 4-year-old children, a second purpose of the present study is to determine if the instrument can also be used with 3-year-old children; both age groups attend public preschool programs, often in mixed-aged classrooms.

This study tested two models to determine the relationship between scores on cognitive assessments and performance on the GRTR. The preschool cognitive skills most often identified as important for the development of reading (i.e., phonological sensitivity and vocabulary skills) are included in the first model using GRTR as the outcome measure. Researchers have found that combinations of phonological sensitivity and vocabulary skills, rather than the individual skills, are related to word-level reading skills (Badian, 1995; Catts & Kamhi, 1998; Scarborough & Dobrich, 1990; Wesseling & Reitsma, 2001). The second model is based on a body of research that hypothesizes a progression in early reading skills from logographic (deriving meaning from whole visual patterns including logos, signs, and labels) to alphabetic (recognizing individual letters and understanding letter-sound correspondences) to orthographic abilities (understanding the letter sequence/word conventions of English).

There is considerable disagreement as to the role of environmental print as a component in this progression (Cronin, Farrell, & Delaney, 1999; Share & Gur, 1999). Environmental print tasks have contributed to the disagreement because these tasks can involve assessments of print knowledge using logos complete with the surrounding context of color, graphics, and stylized print as well as the use of logo names alone in stylized or regular print. Whether it is the contextual cues or actual attention to the letters in the printed words that is measured by these tasks is one source of disagreement (Bastien-Toniazzo & Jullien, 2001). However, there is some agreement that preschool children's growing awareness of print as containing meaning and their abilities to attend to and use phonological skills to decode printed letters and words contributes to the development of early reading skills (Cronin et al., 1999; Johnson, Anderson, & Holligan, 1996; Riley, 1996; Share & Gur, 1999). GRTR includes

items that are print-related (recognition of printed letters and text, understanding how books are read, and understanding what text looks like) and items that are phonological in nature. The relationship between assessments of environmental print and phonological skills and performance on GRTR is evaluated in the second model.

These two models are assessed using a sample of children from low-income families attending a federally subsidized preschool program where literacy and phonological skills are emphasized as part of the district-wide curriculum. The use of this sample is particularly important because children from low-income families are the ones most likely to be "left behind" despite participation in preschool programs (Lee & Croninger, 1994; McLoyd, 1998; Peisner-Feinberg et al., 2001). If GRTR scores can be linked to performance on other assessments that are predictive of reading skills, then GRTR might prove to be a useful approach for the early identification of preschool children who need additional skill development. In addition, because screening instruments such as GRTR can be administered without extensive training for examiners, childcare programs and center personnel could use this approach as a means of documenting specific cognitive gains made by children in preschool.

METHOD

Participants

Participants were children enrolled in preschool programs for economically or developmentally disadvantaged children in public schools. District-wide enrollment in these preschool programs is based on family income eligibility (total annual family income is less than $22,945 for a family of four). Participants in the study were normally developing children who spoke English as their first language. The participants were 73 three-year-olds (mean age of 42.04 months, range 36 to 47 months; 38 female, 35 male) and 79 four-year-olds (mean age of 54.61 months, range 48 to 59 months; 40 female, 39 male). The racial composition of the participants was 77% Caucasian, 14% African American, 5% Hispanic, and 4% other. The mean General Conceptual Ability score (GCA; Elliott, 1990) was 87.40 (SD = 13.71) for the 3-year-olds and 90.59 (SD = 13.92) for the 4-year-olds. The range of GCA scores reflects low average and minimum scores for each age group. Low average and minimum scores were also found for Vocabulary (shown in Table 1). Preschool children from low-income families often enter preschool with fewer experiences and less developed cognitive skills than children from higher income homes. For decades, research has documented the impacts of low income and parental education and less stimulating family environments on children's intelligence (see Bradley & Corwyn, 2002, for a review). For these reasons, federally funded preschool enrichment programs were established (U.S. Department of Health and Human Services, 2001, 2003).

Table 1
Means (M), Standard Deviations (SD), and Range of Scores for Variables in This Study for Three-Year-Old and Four-Year-Old Groups

	Three-Year-Olds			Four-Year-Olds		
	M	*SD*	*Range*	*M*	*SD*	*Range*
PPVT-III	87.54	13.68	58-116	93.99	14.24	40-123
EVT	97.01	11.28	68-126	97.36	10.51	62-132
Environmental Print	7.89	3.47	0-15	9.80	3.40	2-16
Phonological Processing	8.53	2.88	3-15	9.10	3.21	1-15
Rhyme Detection	2.71	2.09	0-10	3.88	2.92	0-10
Get Ready to Read	7.09	3.32	1-15	11.51	3.75	4-20

Measures

General cognitive measures. Measures of verbal, nonverbal, and overall cognitive abilities were obtained to characterize the sample using the Differential Ability Scales (DAS; Elliott, 1990). The Preschool Level of the scale can be used with children from 2.6 years through 5.11 years and includes assessments of Verbal Abilities (Verbal Comprehension and Naming Vocabulary) and Nonverbal Abilities (Picture Similarities, Pattern Construction, and Copying). These measures plus Block Building and Early Number Concepts are used to obtain GCA scores. GCA scores have a mean equal to 100 and a standard deviation set at 15. Preschool-level test-retest reliabilities over a period averaging 30 days range from .90 to .94. The criterion-related validity of the Preschool Level of the DAS GCA is reported against the Stanford-Binet: Fourth Edition Composite (SB-IV; Thorndike, Hagen, & Sattler, 1986), with which it correlated .77, and against the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 1989), with which it correlated .89 (Elliott, 1990).

Vocabulary measures. The Peabody Picture Vocabulary Test–Third Edition (PPVT-III; Dunn & Dunn, 1997) was used to measure receptive vocabulary, and the Expressive Vocabulary Test (EVT; Williams, 1997) was used to measure expressive vocabulary. Both tests can be used with individuals aged 2.5 years through adulthood. The tests ask individuals to either point to a picture from an array of four that corresponds to the named word or to name the picture shown. The PPVT-III scores are standardized with a mean equal to 100 and a standard deviation set at 15. The PPVT-III *Examiner's Manual* reports alpha coefficients (.92 to .98 for both Form A and Form B) and test-retest reliability (.91 to .93 for Form A and .91 to .94 for Form B). The criterion-related validity of the PPVT-III for ages comparable to those used in the present study (36 to 59 months) is reported against the Oral and Written Language Scales (OWLS; Carrow-Woolfolk, 1995). Although the OWLS is a broader assessment of oral language than the PPVT-III, the correlations range from .63 to .83. EVT scores are standardized with a mean equal to 100 and a standard deviation set at 15. The EVT *Examiner's Manual* reports alpha coefficients of .83 to .97. Test-retest reliabilities range from .77 to .90. The criterion-related validity of the EVT is reported against the oral expression subtest of the OWLS (Carrow-Woolfolk, 1995). These tests correlated .77.

Phonological awareness measures. Rhyme Detection is one of eight subtests of the Phonological Abilities Test (PAT; Muter, Hulme, & Snowling, 1997). The test is designed to be a rapid assessment of phonological awareness skills and is suitable for children from 4 to 7 years of age. Internal consistency reliabilities for the subtests ranged from .67 to .97. Test-retest reliability obtained over a 3-week interval ranged from .58 to .86. To establish criterion-related validity, Phonological Abilities Test scores were correlated with Single Word Reading from the British Abilities Scales (BAS) scores (Elliott, Smith, & McCulloch, 1996). Correlations ranged from .37 to .66, which reflects the differences between the word reading skills tapped by the BAS and the letter knowledge skills tapped by the PAT. The Rhyme Detection subtest has three demonstration items and ten test words. Children are shown a page with four pictures. A target picture appears above three test pictures. The child is asked to point to the picture whose name rhymes with the target word ("What rhymes with cat? Fish, bell, or hat?").

Phonological Processing (NEPSY; Kirkman, Kirk, & Kemp, 1998). The NEPSY is a developmental neuropsychological assessment for children aged 3 through 12 years with five function domains. Phonological Processing is a subtest in the Language domain. For the age range 3 to 6 years, the Phonological Processing subtest contains 14 items and requires the child to identify one of three pictures after the examiner says a segmented word. The subtests have a mean of 10 and a standard deviation of 3. The test-retest reliabilities for the Phonological Processing subtest range from .79 to .88 for 3- to 5-year-olds across an average period of 38 days. The criterion-related validity is reported for the Language Domain at the ages comparable to those used in the present study (36 to 59 months) against the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R; Wechsler, 1989). The correlation for Language Domain language and WPPSI Verbal IQ is .60 (Kirkman et al., 1998).

Environmental print measure. Environmental print knowledge was assessed using colored pictures of logos and signs for products (Cheerios, Pepsi), stores (McDonalds, Kroger, Blockbuster), and services (restroom, school crossing) that appear in print in the environment around the children's schools or neighborhoods. Ten test items plus two demonstration items were used. Children received credit for providing specific labels (2 points = McDonalds) or for general labels (1 point = burgers, fries, Happy Meal). Although measures of environmental print are popular in preschool education curricula and are used in research, the specific pictures used and the products, services, signs, or stores selected vary widely. This variability is due to the need to match the environmental print items to the print actually found in the children's environments.

Early reading measure. Get Ready to Read (GRTR; Whitehurst & Lonigan, 2001) is a screening tool on which children point to one of four pictures in response to a question or command. The 20-item assessment (see Table 2) includes 4 items related to print knowledge (understanding of books, printed letters and words), 6 items on emergent writing (text knowledge), and 10 items

on phonological awareness (letter sounds, rhyming, and segmenting words). The entire screening tool and technical report are available at http://www.teachervision.com/lesson-plans/lesson-7836.html. The standardization sample of 4-year-olds yielded a mean total scale score equal to 9 with a standard deviation of 4. Split-half reliability is reported by Whitehurst and Lonigan (2001) to be .80 for the sample of 342 four-year-olds. The criterion-related validity of GRTR is reported against the Developing Skills Checklist (DSC; CTB/McGraw-Hill, 1990), which contains 14 language measures such as naming letters, identifying letters and sounds, segmenting sentences, and segmenting compound and regular words. The correlation between GRTR and DSC for children from low-income families (Head Start) was .70, and the correlation for children from middle-income homes was .79 for the standardization sample.

Table 2
Get Ready to Read Items

1. These are pictures of a book. Find the one that shows the back of the book.	2. Find the picture that has letters in it.
3. Find the picture that has letters in it.	4. Find the picture that has a word in it.
5. These are pictures of a cereal box. Find the one that tells you the name of the cereal.	6. Find the letter R.
7. Find the letter G.	8. Find the letter that makes an sss sound.
9. Find the letter than makes a tuh sound.	10. Find the letter than makes a buh sound.
11. Some children wrote the letter F. Find the one that is written the best.	12. Some children wrote their name. Find the one that is written the best.
13. Some children wrote stories. Find the longest story.	14. These pictures are: ball, skate, apple, star. Find the one that starts with the buh sound.
15. These pictures are: dog, kite, fan, snake. Find the one that starts with the duh sound.	16. This is ball, and these pictures are: zebra, shoe, wall, leaf. Does ball sound like zebra, shoe, wall, or leaf? Find the one that rhymes with ball.
17. These pictures are: seashell, racket, shoe, chimney. Find what you get when you put SEA and SHELL together. Find sea (pause) shell.	18. These pictures are: penguin, moon, carrot, dragon. Find what you get when you put PEN and GUIN together. Find pen (pause) guin.
19. These pictures are: mouse, cloud, cow, moon. Find what you get when you put MMM and OON together. Find mmm (pause) oon.	20. These pictures are: sun, key, frog, mop. Find turkey without the tur.

Procedure

In the fall of the school year, parents of children participating in preschool programs at four schools were sent requests for participation and informed consent letters. Those families who returned the consent letters (92%) were sent the packets with family background questionnaires. The general cognitive and vocabulary measures were administered in the fall (October-November) and the measures of phonological sensitivity, environmental print, and GRTR were administered the following spring (April-May). Each child was tested individually by trained researchers at school in a room near the child's classroom. Testing continued for each child across several days as needed to complete the assessments due to unavoidable constraints on assessment time during the children's school day.

RESULTS

The means and standard deviations for the independent and dependent measures are shown in Table 1. Correlations of GRTR scores with the five cognitive ability measures for the 3- and 4-year-olds are shown in Table 3. The lexical measures (PPVT-III and EVT Vocabulary) as well as the measures of phonological sensitivity (Phonological Processing and Rhyme Detection) were significant correlates of GRTR at 3 years (r range = .29 to .51). Environmental Print was not a significant correlate. At 4 years, GRTR correlated significantly with PPVT-III, EVT, Rhyme Detection, and Environmental Print (r range = .25 to .45). Phonological Processing was not a significant correlate. The amount of shared variance between GRTR scores and the cognitive ability measures is larger for the 3-year-olds than for the 4-year-olds (.08 to .26 and .06 to .20, respectively).

Table 3
Correlations between Cognitive Scores and Get Ready to Read Total Scores

	Get Ready to Read Total Scores (3-year-olds)	Get Ready to Read Total Scores (4-year-olds)
PPVT-III	.51**	.43**
EVT	.47**	.45**
Environmental Print	.12	.25*
Phonological Processing	.46**	.09
Rhyme Detection	.29*	.41**

*$p < .05$. **$p < .01$.

Multiple regression analyses were used to test the two models of predictive relations between multiple measures of cognitive abilities and performance scores on GRTR. A forced entry regression and multiple-step forced entry regression were used to test each model. In Model 1, the relation between phonological sensitivity (Phonological Processing and Rhyme Detection) and vocabulary skills (PPVT-III and EVT) as predictors of GRTR scores was tested. The forced entry regression was used to determine how all the variables

Table 4
Regression Results for Two Models for Three-Year-Olds

	R	R^2	Adjusted R^2	F for equation	ΔR^2	β
Model 1 (forced entry)	.66	.44	.39	$F(4, 59) = 11.37, p < .01$ $f^2 = .66$		
Rhyme Detection						.14
Phonological Processing						.25*
EVT						.17
PPVT-III						.35*
Model 1 (multiple-step entry)						
Step 1	.48	.23	.21	$F(2, 61) = 9.22, p < .01$ $f^2 = .26$	.23	
Phonological Processing						.40**
Rhyme Detection						.23*
Step 2	.66	.44	.40	$F(4, 59) = 11.37, p < .01$ $f^2 = .66$	.21	
PPVT-III						.35*
EVT						.17
Step 1	.60	.36	.34	$F(2, 61) = 16.96, p < .01$ $f^2 = .51$	.36	
PPVT-III						.45**
EVT						.19
Step 2	.66	.44	.40	$F(4, 59) = 11.37, p < .01$ $f^2 = .66$	.08	
Phonological Processing						.25**
Rhyme Detection						.14
Model 2 (forced entry)	.50	.25	.21	$F(3, 66) = 7.27, p < .01$ $f^2 = .27$		
Environmental Print						.02
Rhyme Detection						.21
Phonological Processing						.41**
Model 2 (multiple-step entry)						
Step 1	.50	.25	.23	$F(2, 67) = 11.05, p < .01$ $f^2 = .29$	.25	
Rhyme Detection						.21
Phonological Processing						.41**
Step 2	.50	.25	.21	$F(3, 66) = 7.27, p < .01$ $f^2 = .27$	.00	
Environmental Print						.02
Step 1	.17	.03	.01	$F(1, 68) = 1.91, p = .17$ $f^2 = .01$	.03	
Environmental Print						.17
Step 2	.50	.25	.21	$F(3, 66) = 7.27, p = .01$ $f^2 = .27$	.22	
Rhyme Detection						.21
Phonological Processing						.41

*$p < .05$. **$p < .01$.

(Rhyme Detection, Phonological Processing, PPVT-III, and EVT) related to the GRTR scores. A multiple-step forced entry regression tested whether the order in which the variables were entered influenced the regression results. Two multiple-step entry regressions were tested, one where phonological sensitivity scores were entered in the first step and vocabulary scores were entered in the second step, and the other that was just the reverse (i.e., vocabulary scores were entered first). Tables 4 and 5 present the results for each age group separately. The full model and the multiple-step models with phonological sensitivity scores entered before or after vocabulary scores were both significant for both age groups. For the 3-year-olds, the phonological sensitivity scores and

Table 5
Regression Results for Two Models for Four-Year-Olds

	R	R^2	Adjusted R^2	F for equation	ΔR^2	β
Model 1 (forced entry)	.57	.33	.29	$F(4, 65) = 7.96, p < .01$ $f^2 = .40$		
Rhyme Detection						.26*
Phonological Processing						-.11
EVT						.27*
PPVT-III						.24
Model 1 (multiple-step entry)						
Step 1	.44	.19	.17	$F(2, 67) = 7.83, p < .01$	.19	
Phonological Processing				$f^2 = .20$		.08
Rhyme Detection						.43**
Step 2	.57	.33	.29	$F(4, 65) = 7.96, p < .01$	.14	
PPVT-III				$f^2 = .40$		.24
EVT						.27*
Step 1	.51	.26	.23	$F(2, 67) = 11.47, p < .01$	.26	
PPVT-III				$f^2 = .30$		.28*
EVT						.28*
Step 2	.57	.33	.29	$F(4, 65) = 7.96, p < .01$	.07	
Phonological Processing				$f^2 = .40$		-.11
Rhyme Detection						.26*
Model 2 (forced entry)	.46	.21	.18	$F(3, 73) = 6.59, p < .01$ $f^2 = .33$		
Environmental Print						.21*
Rhyme Detection						.39**
Phonological Processing						.06
Model 2 (multiple-step entry)						
Step 1	.41	.17	.15	$F(2, 74) = 7.54, p < .01$	.17	
Rhyme Detection				$f^2 = .17$		.40**
Phonological Processing						.08
Step 2	.46	.21	.18	$F(3, 73) = 6.59, p < .01$	.04	
Environmental Print				$f^2 = .22$		.21*
Step 1	.24	.06	.05	$F(1, 75) = 4.63, p = .04$	.06	
Environmental Print				$f^2 = .05$		.24*
Step 2	.46	.21	.18	$F(3, 73) = 6.59, p < .01$	.15	
Rhyme Detection				$f^2 = .22$		.39**
Phonological Processing						.06

*$p < .05$. **$p < .01$.

PPVT-III were the strongest contributors to the models. Vocabulary scores contributed more to the variance accounted for when these scores were entered before phonological sensitivity scores (.36 compared to .23). For the 4-year-olds, Rhyme Detection and EVT were the strongest contributors to the model. Vocabulary scores contributed more to the variance accounted for than did phonological sensitivity scores (.26 compared to .19).

Model 2 explored the role of environmental print skills compared to phonological sensitivity skills in predicting GRTR scores. Both forced entry and multiple-step forced entry regression analyses were used. Tables 4 and 5 pre-

sent the results for each age group separately. Both the full model and the multiple-step models were significant for both age groups. For the 3-year-olds, Phonological Processing was the strongest contributor to the model and the phonological sensitivity scores when entered first accounted for more variance than did Environmental Print when it was entered first (.25 compared to .03). For the 4-year-olds, Rhyme Detection and Environmental Print were the strongest contributors to the model. Phonological sensitivity scores accounted for more variance than Environmental Print (.17 compared to .06).

DISCUSSION

The relationship between GRTR scores and assessments of phonological sensitivity, vocabulary, and environmental print provides some evidence for the content validity of the screening scale. Skills in phonological sensitivity are related to performance on GRTR. For 3-year-olds, skills in Phonological Processing and Rhyme Detection are related to GRTR scores, and for 4-year-olds, Rhyme Detection but not Phonological Processing skills are related to GRTR scores. Also related to GRTR scores are skills that involve the more global understandings of language that may facilitate reading development—vocabulary and environmental print. Again, different specific measures are correlates (all but Environmental Print for the 3-year-olds and all scores for the 4-year-olds) of performance on GRTR. Although GRTR is developed for use with 4-year-old children, the results for the 3-year-olds resemble those found for 4-year-olds and these findings are comparable to results reported with a sample of 4-year-old children from low-income families in a GTRT technical report (Whitehurst, 2003). The magnitudes of the correlations reported by Whitehurst (2003) for GRTR and PPVT-III and phonological sensitivity (letter name knowledge and phonological awareness tests) are stronger than those found in the present study (.09 to .43). However, the types of phonological sensitivity measures may have differed between the two studies, although this is difficult to determine because details about the specific phonological tests are not provided by the GRTR technical report.

The correlations in the present study are explored further in analyses that use combinations of cognitive skills to predict scores on GRTR. Two different models were tested. Model 1 included phonological sensitivity and vocabulary, two measures identified as important for the development of reading, as predictors of GRTR scores. For both age groups, phonological and vocabulary scores were predictive of GRTR scores but vocabulary contributed more to the variance accounted for than did phonological sensitivity for both age groups. Although the sample item on GRTR directly tests picture vocabulary, none of the items tests either receptive or expressive vocabulary knowledge per se. However, children must understand the words used by the examiner in the instructions for each item to perform the tasks associated with each item. That GRTR scores are reflective of children's vocabulary skills is particularly important for this screening tool. Researchers have identified vocabulary skills as predictors of reading success. Scarborough's (1990) early work links deficits in

receptive and expressive vocabulary skills in 3-year-olds with the subsequent development of reading disabilities. Tomblin, Records, Buckwalter, Zhang, Smith, and O'Brien (1997) reported that reading-disabled second-grade children had poor receptive and expressive vocabulary scores in kindergarten. Bowey (1995) found that differences in the receptive vocabularies of preschool children predicted word-level reading skills in first grade. Catts, Fey, Zhang, and Tomblin (1999) reported that oral language deficits were more common than phonological deficits at kindergarten age in children characterized by poor reading skills in second grade. Although vocabulary skills are an important component of any language-based assessment instrument, these skills are particularly important to consider because of the important link between vocabulary and the development of reading. Vocabulary skills merit a more direct assessment than is possible from GRTR to complement assessments of preschool children's reading readiness.

Finding that the phonological sensitivity scores are not more strongly linked with performance on GRTR is surprising because more than 60% of the GRTR items tap phonological sensitivity skills. Further, phonological sensitivity skills were assessed concurrent with GRTR in the spring whereas vocabulary was assessed in the fall. Instead, the low correlations found for phonological sensitivity may be due to the types of phonological skills assessed. Six of the 13 phonological items on GRTR tap skills in letter-sound knowledge that are not included on either Phonological Processing or Rhyme Detection. GRTR does include items that tap word segments and rhyming, as do Phonological Processing and Rhyme Detection, respectively. Identification of words by onset and final sounds, rhyming words, and identifying or blending segmented words are typical phonological tasks used with preschool children, and assessments of these skills were chosen in this study because of their importance to word-level reading skills (Bowey, 1995; Scarborough, 1990; Vandervelden & Siegel, 1997). Although the use of phonological tasks that more closely approximate the range of phonological items on GRTR might yield stronger correlations, further research is needed to determine whether this selection of phonological items is sufficient to provide the strong link with later reading skills that have been found using a broader array of phonological tasks.

The contribution of phonological sensitivity compared to understanding environmental print is explored in Model 2. Phonological skills (Phonological Processing for 3-year-olds and Rhyme Detection for 4-year-olds) are more strongly correlated with GRTR scores and accounted for more variance than Environmental Print. The weak correlations for Environmental Print may reflect differences between the knowledge needed to recognize and name the products, stores, or services depicted in logos and the knowledge needed to identify book parts, letters, and writing as contained in GRTR items. There is research support for a developmental continuum from the basic visual and auditory mechanisms needed for speech and print perception, to knowledge of print concepts, and phonological skills in linking letters with sounds that facilitate the development of reading skills (Johnson et al., 1996; Molfese,

Molfese, & Modglin, 2001; Riley, 1996; Share & Gur, 1999). However, strong research support for the print concepts portion of the continuum in directly influencing word-level reading skills has not been reported. Although the children who participated in the present study were enrolled in preschool programs where literacy (including environmental print and print awareness skills) and phonological skills are emphasized, the low average scores for each age group on Environmental Print reflect the underdevelopment of these skills. Whether greater development of Environmental Print skills or the use of different print concepts measures is needed to validate this component of GRTR requires further research.

Early childhood educators are seeking developmentally appropriate assessment tools that can be used to indicate preschool children's status in acquiring early reading–related skills. A screening tool such as GRTR is one option. Further research is needed to determine whether scores on GRTR are related to the development of reading skills assessed in kindergarten or primary grades. Although good classification accuracy is reported between scores of 4-year-old pre-K Head Start children on 14 measures from which GRTR items are drawn and word-level reading skills (Whitehurst, 2003), GRTR scores have not yet been validated by reading outcomes. It is also not known whether the GRTR instrument in its current form can be used as intended by childcare program and center personnel. However, the skills assessed by GRTR, especially phonological skills, are an important focus of early childhood curricula and early childhood educators could benefit from an easy-to-use assessment instrument as they ready preschool children for kindergarten entry.

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