

MIDDLE TENNESSEE STATE UNIVERSITY

Introduction

Although testing with a diagnostic battery is not necessary for students to qualify for help under Response to Intervention II (RTI-II), it remains relevant for instructional planning. Our study explored the role of morphological awareness in diagnostic testing of children under RTI, in an effort to clarify two opposing ideas. One theory is that difficulty in learning to read and spell is associated with deficits in morphological awareness (Rubin, Patterson, & Kantor, 1991). However, recent findings suggest morphological awareness (MA) could be a protective factor for individuals with dyslexia (Farris, Cristan, Bernstein, & Odegard, 2019; Law, Wouters, & Ghesquière, 2015). In a recent study of Greek children, scores on two tests of morphological awareness as well as scores in phonological awareness were significantly lower than in controls. However, in a binary logistic regression the deficiency in MA did not predict the classification of children in the group with dyslexia compared to typically developing readers – only phonological awareness predicted classification (Rothou & Padeliadu, 2019).

MA has still not been clearly identified as a deficit in at-risk late elementary students, perhaps as it is often presumed to be learned. Moreover, MA has yet to successfully predict dyslexia membership in a regression model. In the current study, 4th and 5th graders (N = 95) already classified in RTI tiers completed a battery of diagnostic tests. Tests included standard subtests of the WRMT and experimental measures of reading morphologically complex words, morphological awareness, and sensitivity to prosody. The data were utilized to answer two questions. First, whether the dyslexia group scored lower in all measures. Second, which of those differences predict membership in Tiers III & IV (dyslexia). Between-group *t*-tests were used to determine a difference in dyslexics. We used a binary logistic hierarchical regression analysis to predict whether these differences could predict dyslexia.

Methodology

A sample of 95 elementary school students in fourth and fifth grades were recruited for the study. All students attended a public elementary school in a middle-to-low-socioeconomic class suburban area of the central Tennessee. Ages ranged from 9 years, 1 month to 12 years, 1 month (M = 10 years, 7 months, SD) = 7.89 months). Students were already assigned into RTI tiers by the school.

Test battery included:

- Subtests of the Woodcock-Johnson III Tests of Achievement (WJ-III: Woodcock, McGrew, & Mather, 2003)
- The word reading test extended (WRT-E) adapted from Carlisle's (2000) word reading test
- The Test of Written Spelling, Fourth Edition (TWS-4; Larsen, Hammill, & Moats, 1999)
- Developmental Spelling Assessment (DSA) (Ganske, 2007)
- Vocabulary: WJ-III Synonyms, Antonyms, and Analogies subtests
- An experimental morphological awareness task (MAT) (Rubin, et al., 1991, Carlisle & Fleming, 2003, and Jarmulowicz, et al., 2007)
- The Phonological awareness task (AAT-Nonce) adapted from Rosner and Simon (1971) and Singson et al. (2000)
- Prosodic sensitivity test (PST)
- The Tennessee Comprehensive Assessment Program (TCAP) Achievement Test

Please refer to the manuscript for a detailed procedure.

Morphological Awareness Across RTI Tiers – Deficit or Strength?

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Results

Table 1. Group differences in test battery components ($N = 95$). Groups are regular education (Tiers I & II) vs. reading disability (Tiers III & IV). Comparisons with independent groups t tests, Bonferroni corrected.								
	Tiers I & II		Tiers III & IV					
	(n = 75)		(n = 20)					
	M	SD	M	SD	t	р	d	
Age in Months	126.35	6.23	126.79	9.55	-1.09	.280	27	
Vocab STD	103.31	8.26	95.96	9.52	*5.32	<.001	1.34	
Letter/Word Id STD	103.63	7.97	95.92	8.08	*7.25	<.001	1.82	
Word Attack STD	104.33	8.79	96.50	8.13	*3.97	<.001	1.00	
WRT	89.71	16.31	75.25	13.03	*7.65	<.001	1.92	
AAT Nonce	26	6	21	7	2.82	.006	.71	
Passage Fluency (wcpm)	128	23	93	28	*5.99	<.001	1.51	
Prosody	1.56	0.52	1.63	0.39	2.18	.032	.55	
Morphology	79	10	64	15	*5.34	<.001	1.35	

* Bonferroni corrected significance

Table 2. Correlations Among Tasks in The Test Battery Along with Means

	1	2	3	4	5	6	7	8	9
1. Age in Months	1								
2. Vocab STD	.187	1							
3. Letter/Word Id STD	.068	.555***	1						
4. Word Attack STD	081	.333***	.330***	1					
5. WRT	077	.592***	.806***	.571***	1				
6. AAT Nonce	.100	.334***	.441***	.485***	.566***	1			
7. Passage Fluency	092	.466***	.670***	.382***	.637***	.202*	1		
8. Prosody	024	.190	.183	095	.105	.116	.103	1	
9. Morphology	.086	.516***	.354***	.241*	.444***	.300**	.375***	.250*	1

* p < .05, ** p < .01, *** p < .001

Table 3. Hierarchical Binary Logistic Regression Model for Predicting S

							$e^{ m p}$
Step	Predictor	Model χ^2	β	$SE \beta$	Wald's χ^2	р	(odds ratio)
1	Passage Fluency	27.997***	-1.622**	.394	16.94	.001	.197**
	PA (AAT)		0.665	.538	1.52	.217	1.945
2	Word Attack	25.810***	-1.320*	.595	4.92	.027	.267
	Letter Word ID		-2.181**	.809	7.27	.007	.113**
	Vocabulary		-0.944*	.469	4.05	.044	.389*
	WRT		-1.289	1.196	1.65	.281	.275
3	Morphology D-Prime	10.390*	-1.242*	.586	4.50	.034	.289*
	Prosody		-0.666	.518	1.65	.199	.514
	Constant		-3.75*	.935	16.09	.000	.023*

p* < .05, *p* < .01, ****p*<.001

and Standard	Deviations.

PED	Classification	with	Test Batter	V.
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Children with dyslexia performed significantly lower in every task, with the The hierarchical analysis was used to show the levels of the existing test battery plus Rubin et. al. (1991) accurately predicted spelling ability in adults with learning

exception of PA (AAT Nonce) and prosody, as compared with typically developing readers. morphology and prosody as predictors for SPED classification (Tiers III and IV). We found that while the current battery (steps one and two in the regression) is fairly accurate in classifying tier level, the addition of morphology and prosody (step three) raises the hit rate and decreases false alarms, thereby significantly improving classification accuracy. Word reading is a clear contributor in classifying. However, a second word reading task with additional morphologically complex words (WRT), appears to be redundant. disabilities through spoken morphological tasks. These tasks, which were adapted in the current study, have previously been suggested by Rubin to be utilized in assessment. Rothou and colleagues (2019) found a clear deficit of inflectional morphology in Greekspeaking children with dyslexia. This implies that reading and language distinctions in terms of testing may be preventing greater identification for children in need of intervention.

The current work goes further to demonstrate a predictive power to morphology and prosody in distinguishing typically developing readers from children with dyslexia.

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\mathbf{D}	u			a	Ш

- diagnostic accuracy.

These results are a clear indicator that the inclusion of morphology in diagnosis will allow for a more accurate detection of children with dyslexia in the RTI system. Fluency measures alone may not be sufficient to identify children at-risk. However, this proposal should be investigated further.

Our study may have been limited by the simplicity of the eight inflectional morpheme task. This task, adapted from Rubin et. al. (1991), was originally designed for second graders. Derivational morphology was not studied here but deserves future research as a potential predictor. It may also be investigated whether classification could be extended to other features of spoken language or should be more appropriately diagnosed with CELF or CASL.

The data here support the practice of explicit systematic instruction in morphemes as children with dyslexia in Tier-III show difficulty with phonological awareness, decoding, word reading, and fluency (Lyon, et. al., 2003; Shaywitz, 1998). Additional work should explore the seemingly contradictory findings of recent work that points to morphology as a compensatory skill for children with dyslexia (Farris, et. al., 2019 [In Press]).

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Tennessee Center for the Study and Treatment of Dyslexia

Conclusion

Children with dyslexia show significant deficits in word reading, word attack, vocabulary, and morphology compared to typically developing peers. The addition of morphology and prosody to a test battery significantly improves

Future Directions

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