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The Science of Dyslexia Screening: Integrating the Shaywitz DyslexiaScreen into Practice

Adam Scheller, PhD

Moderated by:
Amy Natho, MS, CCC-SLP, CEU Administrator, SpeechPathology.com

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The Science of Dyslexia Screening: Integrating the Shaywitz DyslexiaScreen into Practice

Adam Scheller, Ph.D.

Disclosure

Adam is an employee of Pearson. In the context of best practice Dyslexia Assessment he will discuss several assessments that Pearson developed and/or distributes.

Agenda and Learning Outcomes

- Introduction
- What is dyslexia?
- What is an effective workflow for assessment?
- Screening: The Science
- An explanation of the Shaywitz DyslexiaScreen
- Summary, Q/A

1. *After this course, participants will be able to identify 5 characteristics of dyslexia.*
2. *After this course, participants will be able to list 3 limitations of screener data and 4 data points used to evaluate screener effectiveness.*
3. *After this course, participants will be able to identify the recommended next steps following student screening.*

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What is Dyslexia?

Defining Dyslexia

(IDA, 2002; Cassidy-Mikulski Senate Resolution 275, 2015)

1. …a specific learning disability that is neurobiological in origin.
2. … an unexpected difficulty in reading for an individual who has the intelligence to be a much better reader…
3. …language based...
4. …characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities…
5. …typically result from a deficit in the phonological component of language that is often unexpected in relation to other cognitive abilities and the provision of effective classroom instruction…
6. …secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge…
7. …often (not always) present with an uneven cognitive profile…

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Development of Reading:

Investigating ”typical” to find what’s “atypical”

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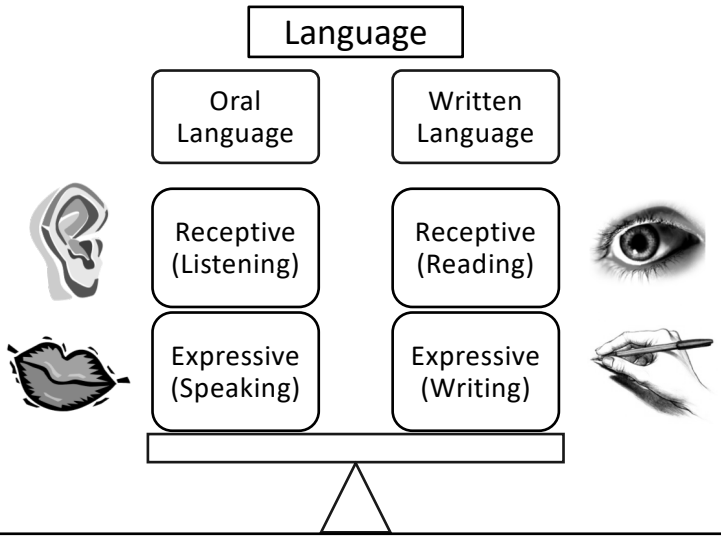
Reading is Language



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Developmental Acquisition of Language

Phonological Skills

- Receptive – Language by ear
- Expressive – Language by mouth

Orthographic Skills

- Receptive – Language by eye
- Expressive – Language by hand

Developing Language Competence (ASHA, 2001)

What is the connection between oral and written language?

a. Oral language provides the foundation for the development of reading and writing;
b. the relationship between oral language and literacy development is reciprocal in nature, with interconnections originating in early childhood;
c. children with speech and language impairments are at increased risk for difficulties with early and conventional literacy development; and
d. intervention for oral language can positively influence literacy development, and vice versa.

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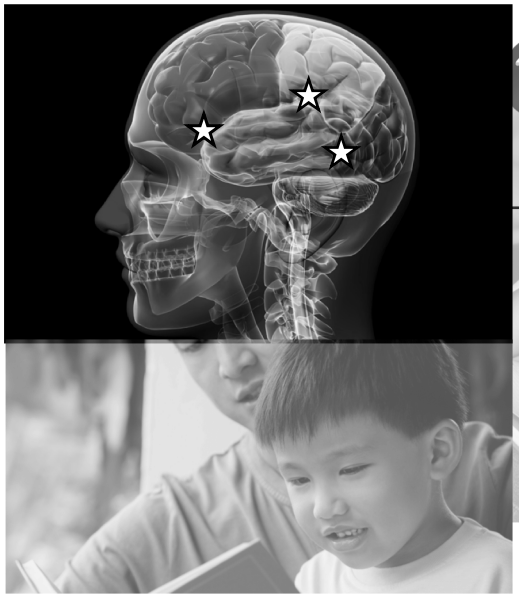
The Neurobiology of Reading (Typical)



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- **Vocalization, Articulation** (Inferior Frontal Gyrus)
- **Word Analysis** (Parieto-Temporal)
- **Word Recognition, Automaticity** (Occipito-Temporal)

Shaywitz (2004)

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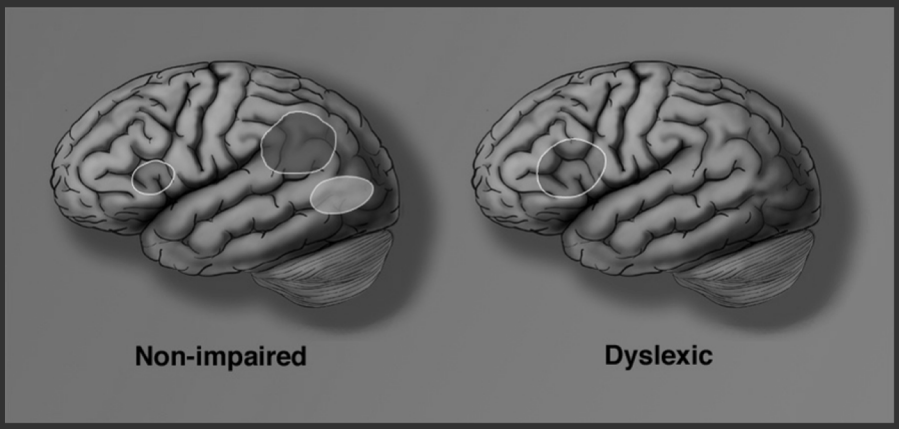
Neural Signature for Dyslexia: Inefficient Posterior Reading Systems



(Adapted from Shaywitz S: Overcoming dyslexia: a new and complete science-based program for reading problems at any level. New York, 2003, Alfred A. Knopf. Copyright 2003 by S. Shaywitz. Adapted with permission.)

Dyslexia "Definition" in Schools

- Dyslexia vs. SLD-Reading?
  - Differences between "diagnosis" of neurobiological condition and educational condition
- Dyslexia (as a medically diagnosed condition) can qualify a student for 504 plan.
- However, Dyslexia (identified in either school as a learning disorder or medically) can qualify a student for special education with a Learning Disability in Reading if…
  - ...student also has documented impact in classroom/educational performance.

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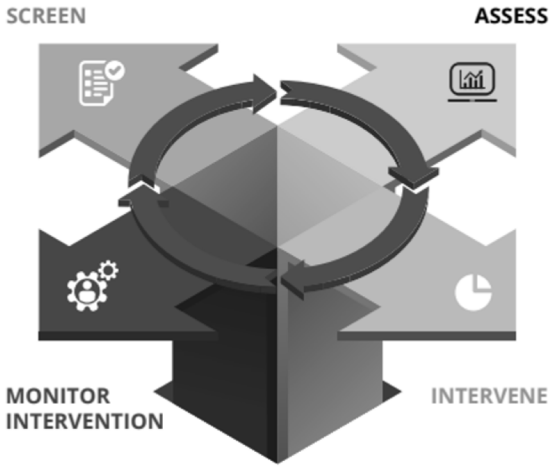
Dyslexia Assessment Workflow:

A Best Practice Model for Addressing Dyslexia and Screening Mandates

Following the...



First…

Don't forget that the path to address Dyslexia in schools should begin in **general education with** universal screening.

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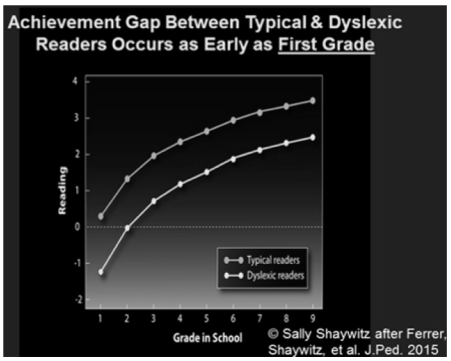
...and second...



The science tells us responding to dyslexia early is CRITICAL! We know that achievement gaps for students with dyslexia can be seen as early as first grade and persist.

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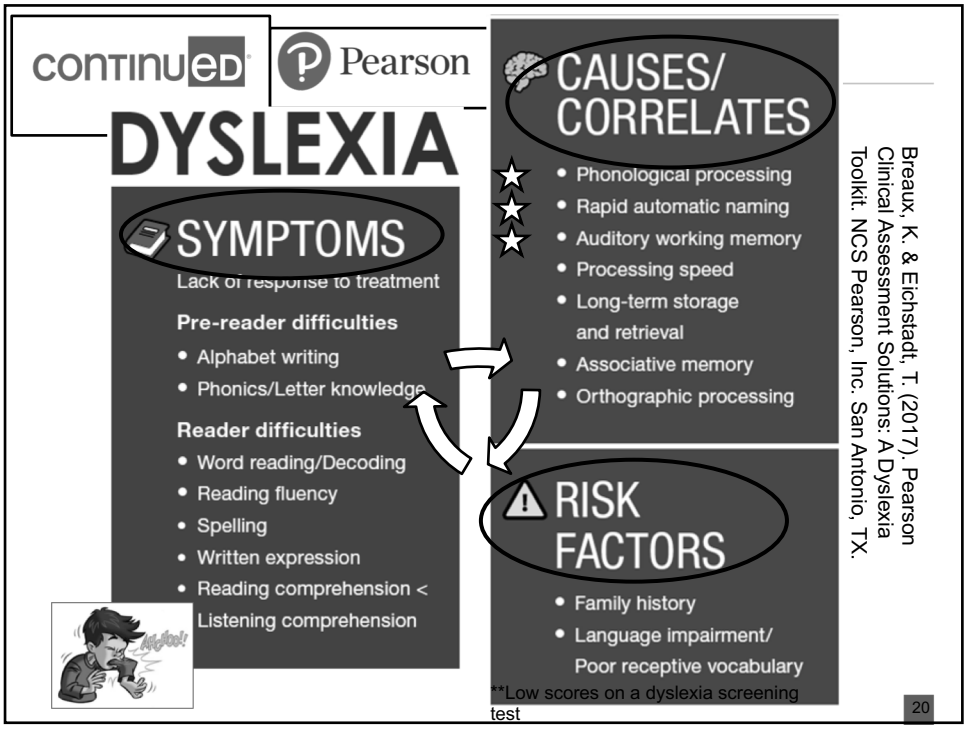

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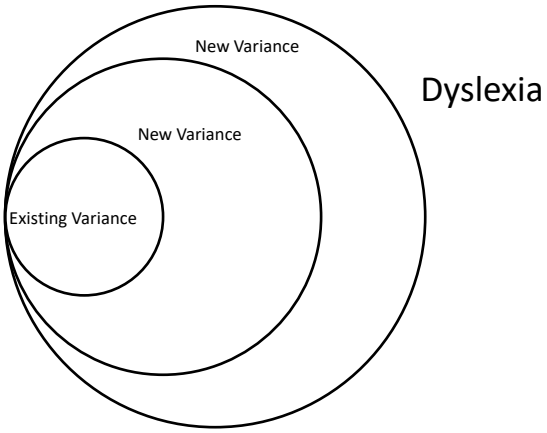
Incremental Variance



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Three Assessment Components of Diagnostic Battery:

Achievement
Cognitive
Processing
Oral Language

	Skill/Ability/Indicator	IDA key indicator[a]	Test/ Source	Low/ Below average	Average	High/ Above average	At risk (Y)/ Not at risk (N)	N/A or Not observed
Symptoms of Difficulty	Treatment response[b]							
	Alphabet writing							
	Letter knowledge and phonics	X						
	Decoding pseudowords	X						
	Word reading	X						
	Reading fluency	X						
	Spelling	X						
	Written expression	X						
	Reading comprehension < Listening comprehension[c]							
Causes/Correlates	Phonological processing	X						
	Rapid automatic naming	X						
	Auditory verbal working memory	X						
	Processing speed							
	Long-term storage and retrieval							
	Associative memory (Learning efficiency)							
	Orthographic processing							
Risk Factors	Dyslexia screening results							
	Family history							
	History of language impairment							
	Receptive vocabulary[d]	X						
Possible Strengths	Fluid reasoning							
	Oral language: Listening, speaking, vocabulary, grammar							
	Math: Calculation, problem solving, fluency							

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Screening: The Science

Limitations of a Screener

- A **screener by definition is NOT COMPREHENSIVE**
  - Does not provide a diagnosis
  - Should not be used to identify the degree of impairment
  - Should not be used to identify pattern of strengths and weaknesses
- Difference between full (universal) screener and targeted screener?
- Error rates: False + and False -

Screeners can be either…

Performance-based

(assessing skills)

or

Rating-based

(rating related characteristics/behaviors)

(…but most are performance)

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Examples of Screeners for Reading

- Pearson Published
  - ***Shaywitz DyslexiaScreen**** - only Dyslexia Specific Screener
  - KTEA-3 Brief **
  - WRAT5 Reading Composite **
  - KTEA-3 and WIAT Dyslexia Index Scores (Screeners, but also can be used diagnostically) **
  - *aimsweb+* **
  - WRMT-III Readiness Cluster **
- Examples of Others
  - DIBELS (Dynamic Measurement Group) **
  - Predictive Assessment of Reading **
  - easyCBM Reading (University of Oregon) **
  - MindPlay Universal Screener (MindPlay) **
  - TPRI Screening (UT Health) **
  - Feifer Assessment of Reading Screening Form (PAR) **

* Rating
** Performance

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How do we evaluate screener effectiveness?

- 4 points of data
  1. Reliability
     - Reflection of error
  2. Sensitivity and Specificity?
     - True + and False +
     - True – and False –
  3. Area Under the ROC (receiver operating characteristic) Curve (AUC)
  4. Clinical Studies
     - How does it perform?
     - Effect size (differentiates between 2 groups)

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What is Area Under ROC Curve (AUC)?

- History: Developed during World War II to analyze radar and help operators decide whether a blip on the screen represented an enemy target, a friendly ship, or just noise.
- Plot true positive rate against the false positive rate across various thresholds.
- Tests Discrimination: Gives an indication of binomial group distribution (with and without)
- .5 AUC is chance accuracy (worthless, flip a coin)
- 1.0 AUC indicates perfect test
- .80 - .90 + range indicates good to excellent

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Examples of Screener Effectiveness

Test or index score	Grade/ Age	Subtests/Items	Mean reliability	Effect size	AUC	Administration time (min.)
Shaywitz DyslexiaScreen™: Form 0	Kindergarten	10 items	.87	1.48	.81	< 5
Shaywitz DyslexiaScreen™: Form 1	1	12 items	.90	0.96	.89	< 5
Shaywitz DyslexiaScreen™: Form 2	2	10 items	.92	1.47	.92	< 5
WRAT5: Reading Composite	1–12+ Ages 6–89+	Word Reading + Sentence Comprehension	.96	1.70	.89	10–20
KTEA™–3 Brief: BA-3 composite	K–12+ Ages 5–25	Letter & Word Recognition + Spelling + Math Computation	.98	2.11	.93	20

Note. AUC = Area Under the Curve estimate. Data for KTEA–3, WIAT–III, and WRAT5 were derived from age-based standard scores. Alpha reliability is reported for the Shaywitz DyslexiaScreen forms; split half reliability is reported for all other tests. All scores from the dyslexia groups were significantly ($p < .01$) lower than those of the nonclinical matched control groups. Clinical *n*-counts for the KTEA–3 and WIAT–III Dyslexia Index scores at grades K–1 were insufficient (< 20) for group comparisons; for this reason, group means, effect sizes, and AUC estimates for the Dyslexia Index 1 scores were based on a sample of students in grades 1–4, ages 6–10.

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Combining 2 Methods to Make Screening Process More Precise

- Screener identifies approximately 20% of a typical classroom as "at-risk", more if it's a Title 1 classroom
- A Hybrid Screening Method: 2-Stage Performance and Rating
  1. Use aimswebPlus targeted probe data to determine performance
     - Shows us who is having difficulty reading
     - Validates question of "poor reading performance"
  2. After 6-8 weeks with student in classroom, teacher completes the Shaywitz DyslexiaScreen
     - Shows us who is "at-risk" specifically for Dyslexia
     - Gives us better idea for "next steps"

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How should I interpret screener results?

- **At Risk for Dyslexia** considerations include:
  - Increasing the frequency and duration of interventions
  - Selecting a more intensive intervention program
  - Closely monitoring the student's academic performance
  - Referring the student for a more comprehensive diagnostic evaluation.
- A student classified as **Not At Risk for Dyslexia**
  - Language and academic skills may be monitored and supported within the general academic setting.
- **Remember, screeners do not provide a diagnosis.**

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Shaywitz
DyslexiaScreen™

Shaywitz DyslexiaScreen

- Brief teacher survey for identifying students **at-risk for dyslexia**.
- Capable of screening all students, but can also be used with specific groups of students experiencing academic difficulties.
  - Therefore…universal or Tier 2 capable
- 5 minutes (or less) using an online form
- Digital administration and automatic scoring
- The classification accuracy data indicate moderately high sensitivity and specificity

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What does the Shaywitz DyslexiaScreen measure?

- **Observational** Ratings Analyze:
  1. Phonological,
  2. Linguistic, and
  3. Academic performance
- Ratings based on classroom teacher observations
  - Subjectivity **limited** because teacher answers questions after having worked with student daily for 6-8 weeks.
- Raw score: the number of items that meet criteria for the At Risk for Dyslexia classification
  - The raw score is compared to a normative cut score (varies by item)

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Forms

- The Shaywitz DyslexiaScreen offers four forms:
  - **Form 0:** Grade K (Ages 5-6) consists of 10 items.
  - **Form 1:** Grade 1 (Ages 6-7) consists of 12 items.
  - **Form 2**: Grade 2 (Ages 7-8) consists of 10 items.
  - **Form 3**: Grade 3 (Ages 7-8) consists of 10 items.
    - Fall 2018

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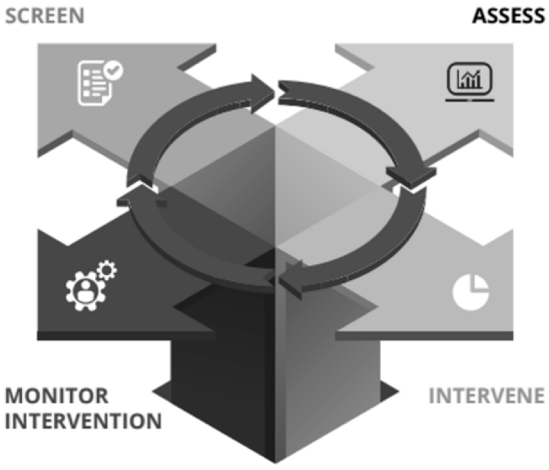
So, what is (should be) next?



Psychometrics:

Sample, Reliability, & Validity

Description of the Sample

- Connecticut Longitudinal Study
  414 Connecticut schoolchildren representative of those students entering public kindergarten in Connecticut in 1983, as well as their parents and teachers, provided data for the Shaywitz DyslexiaScreen norms.
- Pearson Clinical Validation Study
  In addition, a sample of 279 children in grades K – 3 participated in a national clinical validity study.
- All student participants in both samples spoke English as their primary language.

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Table 3.2 Demographics of National Validity Samples

	Form 0 (Kindergarten)	Form 1 (Grade 1)	Form 2 (Grade 2)	Form 3 (Grade 3)
N	63	52	80	84
Education				
0–12 years of school, no diploma	4.8	1.9	13.8	8.3
High school diploma or equivalent	11.1	19.2	15.0	17.9
Some college or technical school, associate's degree	36.5	48.1	50.0	41.7
Bachelor's degree	47.6	30.8	21.3	32.1
Race/ethnicity				
African American	—	1.9	6.3	6.0
Asian	1.6	3.8	12.5	14.3
Hispanic	11.1	15.4	12.5	10.7
Other	12.7	9.6	7.5	21.4
White	74.6	69.2	61.3	47.6
Region				
Midwest	15.9	23.1	45.0	26.2
Northeast	—	—	—	—
South	60.3	67.3	37.5	48.8
West	23.8	9.6	17.5	25.0
Sex				
Female	42.9	53.8	48.8	48.8
Male	57.1	46.2	51.3	51.2

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Evidence of Reliability
(Based on National Clinical Study)

Table 3.3 Cronbach's Alpha Reliability, by Form

Shaywitz DyslexiaScreen™	Raw scores	Dichotomous items
Form 0 (Kindergarten)	.92	.87
Form 1 (Grade 1)	.95	.90
Form 2 (Grade 2)	.97	.94
Form 3 (Grade 3)	.97	.95

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Table 3.4 Dyslexia Group Compared to Nonclinical Group, Forms 0 and 1

	Dyslexia		Nonclinical					
Score	Mean	*SD*	Mean	*SD*	Difference	*t* value	*p* value	Standard difference
Shaywitz DyslexiaScreen™								
Form 0 (Kindergarten)	6.3	3.4	2.4	2.4	–3.87	–4.46	<.01	–1.48
Form 1 (Grade 1)	7.6	3.2	2.4	2.9	–5.20	–5.07	<.01	–1.78
WIAT®–III								
Early Reading Skills (Kindergarten)	92.0	2.7	105.7	6.6	13.69	6.73	<.01	2.23
Word Reading (Grade 1)	86.8	5.8	110.2	11.3	23.42	5.67	<.01	2.19
Pseudoword Decoding (Grade 1)	83.9	9.0	108.9	11.0	25.04	6.39	<.01	2.35

Table 3.5 Dyslexia Group Compared to Nonclinical Group, Forms 2 and 3

	Dyslexia		Nonclinical					
Score	Mean	*SD*	Mean	*SD*	Difference	*t* value	*p* value	Standard difference
Shaywitz DyslexiaScreen™								
Form 2 (Grade 2)	8.1	2.4	2.2	3.0	–5.89	–7.36	<.01	–2.06
Form 3 (Grade 3)	9.0	1.6	2.3	3.1	–6.74	–8.96	<.01	–2.38
WIAT®–III								
Pseudoword Decoding	81.3	6.9	106.7	12.7	25.36	11.21	<.01	2.16
Oral Reading Fluency	77.3	13.7	107.6	10.6	30.25	13.94	<.01	2.68
Oral Reading Accuracy	84.7	12.4	107.1	12.8	22.42	9.13	<.01	1.76
Oral Reading Rate	80.7	13.2	106.4	11.1	25.70	11.54	<.01	2.22
Spelling	84.1	8.8	105.8	10.9	21.64	10.69	<.01	2.06

Classification Accuracy
(Based on National Clinical Study)

Table 3.6 Classification Accuracy and ROC Area, by Form

Shaywitz DyslexiaScreen™	Sensitivity	Specificity	ROC Area
Form 0 (Kindergarten)	.73	.71	.81
Form 1 (Grade 1)	.70	.88	.89
Form 2 (Grade 2)	1.00	.75	.92
Form 3 (Grade 3)	.94	.82	.94

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Table 3.7 Forms 0 and 1 Correlations With WIAT®–III

	WIAT®–III			Shaywitz DyslexiaScreen™	
	Early Reading Skills	Word Reading	Pseudoword Decoding	Mean	*SD*
Shaywitz DyslexiaScreen™					
Form 0 (Kindergarten)	–.74	—	—	3.1	3.0
Form 1 (Grade 1)	—	–.56	–.56	3.4	3.5
WIAT®–III					
Mean	103.3	106.4	104.5		
SD	8.0	13.7	14.3		

Table 3.8 Forms 2 and 3 Correlations With WIAT®–III

	WIAT®–III						Shaywitz DyslexiaScreen™	
	Pseudoword Decoding	Oral Reading Fluency	Oral Reading Accuracy	Oral Reading Rate	Spelling	Dyslexia Index	Mean	*SD*
Shaywitz DyslexiaScreen™								
Form 2 (Grade 2)	–.55	–.70	–.63	–.65	–.80	–.70	3.4	3.7
Form 3 (Grade 3)	–.64	–.66	–.54	–.67	–.64	–.68	3.7	4.0
WIAT®–III								
Mean	101.4	101.3	102.5	101.1	101.3	101.3		
SD	15.6	16.7	15.6	15.6	13.7	15.7		


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