PROCESS ASSESSMENT OF THE LEARNER
pal-II™ User's Guide
Diagnostic Assessment for Reading, Writing, and Math

Diagnoses

Diagnosing Reading Problems

Differential Diagnosis of Specific Written Language Disabilities

Tier 3 Differential Diagnosis Based on Three Word Forms
For students whose development falls within the normal limits in the five developmental domains, three kinds of specific learning disabilities affecting written language have been identified: dysgraphia, dyslexia, and OWL LD. One research finding is that the nature of the specific written-language deficit is related to the coding operation (storage and processing for phonological, orthographic, and morphological word forms) that is impaired. Those with orthographic coding impairment only are likely to have dysgraphia (see Tier 3 Writing Assessment). Those with orthographic coding and phonological coding impairment are likely to have dyslexia. Those with impaired orthographic, phonological, and morphological/syntactic coding are likely to have OWL LD. See Figure 1. PAL–II assesses Phonological, Orthographic, and Morphological Coding.
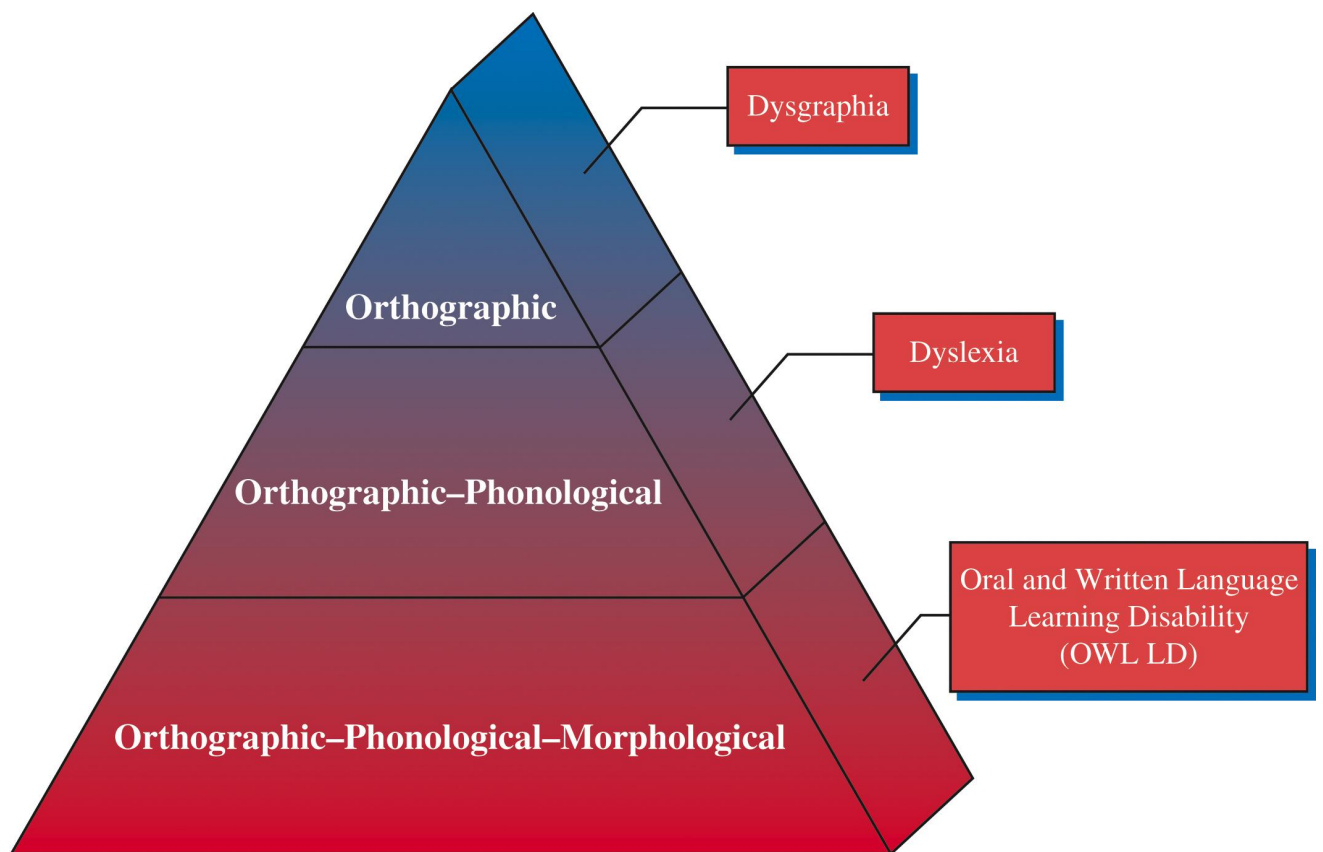

Figure 1   Predicting specific written language learning disabilities from the three word forms

Tier 3 Differential Diagnosis Based on a Working Memory Architecture

These word forms are coded into separate storage units in verbal working memory. However, in the process of learning to read, children create cross-code connections among these word forms two at a time (see overlap between each combination of two word forms in Figure 2) and three at a time (see central area of overlap in Figure 2). When these connections are well forged, the child then can rely on an autonomous orthographic lexicon for written words, which contributes to fluent reading and spelling (see central area of overlap in Figure 2). PAL–II Orthographic, Phonological, and Morphological Coding assess each of the word forms. PAL–II Word Choice assesses the autonomous orthographic lexicon.
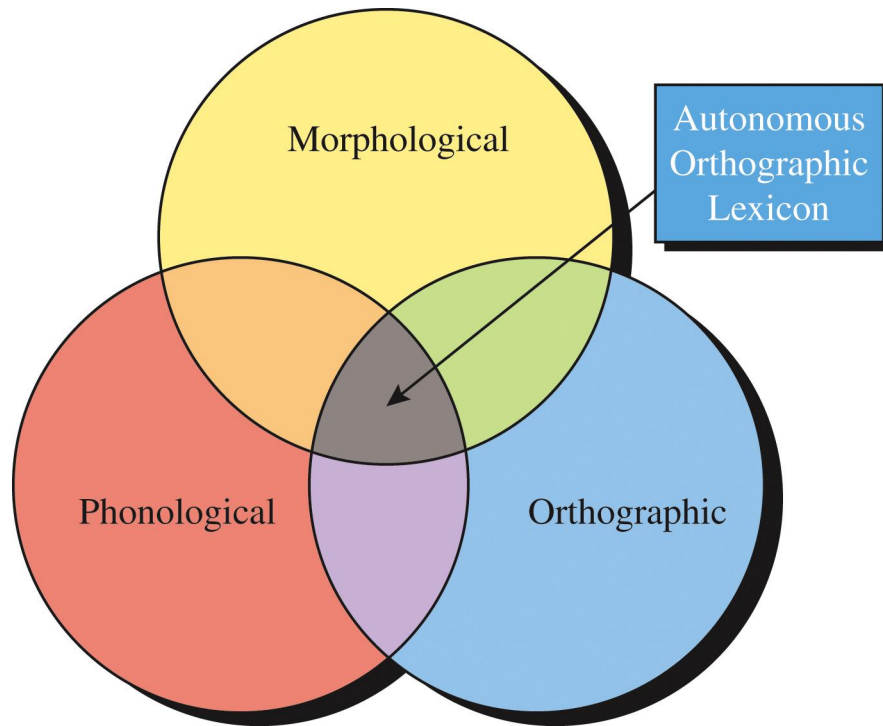
Figure 2   Creating interrelationships among the three word forms

Verbal working memory also has a time-sensitive phonological loop for regulating the cross-code mapping, especially the orthographic and phonological codes (see Figure 3). PAL–II RAN– Letters, –Letter Groups, and –Words assess the phonological loop.

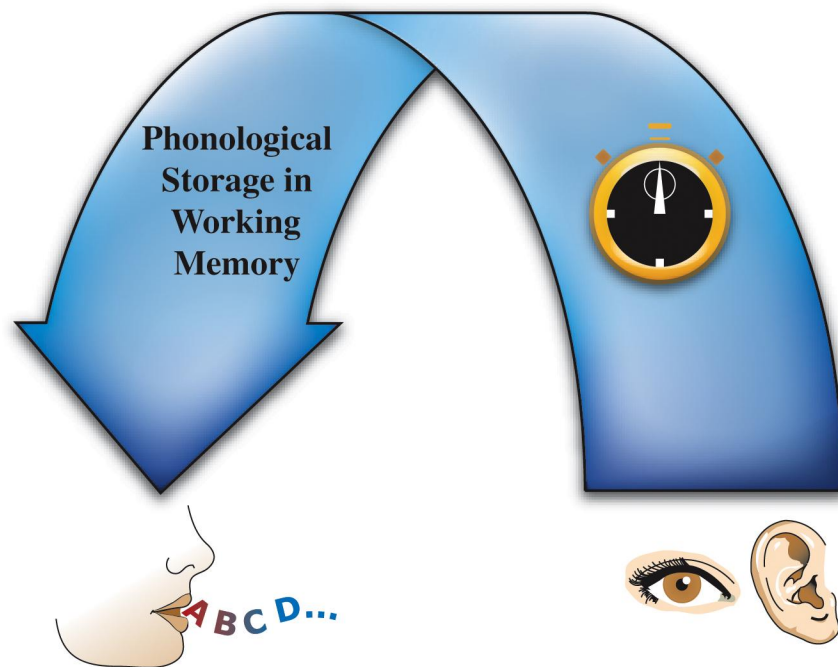Figure 3   The phonological loop

Verbal working memory also has a panel of supervisory executive functions that helps to manage and coordinate the various components of working memory: Switching Attention or Mental Set (Figure 4), Inhibition (Figure 5), and Self-Monitor and Update/Revise Working Memory (Figure 6).
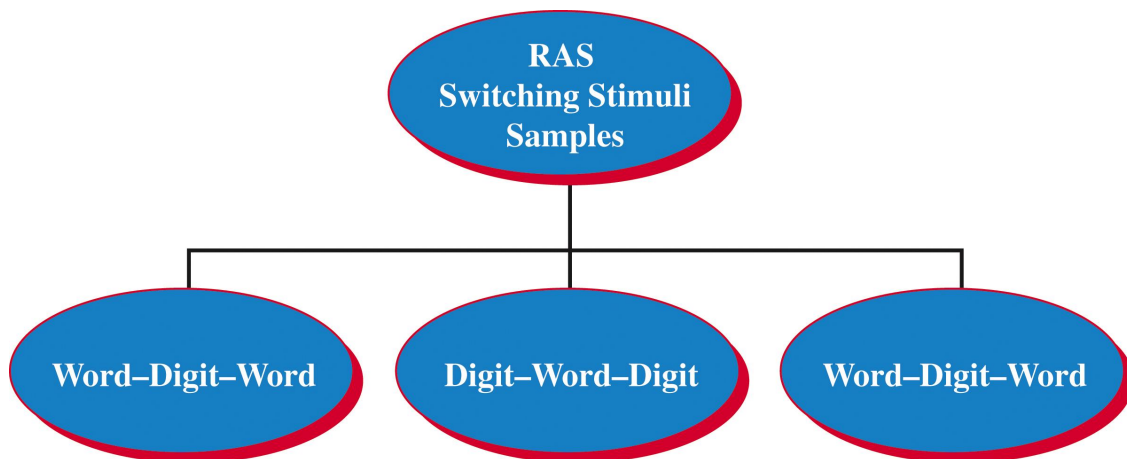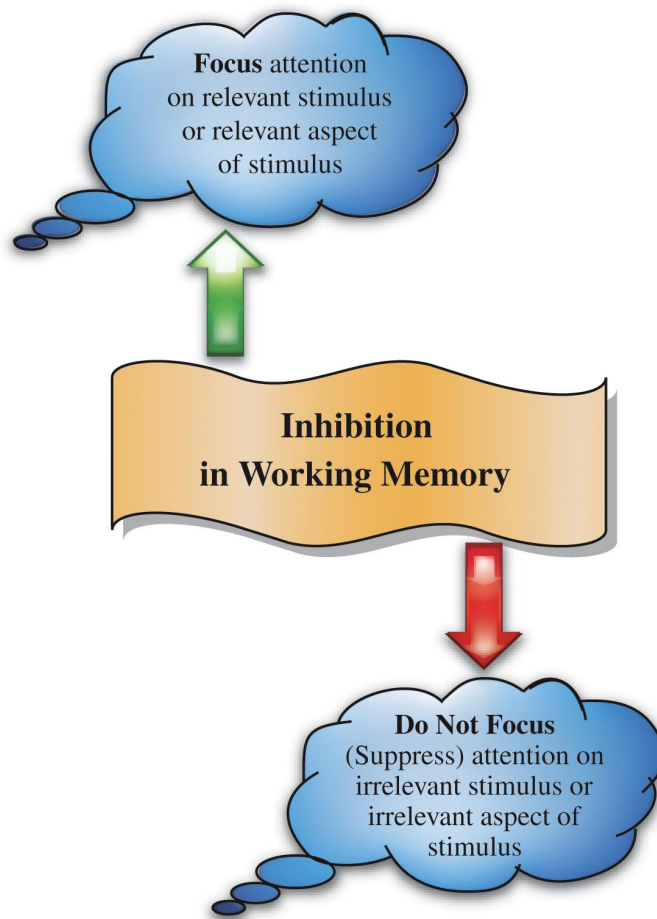

Figure 4   Switching attention or mental set

Figure 5   Inhibition in working memory

Self-Monitoring:

Review contents and/or
processing in
working memory

Updating and Revising:

Make changes in contents
and/or processing in
working memory
(based on Review during
Monitoring)
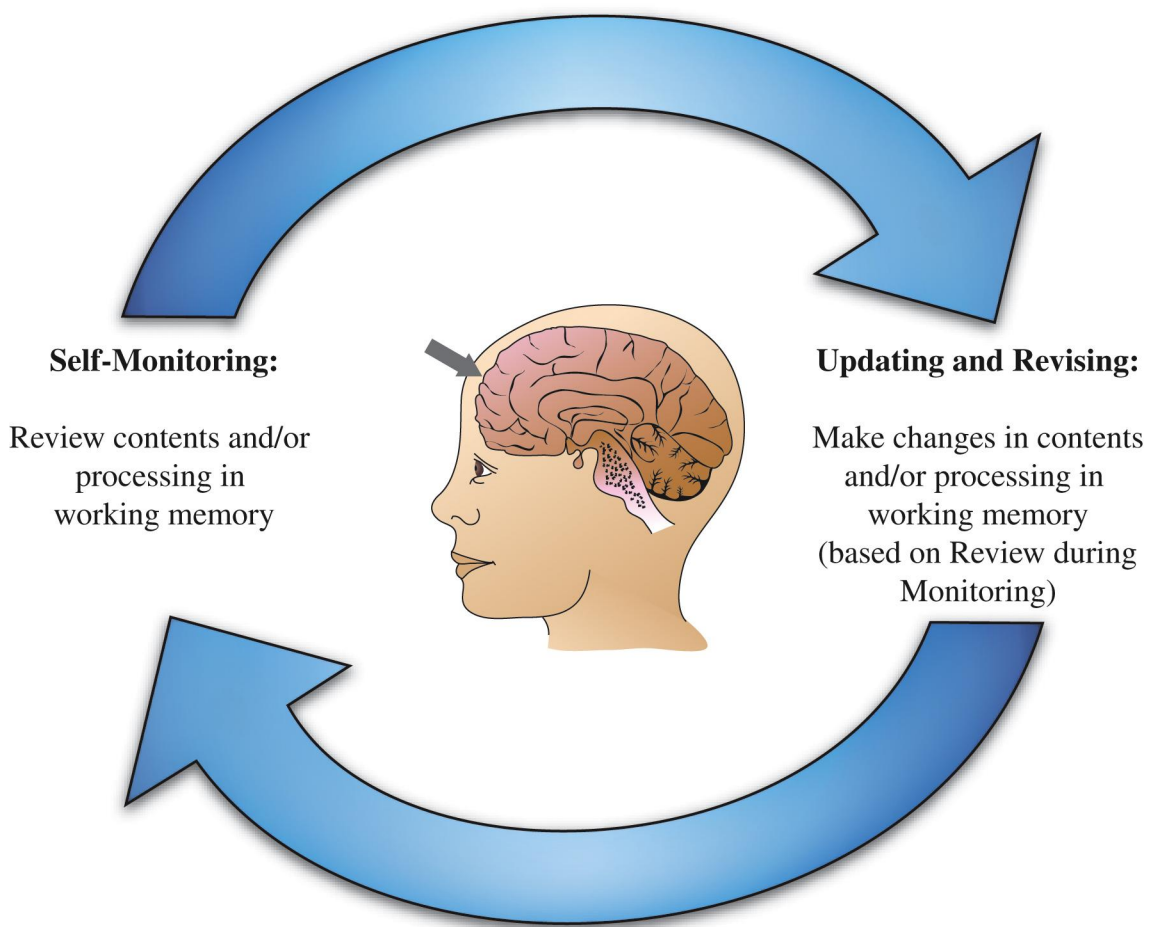
Figure 6   Self monitoring and updating/revising working memory

The Understanding Reading Disabilities within a Working Memory Architecture table provides additional information on how this working memory architecture (three word forms, time-sensitive phonological loop, and executive functions) informs reading disability. Difficulties in mapping the orthographic and phonological word forms (see Figure 2) contributes to problems in accuracy of beginning and developing word decoding and spelling. However, difficulties in coordinating all working memory components (storage, time-sensitive loop, and executive functions) in time contribute to fluency problems. Figure 7 provides another illustration of the working memory architecture that includes both a phonological loop that supports oral reading and an orthographic loop that supports writing language and writing math.
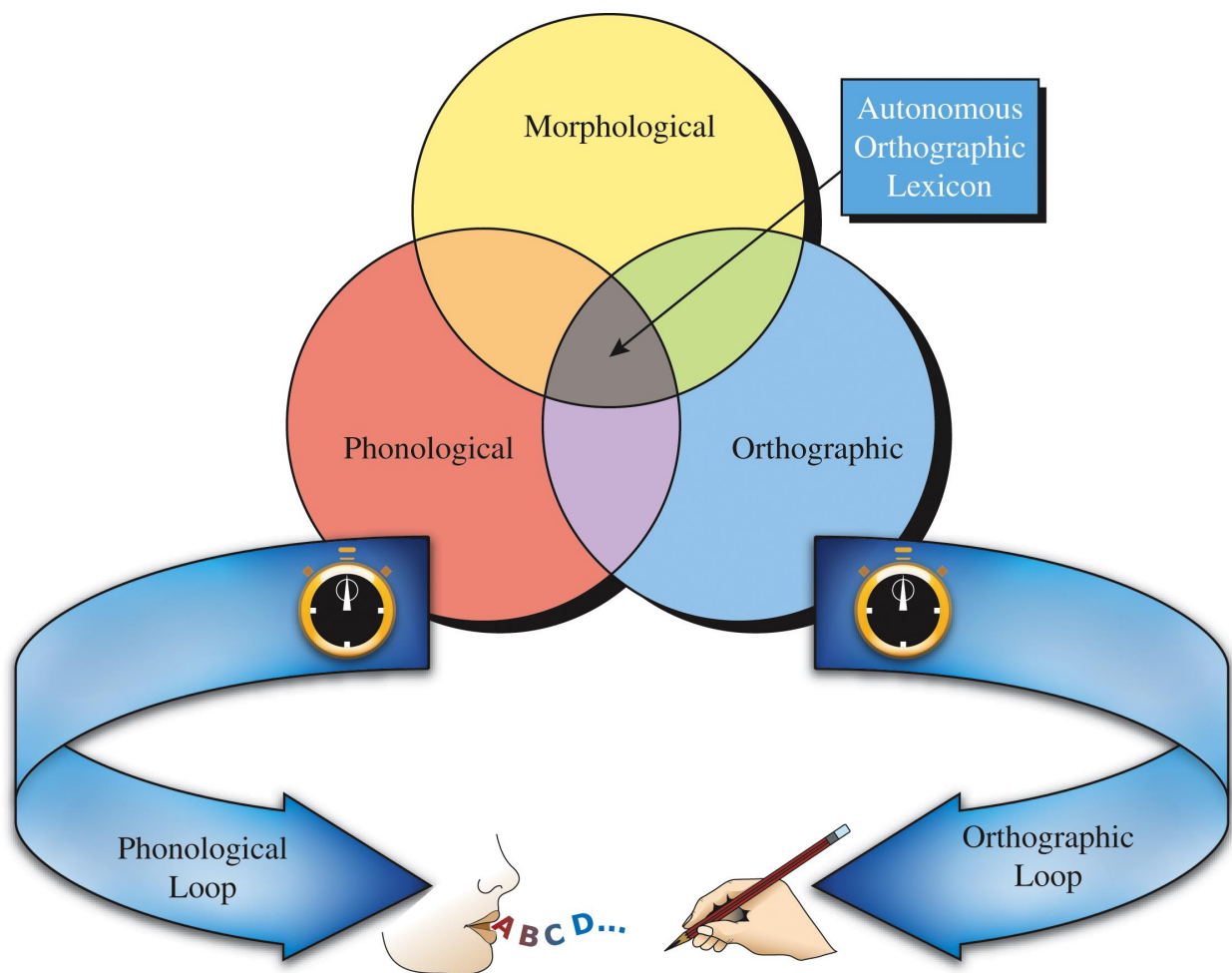
Figure 7   Working memory architecture

Other neuropsychological processes also need to be considered in understanding reading disabilities (see Understanding Reading Disabilities within a Working Memory Architecture). The oral reading of children with oral motor planning problems tends to be dysfluent. Touch sensation in the hands may be helpful to children with dyslexia in learning phonological decoding and spelling skills because brain regions for touch sensation and phonological processing are near each other. Higher-order executive functions and verbal reasoning play an important role in reading comprehension.

The skills shown in blue are the skills on which both children and adults with dyslexia tend to be impaired within the working memory architecture.

Understanding Reading Disabilities within a Working Memory Architecture

What is Working Memory: temporary storage and processing in the present that

- Stores current incoming information from environment in Short Term Memory
- Activates Past information in Long-Term Memory, and Anticipates Future through goals and plans
- **Phonological Word Forms and Parts (Storage System of Working Memory)**
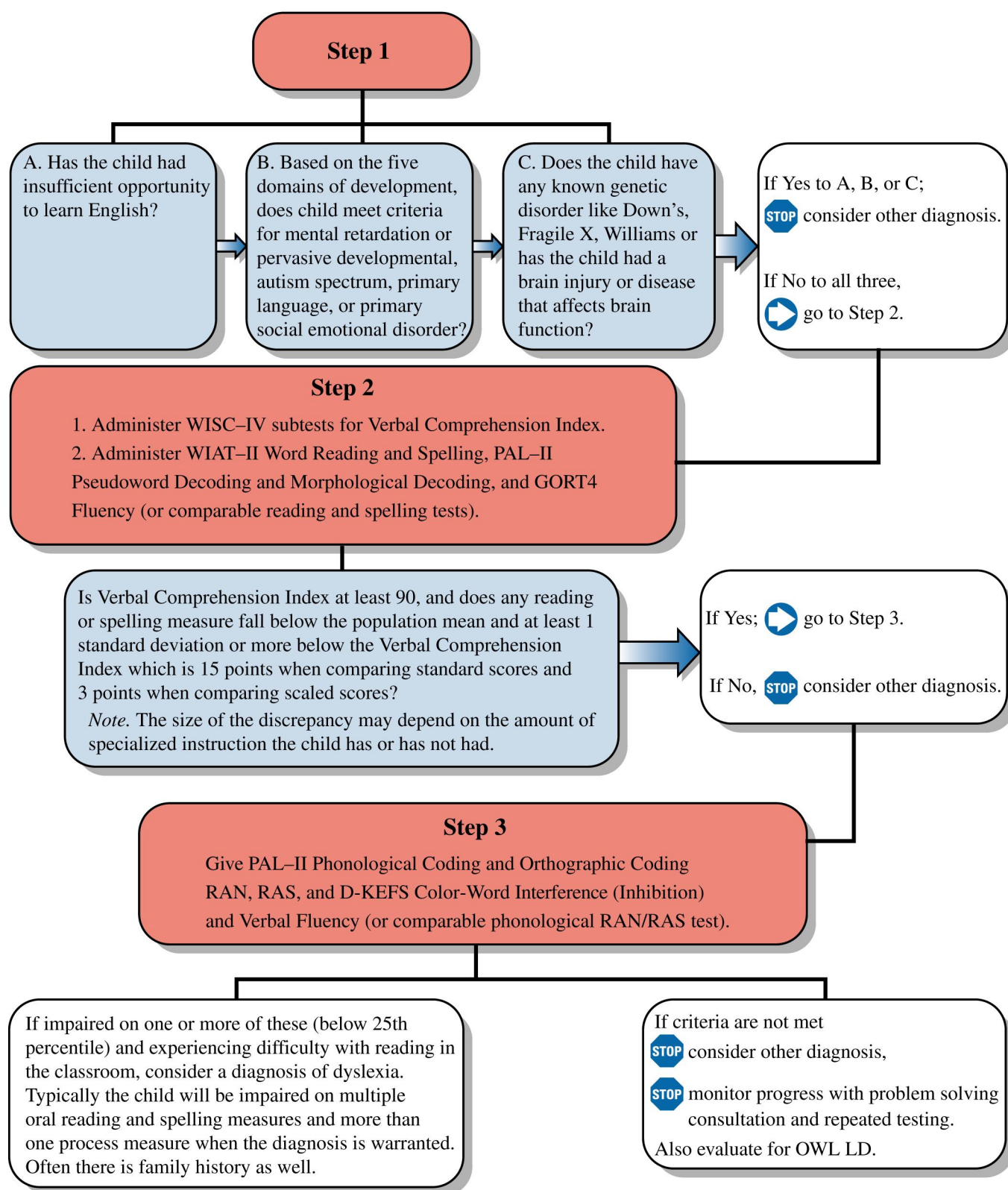- **Orthographic Word Forms and Parts (Storage System of Working Memory)**
- **Morphological Word Forms and Parts (Storage System of Working Memory)**
- **RAN for Letters (Phonological Loop of Working Memory)**
- Oral Motor Planning
- Finger Sense—Localization and Recognition (Somatosensory Sense)
- Lower Order Executive Functions (Central Executive of Working Memory)

   1. **Inhibition (Stroop Color Word Form)**
   2. **Mental Set Switching (RAS for Words and Double Digits)**
   3. Verbal Fluency (Automatic and Controlled Access to Memory)
   4. **Self-Monitoring and Updating Working Memory (Repetitions on Verbal Fluency)**

- Higher Order Executive Functions

   5. Planning (Setting Goals and Making Plans to Reach Goals) (Tower Tests)
   6. Organizing (Text Retells)
   7. Reviewing, Integrating Multiple Sources of Information, Executive Decision Making (Play Important Roles in Reading Comprehension)
   8. Revising Representations or Strategies

Differentiating Dyslexia and OWL LD

Dyslexia is a developmental disorder in individuals whose verbal comprehension (verbal cognition or verbal reasoning on tests administered aurally that require an oral response) falls at least within the lower limits of the average range and above (top 75% of the population). Their accuracy and/or rate of word reading, decoding, and oral passage reading and/or spelling fall below the population mean and at least one standard deviation below their verbal comprehension. Dyslexics tend to be impaired on multiple measures of oral reading and spelling during the school years. They have associated deficits in orthographic coding, phonological coding, RAN and or RAS, and executive functions (inhibition, switching mental set, and repetitions on verbal fluency tasks). Their morphological coding and syntax abilities tend to be near the population mean and generally do not fall outside the normal range. See diagnostic flow chart for diagnosing dyslexia.

Tier 3 Diagnostic Flow Chart for Dyslexia

Step 1

A. Has the child had insufficient opportunity to learn English?

B. Based on the five domains of development, does child meet criteria for mental retardation or pervasive developmental, autism spectrum, primary language, or primary social emotional disorder?

C. Does the child have any known genetic disorder like Down's, Fragile X, Williams or has the child had a brain injury or disease that affects brain function?

If Yes to A, B, or C; **STOP** consider other diagnosis.

If No to all three, ▷ go to Step 2.

Step 2

1. Administer WISC–IV subtests for Verbal Comprehension Index.
2. Administer WIAT–II Word Reading and Spelling, PAL–II Pseudoword Decoding and Morphological Decoding, and GORT4 Fluency (or comparable reading and spelling tests).

Is Verbal Comprehension Index at least 90, and does any reading or spelling measure fall below the population mean and at least 1 standard deviation or more below the Verbal Comprehension Index which is 15 points when comparing standard scores and 3 points when comparing scaled scores?

Note. The size of the discrepancy may depend on the amount of specialized instruction the child has or has not had.

If Yes; ▷ go to Step 3.

If No, **STOP** consider other diagnosis.

Step 3

Give PAL–II Phonological Coding and Orthographic Coding RAN, RAS, and D-KEFS Color-Word Interference (Inhibition) and Verbal Fluency (or comparable phonological RAN/RAS test).

If impaired on one or more of these (below 25th percentile) and experiencing difficulty with reading in the classroom, consider a diagnosis of dyslexia. Typically the child will be impaired on multiple oral reading and spelling measures and more than one process measure when the diagnosis is warranted. Often there is family history as well.

If criteria are not met
STOP consider other diagnosis,
STOP monitor progress with problem solving consultation and repeated testing.
Also evaluate for OWL LD.

The reading and spelling problems of the children with dyslexia are unexpected for their level of verbal intelligence, listening comprehension, and morphological and syntactic awareness. Dyslexia has been shown by many research studies to be of neurobiological origin and is not a disorder that affects only white middle-class children. Some children who are adopted or are immigrants and learn English as a second language also show the classic signs of dyslexia. Research has shown that they respond to the same reading interventions as children whose first language is English. See Dyslexics Can Learn to Read and Write and Teachers can Teach Them for the persisting hallmark features of dyslexia in children and adults, and the Recommended Resources section for suggested readings about reading disabilities in children whose first language is not English. Dyslexia also occurs in many families with low incomes and not only in those who are affluent.

OWL LD is a disorder in individuals who do not have primary language disability but whose
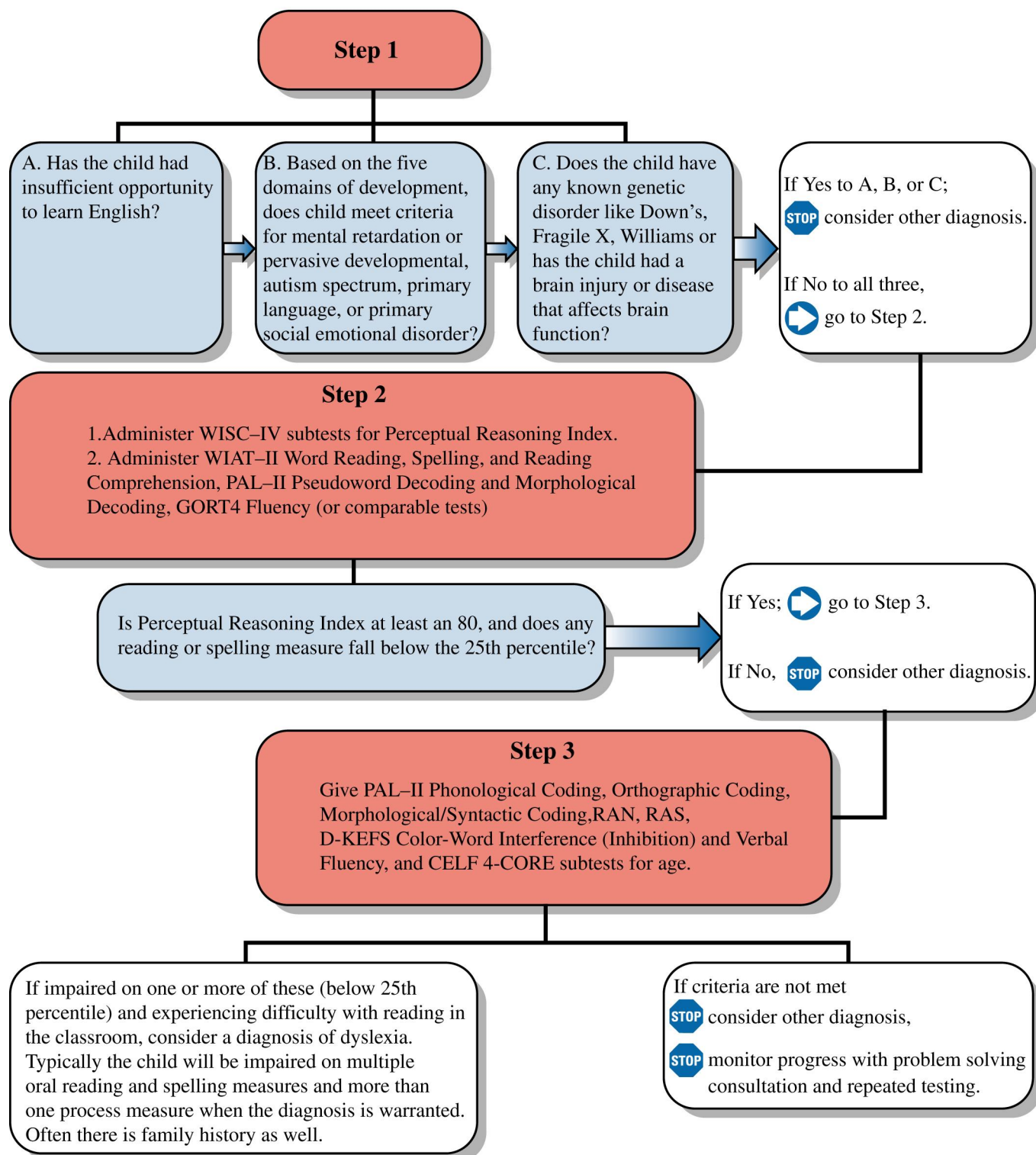
- Nonverbal reasoning or cognition falls at least within the lower limits of the low average range

- Verbal comprehension, morphological coding, and syntax skills may fall below and often significantly below the 25th percentile (lower limit of the average range)

Children with OWL LD have selective receptive and expressive rather than primary language disability—not all of their language skills fall 2 standard deviations below the mean. Children with OWL LD differ from children with dyslexia in the morphological word form storage and syntax storage for accumulating word units in working memory (see Figure 2), which are less well developed in OWL LD than in dyslexia. Both children with dyslexia and children with OWL LD may be impaired in the other components of working memory—phonology, orthography, time-sensitive phonological loop, and executive functions.

Typically children with OWL LD do not show discrepancy between Verbal Comprehension Index or even Full Scale IQ as those with dyslexia do. That is because they have residual problems in oral language and using language to learn that often go undetected by school professionals. Because some do show discrepancy, it is a good idea to check when a child might meet criteria for OWL LD as well as dyslexia. Children with OWL LD who are impaired in both oral and written language tend to be impaired in listening and reading comprehension as well as accuracy and rate of word reading and decoding and oral passage reading and spelling.

Children with OWL LD often experience delays with word combinations or sentences in the preschool years but their oral language problems resolve to the point where they do not qualify for language services during the school years. However, they may have significant problems in using language out of conversational context to learn academic subjects and understand teachers' instructional talk. They often have word retrieval problems from long-term memory as assessed on verbal fluency measures. In Understanding Reading Disabilities within a Working Memory Architecture table, Verbal Fluency does not appear in blue because children with dyslexia tended to be impaired only on the Repetitions score on Verbal Fluency (an index of ability to self-monitor and update working memory) but children with OWL LD are often significantly impaired in total score on Verbal Fluency, (an index of automatic access to or controlled search for words in long-term memory). Because of the subtle but significant language problems of children with OWL LD, they are at risk for behavioral problems as well as reading problems. Language is a code that typically developing children use to self-regulate behavior as well as learning. Any child who is referred for behavioral problems should also be assessed for OWL LD.

Tier 3 Diagnostic Flow Chart for Oral and Written Language Learning Disability (OWL LD)

Step 1

A. Has the child had insufficient opportunity to learn English?

B. Based on the five domains of development, does child meet criteria for mental retardation or pervasive developmental, autism spectrum, primary language, or primary social emotional disorder?

C. Does the child have any known genetic disorder like Down's, Fragile X, Williams or has the child had a brain injury or disease that affects brain function?

If Yes to A, B, or C; **STOP** consider other diagnosis.

If No to all three, ➡ go to Step 2.

Step 2

1. Administer WISC–IV subtests for Perceptual Reasoning Index.
2. Administer WIAT–II Word Reading, Spelling, and Reading Comprehension, PAL–II Pseudoword Decoding and Morphological Decoding, GORT4 Fluency (or comparable tests)

Is Perceptual Reasoning Index at least an 80, and does any reading or spelling measure fall below the 25th percentile?

If Yes; ➡ go to Step 3.

If No, **STOP** consider other diagnosis.

Step 3

Give PAL–II Phonological Coding, Orthographic Coding, Morphological/Syntactic Coding, RAN, RAS, D-KEFS Color-Word Interference (Inhibition) and Verbal Fluency, and CELF 4-CORE subtests for age.

If impaired on one or more of these (below 25th percentile) and experiencing difficulty with reading in the classroom, consider a diagnosis of dyslexia. Typically the child will be impaired on multiple oral reading and spelling measures and more than one process measure when the diagnosis is warranted. Often there is family history as well.

If criteria are not met
STOP consider other diagnosis,
STOP monitor progress with problem solving consultation and repeated testing.

PAL–II Diagnostic Thinking for Identifying Dyslexia or Oral or Written Language Learning Disability (OWL LD)

Client's name:_____ Date of assessment: _____

Child's date of birth:_____ Examiner's name:_____

Enter standard scores and percentiles.

I. Assessment of Domains of Development

Domain	Indicate name of test, subtest, and/or level
Cognitive and Memory	
• Cognitive	☐ **WAIS–III**
	☐ **WISC–IV**
	☐ WISC–IV Verbal Comprehension Index _____
	☐ WISC–IV Perceptual Reasoning Index _____
Oral Language	
• Oral Language Mode Receptive and Expressive **• Levels of Oral Language**	**CELF–4** ☐ Receptive (Aural) Core _____ ☐ Expressive (Oral) Language Core _____ Circle the developmental levels: 5–8 9–12 13–16
Word/Semantics	☐ Expressive Vocabulary Confrontational Naming _____
	☐ Semantic Relationships _____
Syntax	☐ Concepts and Following Directions _____
	☐ Word Structure _____
	☐ Recalling Sentences _____
	☐ Formulated Sentences _____
	☐ Sentence Assembly _____
Discourse	☐ Understanding Spoken Paragraphs compared to WIAT–II Reading Comprehension _____
Gross and Fine Motor	
Sensory Screening	☐ **Movement ABC–2 Parent Checklist** _____
Attention and Executive Function	
(List scales in clinical	☐ **Brown Attention-Deficit Disorder Scales for Children and Adolescents**

Domain	Indicate name of test, subtest, and/or level
range)	_____ □ **BRIEF** _____
Social and Emotional	
(Note any results in clinical range)	□ **BASC–2** □ **Narrow band measures of depression, anxiety, etc.** □ **CARS** □ **GARS**
Adaptive Functioning	
(Give if intellectual disability or pervasive developmental disorder suspected)	□ **ABAS–II** _____

II. Current Levels of Academic Functioning for Comprehensive Reading Assessment

Skill	Indicate name of test, subtest, and/or level
Reading	
• Accuracy of word reading on a list	□ WIAT–II Word Reading _____ □ PAL–II Find the True Fixes _____
• Accuracy of pseudoword reading on a list	□ WIAT–II Pseudoword Reading _____ □ PAL–II Pseudoword Decoding _____
• Rate of word reading on a list	□ TOWRE Sight Word Efficiency _____ □ PAL–II Morphological Decoding _____
• Rate of pseudoword reading on a list	□ TOWRE Phonemic Efficiency _____ □ PAL–II Pseudoword Decoding _____
• Accuracy of oral reading of passages	□ GORT–4 _____
• Time and fluency for oral reading of passages	□ GORT–4 _____
• Silent reading fluency	□ PAL–II Sentence Sense _____
• Reading comprehension	□ WIAT–II Reading Comprehension _____
Writing Skills That May Affect Reading Skills	
• Legible handwriting	□ PAL–II Handwriting _____ Alphabet Writing _____

Skill	Indicate name of test, subtest, and/or level
• Legible and automatic handwriting	Task A–Sentence Copying _____ Task B–Paragraph Copying _____ Handwriting Legibility Composite _____ □ PAL–II Handwriting _____ Alphabet Writing _____ Task A–Sentence Copying _____ Task B–Paragraph Copying _____ Handwriting Legibility Composite _____
• Phonological spelling	□ WJ III Spell Sounds _____
• Orthographic spelling	□ PAL–II Word Choice _____
• Morphological decoding/spelling	□ PAL–II Find the True Fixes _____
• Composing fluency	□ PAL–II Narrative Compositional Fluency _____
• Composing quality	□ PAL–II Expository Note Taking _____ □ PAL–II Expository Report Writing _____

Note. If these score are very low, comprehensive assessment of writing may be in order.

Math Skills That May Affect Reading Skills	
• Numeral writing	□ PAL–II Numeral Writing _____ □ PAL–II Part-Whole Time _____
• Math fact retrieval (accuracy and rate)	□ PAL–II Math Fact Retrieval Fluency _____ (three tasks for addition, subtraction, and mixed addition and subtraction and three tasks for multiplication, division, and mixed multiplication and division for each of two input-output combinations: Look and Write and Listen and Say)
• Math computations	□ PAL–II Computation Operations _____
• Math problem solving	□ PAL–II Multi-Step Problem Solving _____

Note. If these score are very low, comprehensive assessment of math may be in order.

III. Neuropsychological Processes for Comprehensive Assessment of Reading

Skill	Indicate name of test, subtest, and/or level
Reading	
• Phonological	□ PAL–II Rhyming □ PAL–II Syllables □ PAL–II Phonemes □ PAL–II Rimes

Skill	Indicate name of test, subtest, and/or level
• Orthographic	□ PAL–II Receptive Coding
	□ PAL–II Expressive Coding
• Morphological/ syntactic	□ PAL–II Are They Related?
	□ PAL–II Does It Fit?
	□ PAL–II Sentence Structure
• RAN	□ PAL–II RAN–Letters
	□ PAL–II RAN–Letter Groups
	□ PAL–II RAN–Words
• Oral and Grapho Motor	□ PAL–II Oral Motor Planning
	□ PAL–II Finger Localization
	□ PAL–II Finger Recognition
• Executive Function	□ D-KEFS
	□ Color Word Interference—Inhibition
	□ Verbal Fluency—Repetition
	□ PAL–II RAS
• Working Memory	□ PAL–II Verbal Working Memory–Words
	□ PAL–II Verbal Working Memory–Sentences: Listening and Sentences: Writing
	□ PAL–II Total Verbal Working Memory Composite
	□ WISC–IV Working Memory Index
• Reasoning specific to academic domain	(See cognitive domain)

Summary of Record Review: Medical, Developmental, Educational, and Family History

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Diagnosis based on diagnostic flow chart

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