

Language, Literacy and Executive Functions

Elisabeth H. Wiig, Ph.D.

Ohio Speech-Language-Hearing Association

2009 ANNUAL CONFERENCE

MARCH 7, 2009

COLUMBUS, OHIO

A Clinical Assessment Process

- 1. Is there a language disorder?
Score*
Total language or Core Language
- 2. What is the nature of the disorder?
Scores*
**Receptive and Expressive
Listening and Speaking
Reading and Writing
Syntax, Morphology,
Semantics, Pragmatics
Language and Memory**
Language Composite or Index
 - **Modality based**
 - **Educationally based**
 - **Linguistically based**
 - **Language & memory interfaces**
- 3. What are the language weaknesses?
What are the language strengths?*
Profiling
Significance of discrepancies

Language Disorder Case Study: Executive Functions

This student ...

has problems **paying attention**
doesn't **focus** on what's going on in class
has difficulty **following directions**
has problems **remembering** things in class
has **difficulty complying** with my requests
loses things
has trouble **sequencing** things in proper order
writes in a **sloppy or disorganized** manner
does work in a **disorganized** way
does **not** come to class **prepared**
seems lost or **confused** in school
makes the **same mistakes** over and over again
doesn't ask for help when it's necessary
distracts the class
exhibits **emotional outbursts**
is **not interested** in classroom activities
needs to be in control
is impulsive
needs to be the **center of attention**

Executive Functions

Attention

Memory

Organization

Monitoring

Behavioral Regulation

A Norm-Referenced/Clinical Perspective

Question 1. *Is there evidence of a language disorder?*

Total Language, Receptive or Expressive (Modalities)

Question 2. *What is the nature of the disorder?*

Language Strengths and Weaknesses (Content)

Syntax, Morphology, Semantics, Language & Memory

Question 3. *How does this student's performance compare with that of his/her peers?*

Educational level of performance compared to age/grade peers

Question 4. *Does the student's clinical performance profile meet criteria for eligibility for speech and language services?*

A Neuropsychological/Brain-Behavior Perspective

Question 1. *What evidence is there of co-morbidities?*

Developmental and medical history

Reasons for referral

Behavioral indicators

Question 2. *What critical neuropsychological behaviors underlie the disorder?*

Attention/hyperactivity, auditory processing, dysnomia, cognitive, memory deficits, etc.

Question 3. *Which neuropsychological functions are involved?*

Executive functions, visual spatial, motor, processing speed, verbal automaticity, etc.

Question 4. *Which neuro-psychological functions represent strengths?*

An Educational Perspective

Question 1. *Which aspects of communication in context are compromised?*

Verbal pragmatics

Nonverbal communication

Question 2. *Which aspects of academic performance are compromised?*

Listening, speaking, reading, writing, mathematics

Question 3. *Which curriculum and learning objectives are compromised?*

English and language arts, social studies, natural/physical sciences, arithmetic, algebra, physical education, arts

Questions 4. *Which areas of performance represent communication strengths?*

A Social Perspective

Question 1. *Which aspects of social communication are compromised?*

**Verbal pragmatics - perspective taking
Nonverbal communication**

Question 2. *Which aspects of peer relations are compromised?*

**Play or game activities, friendship, interactive sharing or
participating in conversations or discussions**

Question 3. *Which aspects of student-adult relationships are compromised?*

**Respect, following directions for activities, behavioral
management, mutual respect, trust etc.**

Questions 4. *Which areas of social communication represent strengths?*

Executive Functions

Behavioral Regulation
Inhibition of prepotent cognitive and emotional responses (medial prefrontal region).
(Barkley, Brown, Denckla, Lezak, Pennington)

Initiation of Action

Readiness to start an intended action (mediated by medial frontal lobe).

Planning and Organization

Sequencing and prioritizing, categorizing and developing options (dorso-lateral prefrontal lobe).

Executive Functions

Monitoring

External monitoring to capture errors and evaluate corrections

Responding to Feedback and Shifting
(mediated by orbital prefrontal regions) (Barkley, Brown, Lezak, Lyon & Krasnegor)

Working Memory
Explicit working memory for novel stimuli and conscious processing (orbital prefrontal cortices).
Implicit working memory for familiar and visual stimuli (posterior cortices and left parietal lobe).
Interacts with selective attention (Goldman-Rakich, Shallice, Tulving, Furey, deSimone)

What is processing-speed?

Processing speed is a general term that refers to the rate/speed with which an individual can react and respond to auditory, visual or other input.

Processing speed deficits can affect the auditory and visual domains and are associated with language disorders, reading disabilities/dyslexia, psychiatric disorders and dementia.

Processing speed can be perceptual or cognitive in nature.

***Perceptual speed* measures account for reaction + response time.**

When do we need adequate or rapid processing speed in daily life?

An easy answer would be to say “ALWAYS,” but here are some specific examples:

Child Care – consider being all eyes and ears on a playground.

Reading – consider scanning to decode while processing to interpret.

Driving – consider focusing and responding rapidly to changing traffic patterns during rush hour

Piloting – consider shifting attention to multiple visual panels while making decisions.

Is processing speed related to attention?

There is relationship with interactive components that form the functional system involved in executive attention.

Sustained attention maintains attention over time and is controlled by the reticular formation, brain stem and frontal regions.

Selective attention maintains ability to focus on a stimulus in presence of distracters and is mediated by temporal, parietal and striatal regions of the brain.

Response inhibition, divided attention and shifting attention have been linked to mediation by the frontal regions, as has processing speed.

Are processing speed and working memory related?

Working memory is a neural activation resource with limited capacity and duration.

It holds information in mind, as in a buffer store, while processing, interpreting, or responding to input or information.

It contains distinct subsystems: a phonological loop, a visual-spatial sketchpad and a modality free central executive.

The phonological loop activates verbal information in memory, important for the acquisition of content and structure

What is the evidence of developmental relationships?

There is evidence of developmental relationships between working memory and inhibitory control, general-purpose functions that guide complex cognition and behavior (Roncadin, Pascual-Leone, Rich & Dennis, 2007).

Dual-task efficiency (cognitive speed) correlates positively with working memory activation in children ages 6 through 11 years.

In contrast, working memory correlates with inhibition efficiency in children ages 12 through 17.

When in the child's life can we observe increases in processing speed?

In infancy between 5 and 36 mos. of age.

Developmental studies of visual processing speed (attention and habituation) show similar developmental patterns, but higher levels of performance in full-term than in pre-term infants (Rose, Feldman & Jankowski, 2002).

A longitudinal study of habituation in infants at 40 months and at 4 years of age indicates a small significant, indirect effect of early habituation efficiency (visual processing) on full-scale intelligence (Bornstein, Hahn, Bell et al., 2006).

What happens to processing speed during the school years?

Processing speed differentiates pre-school and school-age children with normal language development from those with language disorders.

Both groups show similar, linear patterns of increase in visual-processing and naming speed (decreased naming time) between ages 5-6 and 15-16 years.

Of the children with significant cognitive speed deficits, about half had a severe language disorder with total language scores below 70.

What happens to processing speed as we age?

In normal adolescents and adults, cognitive speed, measured by naming repeated color-form combinations, slows on average by 10 sec. between ages 15 and 95.

The slowing of cognitive speed with age is linear and amounts to 1 sec. per decade up to age 55 and 1 sec. per 7 years until age 95.

Cognitive speed is significantly reduced in MCI, Alzheimer's disease (AD) and dementia with Lewy bodies (DLB).

Which conditions are associated with reduced processing speed?

- **Severe receptive-expressive language disorders.**
- **SLI and primarily expressive language disorders.**
- **Dyslexia/reading disabilities.**
- **Executive function disorders:**
 - Tourette spectrum syndrome**
 - Attention deficit hyperactivity disorder (ADHD)**
 - Mood disorders (e.g., depression)**
- **Traumatic brain injury (TBI) or stroke (CVA)**
- **Dementia**
 - Frontal-lobe dementia**
 - Alzheimer's disease (AD)**
 - Dementia with Lewy bodies (DLB)**

Why would SLPs assess processing speed?

Deficits in processing speed are predictors of ...
specific language impairments (SLI)
reading disabilities, including dyslexia
attention deficit hyperactivity disorders
(ADHD)
generalized executive function disorders
mild cognitive impairment (MCI)
dementia (AD)

Executive function disorders may require medication as in

the management of ADHD, Tourette, mood disorders and dementia of the Alzheimer's

How are processing-speed tests designed?

Processing-speed tests require rapid, sustained responses to a series of single- or dual-dimension visual stimuli.

The total time (sec.) used to complete the task is measured objectively and is the measure of performance.

Processing speed for single-dimension stimuli measures reaction + response time (perceptual speed).

Processing speed for dual-dimension stimuli measures perceptual speed + cognitive overhead from demands on attention, working memory, inhibition or set-shifting (cognitive speed).

The *Stroop Color-Word Test, AQT, RAN-RAS, and Trail-Making Test* are standardized perceptual- and cognitive-processing speed tests. The cognitive overhead varies as a function of the design, task demands and required responses.



ELLA Rapid Naming (Wiig & Secord, 2006)

- **Continuous rapid naming (RAN) of single-dimension stimuli (colors and objects) measures perceptual speed (i.e., reaction + response time) for highly familiar stimuli.**
- **Rapid naming of alternating stimuli (i.e., repeated color and object sequences) measures cognitive speed (i.e., perceptual speed + cognitive overhead --- visual working memory and set shifting).**
- **Allow identification of students at risk for reading failure/dyslexia.**
- **Naming times are converted to criterion-referenced scores by age/grade.**
- **Presumably involves mediation by activation of the temporal-parietal lobe.**



RAN/RAS (Wolf & Denckla, 2005)

- **Continuous rapid naming (RAN) of single-dimension stimuli (letters, numbers, colors and objects) measures perceptual speed (i.e., reaction + response time) for highly familiar stimuli.**
- **Rapid alternating stimuli (RAS) of (a) letters and numbers, and (b) letters, numbers and colors measure cognitive speed (i.e., perceptual speed + cognitive overhead --- visual working memory and set shifting).**
- **Allow identification of students at risk for reading failure/dyslexia.**
- **Naming times are converted to percentiles, standard scores and age and grade equivalents.**
- **Presumably involves mediation by activation of the angular gyrus.**



CELF-4. Rapid Automatic Naming (RAN)

- **Continuous rapid naming of dual-dimension visual stimuli (e.g., color-form combinations) requires control of attention, working memory and set shifting.**
- **Attention is controlled and divided in proportion to:**
 - (1) The degree of automaticity and available working memory resources**
 - (2) Resource allocation and requirements for cognitive/set switching**
 - (3) Structural factors in the input (e. g., single- versus dual-dimension visual stimuli)**
 - (4) Degree of similarity and possible confusion**

Word Association Tests

CELF-4 Word Associations

Requires retrieval and naming of members of the semantic categories: Animals, foods, and jobs/occupations. Subtest is supplemental and criterion-referenced

Emergent Literacy and Language Assessment (ELLA)

Requires retrieval and naming of members of the semantic categories: Snacks, classroom things, words beginning with “m,” and words beginning with “s”

Verbal Fluency Test (FAS)

Requires identification, retrieval and naming of words that begin with the same sounds (F - A - S).

Executive functions evaluated, among them explicit/conscious, verbal working memory, are mediated by orbito-frontal lobe activation.

CELF-4 Memory Index

Number Repetition 1 (Ages 5-16)

Eight digit forward items (2 sequences each); length: 2-9 digits.

Eight digit backward items (2 sequences each); length: 2-8 digits.

Number Repetition 2 (Ages 17-21)

Eight digit forward items (2 sequences each); length: 2-9 digits.

Eight digit backward items (2 sequences each); length: 2-8 digits.

Familiar Sequences 1.

Number sequences (counting forward and backward); days of the week; months of the year (forward and backward); alternating alphanumerical counting (e.g., A1, B2, etc.).

Familiar Sequences 2.

Number sequences (counting forward and backward); days of the week; months of the year (forward and backward; alternating numerical/day of the week (e.g., 0/Sun, 6/Mon, 12/Tues, etc.).

Observational Rating Scales

CELF-4

Content

- **40 statements describe problems a student may have in listening, speaking, reading, and writing**
- **Uses negatively stated queries about observable behaviors (e.g., has difficulties)**
- **Rated on a 4-point frequency of occurrence scale (1=Never, 2=Sometimes, 3=Often, 4=Always)**
- **Separate ratings by teachers and parents**

Standard Scores and Educational Performance Ranges

Above Educational Average

Standard score 115 and above (+1 SD)

Average Educational Range

Standard score 86 to 114 (within +/-1 SD)

Marginal Educational Range

Standard score 79 to 85 (within -1 to -1.5 SD)

Low Educational Range

Standard score 71 to 78 (within -1.5 to -2 SD)

Very Low Educational Range

Standard score 70 and below (-2 SD)

Case Study 1 Female (6 yrs. 8 mo.)

Test of Language Development-Primary (TOLD-P-3)

<u>Subtest Performance:</u>	<u>Standard Scores</u>		<u>Subtest Variation</u>
------------------------------------	-------------------------------	--	---------------------------------

Picture Vocabulary	8		+2
Relational Vocabulary	7		+1
Oral Vocabulary	7		+1
Grammatical Understanding	6		0
Sentence Imitation	3		-3 (-)
Grammatical Completion		5	-1

Mean of Subtest Standard Scores: $36/6 = 6$

***Case Study 1* Female (6 yrs. 8 mo.)**

TOLD-P-3 Composite Scores	<u>(90%) Level of Confidence</u>	
Listening Quotient	82 \pm 7	(75 to 89)
Spoken Language Quotient	72 \pm 5	(67 to 77)
Semantic Quotient	83 \pm 7	(78 to 90)
Syntactic Quotient	66 \pm 6	(60 to 72)
Listening Quotient	82 \pm 7	(75 to 89)
Organizing Quotient	70 \pm 7	(63 to 77)
Speaking Quotient	76 \pm 7	(69 to 83)
Organizing Quotient	70 \pm 7	(63 to 77)

Case Study 1 Female (6 yrs. 8 mo.)

Clinical Evaluation of Language Fundamentals–4 (CELF-4)

<u>CELF-4 Subtests:</u>	<u>Standard Score</u>	<u>Subtest Variation</u>	
Concepts & Directions	10	+4	(+)
Word Structure	5	-1	
Recalling Sentences	3	-3	(-)
Formulated Sentences	3	-3	(-)
Sentence Structure	9	+3	(+)
Word Classes – Receptive	8	+2	
Word Classes – Total	7	+1	
Expressive Vocabulary	7	+1	

Mean of Subtest Standard Scores: $49/8 = 6.12$ or 6

Case Study 1 Female (6 yrs. 8 mo.)

***CELF-4* Composite/Index (90%) Level of Confidence**

Core Language Score 67 \pm 4 (63-71)

Receptive Language Index 94 \pm 7 (87-101)

Expressive Language Index 61 \pm 5 (56 -66)

Language Content Index 88 \pm 5 (83-93)

Language Structure Index 70 \pm 5 (65-75)

Case Study 1 Female (6 yrs. 8 mo.)

WISC-IV Index Scores **(90%) Level of Confidence**

Verbal Comprehension **95 ± 5 (90-100)**

Perceptual Reasoning **94 ± 6 (88-100)**

Working Memory **72 ± 8 (64-80)**

Processing Speed **97 ± 7 (90-104)**

Case Study 1 Female (6 yrs. 8 mo.)

CELF- IV Level 3. Criterion/Norm Referenced Scores

Phonological Awareness	56	(>46)
Word Associations	22	(>18)
Rapid Automatic Naming	142 sec	(<120 sec.)
Working Memory Index	72 (+/-7 at 90%)	3rd%

There is evidence of deficits in attention, working memory, processing speed and verbal automaticity.

CELF-IV Level 4. Behavioral Ratings

Pragmatics Profile	172 (>125)
--------------------	------------

The expressive, linguistic structure, working memory and verbal automaticity deficits do not appear to carry over to communication in context.

CELF-4 Case Study 1 Summary

The Core Language score (67) is in the very low educational range and supports eligibility for services.

The Receptive score (94) is in the average educational range and the Expressive score (61) in the very low educational range, indicating a severe expressive language disorder.

Language Content (84) is in the marginal educational performance range and Language Structure score (70) in the very low educational range.

RAN color-form time was 142 seconds and in the slower-than-normal range, indicating a cognitive speed (attention, visual working memory, set shifting) and verbal automaticity deficit.

The Working Memory Index (72) is in the low to very low educational range.

The Pragmatics score (172) is well above criterion.

Case Study 2 Male (13 yrs. 8 mo.)

Clinical Evaluation of Language Fundamentals-4 (CELF-4)

<u>CELF-4 Subtests:</u>	<u>Standard Score</u>	<u>Subtest Variation</u>	
Recalling Sentences	3	-3	(-)
Formulated Sentences	4	-2	
Word Classes – Total	7	+1	
Word Classes – Receptive	9	+3	(+)
Word Classes - Expressive	5	-1	
Word Definitions	7	+1	
<i>Supplementary Subtests</i>			
Understanding Paragraphs	7	+1	
Semantic Relationships	10	+4	(+)
Sentence Assembly	6	0	

Mean of Subtest Standard Scores: $44/7 = 6.29$ or 6

Case Study 2 Male (13 yrs. 8 mo.)

CELF-4 Composite/Index

(90%) Level of Confidence

Core Language Score

72 \pm 5

(67-77)

Receptive Language Index

92 \pm 8

(84-100)

Expressive Language Index

63 \pm 7

(56-70)

Language Content Index

80 \pm 8

(72-88)

Language & Memory Index

74 \pm 7

(67-81)

Case Study 2 Male (13 yrs. 8 mo.)

Test of Language Competence - Expanded (TLC-E)

Composite Scores	Standard Score <u>(90%) SEM</u>		
Total Score	73	<u>±</u> 8	(61-85)
Expressing Intents	69	<u>±</u> 13	(56-82)
Interpreting Intents	82	<u>±</u> 12	(70-94)
Screening Composite	65	<u>±</u> 15	(50-80)

Case Study 2 Male (13 yrs. 8 mo.)

TLC-E Subtest Scores (90%) Level of Confidence

Ambiguous Sentences	7	+1
Making Inferences	10	+4 (+)
Recreating Sentences	3	-3 (-)
Figurative Language	4	-2

Mean of the Subtests $24/4 = 6$

Case Study 2 Male (13 yrs. 8 mo.)

CELF-4 Level 3. Criterion/Norm Referenced Scores

Phonological Awareness	51	(>24)
Word Associations	24	(>13)
Rapid Automatic Naming	204	(<135)
	(8 err.)	(<10)
Working Memory Index	75 (+/-9)	percentile 5

There is evidence of attention, working memory and verbal automaticity deficits.

CELF-4 Level 4. Behavioral Ratings

Pragmatics Profile	108	(>125)
--------------------	-----	--------

The linguistic and neuropsychological deficits carry over to communication in context.

Case Study 2 Male (13 yrs. 8 mo.)

WISC-IV Index Scores (90%) Level of Confidence

Verbal Comprehension	93	± 6	(87-99)
Perceptual Reasoning	108	± 6	(102-114)
Working Memory	90	± 6	(84-96)
Processing Speed	101	± 8	(93-109)

Peabody Picture Vocabulary Test - III (PPVT-III)

Total score **98**

Case 2. Academic Referencing

7th Grader (CA 13.8 yrs.) receiving services in a public school.

Woodcock-Johnson III

Letter-Word Identification	Grade 4.1
Word Attack	Grade 6.1
Reading Vocabulary	Grade 7.6
Passage Comprehension	Grade 3.8
Reading Fluency	Grade 3.6
Spelling	Grade 5.2

CELF-4 Case Study 2. Summary

The Core Language score (72) is in the low to very low educational range and supports eligibility for continuing language intervention.

The Modality Index scores differ significantly. The Receptive score (92) is in the average educational range and the Expressive score (63) in the very low educational range, indicating a severe expressive language disorder. The Language Content score (80) is in the marginal educational range and the Language and Memory score (74) is in the low educational range.

The RAN time (204 sec) is in the atypical range, indicating a naming-speed deficit with reduced cognitive speed (attention, working memory for visual input and set shifting).

The Working Memory Index (75) falls in the low educational range.

The Pragmatics profile score (108) indicates inadequacies in communication in context, especially pronounced for informing.

Authentic-Contextual Assessment

THE CLASSROOM PERFORMANCE ASSESSMENT (CPA)

LEVEL A

Listening	Speaking	Reading	Writing	Social Communication	Critical Thinking	Executive Functions	Other
-----------	----------	---------	---------	-------------------------	----------------------	------------------------	-------

LEVEL B

1. Listening Skills	Oral Presentation	Emergent Skills	Emergent Skills	Comm Rules Intentions	Reasoning	Awareness Self-Control
Attention Discrimination Acuity Processing	Articulation Phonology Rate, Fluency Intonation	Print Awareness Sound Awareness Book Knowledge Story Knowledge	Print Patterns Prewriting Motor Skills	Ritualizing Requesting Informing Controlling	Analysis Synthesis Deductive Inductive	Attention-Impulsivity Self-Regulation Compensation Motivation
2. Language Comprehension	Content & Structure	Reading Comprehension	Content Structure	Conversational Knowledge	Organization	Memory
Words Concepts Expressions Abstract - Figurative	Words Expressions Word Structures Sentence Structures	Words Concepts Story Schemas Narratives	Words Concepts Word Structures Sentence Structures	Conventions Topic Mgt. Turn Taking Negotiating	Chronology Emphasis Prioritizing Planning	Immediate Short-Term Working Long-Term
3. Following Instructions	Organization Formulation	Reading Strategies	Organization Mechanics	NonVerb Comm Social Skills	Problem Solving	Organization Study Skills
Following Schema Academic Rules Classroom Mgt. Teacher Knowledge	Planning Description Discussion Cause-Effect	Meaning Based Prediction Structural Cognitive	Formal - Informal Advanced Narratives Spelling, Punctuation Capitalization, etc.	Facial Expression Body Language Social Knowledge Perspective Taking	Comp/Cont Math Problems Evaluation Moral Judgment	Time Management Task Management Following Structure Scripts, Routines
4. Other	Other	Other	Other	Other	Other	Other
Elisabeth Wiig	Wayne Secord	Other	Jo-Anne Prendeville	Carney Sotto	Other	Ann Glaser

Red Rock Educational Publications, 2004, All Rights Reserved

CASE REPORT FORM

CPA CASE ANALYSIS – Case No. ____

CPA

Elisabeth Wiig

Wayne Secord

Jo-Anne Prendeville

Carney Sotto

Ann Glaser

COMMUNICATION DOMAINS						
LISTENING	SPEAKING	READING	WRITING	SOCIAL COMMUNICATION	CRITICAL THINKING	EXECUTIVE FUNCTION
Listening Skills	Oral Presentation	Emergent Skills	Emergent Skills	Communication Rules	Reasoning	Awareness and Self Control
Language Comprehension	Language Content - Structure	Reading Comprehension	Content and Structure	Conversational Knowledge	Organization	Using Memory
Following Instructions	Organization - Formulation	Reading Strategies	Organization Mechanics	Nonverbal Communication Social Skills	Problem Solving	Organization and Study Skills
Strengths - Interests	Strengths - Interests	Strengths - Interests	Strengths - Interests	Strengths - Interests	Strengths - Interests	Strengths - Interests
Learn Adjustment	Learn Adjustment	Learn Adjustment	Learn Adjustment	Learn Adjustment	Learn Adjustment	Learn Adjustment
Other	Other	Other	Other	Other	Other	Other

CASE NUMBER ____ (Summary of Patterns)

© 2006 by Red Rock Educational Publications, Inc. and Schema Press, Inc.
All Rights Reserved – Used by Permission

Authentic-Contextual Assessment

CPA						
COMMUNICATION DOMAINS						
LISTENING	SPEAKING	READING	WRITING	SOCIAL COMMUNICATION	CRITICAL THINKING	EXECUTIVE FUNCTION
Listening Skills	Speaking Mechanics	Emergent Skills	Emergent Skills	Conversational Knowledge	Knowledge	Task Development
Listening Vocabulary	Structure	Phonological Awareness	Writing Vocabulary	Classroom Language Use	Comprehension	Organizing Tasks
Listening Comprehension and Analysis	Speaking Vocabulary	Word Analysis	Language Structure	Situation Specific Register	Analysis	Starting Tasks
Classroom Directions	Speaking Applications & Presentations	Reading Vocabulary	Text Structures	Pragmatic Language Structure	Synthesis	Changing Tasks
Classroom Discourse		Reading Comprehension and Analysis	Writing Process and Organization	Non-Verbal Communication	Evaluation	Self Regulation
		Reading Applications	Writing Conventions		Application	Using Memory

Elisabeth Wiig

Wayne Secord

Jo-Anne Prendeville

Carney Sotto

Ann Glaser

Red Rock Educational Publications, 2004, All Rights Reserved

Observational Rating Scale for Executive Functions

<i>The Student ...</i>
Focuses and maintains attention on speakers and materials used in teaching
Answers questions and responds to requests for information within a reasonable time period
Returns to task within an appropriate amount of time if interrupted during an activity
Reflects on and thinks about answers to complex questions and <u>does not</u> act impulsively
Plans ahead before starting an activity (e.g., shopping, cleaning room)
Organizes activities by breaking them down into steps, grouping or categorizing, and deciding on an order of action
Monitors what she/he is doing and takes steps to correct errors
Handles two or more simple activities or tasks in parallel (e.g., making a sandwich and answering the phone)
Prioritizes two or more simple, often repeated activities or tasks (e.g., dressing, eating, packing back pack)
Prioritizes two or more complex activities or tasks and alternate between them (e.g., projects - - language arts/science)



Executive Functions and Written Expression

Language Domain

- **Difficulty initiating ideas**
- **Difficulty limiting topic**
- **Disorganization and lack of planning**
- **Poor self-monitoring -- many careless errors**
- **Inability to edit written production**
- **Unable to change sets to maintain topic**



Executive Function Disorders and Written Expression

Memory Domain

**Difficulty handling complex
memory demands**

- **Poor recall and maintenance
of ideas**
- **Difficulty remembering
appearance of letters/words**
- **Difficulty making writing
legible**

Executive Function Disorders and Grapho-Motor and Handwriting Domains

Poor Fine Motor Skills

- **Handwriting Not an Integrated Skill**
- **Impulsivity - Rapid, Unplanned Writing**
- **Excessively Slow Writing**
- **Impersistence When Writing Several Paragraphs**
- **Tic Interference**
- **Perseverating on Letters**
- **Perfectionism (Erasing Constantly)**





Implications for Daily Living

Academic Barriers

Students with expressive language disorders, word retrieval and automaticity-of-naming deficits cannot perform within established time limits in the regular classroom.

They need extended time for responding to questions and completing oral-verbal and written assignments and untimed tests.

Teachers may need training to provide models, scaffolding, guided questioning, and individualized cues for retrieval that benefit performance.



Implications for Daily Living

Academic Accommodations

- (1) Untimed test taking and untimed written language assignments**
- (2) Use of computers for written language assignments**
- (3) “Word banks” for fill-in-the-blank tests due to word retrieval deficits**



Generic Language Intervention Principles

Provide structure to support planning, organizing, problem solving and implementing oral or written communication (e.g., webbing, conceptual mapping, Inspiration software)

Use mediated learning procedures with guided questioning, cognitive mediation, coaching and scaffolding

Develop mental models (scripts and schema) for interpreting and writing text

Develop critical thinking strategies for analysis, categorization, comparison and contrast, synthesis, evaluation and application of concepts, expressions and text to develop in-depth understanding



Generic Language Intervention Principles

Provide bridges for the transitions from concrete (e.g., hand) to abstract (e.g., handouts) and figurative uses (e.g., empty handed) of words and expressions

Develop automaticity for serial language, academic sequences, structural rules, and social pragmatic repertoires

Develop self-monitoring processes by scaffolding, editing spoken and written language, and using strategies for elaborating

Develop self-awareness of barriers to performance and inefficient compensatory strategies, and develop effective compensatory strategies for life

Develop strategies for appropriate self-advocacy



Intervention Strategies for Expressive Language Disorders

Semantic Development

Developing word associations and broadening knowledge of meaning features.

Defining words and comparing-contrasting words and concepts.

Relating words from multiple perspectives

Building semantic categories and hierarchies and comparing-contrasting.

Map It Out! Wiig & Wilson, 2000)



Intervention Strategies for Expressive Language Disorders

Semantic-Syntactic Interfaces

Automaticity in forming and using basic sentence structures.

Developing structural/transformational rules for forming complex sentences with conjunctions and relative clauses, among others.

Using transition words and phrases to form logical ties and mark relationships (coherence and cohesion).



Intervention Strategies for Expressive Language Disorders

Strategies for Word Retrieval

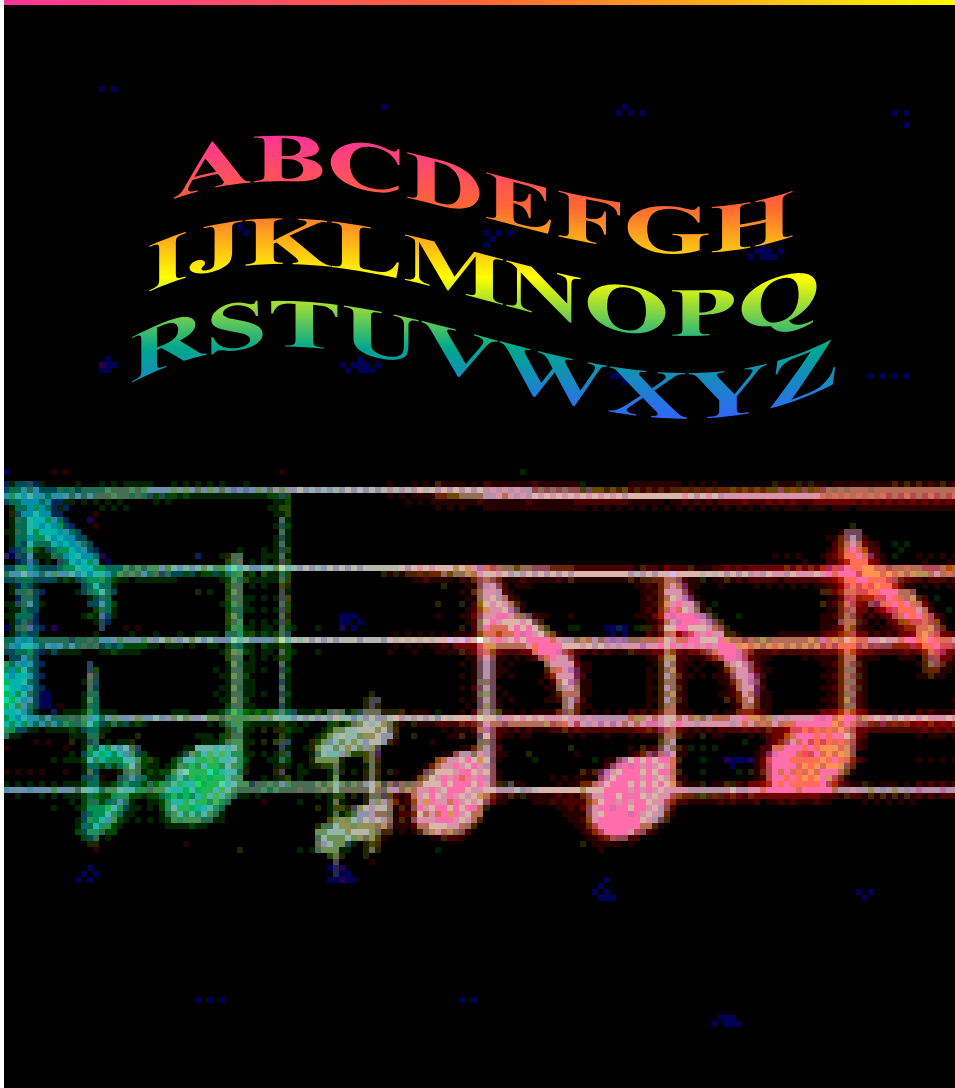
Using word associations, word opposites, visual or symbolic imagery.

Substituting synonyms for hard-to-find words.

Expanding the stored vocabulary.

Using appropriate place-holding for processing and answering questions and when writing.

Intervention Strategies for Expressive Language Disorders



Automaticity for Serial Language

Alphabet recital with melodic cues (e.g., the alphabet song).

Sequential and patterned counting (e.g., 2,4, 6...) and basic multiplication tables.

Time sequences such as days of the week, months of the year, and seasons.

Intervention Strategies for Expressive Language Disorders



Pragmatic Flexibility

Automaticity for commonly used verbal rituals and social exchanges.

Using different words and structures to express the same intent (i.e., one intent-many expressions).

Using discourse strategies (e.g., repeating or using the previous speaker's words or phrases). Role-playing in skits designed to reflect daily-life interactions.



Intervention Strategies for Expressive Language Disorders

Executive Functions

Develop self-monitoring processes by scaffolding, editing spoken and written language, and using strategies for elaborating.

Develop strategies for planning and organizing spoken and written narrative (conceptual mapping).

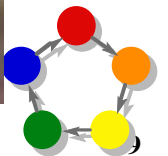
Develop mental models for narrative structure and basic types (story telling, descriptive, expositive, argumentative)

(Map It Out! Wiig & Wilson, 2000)

Literacy Begins at Home!!



Copyright © 2006 Knowledge Research Institute, Inc.



Literacy Defined

National Assessment of Adult Literacy (NAAL) 2003

“Literacy is defined as an individual’s ability to read, write, speak in English, compute and solve problems at levels of proficiency necessary to function on the job, in the family and in society.”

Scribner, S. & Cole, M. (1981). From “*The Psychology of Literacy.*”

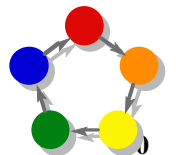
“Literacy is not simply knowing how to read and write a particular script but applying the knowledge for specific purposes in specific contexts of use.”

Gee, J.P. (2001). A sociocultural perspective on early literacy development.

Specific uses of literacy serve to enhance or amplify ways of thinking, including how we classify, reason and remember.

Olson, D. & Torrance, N. (1991). From “Literacy and Orality.”

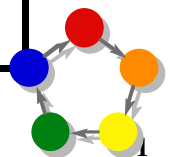
Literate thought is abstract, analytical, logical, reflective, decontextualized and complex.



Literacy Levels Defined

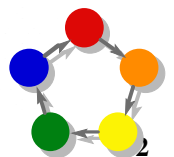
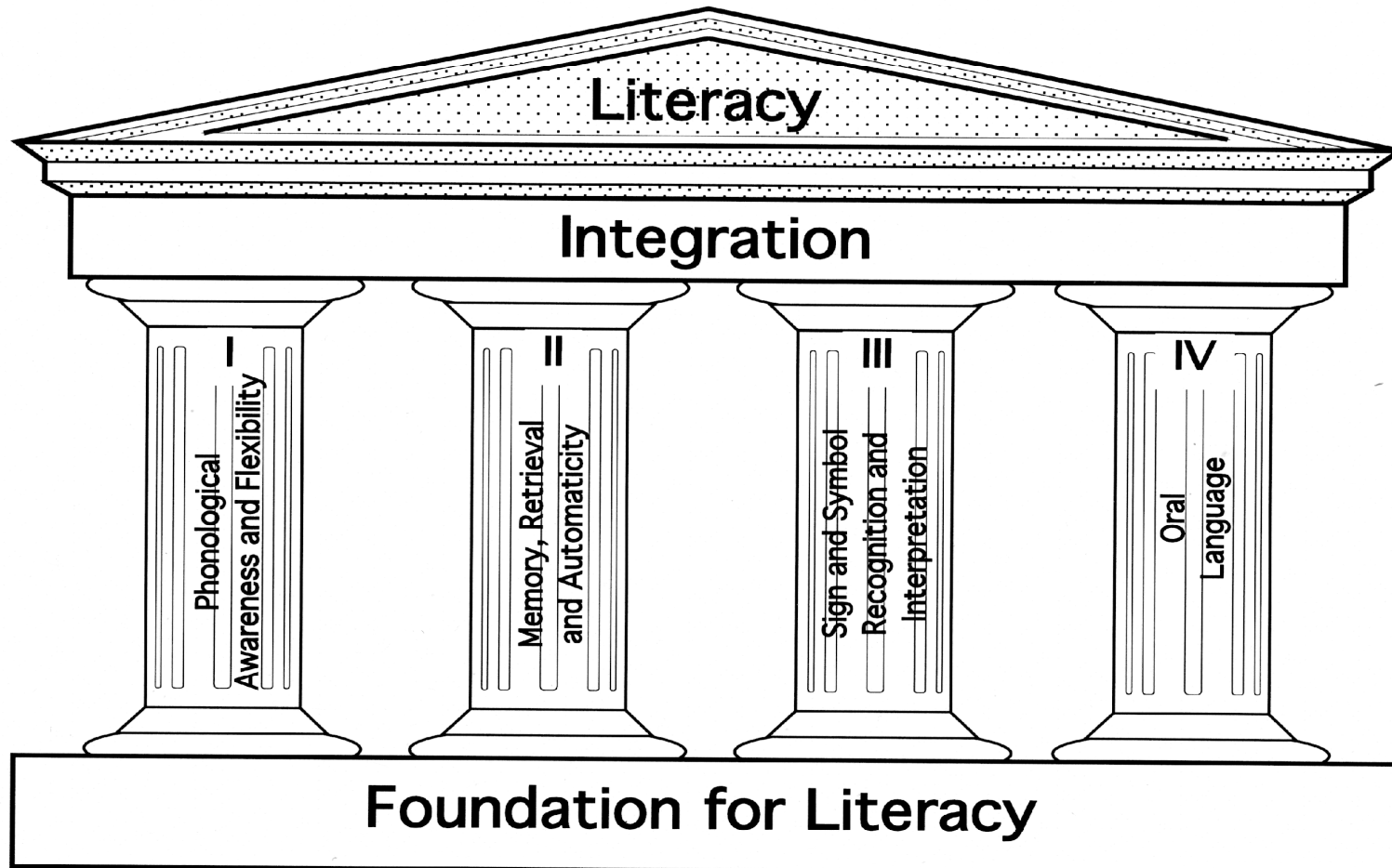
NAALS Literacy Levels (Baldwin et al.,1995)

	Prose Literacy	Document Literacy	Quantitative Literacy
Level 1	Read short text and identify single piece of information.	Locate information based on literal match; enter personal information.	Perform single, specified arithmetic operations using provided numbers.
Level 2	Locate single piece of information; make low-level inferences; compare and contrast.	Match information; make low-level inferences; cycle through and integrate data from document parts.	Perform single operation with given numbers; determine operation by the format.
Level 3	Match literal information; make low-level inferences; integrate information; respond to or answer questions.	Integrate multiple pieces of information; cycle through complex data or graphs for information.	Locate two or more numbers in material; determine operation from terms used.
Level 4	Perform multiple feature matches; integrate/ synthesize complex, lengthy information; make complex inferences.	Perform multiple feature matches; integrate information; make higher level inferences.	Perform two or more sequential operations; infer operations from information or knowledge.
Level 5	Search for information in dense text; make high-level inferences; use knowledge; contrast complex information.	Search through complex displays with multiple distracters; make high-level, text-based inferences; use specialized knowledge.	Perform multiple operations sequentially; identify problem features from text; use knowledge to determine quantities or operations needed.

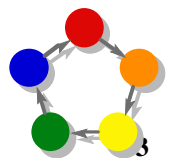
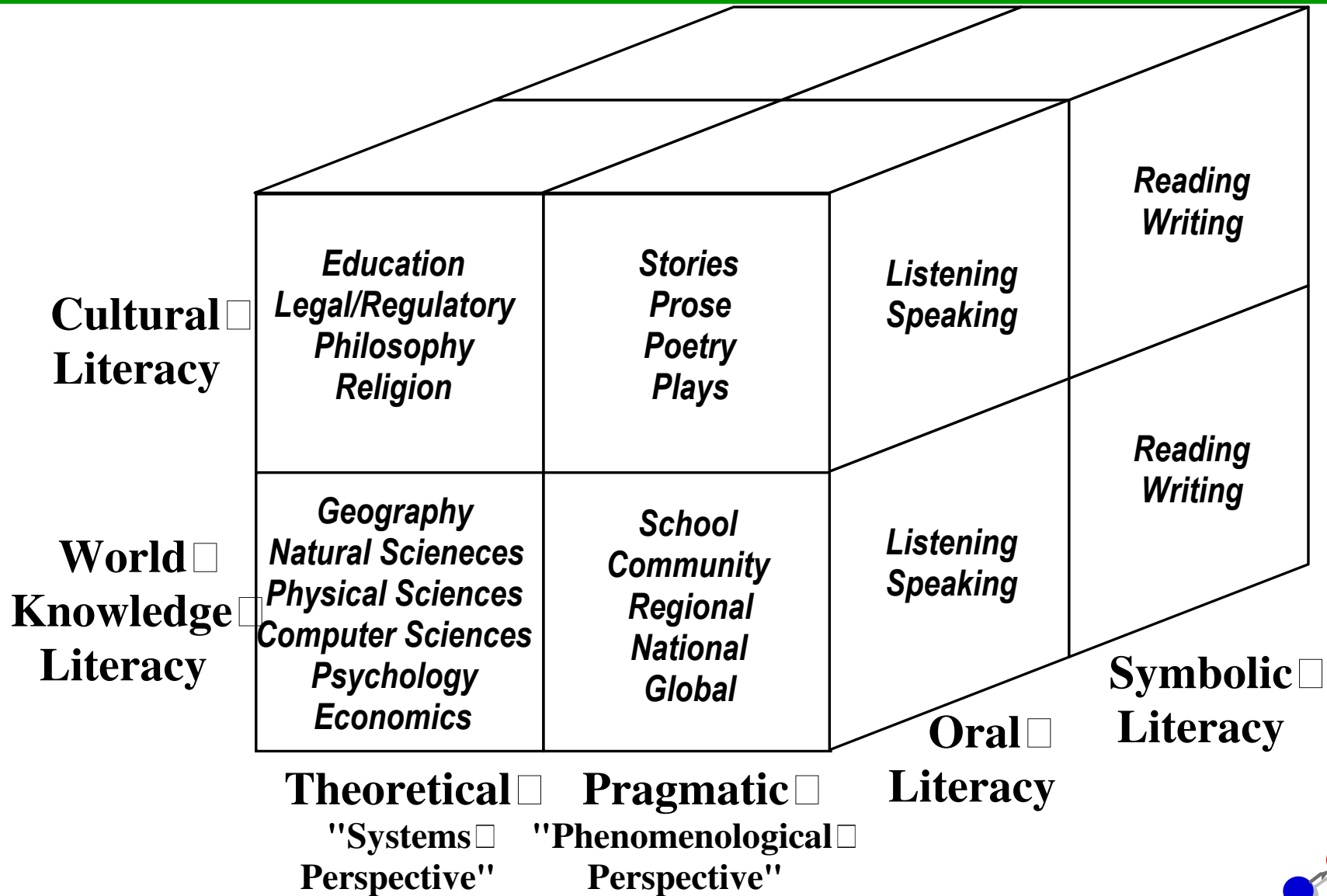


AN EMERGING LITERACY MODEL

Four Pillars of Emerging Literacy



A MULTIPLE LITERACIES MODEL



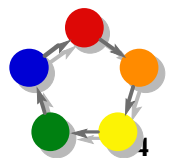
LITERACY and Work Types

US Knowledge Workers

<i>Tacit Interaction Workers</i>	41%
<i>Transaction Workers</i>	44%
<i>Transformational Workers</i>	15%

Tacit Interaction Workers in 2004

UK 45%	Germany 37%	Russia 29%	US
41%	China 25%	India 26%	



Literacy and Work Requirements

Tacit Interaction

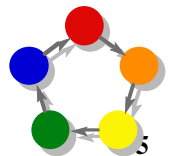
Requires oral and symbolic literacy, primarily of a theoretical nature, and encompassing high-level cultural and world knowledge literacy (NAALS levels 4 and 5)

Transaction

Requires oral and symbolic literacy, pragmatic and somewhat theoretical in nature, and cultural and world knowledge literacy (NAALS levels 3 and 4)

Transformation

Requires oral and symbolic literacy, primarily pragmatic in nature, and world knowledge (NAALS levels 1 and 2)



Economic Impact of Literacy

World Literacy Rates

26 percent of the world's population are illiterate (UNESCO).

98 percent of non-literates live in developing countries.

52 percent of all non-literates live in India and China (1/3 of world population).

Less than 60 percent are literate in Africa.

Women make up two thirds of all non-literates.

Literacy and Income Averages

**Per capita income in countries with literacy rates less than 55 percent average about
\$600**

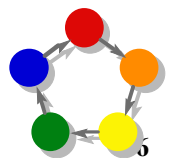
**Per capita income in countries with a literacy rate between 55-84 percent
is \$2,400**

**Per capita income in countries with a literacy rate between 85-95 percent
is \$3,700**

**Per capita income in countries with a literacy rate above 96 percent
is \$12,600**

Source: International Literacy Day -- September 2001, Washington, DC

Copyright © 2006 Knowledge Research Institute, Inc.



Requirements for Developing Literacy

Self-Regulation and Executive Functions

Attention -- **Select, focus, and sustain attention.**

Inhibition -- **Disregard extraneous stimuli or thoughts.**

Initiation -- **Overcome resistance to begin task.**

Reflection -- **Control impulsive acting or responding.**

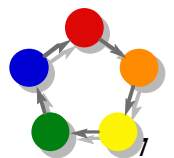
Persistence -- **Use different attacks, if one does not work.**

Using Senses -- **Use multimodal approaches/learning styles.**

Memory Strategies -- **Chunking, visual imagery, associations.**

Cognitive Flexibility -- **Set shifting and taking multiple views.**

Self-Monitoring -- **Focus, evaluate, repair, monitor outcome.**



Requirements *for Developing Literacy*

Critical Thinking Strategies

Analysis

Identification of significant features, components, relations or sequences.

Synthesis

Perception/creation of patterns in stimuli, contexts, relations or processes.

Hypothesis Formation

Formulating and testing hypotheses about the significance of patterns.

Evaluation

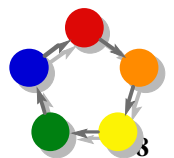
Checking the adequacy and completeness of every step above.

Decision Making

Selecting a response or plan of action with high probability of success.

Execution

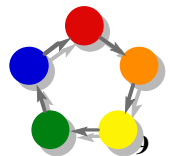
Self-monitoring, evaluation, revision and repair to improve efficiency or effectiveness.



Requirements for Developing Literacy

Domains: Skills/Knowledge Methodology World Understanding

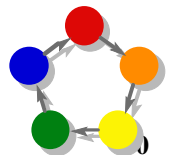
<i>SCHEMA</i>	Text Structure	Critical Thinking Conceptual Blending	Environment/ Society (Macro-World)
<i>SCRIPTS</i>	Narrative/Dialogue Event Sequences	Critical Thinking Strategies	Community (Micro-World)
<i>PROCESSING</i>	Creating Meaning and Structure	Cause-Effect/Time Relationships	Relating to Self and Others
<i>ROUTINES</i>	Decoding Encoding	Repeated Events Rote Actions	Own Experiences/ Mirroring Others



Literacy Require Metaknowledge!

Three empty rectangular boxes arranged horizontally, intended for notes or content.

Two empty rectangular boxes arranged horizontally, intended for notes or content.

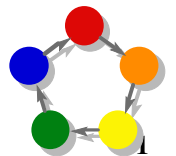


Stories Are Mental Reference Models!

Stories provide the basic structure and are often the origin of mental reference models!

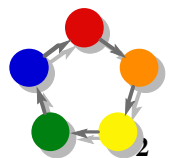
This is because ...

- **It is difficult to grasp the whole coherently**
- **Stories are unsurpassed for effective communication**
- **We rely on stories to tackle new problems**
- **Stories help us learn, remember and recall**
- **We use stories to perform mental simulations**



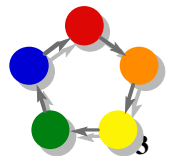
The Power of Stories and Conceptual Blending

- **Stories provide context, structure, meaning, metaphors and overall understanding of complex topic areas and their relations to other parts of the system in which they exist**
- **Stories portray actors, tell of conflicts and relationships, illuminates objectives and drives, and identifies threats and opportunities and all other aspects of interesting situations**



The Power of Stories and Conceptual Blending

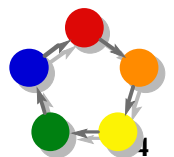
- **Stories cover many abstraction levels (How to, know that and why, patterns and metaphors) and complement theories and practices**
- **By engaging in conceptual blending, stories tie together concepts, judgments and other objects into mental spaces (schema) that provide meaningful structure, organization and relationships**



Higher Order Reasoning for Knowledge Acquisition and Implementation

Mental reference libraries support effective academic and social functioning by providing capabilities to...

- **Consider higher order consequences**
- **Balance multiple factors and objectives**
- **Reason with metaphors and conjectures**
- **Create, innovate and deal with complex challenges**
- **Perceive situations from different perspectives**
- **Anticipate behaviors of complex dynamic systems**
- **Understand complex academic, personal, cultural and societal relationships**



Language and Literacy Assessment and Intervention



Elisabeth H. Wiig and Carolyn C. Wilson

A. Assessment Component

Design and Assessment Objectives

Administration, Scoring, and Interpretation

B. Intervention Component

Curriculum Objectives

Ladder Steps for Intervention

Adding Conceptual Mapping

@Thinking Publications

The Learning Ladder -- Assessment

Design Features and Purposes

Provides a standard method of evaluating text comprehension

Uses a story format, presented in spoken and printed forms

Features two stories for each grade level (K-7); one for early and one for late in the school year

Uses ten questions for each story; five focus on given information and five on going beyond the given

Allows for comparison of comprehension and recall of the given information and going beyond the given (inference, application)

Gives criterion-referenced as well as qualitative measures

Provides a direct link to intervention

The Learning Ladder -- Assessment

Bloom's Taxonomy of Educational Questions

A. Lower Order Questions

Knowledge -- Recall of given information (Who? What?)

Analysis -- Similarities and differences (How ... alike?)

B. Higher Order Questions

Comprehension -- Meanings and abstract patterns (How? Why?)

Application -- Generalize to a related context by analogy (What if?)

Synthesis -- Connect, create, problem solve (How else? Improve!)

Evaluation -- Judge by academic, social or other criteria (How do you feel about?)

Source: Bloom, 1965; Kindsvatter et al., 1988.

The Learning Ladder -- Assessment

Assessment Stories

Small-print version to be read aloud by examiner.

Large-print version to be read silently by students.

Assessment Questions

Questions for the examiner to read aloud with scoring guidelines.

Question sheets with areas for student to write responses.

Scoring Responses to Items

Complete one- or two-part correct response -- Score 2

Partial or incomplete correct response -- Score 1

Incorrect response or no response -- Score 0

The Learning Ladder -- Intervention

Curriculum Objectives for Critical Thinking

- 1. Analyzing Meanings and Topics*
- 2. Grouping and Categorizing Information*
- 3. Comparing and Contrasting for Similarities and Differences*
- 4. Making Predictions and Drawing Inferences*
- 5. Generalizing to New Contexts and Applications*
- 6. Summarizing and Supporting Ideas*
- 7. Evaluating Outcomes and Products*
- 8. Showing Awareness and Use of Metaknowledge*

The Learning Ladder

Given Information

Ladder Step 1. Interpreting the Title

What does the title tell me?

Objectives

Teacher - Identify missing concept knowledge

Student - Understand key words, concepts, and expressions in the title

Outcomes

Teacher - Identify individual variations and needs

Student - Awareness of relationships among words and concepts in a title and the content of the text

The Learning Ladder

Given Information

Ladder Step 2. Prior Knowledge of Theme

What do I already know?

Objectives

Teacher - Establish prior knowledge as a baseline for teaching

Student - Answer Who, What, Where, When, How, and Why questions

Outcomes

Teacher - Awareness of existing knowledge and of what must be taught

Student - Awareness of strategies for recalling existing knowledge

The Learning Ladder

Given Information

Ladder Step 3. Key Words and Concepts

What are the key words and ideas?

Objectives

Teacher - Identify key words and concepts for teaching

Student - Scan and identify difficult words and concepts

Outcomes

**Teacher - Lists of words and concepts to be emphasized
in teaching**

Student - Mark or write difficult words and concepts

The Learning Ladder

Given Information

Ladder Step 4. Prior Word and Concept Knowledge

What words and ideas do I already know?

Objectives

Teacher - Identify existing and missing word- and concept-knowledge

Student - Define key words and concepts

Outcomes

Teacher - Awareness of individual variations in knowledge

Student - Broadened meanings for critical words and concepts in the text

The Learning Ladder

Given Information

Ladder Step 5. Strategies for Recalling Information

What can I remember?

Objectives

Teacher - Identify existing and missing memory strategies

Student - Establish level of recall and identify strategies used

Outcomes

Teacher - Awareness of individual variations in strategy use

Student - Use of additional strategies for recalling information

The Learning Ladder

Beyond the Given Information

Ladder Step 6. Likenesses and Differences

How are words and ideas alike or different?

Objectives

Teacher - Identify existing or missing meaning contrasts

Student - Develop similarities and differences

Outcomes

Teacher - Awareness of individual variations and needs

Student - Knowledge of semantic relations for establishing semantic networks

The Learning Ladder

Beyond the Given Information

Step 7. Cause-Effect, Time, Location, and Human-Relationship Changes

What changes do I see?

Objectives

Teacher - Identify existing and missing perceptions of change

**Student - Identify relations and changes in ideas and
information**

Outcomes

Teacher - Awareness of individual variations and needs

**Student - Knowledge of cause-effects, times, locations, and
emotions and their changes**

Developing Causal Networks

Observational and Instrumental Cause-Effect Models

A. One-Cause---One-Outcome Model:

Cause ----- Effect

B. Common Cause Model:

Effect (1)

Cause

Effect (2)

C. Causal-Chain Model:

Effect (1)

Cause Effect (2)

The Learning Ladder

Beyond the Given Information

Ladder Step 8. Application to Self and Others

How does it apply to my life?

Objectives

Teacher - Identify existing or missing abilities

Student - Utilize and extend information to situations related to self and others

Outcomes

Teacher - Awareness of individual variations and needs

Student - Ability to utilize and extend acquired information to related contexts

The Learning Ladder

Beyond the Given Information

Ladder Step 9. Identifying and Organizing Main Ideas

What are the main ideas?

Objectives

Teacher - Identify existing and missing strategies

Student - Develop mental models for organizing text

Outcomes

Teacher - Awareness of individual variations and needs

Student - Internalized mental models (schema) for text structure

The Learning Ladder

Beyond the Given Information

Ladder Step 10. Predicting, Creating, Imagining

What can I predict or imagine?

Objectives

Teacher - Identify existing or missing strategies

**Student - Use information in new and complex situations
to predict, create, or imagine**

Outcomes

Teacher - Awareness of individual variations and needs

**Student - Ability to utilize information to predict, create, and
imagine beyond the given**

MAP 97 OUT!

Elisabeth H. Wiig and Carolyn C. Wilson

Presentation Overview

A. Introducing the Resource

Design and Intervention Objectives

Generic Conceptual Map Designs

B. Presenting the Intervention Materials

Focused Master Maps

Cognitive Mediation

Intervention Illustration

@Thinking Publications

MAP IT OUT!

Visual Tools for Planning, Organizing and Communicating

Educational Objectives

- 1. Develop critical thinking and assist in constructing individual and group knowledge**
- 2. Facilitate storage of the constructed knowledge in memory as mental models such as for routines, scripts, or schema**
- 3. Augment and structure existing knowledge**
- 4. Integrate old and new knowledge for immediate and long term learning and application**

MAP IT OUT!

Visual Tools for Planning, Organizing and Communicating

Conceptual Mapping with Cognitive Mediation

1. Provide explicit, organizing templates for critical thinking.
2. Use a mediated process for developing metaknowledge.
3. Serve as guides for a conscious reasoning and problem-solving process (critical thinking).

The mode and process of critical thinking generalize, become automatic with time and can therefore be used to attack new content, contexts, and problems expertly.

MAP 97 OUT!

Visual Tools for Planning, Organizing and Communicating

Appreciative Inquiry

Appreciating

Valuing the best in a context

Envisioning

Imagining what effect changes would have

Dialoguing

Engaging in intra- and inter-personal dialogue

Innovating

Creating an 'ideal'

Problem Solving

Problem identification

Responding to a challenge for solution

Analysis of causes and factors

Identifying significant aspects of the problem

Analysis of solutions

Identifying possible solutions for the problem

Action planning

Selecting and implementing an effective plan

Adapted from Cooperrider & Srivastva, 1997.

MAP IT OUT!

Visual Tools for Planning, Organizing and Communicating

Associative Maps

Provide visual tools for eliciting word and topic associations

Concept Maps

Provide visual tools for knowledge of meaning features

Comparison-Contrast Maps

Provide visual tools for knowledge of shared and non-shared features and meanings

Theme Maps

Provide visual tools for multiple interpretations of text

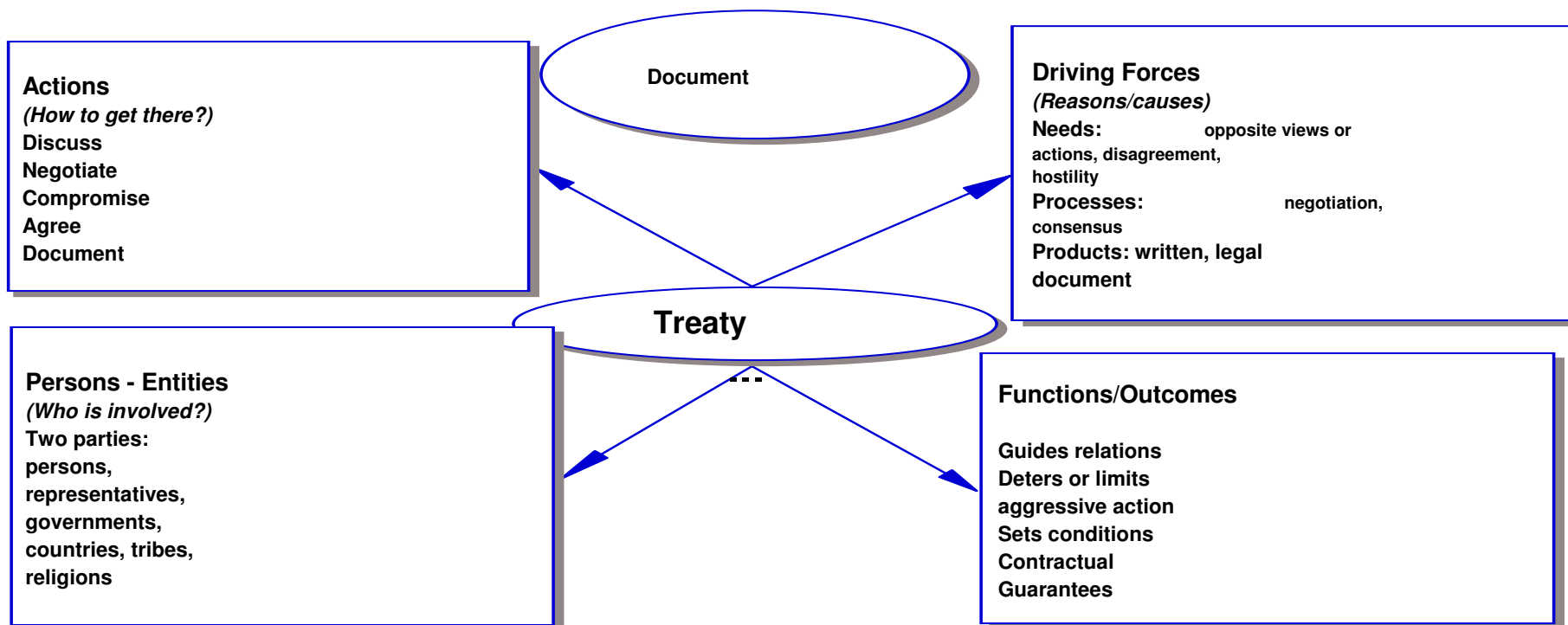
Underlying Structure Maps

Provide visual tools for knowledge of underlying organization and structure

Process Maps

Provide visual tools for knowledge of procedural steps in implementation

MEANINGS OF ABSTRACT WORDS



Examples

Nuclear weapons ban; peace or cease Fire Treaty

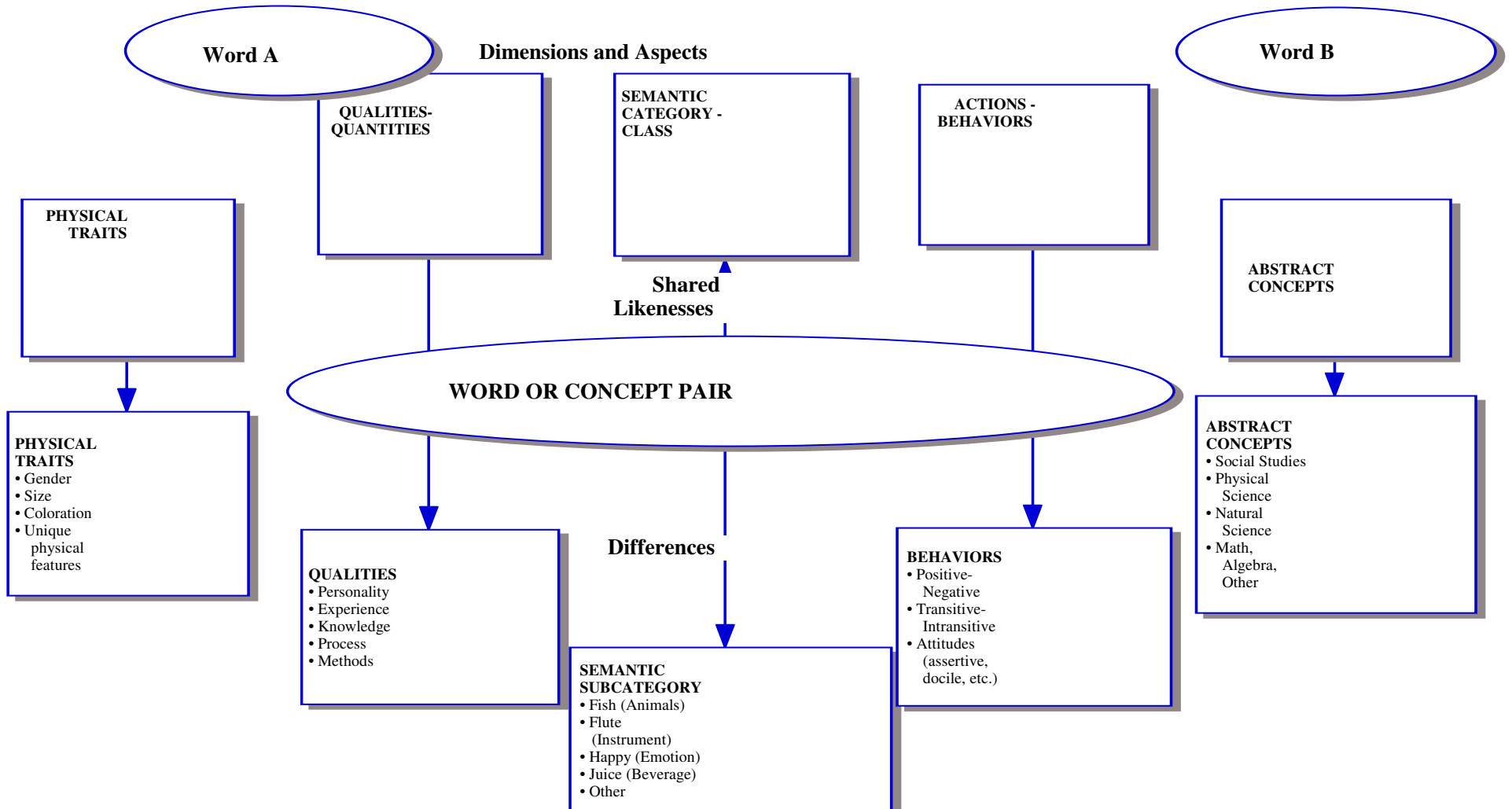
Definition

A written document that sets conditions and guides relations between two parties, arrived at through negotiation

- **Process** -- Students encountered the word in a history lesson. They were guided in identifying aspects for each major dimension, identify a category name, and give examples. Teacher recorded responses in telegraphic form. Each student wrote a definition based on the entries in the map.

MAP IT OUT!

COMPARING AND CONTRASTING WORDS AND CONCEPTS



Process -- This map complements the primary Master Map. It identifies dimensions and aspects that may be alike (shared) or different in the meanings of two words that are being compared.

Selected Resources

- Buzan, T. (1989). *Use both sides of your brain. 3rd Edition.* London:Penguin Books.
- Costa, A. L. (1991). *Developing minds. 2nd. ed.* Alexandria, VA: Association for Supervision and Curriculum Development.
- Costa, A. L., & Lowery, L. F. (1989). *Techniques for teaching thinking.* Pacific Grove, CA: Midwest Publications.
- Hyerle, D. (1996). *Visual tools for constructing knowledge.* Alexandria, VA: Association for Supervision and Curriculum Development.
- Wiig, E. H., & Wilson, C. A. (2000). *Map It Out! Visual tools for planning, organizing, and communicating.* Super Duper/Thinking Publications.
- Wiig, E. H., & Wilson, C. C. (2001). *The Learning Ladder: Assessing and developing text comprehension.* Super Duper/Thinking Publications.
- Wilson, C.C. et al. (2003) *Concept Power.* Super Duper/Thinking Publications.

Selected References

- Barkley, RA. (1990). *Attention deficit hyperactivity disorder: A handbook for diagnosis and treatment*. New York, NY: Guilford.
- Bornstein, RA. (1991). Neuropsychological performance in children with Tourette's syndrome. *Psychiatry Research*, 33, 73-81.
- Bornstein, RA. (1991). Neuropsychological performance in adults with Tourette's syndrome. *Psychiatry Research*, 37, 229-236.
- Brown, TE. (2000). *Attention-deficit disorders and comorbidities in children, adolescents, and adults*. Washington, D.C.: American Psychiatric Press.
- Denckla, MB, & Cutting, LE. (1999). History and significance of rapid automatized naming. *Annals of Dyslexia*, 49, 29-42.
- Harris, EL, Schuerholz, LJ, Singer, HS. & Reader, MJ. (1995). Executive function in children with Tourette syndrome and/or attention-deficit hyperactivity disorder. *Journal of the International Neuropsychological Society*, 1, 511-516.
- Kimberg, DY, D'Esposito, & Farah, MJ. (1998). Cognitive functions in the prefrontal cortex -- Working memory and executive control. *Current Directions in Psychological Science*, 185-192.
- Landa, R. (2000). Social language use in Asperger Syndrome and high-functioning autism. In A. Klin, F. Volkmar & S. Sparros (Eds.), *Asperger Syndrome (Pp. 125-158)*. New York: Guilford.
- Leonard, L.B., Weismer, S.E, Miller, C.A., Francis, D.J., Tomblin, J.B., & Kail, R.V. (2007). Speed of processing, working memory, and language impairment in children. *Journal of Speech, Language, and Hearing Research*, 50, 408-428.
- Lyon, GR, & Krasgenor, NA. (1996). *Attention, memory, and executive function*. Baltimore, MD: Paul H. Brookes.
- Semel, EM, Wiig, EH, & Secord, WA. (1995). *Clinical evaluation of language fundamentals – 3rd edition*. San Antonio, TX: Psychological Corporation.

Selected References

- Singer, HS, & Walkup, JT. (1991). Tourette Syndrome and other tic disorders: Diagnosis, pathophysiology, and treatment. *Medicine*, *70* 15-32.
- Stebbins, GT, Singh, J. Weiner, J, & Wilson, RS. (1995). Selective impairments of memory functioning in unmedicated adults with Gilles de la Tourette's syndrome. *Neuropsychology*, *9*, 329-337.
- Waldman, ID, Rowe, DC, Abramowitz, A, *et al.*, C. (1998). Association and linkage of the dopamine transporter gene and attention deficit hyperactivity disorder in children: Heterogeneity owing to diagnostic subtype and severity. *Am. J. Human Genetics*, *63*, 1767-1776.
- Wechsler, D. (1991). *Wechsler intelligence scale for children (3rd Ed.)*. San Antonio, TX: Psychological Corporation.
- Wechsler, D. (1997). *Wechsler adult intelligence scale – III*. San Antonio, TX: Psychological Corporation.
- Wechsler, D. (2003). *Wechsler intelligence scale for children (3rd Ed.)*. San Antonio, TX: Psychological Corporation.
- Wiig, EH, & Wilson, CC. (2000). *Map it out! Visual tools for planning, organizing and communicating*. Greenville, SC: Thinking Publications/SuperDuper .
- Wiig, EH, & Wilson, CC. (2001). *The learning ladder: Assessing and developing text comprehension*. Greenville, SC: Thinking Publications/Super Duper.
- Wiig, EH, Zureich, P, & Chan, HH. (2000). A clinical rationale for assessing rapid, automatic naming in children with language disorders. *J. Learn. Dis.* *33*, 359-374.