

# The Neuropsychology of Written Language Disorders

## Diagnosis and Intervention



Steven G. Feifer, D.Ed., NCSP  
Feifer@comcast.net

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## Presentation Goals

1. Discuss national trends in written language, and the pitfalls of over-relying on curriculum-based measurement data to diagnose written language disorders in children.
2. Discuss the neural architecture of language development in children and learn key brain regions responsible for the organization and production of written language.
3. Develop a *brain-based* educational model of assessing written language by identifying various subtypes of language based dysgraphias, as well as interventions for each subtype.

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## National Center for Educational Statistics

National Center for Educational Statistics has been evaluating trends in educational progress in a variety of subjects since 1969. Most comprehensive longitudinal study of writing took place between 1984-1996.

- The National Center for Educational Statistics (2003) changed both the format and scoring mechanisms of the test.
- Writing assessment administered to 276,000 students in grades 4, 8, and 12.

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## National Center for Educational Statistics (2007)

- **Narrative Writing** – involves the production of stories or personal essays to capture a reader’s imagination. Can include responses to photographs, poems, and cartoons.
- **Informative Writing** – communicates information to the reader to convey a message, instruction, or an idea. Includes reports, reviews, and letters.
- **Persuasive Writing** – influence the reader to take action to bring about change. Should include reasons, examples, comparisons. Examples included writing to a friend, newspaper editor, or refute an argument in a debate.

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## National Center for Educational Statistics (2003): Scoring

- **BASIC** – this level denotes partial mastery of prerequisite knowledge and skills that are fundamental for proficient work at each grade.
- **PROFICIENT** – this level represents solid academic performance for each grade. Students demonstrated competency over the subject matter, and were able to use proper analytic skills to apply to real world situations.
- **ADVANCED** – this level signifies superior performance.

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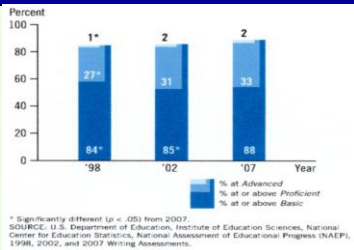
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## National Center for Educational Statistics (2007): 8<sup>th</sup> Grade Scoring



**8<sup>th</sup> grade proficient level:**  
**2007 – 33% at or above proficiency**  
**2002 – 31% at or above proficiency**  
**1998 – 27% at or above proficiency**

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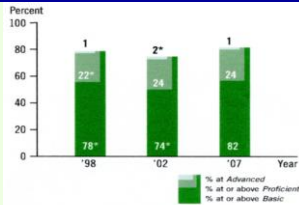
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## National Center for Educational Statistics (2007): 12<sup>th</sup> Grade Scoring



\* Significantly different ( $p < .05$ ) from 2007.  
 SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Educational Statistics, National Assessment of Educational Progress (NAEP), 1998, 2002, and 2007 Writing Assessments.

**12<sup>th</sup> grade proficient level:**  
 2007 – 24% at or above proficiency  
 2002 – 24% at or above proficiency  
 1998 – 22% at or above proficiency

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## IDEA-2004

- States may opt out of using a discrepancy model to identify learning disabilities, and replace by using a **R**esponse-**T**o-**I**ntervention model.
- Gives school districts flexibility to craft a policy whereby students who do not respond to scientifically-based early literacy programs may be considered eligible for special education services.
- Focus on results, not the special education process.

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## Curriculum-Based Measurement

### 6 Components to Assess Writing:

- (1) *Fluency*: measure the number of words written and spelled correctly in a time period.
- (2) *Grammar*: informally assess from passage.
- (3) *Vocabulary*: assess variety by dividing number of different words by total number of words.
- (4) *Sentence Structure*: summarize sentences as being incomplete, simple, compound, complex, run-on, or fragmented.
- (5) *Conventions*: percent of words spelled correctly, proportion of errors per 100 words, correct writing sequence.
- (6) *Content*: develop analytic rating scale.

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## Curriculum-Based Measurement

### • **Advantages:**

- (1) Better ecological validity than norm referenced testing.
- (2) Quicker and cheaper than norm referenced testing.
- (3) Allows for earlier intervention opportunities. Emphasis on discrepancy from peer performance, not IQ
- (4) Evaluation hi-lights writing, not bureaucratic categories
- (5) Linked to a problem solving model. (Shinn, 2002)

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## Curriculum-Based Measurement

### • **Disadvantages:**

- (1) Not a diagnostic approach.
- (2) No guidelines on how long to stay within a tier.
- (3) Subjective and incongruent scoring.
- (4) Dearth of scientifically valid intervention techniques.

- *\*RTI alone is not sufficient to identify a learning disability (National Joint Commission on Learning Disabilities, - June 2005)*

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## My Response - Neuropsychology

- *A brain-based educational model of learning utilizing scientific research and neuro-imaging procedures to develop optimum learning opportunities for all children.*
- *Need for educators to better understand the neural underpinnings of written language to create a brain-based educational model of learning.*



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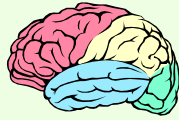
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## Cognitive Constructs Involved with Written Language

- Attention
  - Poor planning
  - Uneven tempo
  - Erratic legibility
  - Inconsistent spelling
  - Poor self monitoring
  - Impersistence



*BRAIN REGION* - Anterior Cingulate

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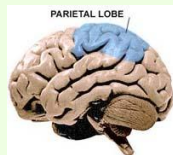
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## Cognitive Constructs Involved with Written Language

- Spatial Production
  - Poor spatial production
  - Poor visualization
  - Poor margination
  - Organization problems
  - Uneven spacing
  - Poor use of lines



*BRAIN REGION* - Right Parietal Lobe

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## Cognitive Constructs Involved with Written Language

- Sequential Production
  - Poor connected writing
  - Letter reversals
  - Organizational deficits
  - Lack of cohesive ties



*BRAIN REGION* - Left Prefrontal Cortex

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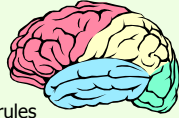
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## Cognitive Constructs Involved with Written Language

### • Memory

- Poor word retrieval
- Poor spelling
- Poor recall of grammar rules
- Preference for printing
- Loss of train of thought
- Deterioration of continuous writing



*BRAIN REGION* - Semantic memories stored in Temporal Lobes. Retrieved by Frontal Lobes

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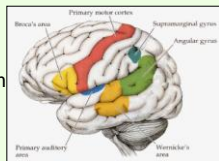
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## Cognitive Constructs Involved with Written Language

### • Language

- Poor vocabulary
- Poor written expression
- Dysphonetic spelling
- Lack of cohesive ties
- Unconventional grammar
- Simplistic sentence structure



*BRAIN REGION* - Left Temporal Lobe

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## Cognitive Constructs Involved with Written Language

### • Intelligence

- Concrete ideation
- Poor development of ideas
- Poor audience awareness
- Weak opinion development
- Simplistic sentence structure



*BRAIN REGION* - Inferior Parietal Lobes

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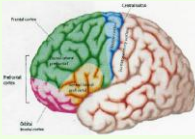
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## Cognitive Constructs Involved with Written Language

- Executive Functioning
  - Organize and plan ideas
  - Self monitor
  - Task initiation
  - Sustain attention to task



BRAIN REGION – Dorsolateral Prefrontal Cortex



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## (1) Phonological Dysgraphia

### Subtypes of Dysgraphia

- The hallmark feature of this disorder is an inability to spell by *sound*, thus rendering an over-reliance on the visual features of words.
- Inability to convert graphemes to phonemes.

BRAIN REGION - Temporal Lobes & Supramarginal Gyrus

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## Dysphonetic Spelling Examples

<u>Target Word</u>	<u>Misspelling</u>
<i>point</i>	<i>pot</i>
<i>train</i>	<i>chan</i>
<i>old</i>	<i>od</i>
<i>climbing</i>	<i>cling</i>
<i>job</i>	<i>joib</i>
<i>video</i>	<i>veio</i>
<i>kitchen</i>	<i>tihn</i>

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## (2) Surface Dysgraphia

### Subtypes of Dysgraphia

- This disorder is characterized by a fundamental breakdown in the orthographic representation of words.
- Students tend to over-rely on sound patterns when spelling and are prone to making miscues on 20% of English words which are phonetically irregular.

BRAIN REGION - Angular Gyrus

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## (2) Surface Dysgraphia

<u>Target Word</u>	<u>Misspelling</u>
<i>knock</i>	<i>nok</i>
<i>build</i>	<i>bild</i>
<i>mighty</i>	<i>mite</i>
<i>juice</i>	<i>juse</i>
<i>onion</i>	<i>unnyun</i>
<i>said</i>	<i>sed</i>
<i>yacht</i>	<i>yot</i>
<i>laugh</i>	<i>laf</i>

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## (3) Mixed Dysgraphia

### Subtypes of Dysgraphia

- This disorder is characterized by a combination of both phonological errors and orthographical errors depicting faulty arrangement of letters. Copying and letter formation skills are preserved.
- Most severe form of spelling deficit as there is no usable key to unlock the linguistic code. Sequencing letters are the main impairment.
- Key - 44 phonemes arranged to form some 50,000 words by the time we graduate high school.
- Avg spelling words 15/week = 540/yr= 6480 words to be learned in didactic fashion.

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### (3) Mixed Dysgraphia

<u>Target Word</u>	<u>Misspelling</u>
<i>advantage</i>	<i>advangate</i>
<i>cobweb</i>	<i>coweb</i>
<i>illusion</i>	<i>elushn</i>
<i>pocket</i>	<i>poet</i>
<i>work</i>	<i>wrok</i>
<i>kitchen</i>	<i>kinchen</i>

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### (4) Executive Dysgraphia

- An inability to master the implicit rules for grammar which dictate how words and phrases can be combined.
- Characterized by:
  - Word omissions
  - Word ordering
  - Incorrect verb usage
  - Word ending errors
  - Poor punctuation
  - Lack of capitalization
  - Oral vs. written language discrepancy

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### Executive Dysgraphia

#### Working Memory Skills (Baddeley, 1998)

- Phonological Loop - holds and manipulates acoustic information..
- Visual-Spatial Sketchpad - holds visual, spatial, and kinesthetic information in temporary storage by way of mental imagery.
- Central Executive System - allocates attention resources. Heavily influenced by emotional conditions such as anxiety and stress.
- Working memory is key to holding semantic information in mind long enough for motoric output.

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## What is Executive Functioning?

### Executive functioning and Written Language

- *Executive Functioning* refers to several aspects of independent, purposeful, and self-regulating behavior.
- Executive control mechanisms such as planning, self-monitoring, organizing, and allocating attention resources provide a set of building blocks or subroutines for effectively accomplishing the writing task.
- Primarily housed in prefrontal cortex.

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## Executive Functioning and Written Language

### Classification

(1) Initiating

(2) Sustaining

(3) Inhibiting

(4) Shifting

### Writing Dysfunction

\* Poor idea generation

\* Poor independence

\* Lose track of thoughts

\* Difficulty finishing

\* Sentences disjointed

\* Impulsive/Distractible

\* Perseverations

\* "Stuck" on topic

\* Difficulty writing about multiple events

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## Executive Functioning and Written Language

### Classification

(5) Poor Organization

(6) Poor Planning

(7) Poor Self Monitor

### Writing Dysfunction

\* Frequent erasers

\* Forget main idea

\* Disjointed content

\* Poor flow of ideas

\* Incorrect spacing

\* Lack of cohesive ties

\* Spelling miscues

\* Spelling miscues

\* Sloppy work

\* Careless errors

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## 5 Intervention Keys: Automaticity

- (1) Motor Skills Automaticity: "Handwriting without tears"
- (2) Spelling Automaticity: "Alphabetic Phonics"
- (3) Language Automaticity: "Scaffolding to enhance verbal fluency"
- (4) Executive Functioning Automaticity: "Graphic Organizers"
- (5) Self Monitoring Automaticity: "Peer review with COPS strategy"

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## Research Based Interventions

(Graham & Perin, 2007)

- (1) Writing Strategies (*effect size .82*)
- (2) Summarization (*effect size .82*)
- (3) Collaborative Writing (*effect size .75*)
- (4) Specific Product Goals (*effect size .70*)
- (5) Word Processing (*effect size .55*)
- (6) Sentence Combining (*effect size .50*)
- (7) Prewriting (*effect size .32*)
- (8) Inquiry activities (*effect size .32*)
- (9) Process Writing Approach (*effect size .32*)
- (10) Study of Models (*effect size .25*)
- (11) Writing for Content Learning (*effect size .23*)

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## Five Major Steps of Writing Process

(Ray, 2001)

- (1) Prewriting - use graphic organizers.
- (2) Drafting - use model to take notes and model how to organize in a text form using topic sentences.
- (3) Revising - second draft emphasizing content, and elaboration of ideas and making connections.
- (4) Editing - re-read for capitalization and punctuation errors.
- (5) Publishing - peer assisted strategies and teaching students to give and receive feedback.



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## Eight Constructs

### The 90 Minute Dysgraphia Evaluation

Intelligence Measures

Visual-Motor Integration

Attention

\*Working Memory\*

\*Executive Functions\*

Writing and Spelling Skills

Phonological Awareness Skills

Retrieval Fluency Skills

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