Dysgraphia is more than Messy Handwriting

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Overview
- Definitions
- Skills involved in handwriting
- At-risk characteristics
- Informal screening
- Handwriting difficulties
- Assessment
- A Look at dyslexia & dysgraphia

Simple (or not so simple) View of Writing


Definition - Dysgraphia

Greek word meaning impaired letter form production by hand

**Definition - Dysgraphia**

Motor Function (WNL)  
Handwriting Problems

The writing skill most related to students with dysgraphia... 

*Berninger, 2009*

**Terms**

Frontal lobe: articulation  
Parietotemporal: word analysis  
Occipitotemporal: word form area

The Reading Brain

*Berninger, 2009*
Orthographic memory:
Memory of letter patterns and word spellings

Orthographic coding – holding written words in memory while analyzing letter patterns in them

Orthographic loop:
links orthographic codes in the mind's eye with the sequential finger movements to form the letters (working memory component)

Terms
- Orthographic loop

Terms
- Graphomotor function – coordination of hand and finger movements for handwriting
- Graphomotor dysfunction – fine motor problems only affect their written language skills

Fierer & De Fina (2002); Pohlman (2008)
Handwriting Components

- Orthographic memory/coding
  Name and retrieve the letter/word
  Store the letter/word in the mind’s eye
  Plan to form letter (before writing)

- Graphomotor skills

- Spatial

“At risk” Characteristics

- Excessive erasures
- Mixture of upper- and lowercase letters
- Inconsistent letter formations and slant
- Irregular letter sizes and shapes
- Unfinished cursive letters

Richards, R. (1999)

“At risk” Characteristics

- Inefficient speed in copying
- Decreased speed of writing
- Excessive speed when writing
- Inattentiveness about details when writing
- Heavy reliance on vision to monitor what the hand is doing while writing

Richards, R., 1999

“At risk” Characteristics

- Endurance – become fatigued with longer written tasks
- Attention to task
- Motivation – needs excessive encouragement from the teacher

Pollock, N., et al., 2009
Informal Screening

Automatic letter writing is the best predictor of composition length and quality of typically developing writers in elementary through college

(Berninger, In Morris & Mather, 2008 – Evidence-Based Interventions for Students with Learning and Behavioral Challenges)

“At risk” Predictor

- The Alphabet Writing Task (15 sec.)
  - orthographic-motor integration
  - long-term motor memory for letter forms and sequence
  - motor planning & execution

Screening for Handwriting (K-3rd)

- Use of eraserless pencil & primary-lined paper
- Have students cross out and rewrite if they make a mistake
- Use of handwriting style used in instruction; lowercase letters
- Alphabet letters on display are covered


Directions:
The pencil you will use does not have an eraser. Whenever you want to make a correction, cross out and write the change above or below what you want to correct. With this pencil write the entire alphabet in order in lower-case, manuscript letters. Make sure you print and do not use cursive handwriting. Work as quickly as you can without making mistakes. Remember to print in lower-case letters, not capital letters. Ready? Go.

Berninger & Rutberg, (1992)

Alphabet Task

• After directions, start stopwatch. Time for one minute. Note what letter the student is writing every 15 seconds (or make a red slash on the student’s paper)

• Score is the number of letters produced within 15 seconds:
  - lower case,
  - not reversed,
  - legible (out of context), and
  - in correct sequence

Alphabet Task

- Accuracy of letter retrieval in first 15 seconds

<table>
<thead>
<tr>
<th></th>
<th>Grade 1</th>
<th>Grade 2</th>
<th>Grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>5</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>At-risk</td>
<td>$\leq 3$</td>
<td>$\leq 4$</td>
<td>$\leq 6$</td>
</tr>
<tr>
<td>$&lt; \text{Average}$</td>
<td>1</td>
<td>2</td>
<td>4</td>
</tr>
</tbody>
</table>

• Average – mean number of letters produced in 15 seconds
• At-risk – at or below $-1\ SD$ (standard deviation)

HWT: Screener of Handwriting Proficiency

- Memory
- Orientation
- Placement
- Sentence
- Posture, Pencil Grip, Helper Hand

- Formation
- Size
- Neatness
- Speed

Berninger & Rutberg, 1992
Handwriting Difficulties

Common graphomotor difficulties
- Motor memory
- Motor implementation
- Motor feedback


Nonmotor difficulties with handwriting
Motor Function (WNL)
Due to weak orthographic processing skills
Handwriting Problems

Berninger, 2009

Handwriting is Language by Hand

Orthographic codes (letter forms)
Phonological codes (letter names)
Graphomotor codes (output)
At-Risk Characteristics for Difficulties with Orthographic Memory

- Crossed out letters and words
- Inconsistent letter formations
- Frequent letter reversals
- Spacing the same between letters as between words
- Many may also lead to spelling delays
- Difficulty copying from the board

Levine, 2002

Assessment

Dysgraphia Assessment

Examine school records

Collect writing samples

Obtain teacher input

Obtain parent input (family history?)

Observe & Describe:

Handedness

Pencil grip

Paper position

Posture
Grip - Understanding the Hand

Two sides:
1. **Mobile side:** thumb, index finger, and middle finger; these fingers move when you write

2. **Stable side:** ring and pinky finger; these two fingers are generally closed and resting on the table during writing

- From: *Hold On....You Have to Teach Grip, Handwriting Without Tears*

Typical Pencil Grip

- **Tripod grip**
- Pencil held at a 45-degree angle to the page
- Pencil should rest in the "web space"
- Students should hold the pencil firmly with a relaxed arm and hand
- Pencil should point toward the shoulder of the writing arm

- Teaching Students with Dyslexia and Dysgraphia, Berninger & Wolf, 2009

Assessment of Handwriting & Related Processes:

- **Areas to assess:**
  - Legibility of handwriting – paying special attention to letter formations
  - Rate of handwriting
    - Alphabet Task
    - Copying Task
  - Orthographic processing
  - Spelling
  - Composition

- Legibility

  - Legible handwriting includes the following characteristics:
    - **Letter formation** – recognizable out of context; inconsistent formations
    - Size – of the letters and proportional size between upper and lowercase letters
    - Spacing – between letters and words
    - Line quality – steadiness and thickness of line
    - Slant – consistency in direction
    - alignment – uniformity of size and consistency on the writing line

**Handwriting Legibility Scale (HLS)**

- An informal tool to assess overall legibility/quality of writing for children aged 9 years and older (attached to handout).

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**Rate – Simple Evaluation**

- Count the total number of letters the student has written in the 3-minute period.
- Divide this number by 3 to get the total letters per minute (lpm).

\[93 \div 3 = 31 \text{ lpm}\]

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**Rate – Simple Evaluation**

- Compare the student’s proficiency to the following scale:

  - Grade 1: 25 lpm
  - Grade 2: 30 lpm
  - Grade 3: 38 lpm
  - Grade 4: 45 lpm
  - Grade 5: 60 lpm
  - Grade 6: 67 lpm
  - Grade 7: 74 lpm

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**Mather & Goldstein, 2001**
5th Grade

![Handwriting Sample]


### Spelling

- Norm-referenced or informal measure
- Compare oral spelling to written spelling

**Example:**

- Written spelling in isolation – *shipe*
- Oral spelling – *ship*

When asked to look at written spelling, the student recognized an error.

### Analyzing Spelling Errors

<table>
<thead>
<tr>
<th>Phonological (phonetically inaccurate)</th>
<th>Orthographical (phonetically plausible)</th>
<th>Morphological (word structure)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>gaj for garage</em></td>
<td><em>throte for throat</em></td>
<td><em>strapt for strapped</em></td>
</tr>
</tbody>
</table>

### Orthographic Processing

**Informal Checklist**

- Does the student have difficulty spelling irregular words?
- Forgets how letters look (inconsistent letter formations)
- Reverses letters when spelling (*b* for *d*)
- Has trouble copying from a book or board to paper
- Spells the same word in different ways
- Spells words how they sound rather than how they look

Assessment Checklist

- Review history/records
- Parents’ concerns/observations
- Teacher observations
- Assessment:
  - Observe grip, posture, paper position
  - Assess legibility
  - Assess rate
  - Assess orthographic processing
  - Assess spelling
  - Assess composition
- Write report

What about Special Education?

“Even though IDEA 2004 includes only the one broad category of written expression, poor spelling and handwriting are often symptomatic of a specific writing disability and should not be ignored.”

Mather & Wendling (2011). In Flanagan & Alfonso (Eds.). Essentials of Specific Learning Disabilities Identification. (p. 69)

<table>
<thead>
<tr>
<th>Dyslexia</th>
<th>Dysgraphia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty with lower-level foundational skills of reading (word reading)</td>
<td>Difficulty with lower-level foundational skills of writing (letter production)</td>
</tr>
<tr>
<td>Language-based (phonology and orthography)</td>
<td>Language-based (orthography)</td>
</tr>
<tr>
<td>Difficulties with spelling (transcription skill)</td>
<td>Can interfere with learning to spell words in writing</td>
</tr>
<tr>
<td>Impacts reading comprehension</td>
<td>Impacts written expression</td>
</tr>
<tr>
<td>Students with dyslexia may also have handwriting difficulties</td>
<td>Students with dysgraphia only, will not have difficulties with reading</td>
</tr>
</tbody>
</table>

References

Name of Experiment

fryd ice

Question to be answered

What is a physical change?

Hypothesis

It will change from a solid to a liquid to a gas.

The Experiment Ingredients

1. Ice, electric rice skillet

The Experiment Procedure

1. Heat the skillet 2. Add ice

The Experiment Results

0. Physical Changes when the state of matter changes from solid to liquid to gas the same.

Scoring:

_____ letter formations, size, & proportion

_____ spacing & alignment

_____ line quality

_____ slant

_____ general appearance

Overall score and description

Brenda Taylor, Ph.D., CALT, LDT
Handwriting Legibility Scale (HLS)

Name/ID of writer: ________________________________ Male / Female. Age: __________
Name of assessor:________________________________Date:______________________
Profession: _______________________________________________________________________
Number of years of experience working with children in this capacity: __________________________

Learning to produce legible handwriting at sufficient speed allows children to keep up with class work and demonstrate their knowledge. However some children struggle to learn this skill and it is important to identify those with difficulties.

The purpose of this scale is to obtain your overall impression of the quality of the written product (not the content of the writing), to establish the extent to which the handwriting allows for effective communication. The scale provides an overall evaluation to identify those with difficulties in producing legible and/or sufficiently fast handwriting. Please note that if a difficulty is identified, then a more detailed analysis of the handwriting may be required in order to plan how best to support the child to develop their skill.

The scale is designed for children aged 9 years and older. It contains five components, each of which should be rated on a five-point scale (1-5), with higher scores indicating poorer performance. Compute the total score by summing the five component scores.

The assessment should be based on a piece of ‘free writing’ produced by the child, ideally on an A4 sized sheet of lined paper. The text should be approximately 10 lines in length.

The focus of this scale is on legibility of the handwriting. However, since speed is also an important element you should also time the writing task. Start to time when the child begins to write and mark their text after six minutes. This will give you a record of the child’s rate of production, useful for comparing against other children of the same age and for monitoring performance over time.

Sometimes legibility is affected by spelling errors. You should therefore indicate below whether or not the child has made spelling errors in the text.

Legibility
Sum score (from over page): ____________________________

Speed
Number of words produced in 6 minutes: ____________
[Include all abbreviations, unfinished and crossed out words]

Spelling
Did the child have many spelling errors in the text compared to other children in the class? Yes / No
For the first three components, consider your overall impression of the writing:

A. Legibility - An overall impression of global legibility based on your first reading of the text.
1 – On first reading, all words are legible
5 – On first reading, only few words are legible

B. Effort - An overall impression of the amount of effort required for you to read the script the first time.
1 – On first reading, no effort is required to read the script
5 – On first reading, the script is extremely effortful to read

C. Layout on the page - An overall impression of the layout of writing on the page. Well organised handwriting is consistent, with elements appropriately positioned in relation to each other (e.g. the position of the margin, placement of letters on the baseline, spaces within and between words).
1 – Very good layout on the page.
5 – Very poor layout on the page.

Now focus on individual letters/words in more detail:

D. Letter formation - An overall impression of letter formation. Well formed letters are appropriately shaped, contain all necessary elements, neat letter closures and are consistent in size and slope.
1 – All letters very well formed
5 – Most letters very poorly formed

E. Alterations - An overall impression of the attempts made to rectify letters within words. Includes the addition of elements, re-tracing or re-writing of letters.
1 – There are no additional elements, re-tracing or over-writing of letters within words.
5 – Most words contain additional elements, re-tracing or over-writing of letters.

Sum score (quality of the written product): _____

Retrieved online from: https://www.brookes.ac.uk/psychology/research/groups/institute-for-research-in-child-development/resources/handwriting-legibility-scale/
Dysgraphia Assessment

- Review:
  - School Records – history of writing difficulties in early grades (K/1st)
  - Parent information:
    o Is there a history of ongoing and current handwriting problems?
    o Is there a family history of handwriting difficulties?
  - Handwriting samples – different times of the day; different lengths; copying vs. composing

- During assessment, observe & describe the following characteristics of the student’s handwriting:
  - Handedness
  - Pencil Grip
  - Paper Position
  - Posture

- Handwriting Assessment (to include rate and legibility):
  - Alphabet Task (compare oral & written)
  - Copying Task
  - Spelling
  - Composition

**Alphabet Task - timed (measure of orthographic loop):**
Measures – orthographic-motor integration; motor planning and execution
requires the child to retrieve from memory and produce alphabet letters in sequence, integrating orthographic symbols and motor output – orthographic loop; long-term and working memory are involved

**Directions:**
Materials: pencil without an eraser and paper lined appropriate to grade level.
Instructions:

The pencil you will use does not have an eraser. Whenever you want to make a correction, cross out and write the change above or below what you want to correct. With this pencil write the entire alphabet in order in lower-case, manuscript letters. Make sure you print and do not use cursive handwriting. [Once in a while I will make a red mark on your paper. Do not pay any attention to this. Keep going.] Work as quickly as you can without making mistakes. Remember to print in lower-case, not capital, letters. Ready? Go. (Start stopwatch. Note what letter the child has written at 15 seconds. Record total time.)
**Scoring Criteria:** Number of letters produced within 15 seconds:
- Must be lower case (directions required this)
- Not reversed
- Legible (letter recognizable out of context)
- Correct sequence

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<td>At-Risk</td>
<td>= or &lt; 3</td>
<td>= or &lt; 4</td>
<td>= or &lt; 6</td>
</tr>
<tr>
<td>Below Average</td>
<td>1</td>
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**Handwriting rate - copying a sentence containing all alphabet letters:** (timed)
[This task is a visual-motor copying task that requires fewer cognitive demands because a model of each word is provided; Short-term and working memory are involved]
- Ask the student to copy a sentence that has most of the letters of the alphabet (see below).
  - Have the student practice writing the sentence one time, and then ask the student to copy the sentence as quickly as possible in 3 minutes. Count the total number of letters the student has written in the 3-minute period and divide this number by 3 to get the total letters per minute (lpm).
  - *The quick brown fox jumped over the lazy dogs.*
  - *The five boxing wizards jump quickly.*
  - *Few black taxis drive up major roads on quiet hazy nights.*
- Compare the student’s proficiency to the following scale:
  - Grade 1: 25 lpm
  - Grade 2: 30 lpm
  - Grade 3: 38 lpm
  - Grade 4: 45 lpm
  - Grade 5: 60 lpm
  - Grade 6: 67 lpm
  - Grade 7: 74 lpm

**Composition:**
- To assess composition, you can have the student write about a topic they are interested in or something they are looking forward to; you could also use an unedited writing sample completed in class. Time the student for approximately 10 minutes (this also includes time for planning).
- Use the 6+1 Trait Rubrics for scoring [http://educationnorthwest.org/trait]
**Handwriting Legibility:**
Legibility can be assessed from either an unedited student work sample or from the student’s work on the composition measure.

1. Letter Formation:
   - Are letters recognizable out of context?
   - Are letters consistently formed?

2. Size:
   - Are there large fluctuations in the size of the letters?
   - Are letters proportional to each other and to case?

3. Spacing:
   - Is there crowding of words, letters, or lines?

4. Line Quality:
   - Is there uneven pressure?
   - Is there pressure that is too heavy?
   - Is there pressure that is too light?

5. Slant:
   - Is the slant generally consistent?

6. Alignment:
   - Are lines of text reasonable straight?
   - Is there consistent use of line boundaries?

   [You may also want to use the **Handwriting Legibility Scale**]

**Spelling**
- Spelling of single words in isolation (compare oral spelling to written spelling):
  - Informal - *Words Their Way Developmental Spelling Inventory*
  - Formal - Various achievement tests include a measure of spelling
- Analyze spelling errors – phonology, orthography, morphology
- If these instruments are available - measure of word choice (ability to identify correctly spelled words in the absence of graphomotor skills):
  - *Test of Orthographic Competence* – Word Choice
  - PAL-III – Word Choice

Brenda Taylor, Ph.D., CALT, LDT – 9/14/19
- **Orthographic Coding**

  Informal:
  - Building Blocks Questionnaire (Adapted from Mather & Goldstein, 2001)
    - Does the student have difficulty spelling irregular words?
    - Forgets how letters look
    - Reverses letters when spelling (b for d)
    - Has trouble copying from a book or board to paper
    - Spells the same word in different ways
    - Spells words how they sound rather than how they look
  
  Formal:
  - PAL-II Receptive Coding; *Symbol Imagery Test*

According to Berninger (2009, p. 75), “The transcription skill that explains unique variance in the handwriting, fluency, and quality of composing of children with dysgraphia, whose motor development falls within the normal range, is automatic retrieval and production of legible letters.”

**References**


