Chapter 14

EVALUATION OF HANDWRITING
Scott D. Tomchek • Colleen M. Schneck

CHAPTER OUTLINE

PRE-EVALUATION DATA COLLECTION
Writing Samples
Interviews
Record Review
EVALUATION OF RELATED PERFORMANCE COMPONENTS
Neuromuscular and Neurodevelopmental Status
Visual Perception
Motor Performance
Formulation of Written Language
Sensory Processing
ACTUAL EVALUATION OF HANDWRITING PERFORMANCE
Domains of Handwriting
Legibility Components
Writing Speed
Ergonomic Factors
Keyboarding Performance
Commercially Available Assessment Tools
SUMMARY

Writing is a way to record information and events; a tool for communication; and a means to project feelings, thoughts, and ideas (Chu, 1997). Occupational therapists are concerned with the occupational performance of individuals in play, work, and self-care activities. In childhood, a major occupation in the area of work is handwriting (Amundson, 1992, 1995; Chu, 1997). It is often one of the first tasks taught to students. Writing within learning tasks continues throughout the academic careers of children and is used to take written tests, compose stories, take notes in class, copy numbers for math computations, and communicate with friends and family. Writing continues to be used throughout their lives in the home and work place to write checks, take messages, and communicate with others.

Learning to write legibly is a complex task of childhood and therefore it is not uncommon for problems to arise during this learning process. Children may have illegible script, difficulties with letter formulation, lack the automaticity of writing, and therefore be unable to keep pace with their peers. As a result, school consequences of handwriting difficulties may be noted (Amundson, 2001) and may include the following.

- A child may be assigned poorer marks for papers with poorer legibility but not poorer content (Chase, 1986; Sweedler-Brown, 1992).
- A child’s slow handwriting speed may limit composition fluency and quality (Graham et al., 1997).
- A child may take a longer time to complete writing tasks than peers (Graham, 1992).
- A child may avoid handwriting tasks because it requires so much effort to produce text (Berninger, Mizokawa, & Bragg, 1991).

When handwriting impairments that affect academic performance are noted, children are often referred to occupational therapists for evaluation and intervention (Bonney, 1992; Case-Smith, 1996; McHale & Cermak, 1992; Reisman, 1991; Tseng & Cermak, 1993). The occupational therapist is responsible for identifying underlying motor, sensory, cognitive, or psychosocial deficits that may interfere with the development of legible handwriting (Amundson & Weil, 1996). The process of evaluation is multifaceted with many interrelated components. The purpose of this chapter is to discuss the process of evaluation for handwriting impairments and is grouped into three main components: (a) pre-evaluation data collection, (b) evaluation of related performance components that may be interfering with handwriting, and (c) evaluation of the actual process of handwriting.
PRE-EVALUATION DATA COLLECTION

Although discussed as separate assessment components by several authors (Amundson, 1992, 2001; Amundson & Weil, 1996), analysis of writing samples, interviews, and record review comprise the pre-evaluation data collection. Analysis of this information guides the necessary components and sequence of evaluation methods.

WRITING SAMPLES

Upon referral for handwriting problems, work samples often are offered to substantiate the need for referral. These samples should represent typical handwriting performance of the child (not the worst examples) and be analyzed to determine the types and magnitude of the handwriting difficulties seen in the classroom (Amundson, 2001). Comparing these samples to those of peers also may be of benefit in determining the magnitude of the difficulties, as well as gaining an understanding of teacher expectations. Informal evaluation of the work samples for alignment, size, letter formation, legibility, and slant may indicate need for further evaluation.

INTERVIEWS

Teachers and parents likely have valuable information about the child that contributes to the assessment process. Teachers can provide information about the child’s unique academic strengths and weaknesses in the classroom, as well as the specific curriculum of the class. In addition, the teacher can describe the type of script used (i.e., manuscript or cursive), the style of script used (i.e., D’Nealian, Zaner-Bloser) and his or her general expectations of the students for handwriting. Specific to the child referred for assessment, the teacher can provide information on the place where the child accomplishes writing, when difficulties occur, what remediation techniques if any have been attempted, and his or her feelings on why the handwriting difficulties may be occurring. In addition, he or she can provide insight on the child’s history of handwriting instruction.

Cornhill and Case-Smith (1996) found that students with poor handwriting, as identified by teacher report, scored significantly lower on three assessments of sensorimotor performance components (eye-hand coordination, visual motor integration, and in-hand manipulation) than students with good handwriting. The authors also found that scores on assessments of these performance components could be used to predict scores in handwriting performance. This information can guide therapists in their evaluation of children based on teacher report of poor handwriting.

Two factors that teachers indicated most frequently as important for handwriting to be acceptable were correct letter formation, and directionality and proper spacing (Hammerschmidt & Sudsawad, 2004). The most important criteria that teachers used to determine whether or not a student was having handwriting difficulties was their not being able to read the student’s writing. The majority of teachers answered that the methods they used to evaluate their students’ handwriting was comparing student handwriting to classroom peers (37%), followed by comparing student handwriting to models in a book (35%). This awareness can help structure the content of the occupational therapy evaluation and ensure that occupational therapy assessments produce results that are relevant to the children’s handwriting function in the classroom.

The parents can provide insight on many of these same factors as the child accomplishes handwriting in the home. In addition, the parents can provide information unknown to the teacher such as the attitudes and interests of the child. This difference in perspective may be useful in identifying the causes of handwriting difficulties.

RECORD REVIEW

Reviewing the child’s educational file can provide information on past academic performance and any special services that may have been provided to the student. Information obtained from the educational file may reveal a pattern of educational difficulty or isolated findings that may be useful in the assessment of handwriting difficulties. This review of information also may require further interview of the teacher.

Through classroom observations, examination of work samples, interviews, and record review a therapist is able to identify related performance components and administer assessments designed to determine whether deficits in the identified components exist and to what extent (Amundson & Weil, 1996).

EVALUATION OF RELATED PERFORMANCE COMPONENTS

To assist in the process of identifying the cause(s) of the handwriting impairments in a student, analysis of the underlying performance components related to handwriting require evaluation. Here, underlying sta-
bility, perceptual, sensorimotor, and written language functions are assessed to determine their impact on handwriting performance.

**Neuromuscular and Neurodevelopmental Status**

A comprehensive neuromuscular assessment often initiates the physical evaluation. Active and passive range of motion limitations are noted and if present, may limit in-hand or upper extremity mobility necessary for handwriting. Muscle tone in the trunk and extremities (both proximally and distally) also is evaluated. Strength often is assessed through structured observation of antigravity postures and movements. Specific muscle testing may be necessary in the hands and upper extremities.

To supplement neuromuscular findings, a neurodevelopmental assessment may be conducted. The neurodevelopmental assessment should include two groups of automated responses as markers for motor dysfunction. The first group of automated responses to be evaluated is the primitive reflexes. These reflexes appear during the late gestational period, are present at birth, and normally are suppressed by higher cortical function by approximately 6 months. Delayed integration of these reflexes has an impact on dissociated head and extremity movements and thus affects motor performance. For example, delayed integration of the asymmetric tonic neck reflex may limit dissociated head and upper extremity movement to the point of affecting development of hand dominance and midline crossing of the upper extremities. After evaluation of the primitive reflexes, the second group of automated responses to be evaluated is the postural reactions. Righting, equilibrium, and protective reactions must be evaluated. The coordination of these reactions into functional balance often is observed during free play and independent movements. Decreased functional balance in sitting may limit independent arm movement from trunk movement for writing. The child then moves the trunk with the arm for writing or frequently re-positions the paper as arm movement is needed.

Together, the tone, strength, reflex integration, and balance development of a child serve as the foundation for the development of stability and stable movement patterns. If a child is posturally unstable she or he will likely use compensatory movement patterns, which in turn may affect motor control during handwriting tasks. For example, a child who exhibits instability in the upper trunk and shoulder may use a mid-guard posture or stabilize at the shoulder to stabilize his or her upper thoracic and cervical areas during handwriting. By doing so, the child’s fluidity and speed of movement will likely be compromised. In addition, the child may fatigue quickly during handwriting tasks. These neuromuscular and neurodevelopmental skills serve as the foundation from which skilled mobility and motor skill are built. Deficits identified in these areas likely have an impact on performance of motor skill.

**Visual Perception**

Visual perception is the ability to use visual information to recognize, recall, discriminate, and make meaning out of what we see. Visual perceptual areas include the visual receptive (acuity, convergence, tracking) and the visual cognitive, which include visual discrimination, visual memory, visual form constancy, visual spatial relation, visual sequential memory, visual figure ground, and visual closure. Together, these perceptual skills provide vital information that is used and relied on by many other systems for optimal functioning. For instance, when copying text from a blackboard, we use visual figure ground to select the appropriate text on the blackboard to copy, visual discrimination to differentiate among letters, and visual memory and sequential memory to recall the text to be copied; therefore it is important to distinguish visual perceptual problems from motor problems.

Visual-perceptual skills, including visual-spatial retrieval and left-right orientation, enable children to distinguish visually among graphic forms and judge their correctness (Solvik, 1975; Thomassen & Teulings, 1983). Tseng and Murray (1994) reported that the 143 children in their sample of children with illegible handwriting had low scores on perceptual-motor measures. Tseng and Chow (2002) found a significant difference between slow and normal handwriters in upper-limb coordination, visual memory, spatial relation, form constancy, visual sequential memory, figure-ground, visual motor integration, and sustained attention.

Clinical observations can be used to obtain some informal information of perceptual abilities in children who cannot participate in formal testing. Situations can be devised to assess specific areas or a child’s work can be evaluated. For instance, having a child find a certain toy in a toy box can assess visual figure ground. Asking a child to find or select an item he or she was shown could be used to assess visual memory. Spatial relation difficulties often can be seen when asking a child to accomplish writing tasks, because drawings, letters, or words may be rotated. In addition, alignment and spacing may be a problem. Visual discrimination difficulties may affect the child’s handwriting in several ways and can be evaluated through observation of the child during handwriting.
For example, the child with poor form constancy may not recognize errors in his or her own handwriting and therefore not make corrections to errors. In addition, the child may be unable to recognize letters or words in different prints and therefore may have difficulty in copying from a different type of print or handwriting. The child also may show poor recognition of letters or numbers of different sizes or in different environments. If the child is unable to discriminate a letter, he or she may show poor letter formation in handwriting.

Children with problems in visual attention may have difficulty with the correct letter formation and can be evaluated through observation of the child during handwriting activities. Children with attention problems may exhibit difficulty with spelling, mechanics of grammar, punctuation, capitalization, and the formulation of a sequential flow of ideas necessary for written communication. For the child to write spontaneously, he or she must be able to visualize letters and words without visual cues. Therefore, if the child has visual memory problems, he or she may have difficulty recalling the shape and formation of letters and numbers (Schneck, 2001). Other problems that may be seen when a child has visual memory problems include missing small and capital letters within a sentence, the same letter may be written in different ways on the same page, and the inability to print the alphabet from memory. The child’s legibility may be poor, and he or she may need a model to write.

A child with visual spatial problems may show reversal of letters such as the m, w, b, d, t, c, and z and of the numbers 2, 3, 5, 6, 7, and 9. Children with difficulty with discrimination of left from right may have difficulty with the left-to-right progression or writing words and sentences (Schneck, 2001). In addition, the child may demonstrate over-spacing or under-spacing and have trouble keeping within the margins. He or she may show inconsistency in letter size and may have difficulty with the placement of letters on a line, or the ability to adapt letter sizes to the space provided on the paper or worksheet. Careful observation and informal assessment can help to uncover problems contributing to poor handwriting.

The formalized assessment of visual perceptual abilities usually is reserved for children of school age and older who have higher receptive language abilities, and are able to comprehend the verbal instructions inherent in these tests. Without receptive language abilities near the 5-year level, testing will likely be invalid because the instructions may be too abstract or not comprehended. To maximize performance and obtain the most accurate assessment of the individual perceptual areas, adaptation or simplification of verbal instructions may be necessary. For instance, when giving directions for the visual spatial relations areas, instead of instructing the child to “find the form that is going a different way” or “find the form that is not the same as the others,” the child will likely better understand the more simple terms of “wrong” or “different.” Therefore a request to find which one is wrong may produce improved performance. Because we are assessing perception and not receptive language abilities or vocabulary, making these adaptations allows evaluation of the focus area, visual perception. Tsurumi and Todd (1998) have applied task analysis to the nonmotor tests of visual perception. This information greatly assists the therapist in analyzing the results of these tests. Care in interpreting and reporting test results should be taken because it is not always clear what visual perceptual tests are measuring. Refer to Table 14-1 for a listing of standardized assessments that may be used to assess these visual perceptual areas. For valid test results it is important to follow the standard instructions on standardized tests. If the standard procedures are not followed it should be stated when reporting the results.

These visual perceptual assessments assess nonmotor perception, in that they do not require motor coordination for the completion of testing. Instead, the child can select his or her choice among the options by saying the appropriate letter that corresponds to his or her selection. Most children, however, point to their response.

Deficits in these perceptual abilities may affect many areas of development, especially fine and visual motor development. The information taken in visually guides our ability to reach to an object and the act of grasping that object. During writing tasks, visual information is used for spacing, alignment, and formation of all drawings and letters. When deficits in these areas, or in any areas that rely heavily on visual input for coordination, are detected, visual perceptual differences should be identified through formal or informal testing.

**Motor Performance**

For the purpose of this section, assessment of motor function is divided into the three broad areas of gross, fine, and visual motor development. There is much overlap between these areas of motor performance, in that common performance components (i.e., muscle tone, strength, coordination, visual motor integration) serve as the foundation for skilled motor output. There is also significant reliance between these motor skill areas. For example, stability aspects of gross motor development are vital in fine motor performance because stability provides a solid foundation from which skilled upper extremity usage is achieved. Both formal and structured observation assessment is described here. Some formalized assessments used to assess gross, fine,
and visual motor development are identified in Table 14-2.

When evaluating any component of motor performance, not only are developmental milestones noted, but also special attention is directed to the qualitative dimensions of the motor skill. Developmental milestones provide evidence of what the child can and cannot do relative to children of a comparable age. A major goal of the assessment should be to determine the source of an observed and documented deficiency, that is, why the skill is problematic. Observations made about the qualitative aspects of motor control often pinpoint the area(s) of dysfunction and serve as the foundation for intervention planning. In addition to the value of direct observation of motor skill, observation of contextual aspects of motor skill also enhances understanding of the source of developmental delays.

### Gross Motor Skill

Gross motor skill refers to movements that require the use of large muscle groups. Ambulating, running, jumping, climbing, and ball play are all considered gross motor skills. In neurodevelopmental theory, the mobility necessary for these locomotor skills is superimposed on stability. Consequently, the ability to perform these skills, and the quality with which they are performed, is dependant on the condition of the child’s neuromuscular and neurodevelopmental status. Often, the neuromuscular status assessment is considered one component of the child’s gross motor status. Accordingly, gross motor includes both evaluation of developmental milestones and observations about the qualitative aspects of movement patterns. Balance and stability are measured and observed as the child performs a number of motor tasks. These observations of

### Table 14-1 Instruments to assess visual perception

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Author, Year</th>
<th>Ages</th>
<th>Areas Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developmental Test of Visual Perception, Second Edition</td>
<td>Hammill, Pearson,</td>
<td>4–9 years</td>
<td>Eye-hand coordination, Spatial relations, Figure ground, Visual-motor speed,</td>
</tr>
<tr>
<td>(DVPT-2)</td>
<td>and Voress, 1993</td>
<td></td>
<td>Copying, Position in space, Visual closure, Form constancy</td>
</tr>
<tr>
<td></td>
<td>, 2003</td>
<td></td>
<td>ground, Visual closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>relation, Visual sequential memory, Visual figure ground, Visual closure</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>relation, Visual sequential memory, Visual figure ground, Visual closure</td>
</tr>
</tbody>
</table>
balance also have application to the vestibular processing of a child, illustrating the link between sensory and motor responses.

Assessment of these gross motor areas often is done within the context of play-based assessment or strictly through observation. Having a child go through a simple obstacle course, for instance, can provide a wealth of information about balance, strength, and postural control. Further, within many clinic settings or natural environments a child has the opportunity to explore his or her environment. In doing so, the child likely ambulates, runs, jumps, or has to climb steps. Situations also can be developed to observe catch and throw abilities. Report of functioning during higher-level bilateral motor tasks such as riding a bike and swimming likely may be obtained from the caregiver. As can be seen, throughout the evaluation, both developmental milestones are assessed and the quality with which they are accomplished is observed and analyzed. Deficits in stability noted during gross motor performance, especially trunk, shoulder, and neck, may or may not be present when a child is seated at a table to participate in handwriting tasks.

### Fine Motor Skill

Fine motor development refers to movements that require precise or fine motor actions and small muscles and more sensory feedback. Grasp of objects, writing, cutting tasks, and dexterity while accomplishing clothing fasteners are all considered fine motor tasks. When assessing fine motor skill it is again important to note the impact of stability and postural awareness.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Author, Year</th>
<th>Ages</th>
<th>Areas Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test of Visual Motor Skills-Revised-Upper Limits</td>
<td>Gardner, 1992</td>
<td>12–40 years</td>
<td>Visual motor control for design copying items</td>
</tr>
<tr>
<td>Developmental Test of Visual Motor Integration (VMI)</td>
<td>Beery and Buktenica, 1997</td>
<td>2–15 years</td>
<td>Visual motor control for design copying items</td>
</tr>
</tbody>
</table>
Stable positioning during fine and visual motor tasks enhances optimal performance, whereas instability diminishes fine coordination. The importance of addressing biomechanical factors, such as weak intrinsic muscles of the hand, has been stressed (Peterson & Nelson, 2003).

Fine motor skills are essential because accurately formed letters can be produced only by the proper timing and force control of coordinated arm, hand, and finger movements (Alston & Taylor, 1987; Thomassen & Tuelings, 1983). Children with illegible handwriting scored lower on fine motor measures than children with good handwriting (Tseng & Murray, 1994). Berninger and Rutberg (1992) examined additional variables and found that a fine motor task (sequentially touching the thumb to the tip of each finger) had the strongest correlation with handwriting. Levine, Oberklaid, and Meltzer (1981) not only found that 72% of 26 children with “developmental output failure” had difficulty with fine motor tasks, they further postulated that these children’s uncoordinated finger movements and diminished pencil control accounted for their slow, illegible handwriting.

Researchers have reported two general types of grip assessment systems: component and whole configuration. In component systems separate components of the grip are evaluated (i.e., the position of each finger and the thumb, the relative position of the grip along the length of the implement, or the forearm position relative to the table). In whole configuration systems, all of the components of an observed grip are described together. The grip is considered as a discrete behavior and is labeled. Burton and Dancisak (2000) have suggested that the use of Schneck and Henderson’s (1990) 10-grip scale be used only for documenting the grips of individual persons and changes in their grips. If comparisons between persons are desired, then the authors recommended Schneck’s (1991) five-level scale be used. Tseng (1998) added three interdigital grasps to this five-level scale in the primitive grasp category and included the quadruped grasp as another mature grasp for a total of 14 grasp patterns.

The task should be considered in the evaluation process. For example, in a coloring task, younger children used a more mature grip to color the edge and then colored the center with a less mature grip. Older children slow down to color the edge and then continue with the same grip for the center of the object (Schneck, 1991). Many children used less mature grips when coloring spaces than when drawing. The most common grip used for coloring was the static tripod grasp, whereas for drawing it was the dynamic tripod grasp (Schneck, 1991). Berninger and Rutberg (1992) contended that finger function is the best predictor of handwriting dysfunction, in which fine motor skill accounted for 52.5% of the variance in handwriting speed. Solvik and Arntzen (1991) found that poor coordination in the form of poor dissociation (exaggerated wrist and thumb movement) was inversely correlated with writing speed.

In-hand manipulation can be assessed with translation and rotation tasks with the five small pegs and pegboard from the Nine-Hole Peg test. Administration and scoring procedures can be found in Case-Smith (1996, 1998).

As in most assessments, initially the foundation skills of an area are assessed. Many of these areas relating to fine motor task performance are assessed through observation. Table 14-3 outlines the pertinent areas and specific questions that guide these structured observations in fine motor evaluation of handwriting.

In conjunction with these observations, the attention of the evaluator can turn to evaluating the functional application of these foundation skills. Here, the child is asked to engage in purposeful tasks as a means of identifying strengths, weaknesses, and developmental levels. If the child is unable to perform a motor task, it is important to try to ascertain why, because an inability to perform a motor task may stem from one or several limitations including lack of strength, deficient muscle control, dyspraxia, cognitive limitations, or motivation. Determining the reason for dysfunction allows for observation of hand dominance and appropriate intervention planning.

**Visual Motor Control**

There is much overlap between fine and visual motor skill, and often they are considered one entity. Visual motor control refers to the ability to coordinate visual information with motor output for visually guided movements. Appropriate visual motor control is predicted on intact visual localization and tracking abilities. Visual motor control is used to string beads, cut on a line, catch a ball, print within lines, and stay in the lines when coloring a picture. Some individuals may demonstrate better abilities for design copying items in tests of visual motor integration, but have difficulty when relating these abilities to handwriting. Therefore it is important to assess each area separately (see handwriting assessment section that follows). Fundamental to assessment is the recurrent theme of pinpointing the location of the breakdown in task performance. In the visual motor area, skills are dependent on adequate attention, visual perception, motor control, and motivation.

A number of researchers have documented a significant relationship between visual motor skills and handwriting performance (Cornhill & Case-Smith, 1996;
Daly, Kelley, & Krauss, 2003; Maeland, 1992; Tseng & Cermak, 1993; Tseng & Murray, 1994; Weil & Amundson, 1994). The Test of Visual Motor Integration (VMI) has been supported in the literature as a useful screening tool for handwriting abilities. Research suggests that students are ready to engage in formal handwriting instruction once they have mastered the ability to copy the first nine forms on the VMI (Beery & Butkenica, 1997; Daly, Kelley, & Krauss, 2003; Weil & Amundson, 1994). The researchers have concluded that most children who are typically developing will be ready for standard handwriting instruction in the later part of their kindergarten year. Visual motor integration was found to be the best predictor of legibility for both American and Norwegian children (Solvik, 1995) and a group of Chinese school-aged children (Tseng & Murray, 1994).

As can be seen by this discussion of assessment of motor performance, much overlap and interdependence exist between the areas of motor development. The ultimate goal of the process of motor assessment is to identify the unique strengths and weaknesses of the individual. Both formal and informal assessments determine this vital information. Once skill levels are identified, determining the etiology or source of the documented skill deficiencies provides the basis for program and intervention planning.

**Formulation of Written Language**

A written language assessment may be indicated during a comprehensive assessment of handwriting, and especially when speed difficulties are noted. Here, the goal is to determine if problems in written language (i.e.,
Formulation) exist and if so, if they could be a factor affecting handwriting rate. It stands to reason that a child who spends more time in formulation of thoughts and written communication will also likely take longer to put those thoughts to paper.

Written language assessment usually is accomplished by a speech language pathologist. Possible tools that may be used to conduct a written language assessment are summarized in Table 14-4.

### Sensory Processing

Sensory processing is a broad term that refers to the way in which the central and peripheral nervous systems manage incoming sensory information from the senses (Lane, Miller, & Hanft, 2000). Basically, sensory processing refers to the sequence of events that occurs as we take in and respond to environmental stimulation. In the assessment of handwriting—in addi-

---

### Table 14-4 Instruments to formally assess written language

<table>
<thead>
<tr>
<th>Instrument</th>
<th>Author, Year</th>
<th>Ages</th>
<th>Areas Assessed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral and Written Language Scales (OWLS)</td>
<td>Carrow-Woolfolk, 1995</td>
<td>3–21.11 years</td>
<td>Use of conventions&lt;br&gt;Use of linguistic forms&lt;br&gt;Communicate meaningfully</td>
</tr>
<tr>
<td>Test of Early Written Language (TEWL-2)</td>
<td>Hresko, Herron, and Peak, 1996</td>
<td>4–10 years</td>
<td>Basic writing&lt;br&gt;Contextual writing&lt;br&gt;Spontaneous formats&lt;br&gt;Contrived formats&lt;br&gt;Style&lt;br&gt;Spelling&lt;br&gt;Vocabulary&lt;br&gt;Logical sentences&lt;br&gt;Sentence combining</td>
</tr>
<tr>
<td>Test of Written Language 3 (TOWL-3)</td>
<td>Hammil and Larsen, 1996</td>
<td>7.6–17.11 years</td>
<td>Contextual conventions&lt;br&gt;Contextual language&lt;br&gt;Story construction&lt;br&gt;Spontaneous formats&lt;br&gt;Spelling&lt;br&gt;Vocabulary&lt;br&gt;Logical sentences&lt;br&gt;Sentence combining</td>
</tr>
<tr>
<td>Test of Written Expression (TOWE)</td>
<td>McGhee, Bryant, Larson, and Rivera, 1995</td>
<td>6.6–14.11 years</td>
<td>Ideation&lt;br&gt;Semantics&lt;br&gt;Syntax&lt;br&gt;Capitalization&lt;br&gt;Punctuation&lt;br&gt;Spelling&lt;br&gt;Composition/essay</td>
</tr>
<tr>
<td>Written Language Assessment</td>
<td>Grill and Kirwin, 1989</td>
<td>8–18 years</td>
<td>General writing ability&lt;br&gt;Productivity&lt;br&gt;Word complexity&lt;br&gt;Readability&lt;br&gt;Written language</td>
</tr>
<tr>
<td>Writing Process Test</td>
<td>Warden and Hutchinson, 1992</td>
<td>Grades 2–12</td>
<td>Purpose/focus&lt;br&gt;Audience&lt;br&gt;Vocabulary&lt;br&gt;Style/tone&lt;br&gt;Support/development&lt;br&gt;Organization&lt;br&gt;Sentence structure/variety&lt;br&gt;Grammar/usage&lt;br&gt;Capitalization&lt;br&gt;Spelling</td>
</tr>
</tbody>
</table>
tion to visual perception—tactile-proproprioceptive, kinesthesia, and praxis aspects require specific attention. Most of these aspects are assessed through structured observation during task performance and are included in Table 14-3. Tactile-proprioceptive processing is necessary to provide the child with information used to grasp the pencil. Kinesthesia provides the child with information that is used to gauge pressure on the pencil and of the pencil on the paper while writing or coloring. In addition, integration of vision and kinesthesia guides the direction of a writing tool. Children who have tactile-proprioceptive or kinesthesia impairments may hold their pencil too firmly or loosely or write with increased or decreased pressure to paper, both of which can influence endurance and quality of writing. Laszlo and Bairstow (1984) proposed that kinesthetic feedback is essential to handwriting development. They proposed that kinesthetic information has two functions in the performance and acquisition of handwriting: It provides ongoing error information, and it is stored in memory to be recalled when the writing is repeated. If kinesthetic information cannot be perceived or used, efficient programming cannot occur. Levine (1987) proposed that kinesthetic impairment in children might lead to decreased speed of handwriting because of either the excessive pressure needed for kinesthetic feedback or the slower visual feedback used to substitute for kinesthetic feedback. In addition, the child who has tactile-proprioceptive or kinesthesia impairment may continue to require visual monitoring of his or her hand for handwriting tasks. A recent study suggested that kinesthetic training did not improve handwriting legibility or kinesthesis in children; therefore evaluation may not offer treatment options but awareness of deficits in the child’s underlying components (Sudsawad et al., 2002).

Praxis refers to the planning and performance of a motor movement or task, or a series of motor movements or tasks. Impairments in praxis interfere with letter formation and may be seen initially as initiation deficits. The child may appear to form the letter differently each time and act as if he or she had never been taught proper formation. Further, praxis can impair building words from letters and writing letters or words on an automatic level.

Together, assessment of all of the discussed performance components provides information for the therapist to determine current developmental strengths and weaknesses related to handwriting performance. Noted deficits may serve as the foundation for noted handwriting difficulties and are used to interpret the findings of the actual assessment of handwriting performance.

**ACTUAL EVALUATION OF HANDWRITING PERFORMANCE**

The process of gathering information for a comprehensive handwriting evaluation has already largely been completed through observations made during previous testing. Specifically, observations about hand dominance, midline crossing, grasp patterns to a pencil, the firmness of that grasp, and the amount of pressure to paper have all been made during the fine and visual motor assessment. In addition, observations about stability and compensatory movement patterns also have been made. In this section, the focus is on the actual process of handwriting. Initially the domains of handwriting, legibility components, speed of writing, and ergonomic factors are discussed as outlined by Amundson (1992, 2001), followed by a discussion of commercially available assessment tools.

**DOMAINS OF HANDWRITING**

Evaluating the various domains of handwriting allows the therapist to identify which tasks the child is having more difficulty with and address those tasks in the intervention plan (Amundson, 1992). Handwriting skills needed by students are included in Box 14-1.

**LEGIBILITY COMPONENTS**

Legibility deficits in handwriting are often the primary reason for referral for handwriting problems. These

---

**BOX 14-1 Handwriting Skills Needed by Students**

- Writing the alphabet and numbers from memory requires that the student remembers letter/number formation, their sequence, and maintains consistent letter case (upper or lower).
- Copying. Both near-point (copying from a nearby model) and far-point (copying from a distant model) are used by students to take notes and communicate information.
- Manuscript-to-cursive transition requires the student to transcribe manuscript letters and words to cursive letters and words and demands a mastery of both letter forms.
- Dictation requires integration of both auditory processing and motor responding.
- Composition is a high level task requiring both written language and handwriting elements.
deficits may be caused by a number of components and are assessed by analysis of a writing sample. Letter formation is assessed initially to be sure letters are properly formed and legible. Alignment of letters on a line and in relation to each other is also assessed. Spacing that needs to be addressed includes letters within words, words within sentences, and the organization of the whole page. Another component to be addressed is letter size, which refers to the size of letters within writing guidelines and in relation to each other. Together, all of these qualitative aspects of legibility comprise the components of handwriting that are often the visible evidence of handwriting impairment. Informal evaluation also may include comparing the child to his or her peers in terms of the completion of a writing task during the allotted time and the amount of work completed.

Common handwriting problems such as incorrect letter formation, poor alignment, reversals, uneven size of letters, irregular spacing between letters and words, and slow motor speed (Alston & Taylor, 1987; Johnson & Carlisle, 1996) do not necessarily arise from identical underlying mechanisms. Careful observation and evaluation are needed to determine the underlying causes.

Two main approaches used in formal assessments to rate handwriting legibility are rating of the legibility components (i.e., slant, size, alignment) and rating of global legibility (i.e., overall readability of writing sample). The assessment of legibility using ratings of legibility components can be extremely time consuming and may not provide a clear picture of the overall readability of a child's written work (Sudawad et al., 2001). Often, the components are judged against standard templates, which may not be adaptable to variations in handwriting style. Changes in these components may or may not indicate whether the child's handwriting is easier or harder to read.

The readability of letters, words, and numerals is the primary criterion that determines global legibility. Evaluation of global legibility is quick and simple and addresses the functional aspects of handwriting legibility (Amundson, 1995). The evaluator is more concerned with whether the handwriting can be read with ease than with whether an exact correspondence exists between a handwritten letter and the model letter (Talbert-Johnson et al., 1991).

Examples of manuscript writing tests that rate legibility components include The Children's Handwriting Evaluation Scale for Manuscript Writing (Phelps & Stempel, 1984) and the Minnesota Handwriting Test (Reisman, 1993, 1999). The Evaluation Tool of Children's Handwriting (Amundson, 1998) evaluates global legibility of manuscript writing.

**Writing Speed**

Coupled with legibility, writing speed is a cornerstone of functional handwriting (Amundson, 1995). In general, speed of handwriting decreases as the complexity of a task increases. Therefore speed of writing needs to be addressed within each of the domains of handwriting to determine the impact of the different task demands. Although speed for copying tasks may be adequate, slower handwriting speed for composition task may indicate coexisting formulation deficits.

Slow handwriting speed affects functional performance because it prevents students from meeting time constraints involved in schoolwork (Cermak, 1991; Levine et al., 1981). Slow hand writers are different in the way they process written information from normal speed writers. Slow hand writers depend on visual processing, whereas normal speed writers are motor based (Tseng & Chow, 2002). Slow hand writers were poorer as a group than children with normal-speed hand writers in graphomotor output, level of perceptual motor skills, and decreased attention (Tseng & Chow, 2000). Rosenblum, Parush, and Weiss (2003) using a computerized digital system found that non-proficient 8- to 9-year-old handwriters required significantly more time to perform handwriting tasks and that their “in air” time, was especially longer as compared to the proficient handwriters. “In air” time refers to pauses, or temporary halts in the flow of writing (Benbow, 1995; Kaminsky & Powers, 1981). The researchers found this phenomenon not as a pause but rather as a “motion tour” taking place in the air between the writing of successive characters, segments, letters, and words. It may be that the “in air” time helps the student to prepare to execute subsequent characters or character segments. This time may be needed to parametrize the motor program or initiate activity in the muscle groups needed to execute the character. In addition, the researchers found that the non-proficient hand writers’ handwriting speed was slower and they wrote fewer characters per minute.

Formal assessments of handwriting speed are included in Table 14-5.

**Ergonomic Factors**

The ergonomic factors affecting handwriting (e.g., writing posture, grip, stability) have been discussed in the related performance components section, but require further mention here. From the literature, writing tools, paper, and surfaces appear to be important factors in handwriting.

In assessing grip it is important to keep in mind the effects of the task and writing tool on the grasp.
### Table 14-5  Instruments to assess handwriting

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age/grade Range:</strong></td>
<td>First and second grades</td>
<td>5–8.11 years</td>
<td>8–10.11 yrs</td>
<td>Grades 1-6</td>
</tr>
<tr>
<td><strong>Test Type:</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td><strong>Script Assessed:</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Manuscript</td>
<td>Cursive</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Domains Tested:</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Near-point copying</td>
<td>Far-point copying</td>
<td>Composition</td>
<td>Dictation</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Upper or lower case</td>
<td>Manuscript to cursive</td>
<td>Sensorimotor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td><strong>Paper:</strong></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lined</td>
<td>Unlined</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Pencil:</strong></td>
<td>Size used by student</td>
<td>No. 2</td>
<td>No. 2</td>
<td>No. 2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No. 2</td>
<td>No. 2</td>
<td>No. 2</td>
</tr>
</tbody>
</table>
### Table 14-5  Instruments to assess handwriting—cont’d

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time:</strong>&lt;br&gt;Administration</td>
<td>2.5 minutes</td>
<td>15-20 minutes</td>
</tr>
<tr>
<td>Scoring</td>
<td>3-7 minutes</td>
<td>15-20 minutes</td>
</tr>
<tr>
<td><strong>Assessed:</strong>&lt;br&gt;Rate</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Quality (types)</td>
<td>L, F, A, Sz, Sp</td>
<td>Sp, A, Sz, F</td>
</tr>
<tr>
<td><strong>Scores Yielded:</strong>&lt;br&gt;Classification/Rating</td>
<td>PR, Std, Sc, St</td>
<td>PR, Std, Sc, St</td>
</tr>
<tr>
<td><strong>Reliability:</strong>&lt;br&gt;Interrater</td>
<td>0.77 to 0.88 for inexperienced raters and from .90 to .99 for experienced raters</td>
<td>0.64 to 0.94 for inexperienced raters and from 0.63 to 0.91 for experienced raters</td>
</tr>
<tr>
<td>Intrarater</td>
<td>Ranged from 0.96 to 1</td>
<td>0.53 to 0.97 for inexperienced raters and from 0.64 to 0.98 for experienced raters</td>
</tr>
<tr>
<td>Test-retest</td>
<td>0.60 to 0.89 (ICC)</td>
<td></td>
</tr>
<tr>
<td><strong>Validated:</strong>&lt;br&gt;2000 first and second grade students from a nationwide sample</td>
<td>On 839 children from a nationwide sample</td>
<td>Items and scoring were developed by literature review and field testing</td>
</tr>
<tr>
<td>Available:</td>
<td>Psychological Corp</td>
<td>Psychological &amp; Educational Pub</td>
</tr>
</tbody>
</table>

**Quality Rating Key:** L=legibility, F=form, A=alignment, Sz=size, Sp=spacing, Sl=slant, R=rhythm, Ap=appearance

**Scores Yielded Key:** PR=percentile rank, Std=standard score, Sc=scaled score, St=stanine

Continued
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age/grade Range:</td>
<td>First and second graders</td>
<td>Grades 3-8</td>
<td>3-12 years</td>
<td>7-18.5 years</td>
<td>Grades 2-6</td>
</tr>
<tr>
<td>Test Type:</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Script Assessed:</td>
<td>Manuscript</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Domains Tested:</td>
<td>Near-point copying</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Far-point copying</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Composition</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Dictation</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Upper or lower case</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Manuscript to cursive</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td></td>
<td>Sensorimotor</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paper:</td>
<td>Lined</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unlined</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pencil:</td>
<td>No. 2</td>
<td>No. 2</td>
<td>No. 2</td>
<td></td>
<td>No. 2</td>
</tr>
<tr>
<td>Time:</td>
<td>Administration</td>
<td>2 minutes</td>
<td>3 minutes</td>
<td>7 minutes</td>
<td>3 minutes</td>
</tr>
<tr>
<td></td>
<td>Scoring</td>
<td>3-7 minutes</td>
<td>2 minutes</td>
<td>2 minutes</td>
<td>2 minutes</td>
</tr>
</tbody>
</table>
### Table 14-5  Instruments to assess handwriting—cont’d

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Scores Yielded:</td>
<td>Std, Pr</td>
<td>Pr</td>
<td>Std</td>
<td>Std, Pr</td>
<td>Std, Pr</td>
</tr>
<tr>
<td>Reliability:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interrater</td>
<td>Ranged from 0.85 to 0.93</td>
<td>Ranged from 0.99 to 1</td>
<td>Reported to be 0.95</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intrarater</td>
<td>Ranged from 0.98 to 1</td>
<td>Ranged from 0.71 to 0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test-retest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Validated:</td>
<td>On 643 Dallas County School students</td>
<td>On 1292 Australian students</td>
<td>On 1525 Chinese students</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Available:</td>
<td>Author</td>
<td>Out of print</td>
<td>Helios Art &amp; Book</td>
<td>Out of print</td>
<td>Author</td>
</tr>
</tbody>
</table>

**Quality Rating Key:** L—legibility, F—form, A—alignment, Sz—size, Sp—spacing, Sl—slant, R—rhythm, Ap—appearance  
**Scores Yielded Key:** Pr—percentile rank, Std—standard score, Sc—scaled score, St—stanine
Children used a less mature grasp in coloring than drawing (Schneck, 1991). Young children aged 23 to 24 months used a more mature grasp when drawing with a piece of crayon than with a pencil (Takimishyn & Magill-Evans, 2002). In addition, no difference in grasp maturity was found when using a pencil compared with a marker. Lastly, a more mature grasp was demonstrated when drawing on the easel compared with the table when using a crayon, not with a marker or pencil. Krzesni (1971) found a significant increase in writing performance with a felt pen. However, Lamme and Aynis (1983) found that writing tools did not affect legibility.

Several studies have extended the effects of writing paper on handwriting performance. Lindsay and McLennan (1983) and Weil and Amundson (1994) reported that for beginning writers, lined paper may add an element of confusion and compromise legibility. Krzesni (1971) found the opposite is true for older children; legibility improved with lined paper in 9-year-old children. Halpin and Halpin (1976) compared handwriting quality in kindergarten children with 1- and 1 1/2-inch–spaced paper and found no difference.

**Keyboarding Performance**

Sixth-grade students demonstrated low to moderate correlation between keyboarding and handwriting performance (Rogers & Case-Smith, 2002). This suggests that these forms of written expression require distinctly different skills. Most students who were slow at handwriting or had poor legibility increased the quantity and overall legibility of the text they produced with a keyboard. This suggests that it is important to assess keyboarding in nonproficient writers because it may simplify their text production. It may allow certain children to concentrate on content and meaning when composing and encourage them to engage in composition writing.

**Commerically Available Assessment Tools**

Several handwriting assessment tools are commercially available. Although Table 14-5 provides a graphic summary of these instruments, Appendix 14A also provides an in-depth analysis of each of the instruments that is still currently available and summarizes some findings.

As can be seen by analyzing Appendix 14A, few quality instruments specifically designed to assess handwriting are available. Selecting the most appropriate instrument is dependent on the individual needs of the evaluating therapist. In selecting a handwriting instrument, therapists must not only consider a child’s area of handwriting difficulty, but also the psychometric properties of the instrument chosen. In the opinion of the present authors, of the available instruments the Minnesota Handwriting Assessment (MHA) (Reisman, 1999), Test of Handwriting Skills (THS) (Gardner, 1998), and Evaluation Tool of Children’s Handwriting (ETCH) (Amundson, 1995) are the most useful. These instruments could be used in any number of settings. Each of these instruments provides for assessment of both legibility and rate or speed aspects of handwriting. All of the instruments also have in-depth scoring procedures that allow determination of the most common legibility errors.

The MHA has the most limited scope in that it is an assessment of near point copying only and can be used for first and second graders only. The flexibility for the assessment of both manuscript and D’Nealian script, its short administration time, and its relatively short scoring time make it attractive for clinical practice. A categoric scoring summary on the MHA allows comparison to peers and can be used to determine the need for intervention. Given these test constructs it is the recommended instrument for first and second graders experiencing difficulties with learning the writing process.

For students older than second grade, the THS and ETCH are the recommended instruments for use. Both of these instruments allow for assessment of rate and quality of writing within a number of handwriting domains (e.g., copying, dictation, composition) and have similar administration and scoring times. The ETCH allows assessment of more domains of handwriting and, in addition, addresses sensorimotor aspects of handwriting as part of the assessment. Given these added benefits of the ETCH, it is the recommended assessment for children in this age group. However, one drawback to its use is its lack of normative data (scoring results in a percentage of accuracy). Therefore if normative data are necessary for eligibility or other purposes, only the THS provides this information of the two in this age group.

Of the other instruments, the Children’s Handwriting Evaluation Scale (CHES) (Phelps & Stempel, 1984) and Children’s Handwriting Evaluation Scale for Manuscript Writing (CHES-M) (Phelps, 1987) were validated approximately 15 years previously and on a convenient sample of students in a school system in Texas. In addition, test composition factors relating to the scoring of quality and its resultant interpretation, and the use of unlined paper cause concern. Given these factors the overall value and validity of these two instruments is questioned. Although the Handwriting Speed Test (HST) (Wallen, Bonney, & Lennox, 1996a,b) may be useful if determining how a student’s handwriting speed compares to others, its lack of legibility scoring makes its uses limited. Further, given
its validation on a sample of students from Australia only, the reliability and validity of finding are questioned also.

It is important to note that when comparing Table 14-5 to the instruments in this Appendix, two of the instruments, the Denver Handwriting Analysis (Anderson, 1983) and Test of Legible Handwriting (Larsen & Hammill, 1989) are no longer commercially available and therefore are not reviewed here. When discussing the out-of-print status with the respective publishers, both stated that there was little demand for the instruments, which is interesting given the fact that handwriting difficulties are a primary reason for referral to occupational therapy. However, this supports the findings of a recent investigation that found that standardized handwriting assessments were rarely employed in assessment of handwriting (Feder, Majnmer, & Synnes, 2000).

**SUMMARY**

As can be seen by this discussion, the assessment of handwriting difficulty is a complex multifaceted process. Administration of a formalized assessment of handwriting alone does not provide the information necessary to determine the root of the difficulty or effectively plan a program. Stability, visual perception, motor performance, written language, and sensory processing aspects of development serve as the foundations for developing the skill of handwriting. Thus although administration of a formalized assessment of handwriting can determine the nature of handwriting difficulty demonstrated by a child, assessment of the related performance components provides the basis for determining the potential cause(s) of the impairments. Identification of these causes allows appropriate intervention planning to develop remediation of the handwriting impairments.

**REFERENCES**


Larsen SC, Hammill DD (1989). Test of legible handwriting. Austin, TX, PRO-ED.


Phipps J (1987). Children’s handwriting evaluation scale for manuscript writing. Dallas, TX, Scottish Rite Hospital for Crippled Children.


Handwriting Assessment Instruments

Minnesota Handwriting Assessment

Author, Year
Reisman, 1999

Description
The Minnesota Handwriting Assessment (MHA) is used to assess manuscript and D’Nealian handwriting in first and second graders who have knowledge of the English language. The MHA assesses Rate for the whole writing sample and five quality categories for each letter of the sample: Legibility, Form, Alignment, Size, and Spacing. Subjective quality ratings are collected and yield interpretive cutoff scores within each category: Performing like peers (top 75% of the final sample), performing somewhat below peers (within the bottom 5% and 25% of the final sample), or performing well below peers (bottom 5% of the final sample). It is recommended that students performing somewhat below peers should be monitored to determine if ongoing instruction or practice is needed or whether the student is demonstrating delayed development of underlying hand skills. It is recommended that students performing in the well-below-peers category be referred for comprehensive evaluation to determine the cause of handwriting difficulties.

Contents
What does the schedule try to measure? The MHA assesses handwriting performance. Specifically measured are Rate for the whole writing sample and five quality categories (Legibility, Form, Alignment, Size, and Spacing) for each letter of the sample.

Does it give a clinical diagnosis? No.

Purpose
The MHA was designed to help meet the needs of many school districts and special education departments that require a handwriting assessment to support the teacher’s subjective judgment of poor quality or slow rate (Reisman, 1999). It is recommended that interpretive ratings obtained after scoring the MHA be used to guide the need for further assessment and the intervention process.

Assessment Components
Type of Assessment: Near-point copy assessment
Task(s): The student is required to copy from a printed stimulus sheet onto lines below the words “the brown jumped lazy fox quick dogs over.” The mixed word order of the sentence is used to reduce the speed and memory advantage of better readers by requiring all students to refer to the stimulus items word by word.
Paper Type: Supplied lined paper with center dotted line
Pencil Type: Any size pencil typically used by the student

Administrative/Scoring Time
Administration: The test is timed for the first 2½ minutes to obtain the Rate score and then, if necessary, the students are given time to complete the sample to allow for scoring the five quality categories.
Scoring: After some experience with the instrument (30 samples), scoring time ranges from 3 to 7 minutes. From experience, scoring takes closer to 10 to 12 minutes.

Participants
Children: First and second graders
Developmental Level: Grade level

Derivation
Writing sample and scoring criteria were developed from a pilot version, through literature review and field testing with revision.

Published Material
Author/Others: author (Reisman, 1993, 1999); others (Peterson, 1999)
Usefulness: The MHA was designed to help meet the needs of many school districts and special education departments that require a handwriting assessment to support the teacher’s subjective judgment of poor quality or slow rate (Reisman, 1999).
Validated: On 2000 first- and second-grade students from a nationwide sample (Reisman, 1993, 1999) with cutoff scores determined after analysis. Content validity was established in development.
Reliability: Interrater ranged from 0.77 to 0.88 (Pearson) for inexperienced raters and from 0.90 to 0.99 for experienced raters. Intrarater reliability (5- to 7-day interval) ranged from 0.96 to 1. Test-retest stability (5- to 7-day interval) for performance level ranged from 64% to 86%. Test-retest reliability was conducted in a related study (Peterson, 1999) with at-risk students with correlations ranging from 0.60 to 0.89 (Internal Consistency Coefficient ICC).

Additional Statistical Analysis: A special group study was conducted to examine first- and second-grade students in regular education, special education, and special education plus occupational therapy. Scores on the MHA and Test of Visual Motor Skills (a design copying visual motor control test) were compared with correlations ranging from 0.37 to 0.89 (occupational therapy).

Test of Handwriting Skills

Author, Year
Gardner, 1998

Description
The Test of Handwriting Skills (THS) is used to assess a child’s neurosensory integration ability in handwriting either manuscript or cursive and in upper and lower case forms, and to measure the speed with which a child handwrites from: writing from memory, upper and lower case letters of the alphabet in sequence; writing from dictation, upper and lower case letters of the alphabet out of sequence; writing from dictation, numbers out of numeric sequence; copying selected letters from the alphabet; copying selected words; copying selected sentences; and writing from dictation selected words. Although the purpose of the THS is to measure how a child (ages 5 years, 0 months to 10 years, 11 months) can write letters, words, and numbers spontaneously, from dictation, or from copying, it is also used to determine the speed by which a child can produce letters spontaneously. Each of the 206 letters in the sample is scored using a four-point scale. The THS provides normative data in 3-month increments for each subtest (standard scores, scaled scores, percentile ranks, and stanines).
**CONTENTS**

What does the schedule try to measure? The THS measures quality of handwriting in children. In addition to the 206 scorable-language symbols, the THS, Manuscript version (for children ages 5 years to 8 years 11 months) has reversal of letters, letters touch one another, speed of writing letters spontaneously from memory, and converting lower case letters to upper case letters, and vice versa special features. The THS, Cursive version (for children ages 8 years to 10 years 11 months) has in addition to the 206 scorable letters, only one feature: speed of writing letters spontaneously from memory.

Does it give a clinical diagnosis? No.

**PURPOSE**

The purpose of the THS is to measure how a child can write letters, words, and numbers spontaneously, from dictation, or from copying. It is also used to determine the speed by which a child can produce letters spontaneously. These components of the assessment can identify both the strengths and weaknesses of a child’s handwriting that can be used to develop a remedial program. The goal of remediation is to improve a child’s legibility of letters, words, and numbers, along with increasing speed of writing.

**ASSESSMENT COMPONENTS**

Type of Assessment: Spontaneous composition, dictation and near-point copy assessment

Task(s): (a) Writing from memory, upper case letters of the alphabet in sequence; (b) writing from memory, lower case letters of the alphabet in sequence; (c) writing from dictation, upper case letters of the alphabet out of sequence; (d) writing from dictation, lower case letters of the alphabet out of sequence; (e) writing from dictation, numbers out of numerical sequence; (f) copying selected upper case letters from the alphabet; (g) copying selected lower case letters from the alphabet; (h) copying selected words; (i) copying selected sentences; and (j) writing from dictation selected words.

Paper Type: Supplied unlined paper in test booklet

Pencil Type: Standard number 2 pencil

**ADMINISTRATION/SCORING TIME**

Administration: The test can be administered in 15 to 20 minutes.

Scoring: After some practice, scoring time ranges from 15 to 20 minutes. From experience, scoring takes all of 20 minutes.

**PARTICIPANTS**

Children: Ages 5 years, 0 months to 10 years 11 months

Developmental Level: Grade level

**DERIVATION**

Overall test developed based on literature review. Words used in dictation components were determined by a group of 15 teachers.

**PUBLISHED MATERIAL**

Author/Others: Author (Gardner, 1998); others

Usefulness: Quality and rate findings of the assessment are used to identify both the strengths and weaknesses of a child’s handwriting that can be used to develop a remedial program.

Validated: On 839 children (Gardner, 1998) from a nationwide sample with normative data determined after analysis. Construct validity was in the moderate range. Concurrent validity studies yielded positive correlations with the TVMS-R, WRAT-3 (spelling component), Bender, and VMI.

Reliability: Internal consistency was described as “acceptable” with reliability coefficients ranging from .51 to .78.

Additional Statistical Analysis: None

**OTHER DATA IN SCHEDULE/OTHER INFORMATION/COMMENTS**

Helpful tool in discerning the types of handwriting errors exhibited by students. Cumbersome scoring and lengthy administration may inhibit frequent use in clinical practice. The use of unlined paper for this assessment may facilitate further handwriting impairments in that several studies have shown that children’s handwriting on unlined paper when compared with lined paper is poorer in quality (Alston & Taylor, 1987; Burnhill et al., 1983; Pasternicki, 1984).

**REFERENCES**


CHILDREN’S HANDWRITING EVALUATION SCALE

AUTHOR, YEAR
Phelps and Stempel (1984)

DESCRIPTION
The Children’s Handwriting Evaluation Scale (CHES) is used to assess cursive handwriting in third through eighth graders who have knowledge of the English language. The CHES assesses Rate to copy the passage (consisting of 197 letters) and five quality categories of the sample: Form, Slant, Rhythm, Space, and General Appearance. Rate and quality are evaluated independently on a five-point scale: very poor, poor, satisfactory, good, and very good. Percentile ranges can be assigned to correspond with rankings. In addition, percentile, standard scores, T-scores, and stanines are provided for Rate of writing for each grade.

CONTENTS
What does the schedule try to measure? The CHES assesses handwriting performance. Specifically, Rate for the whole writing sample and five quality categories (form, slant, rhythm, space, and general appearance) for the whole sample are measured.
Does it give a clinical diagnosis? No.

PURPOSE
The main purpose is to assess the rate and quality of a student’s handwriting. It is recommended that interpretive ratings obtained after scoring the CHES be used to guide need for further assessment and the remediation process.

ASSESSMENT COMPONENTS
Type of Assessment: Near-point copy assessment
Task(s): The student is required to copy a passage from a printed stimulus sheet directly below
Paper Type: Supplied unlined blank sheet with the passage on top
Pencil Type: Number 2 pencil

ADMINISTRATIVE/SCORING TIME
Administration: The test is timed for the first 2 minutes to obtain the Rate score and then, if necessary, the students are given time to complete the sample to allow for scoring the quality categories.
Scoring: Scoring time ranges from 3 to 7 minutes.

PARTICIPANTS
Children: Third through eighth graders
Developmental Level: Grade level

DERIVATION
No information identified.

PUBLISHED MATERIAL
Author/Others: Author (Phelps & Stempel, 1984); others
Usefulness: Interpretive ratings obtained after scoring the CHES should be used to guide need for further assessment and the remediation process.
Validated: On 1365 third- through eighth-grade students in Dallas County Schools (Phelps & Stempel, 1984) with cutoff scores determined after analysis. Content validity was established in development (Phelps & Stempel, 1984).
Reliability: Interrater ranged from 0.88 to 0.95 (ICC).
Additional Statistical Analysis: The reasons for need for remediation (performance below the 24th percentile) were studied with 9% needing remediation for quality only, 13% for rate only, and 2% for both rate and quality. In addition, rate scores for the CHES were compared with rate scores for the American Handwriting Scale (1957) (no longer available). Findings showed that students in 1984 wrote at a slower rate than in 1957 and that the AHS yielded more letters of writing at all grade levels.

OTHER DATA IN SCHEDULE/OTHER INFORMATION/COMMENTS
Useful primarily for rate scoring in that the five-point total quality scoring for whole sample lacks sensitivity to define specific handwriting problems. The short time to administer and score is a positive. Questionable reliability and validity given the convenient sample obtained from only Dallas County Schools. Validity of findings are also questioned given the tool’s use of unlined paper.
CHILDREN'S HANDWRITING EVALUATION SCALE FOR MANUSCRIPT WRITING (CHES-M)

AUTHOR, YEAR
Phelps, 1987

DESCRIPTION
The CHES-M is used to assess manuscript handwriting in first and second graders who have knowledge of the English language. The CHES-M assesses Rate to copy the sentences (consisting of 57 letters) and 10 quality components in four main categories: Form, Rhythm, Space and General Appearance. Rate and Quality are evaluated independently. Percentile ranks and standard scores are provided for Rate of writing for each grade. With respect to quality ratings, 10 points were assigned to each constituent. When all are present, 100 points are possible with 10 points deducted for each criterion not met. Scores between 10 and 40 are considered poor; between 50 and 70, satisfactory; and between 80 and 100 good. Percentile ranks and standard scores are provided for a quality total score based on rating.

CONTENTS
What does the schedule try to measure? The CHES-M assesses handwriting performance. Specifically, the CHES-M measures Rate for the whole writing sample and four quality categories: Form, Rhythm, Space and General Appearance. Rate and Quality are evaluated independently. Percentile ranks and standard scores are provided for Rate of writing for each grade. With respect to quality ratings, 10 points were assigned to each constituent. When all are present, 100 points are possible with 10 points deducted for each criterion not met. Scores between 10 and 40 are considered poor; between 50 and 70, satisfactory; and between 80 and 100 good. Percentile ranks and standard scores are provided for a quality total score based on rating.

Does it give a clinical diagnosis? No.

PURPOSE
The main purpose is to measure rate and quality of manuscript handwriting. It is intended to provide a standard by which to monitor gradual improvement or immediately define specific problem areas.

ASSESSMENT COMPONENTS
Type of Assessment: Near-point copy assessment
Task(s): The student is required to copy two sentences (57 total letters) on a printed stimulus sheet directly below.
Paper Type: Supplied unlined blank sheet with the passage on top
Pencil Type: Number 2 pencil

ADMINISTRATIVE/SCORING TIME
Administration: The test is timed for 2 minutes. If the student finishes before 2 minutes, he or she is asked to start again.
Scoring: Scoring time ranges from 3 to 7 minutes.

PARTICIPANTS
Children: First and second graders
Developmental Level: Grade level

DERIVATION
Derived from the CHES with the same schools used for norming purposes.

PUBLISHED MATERIAL
Author/Others: Author (Phelps, 1987); others
Usefulness: It is intended to provide a standard by which to monitor gradual improvement or immediately define specific problem areas.
Validated: On 643 first- and second-grade students in Dallas County Schools (Phelps & Stempel, 1984) with cutoff scores determined after analysis. Content validity was established in development.
Reliability: Interrater ranged from 0.85 to 0.93 (ICC).
Additional Statistical Analysis: None.

OTHER DATA IN SCHEDULE/OTHER INFORMATION/COMMENTS
Short administration and scoring time are benefits to use in clinical practice. Significant questions relating to reliability and validity given the convenient sample obtained from only Dallas County Schools. Validity of findings is also questioned given the tools use of unlined paper.
Reference
Phelps J (1987). *Children’s handwriting evaluation scale for manuscript writing*. Dallas, TX, Scottish Rite Hospital for Crippled Children.

Evaluation Tool of Children’s Handwriting
Author, Year
Amundson, 1995

Description
The Evaluation Tool of Children’s Handwriting (ETCH) is designed to evaluate manuscript (ETCH-M) and cursive (ETCH-C) handwriting skills of children in grades 1 through 6 who are experiencing difficulty with written communication. The ETCH contains seven cursive writing tasks and six manuscript writing tasks, plus items addressing the child’s ability to handle the writing tool and paper. The primary focus of the ETCH is to assess a child’s legibility and speed of handwriting in writing tasks that are similar to those required of students in the classroom. The ETCH also examines specific legibility components of a child’s handwriting such as letter formation, spacing, size, and alignment, as well as a variety of sensorimotor skills related to the child’s handling of the writing tool and paper. Subtest and ETCH total scores are calculated as percentages on the basis of the number of readable letters, words, and numbers.

Contents
What does the schedule try to measure? The ETCH examines specific legibility components of a child’s handwriting (manuscript or cursive) such as letter formation, spacing, size, and alignment, as well as a variety of sensorimotor skills related to the child’s handling of the writing tool and paper. These components are measured from spontaneous composition, dictation, near-point, and far-point copying tasks.

Does it give a clinical diagnosis? No.

Purpose
The primary purpose of the ETCH is to assess a child’s legibility and speed of handwriting in writing tasks that are similar to those required of students in the classroom.

Assessment Components
Type of Assessment: Spontaneous composition, dictation, near-point, and far-point copy assessment

Task(s): The ETCH-C has the following tasks: (a) writing from memory, upper and lower case letters of the alphabet in sequence; (b) writing from memory, the numbers 1 to 20 in sequence; (c) near-point copying a short sentence; (d) far-point copying a short sentence; (e) manuscript-to-cursive transition a short sentence; (f) dictation three nonsense words; and (g) sentence composition. The ETCH-M consists of all of the preceding subtests with the exception of manuscript-to-cursive transition.

Paper Type: Supplied lined paper in test booklet
Pencil Type: Standard number 2 pencil

Administrative/Scoring Time
Administration: The test can be administered in 15 to 30 minutes depending on the child’s age and handwriting difficulties

Scoring: After some practice, scoring time ranges from 10 to 20 minutes. From experience, scoring takes all of 20 minutes.

Participants
Children: Children in grades 1 through 6, ages 6 years, 0 months to 12 years, 5 months

Adults: Can be used to gather descriptive information related to their functional handwriting performance.

Developmental Level: Grade level

Derivation
Writing sample and scoring criteria were developed from a pilot version through literature review and field testing with revision.

Published Material
Author/Others: Author (Amundson, 1995); others (Diekema, Deitz, & Amundson, 1998; Grace-Frederick, 1998; Koziatek & Powell, 2002; Schneck, 1998; Sudsawad et al., 2001)

Usefulness: Useful in assessing a child’s legibility and speed of handwriting in writing tasks that are similar to those required of students in the classroom. This is useful in analyzing underlying sensorimotor functions of handwriting and assessing handwriting quality to determine the need for intervention and baseline for monitoring progress.

Validated: Although one construct validity study (Grace-Frederick, 1998) showed agreement between teacher ratings of poor handwriting and poor per-
formance on the ETCH, another study (Sudsawad et al., 2001) reported that little agreement was noted between teacher questionnaires of handwriting difficulty and ETCH performance. The concurrent validity coefficients were 0.61 for ETCH-C total words and 0.65 for total letters and handwriting grade.

Reliability: Interrater ranged from 0.64 to 0.94 (Pearson) for inexperienced raters and from 0.63 to 0.91 for experienced and inexperienced raters. Intrarater reliability ranged from 0.53 to 0.97 for inexperienced raters and from 0.64 to 0.98 for experienced and inexperienced raters. Test-retest reliability was conducted in a related study (Diekema et al., 1998) with correlations ranging from 0.63 to 0.71 (Pearson) for total numeral, letter and legibility, with generally lower subtest coefficients (0.20 to 0.76).

Additional Statistical Analysis: None

OTHER DATA IN SCHEDULE/OTHER INFORMATION/COMMENTS

One of the more widely used instruments, although it lacks normative data. Thorough manual and templates eliminate the need for constant ordering of forms. Useful in identifying the types of handwriting difficulties a student may be having, as well as potential underlying sensorimotor difficulties. It is cumbersome scoring a negative. Reliability findings also are questioned given the use of the Pearson (Ottenbacher & Tomchek, 1993, 1994).

REFERENCES


HANDWRITING SPEED TEST

AUTHOR, YEAR

Wallen, Bonney, and Lennox (1996a,b)

DESCRIPTION

The Handwriting Speed Test (HIST) is a standardized, norm-referenced test of handwriting speed for children and adolescents in grades 3 through 12. It is intended to be used as one component of a multifaceted assessment of handwriting. After a 3-minute trial of copying the words “the quick brown fox jumps over the lazy dog” as many times as they can, a letters per minute is obtained and converted to a scaled score. The scaled score can be used in determining the eligibility of students for extra time or other assistance in examinations, identifying children who require intervention for handwriting speed difficulty, and evaluating the effects of intervention on handwriting.

CONTENTS

What does the schedule try to measure? Handwriting speed for children and adolescents in grades 3 through 12.

Does it give a clinical diagnosis? No.

PURPOSE

The HIST was developed to provide an up-to-date and objective means of evaluating the handwriting speed of students presenting with handwriting difficulties.

ASSESSMENT COMPONENTS

Type of Assessment: Near-point copy assessment

Task(s): The student is asked to copy from a typed Handwriting Sample Form onto lines below the words “the quick brown fox jumps over the lazy dog” as many times as they can in a 3-minute period.

Paper Type: Supplied lined paper with center dotted line

Pencil Type: Number 2

ADMINISTRATIVE/SCORING TIME

Administration: The test is timed for 3 minutes to obtain the Rate score.

Scoring: Scoring time ranges from 3 to 5 minutes.
PARTICIPANTS

Children: Third through twelfth graders
Adults: Young adult (high school aged)
Developmental Level: Can be used for children with physical disabilities, learning disabilities, or specific handwriting difficulties

DERIVATION

Writing sample and scoring criteria were developed through literature review

PUBLISHED MATERIAL

Author/Others: Author (Wallen, Bonney, & Lennox, 1996a,b; Wallen & Mackay, 1999); others
Usefulness: The HST was designed to provide an up-to-date and objective means of evaluating the handwriting speed of students presenting with handwriting difficulties. The HST is a useful tool for determining the eligibility of students for extra time or other assistance in examinations, identifying children who require intervention for handwriting speed difficulty, evaluating the effect of intervention on handwriting, and conducting research with handwriting speed as a variable (Wallen et al., 1996b).
Validated: On 1292 third through twelfth grade students from New South Wales, Australia schools with normative data determined after analysis. Content validity was established in development.

Reliability: Interrater ranges from 0.99 to 1.00 (ICC) for each grade and an ICC of 1.00 for the whole sample. Intrarater reliability ICC was 0.99 for the whole sample and ranged from 0.99 to 1.00 for various grades, teacher ratings, and genders of students. Test-retest reliability correlations ranged from 0.717 to 0.916 (ICC) for the various grades and speeds of hand writers.
Additional Statistical Analysis: None

OTHER DATA IN SCHEDULE/OTHER INFORMATION/COMMENTS

Its short administration and scoring time make it advantageous to clinical practice if assessing rate of handwriting in isolation. This is rarely the case; therefore other instruments assessing both handwriting quality and rate will likely see more use.

REFERENCES