

# Motor Assessment

## Overview of Instruments

Motor assessments have not been developed specifically for use with students with autism; however, a variety of instruments are available that may be useful when assessing the motor performance of these students. Because it appears that motor problems are inherent in autism (cf. Aspy & Grossman, 2007; Nayate, Bradshaw, & Rinehart, 2005; Ozonoff et al., 2008), a motor assessment is important to understanding the complex needs of an individual on the spectrum.

The School Function Assessment (SFA; Coster, Deeney, Haltiwanger, & Haley, 1998) and the Pediatric Evaluation of Disabilities Inventory (PEDI; Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992) are criterion-based assessments that measure the functional performance of a variety of motor activities. Both tools benefit from the input of more than one professional. They help identify functional strengths and limitations of a particular student and can help identify areas for program planning. In addition, many standardized, norm-based motor assessments can be used to assess fine- and gross-motor skills, visual motor skills, and handwriting, including the 11 reviewed here.

### **THE BEERY-BUKTENICA DEVELOPMENTAL TEST OF VISUAL-MOTOR INTEGRATION-FIFTH EDITION (BEERY VMI)**

The Beery-Buktenica Developmental Test of Visual-Motor Integration-Fifth Edition (Beery VMI; Beery & Beery, 2006) is a norm-referenced test used to assess the ability to integrate visual and motor abilities. It requires students to copy a sequence of geometric forms using paper and pencil. Copied forms receive a scores of “1” for correct or “0” for incorrect. The Beery VMI can be administered in approximately 10-20 minutes and may be administered in groups or individually.

Two supplemental tests are available to assess visual and motor skills separately: the Beery VMI Visual Perception Test and the Beery VMI Motor Coordination Test. When all three tests are

given, the Beery VMI must be given first, followed by the Visual Perception Test and then the Motor Coordination Test.

## **THE BRUININKS-OSERETSKY TEST OF MOTOR PROFICIENCY-SECOND EDITION (BOT-2)**

The Bruininks-Oseretsky Test of Motor Proficiency-Second Edition (BOT-2; Bruininks & Bruininks, 2005) is a test of motor proficiency for children ages 4-21 years. It consists of eight subtests, four in the gross-motor area (Bilateral Coordination, Balance, Running Speed, and Agility, Strength) and four in the fine-motor area (Fine-Motor Precision, Fine-Motor Integration, Manual Dexterity, and Upper-Extremity Coordination). Four composite scores are available, including Fine-Manual Control, Manual Coordination, Body Coordination, Strength/Agility, and Fine-Motor Coordination. The entire test requires 45-60 minutes for administration; however, separate composite areas can be administered in 10-15 minutes. The BOT-2 also has a Short Form consisting of one to two items from each of the eight areas. This can be used as a screening tool and can be administered in 10-15 minutes.

Therapists are cautioned about using the BOT-2 to determine skill level in specific areas of motor skills because the Total Motor Composite standard score and the Short Form standard score have been shown to be most stable compared to specific task scores. Therapists should also note that children with disabilities were included in the normative sample of this second version; therefore, use of the same cutoff scores as the BOTMP may result in fewer children being identified as needing services (Dietz, Kartin, & Kopp, 2007).

## **THE CLINICAL OBSERVATION OF MOTOR AND POSTURAL SKILLS-SECOND EDITION (COMPS)**

The Clinical Observation of Motor and Postural Skills-Second Edition (COMPS; Wilson, Pollock, Kaplan, & Law, 2000) is a screening tool for identifying the presence or absence of motor problems with a postural component. It is based on six clinical observations suggested by Ayres (1972) to supplement information received from standardized tests, including slow movements,

rapid forearm rotation, finger-nose touching, prone extension posture, asymmetrical tonic neck reflex, and supine flexion posture.

The COMPS, which takes 15-20 minutes to administer, is appropriate for children ages 5 through 15. It can be used to screen groups of children. The authors caution that the COMPS is not designed for children with known neurological or neuromotor problems, such as CP or epilepsy, nor for children with general intellectual delay.

### **THE EVALUATION TOOL OF CHILDREN'S HANDWRITING (ETCH)**

The Evaluation Tool of Children's Handwriting (ETCH; Amundson, 1995) is a criterion-referenced assessment of manuscript and cursive writing for students in grades 1 through 6 (6 years through 12 years 5 months). It is designed for use primarily with students with mild developmental delays, learning disabilities, and mild neuromuscular impairments. The ETCH assesses legibility, speed, letter formation, spacing, size, and alignment. Additionally, it contains observation sections for pencil grasp, pencil management, and classroom behavior.

The ETCH consists of the following seven tasks: writing alphabet from memory, writing numerals from memory, near point copying, far point copying, manuscript to cursive translation, dictation, and sentence composition. This test is simple to administer in 20-25 minutes. Scoring is more challenging and can take 10-20 minutes depending on the scorer's familiarity with the scoring guidelines. ETCH results in legibility and speed scores for the seven tasks as well as a composite score for total legibility.

### **THE MINNESOTA HANDWRITING ASSESSMENT (MHA)**

The Minnesota Handwriting Assessment (MHA; Reisman, 1999) is a norm-based assessment that can be used from January of first grade through second grade to assess manuscript handwriting with Zaner-Bloser, Palmer, or D'Nealian styles. It is a near-point copy assessment that can be administered in 5-10 minutes to a group of students or to a single student. It is a standardized assessment that results in scores for rate, legibility, form, alignment, size, and spacing. Scores are assigned to the following categories: Performing Like Peers, Performing

Below Peers, and Performing Well Below Peers. According to the author, students who fall in the bottom 5% (Performing Well Below Peers) should be considered for further evaluation.

In general, evaluation of handwriting is a challenge to school-based therapists because of the subjectivity involved as well as the complexity of the components involved in the task.

Reliability and validity studies are not conclusive with these tests; therefore, therapists should be careful not to use these exclusively when making decisions about intervention and eligibility (Feder & Majnemer, 2003). The same can be said about the use of all standardized tests in school-based therapy and with students with AU. Best practice involves use of a variety of methods to perform comprehensive evaluations, including standardized measures, observation, functional skill assessment, and/or teacher/parent interviews.

### **THE MOVEMENT ASSESSMENT BATTERY FOR CHILDREN (MOVEMENT ABC)**

The Movement Assessment Battery for Children (Movement ABC; Henderson & Sugden, 1992) is a norm-based assessment of fine- and gross-motor performance for children ages 4 through 12. It contains items in three categories: manual dexterity, ball skills, and dynamic balance. The test is given according to four age bands, with test items changing depending on the age category. Testing results in a Total Impairment Score converted to a percentile. Percentile scores below 5% indicate a definite motor problem, whereas 5 to 15% is considered a Borderline Motor Problem.

The Movement ABC also contains a checklist completed by a teacher or other professional to assess how the child performs motor activities in everyday situations and the child's feelings toward motor tasks. The examiner is allowed to use any method to ensure understanding of the task, which results in a test that is more focused on motor tasks. For this reason, the Movement ABC is particularly suited for children who have difficulties with behavior, communication, intelligence, and/or attention (Greene et al., 2002).

## **THE PEABODY DEVELOPMENTAL MOTOR SCALES-SECOND EDITION (PDMS-2)**

The Peabody Developmental Motor Scales-Second Edition (PDMS-2; Folio & Fewell, 2000) is a test of gross- and fine-motor development for children ages birth to 6 years 11 months. The gross-motor component consists of four subtests: Stationary, Locomotion, Reflexes, and Object Manipulation. Two subtests, Grasping and Visual Motor Integration, make up the fine-motor portion. The test requires the child to perform specific motor items and is scored with a 2, 1, or 0 for each item, depending on whether the child correctly, partially, or does not complete the item according to its description. Standard scores, percentiles, and age-equivalents are available as well as quotient scores in fine- and gross-motor areas. The entire PDMS-2 can be administered in 45-60 minutes. Separate fine- or gross-motor subtest administration takes 20-30 minutes.

## **THE PEDIATRIC EVALUATION OF DISABILITY INVENTORY (PEDI)**

The Pediatric Evaluation of Disability Inventory (PEDI; Haley, Coster, Ludlow, Haltiwanger, & Andrellos, 1992) is a judgment-based questionnaire that evaluates functional skills in the domains of self-care, mobility, and social function for children ages 6 months to 7 years old. Using a 0 or 1 scale, the caregiver rates whether the child is capable or unable to perform each item. The PEDI also includes questions about the amount of caregiver assistance and environmental modifications needed for certain tasks.

The inventory is designed for use as a structured interview; when used in its entirety, it takes 45-60 minutes to administer. It can also be administered as separate components as normative scores are available for each of the three domains. The PEDI is a norm-referenced measure that also contains a criterion-referenced component. For children outside of the age range of the PEDI to whom standard scores do not apply, the score may be looked at on a continuum from low to high functioning.

## **QUICK NEUROLOGICAL SCREENING TEST-II-SECOND REVISED EDITION (QNST-II)**

The Quick Neurological Screening Test-II (QNST-II; Mutti, Sterling, Martin, & Spaulding, 1998) is a norm-referenced screening assessment of 15 areas of neurological integration as they relate to learning. It is designed to be used for students age 5-18 and can be given in approximately 20 minutes. The QNST-II enables professionals to identify possible problems in physical development in such areas as manual dexterity, spatial orientation, fine- and gross-motor movements, visual tracking, and tactile perceptual activities that often co-occur with learning problems.

The examinee completes a series of motor tasks sampling maturity of motor development, skill in controlling large and small muscles, motor planning and sequencing, sense of rate and rhythm, spatial organization, visual and auditory perceptual skills, balance and cerebellar-vestibular function, and disorders of attention.

## **SCHOOL FUNCTION ASSESSMENT (SFA)**

The School Function Assessment (SFA; Coster, Deeney, Haltiwanger, & Haley, 1998) is a criterion-referenced assessment used to measure a student's performance of non-academic functional tasks that support participation in elementary school (K-6). It is designed for use in integrated settings with same-age/grade peers. The SFA measures three areas of school function: (a) level of participation in six major activity settings, (b) task supports – assistance and adaptations provided to the student, and (c) activity performance. The SFA uses a Likert scale with respondents rating a student from “extremely limited participation” to “full participation,” “extensive assistance/adaptations to no adaptations,” and “does not perform to consistent performance.”

Criterion scores indicate the student's place on a functional continuum rather than distance from norms. Because the instrument is criterion referenced, it provides specific information about a student's strengths and limitations, which is useful in program planning. It takes 1-1/2 - 2 hours to complete the entire SFA; however, individual sections can take as little as 5-10

minutes to complete. A single respondent who knows the student well can complete it, or it can be used as a collaborative assessment in which multiple professionals involved with a student contribute information.

### **THE TEST OF HANDWRITING SKILLS-REVISED (THS-R)**

The Test of Handwriting Skills-Revised (THS-R; Milone, 2007) is a standardized, clinician-administered assessment of manuscript and cursive handwriting used with students ages 5 years to 18 years 11 months. The THS takes approximately 25 minutes to administer and score, and may be individually or group administered. It consists of eight tasks that measure how a student writes upper and lower case letters, numbers, words, and sentences. These items are written in one of the following ways: from memory, by copying or from dictation. The test also measures speed of writing, letter reversal, and case substitutions. It can be used with Zaner-Bloser, Palmer, or D’Nealian styles.

### **THE WIDE RANGE ASSESSMENT OF VISUAL MOTOR ABILITIES (WRAVMA)**

The Wide Range Assessment of Visual Motor Abilities (WRAVMA; Adams & Sheslow, 1995) consists of three subtests: Visual-Motor, Visual-Spatial, and Fine-Motor, that can be given to students ages 3-17 in 15-25 minutes. The Visual Motor test presents designs to be copied by the student. The Visual-Spatial test is a matching test that asks the student to select the option that “goes best” with the given figure. The Fine Motor test requires the student to insert as many pegs as possible into a pegboard in 90 seconds. By giving all three subtests, it is possible to determine if visual motor difficulties are the result of problems with spatial skills, motor skills, or an integration of the two.

## Summary of Motor Assessment Instruments

Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
The Beery-Buktenica Developmental Test of Visual-Motor Integration-Fifth Edition (Beery VMI) Beery & Beery (2006)	2-100 Short Form: 2-12	Norm-referenced, clinician-administered VMI: developmental sequence of geometric forms to be copied with paper and pencil Two supplemental tests: (a) Visual Perception (VP) – matching shapes to stimulus form; (b) Motor Coordination (MC) – tracing within a confined space	VMI – 10 min. VP – 5 min. MC – 5 min.	None	NCS Pearson Inc. <a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=PAg105&amp;Mode=summary">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=PAg105&amp;Mode=summary</a>
Bruininks-Oseretsky Test of Motor Proficiency-Second Edition (BOT-2) Bruininks & Bruininks (2005)	4-21	Norm-referenced, clinician-administered Performance items, including fine-motor tasks, such as copying and tracing, and gross-motor tasks, such as sit-ups and running speed	45-60 min. Each composite 10-15 min. Short Form 10-15 min.	Fine-Motor Precision, Fine-Motor Integration, Manual Dexterity, Bilateral Coordination, Balance, Running Speed and Agility, Upper-Extremity Coordination, Strength	AGS Publishing <a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=PAa58000">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=PAa58000</a>

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Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
Clinical Observation of Motor and Postural Skills-Second Edition (COMPS) Wilson, Pollock, Kaplan, & Law (1994, 2000)	6-12.5	Norm-referenced screening tool; clinician-administered Six motor performance items based on Ayres' clinical observations: slow movements, rapid forearm rotation, finger-nose touching, prone extension posture, asymmetrical tonic neck reflex, supine flexion posture	15-20 min.	None	Therapro, Inc. <a href="http://www.therapro.com/Clinical-Observations-of-Motor-and-Postural-Skills-2nd-Edition-COMPS-P7628.aspx">http://www.therapro.com/Clinical-Observations-of-Motor-and-Postural-Skills-2nd-Edition-COMPS-P7628.aspx</a>
Evaluation Tool of Children's Handwriting (ETCH) Amundson (1995)	6-12.5	Criterion-referenced; clinician-administered Grade 1, 2 students write in manuscript; grade 3-6 students write in cursive Legibility and speed measured in tasks similar to classroom Observation sections – pencil grasp, pencil management, classroom behavior	20-25 min.	Alphabet from memory, upper-and lowercase; numerals from memory, 1-20; nearpoint copying; farpoint copying; Manuscript to Cursive Transition; Dictation; Sentence Composition	Therapro, Inc. <a href="http://www.therapro.com/Evaluation-Tool-of-Childrens-Handwriting-ETCH-P7566.aspx">http://www.therapro.com/Evaluation-Tool-of-Childrens-Handwriting-ETCH-P7566.aspx</a>
Minnesota Handwriting Assessment (MHA) Reisman (1999)	6-7	Norm-referenced; clinician-administered Near-point copy assessment of manuscript writing Scores rate, legibility, form, alignment, size, spacing	5 min.	None	Harcourt Assessment <a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1637-001&amp;Mode=summary">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1637-001&amp;Mode=summary</a>

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Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
Movement Assessment Battery for Children (Movement ABC) Henderson & Sugden (1992)	4-12	Norm-referenced, clinician-administered Performance items result in Total Impairment Score Separate checklist completed by teachers to assess classroom/school tasks using a Likert scale	20-40 min.	Manual Dexterity, Ball Skills, Dynamic Balance	Harcourt Assessment <a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=015-8541-308&amp;Mode=summary">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=015-8541-308&amp;Mode=summary</a>
Peabody Developmental Motor Scales-Second Edition (PDMS-2) Folio & Fewell (2000)	Birth-7	Norm-referenced, clinician-administered Performance items scored 2, 1, or 0 based on correct performance, partial performance, or unable to perform	45-60 min.; Gross- or Fine-Motor subtests, 20-30 min. each	Reflexes, Stationary, Locomotion, Object, Manipulation, Grasping, Visual Motor Integration	Pro-Ed Inc. <a href="http://www.proedinc.com/customer/productView.aspx?ID=1783">http://www.proedinc.com/customer/productView.aspx?ID=1783</a>
Pediatric Evaluation of Disability Inventory (PEDI) Haley, Coster, Ludlow, Haltiwanger, & Andrellos (1998)	.5-7.5	Norm-referenced and criterion-referenced; judgment-based questionnaire completed by parent or caregiver  Three scales: (a) Functional Skills – items rated 0 or 1 based on capable or unable; (b) Caregiver Assistance – Likert scale items rated from Total Assistance to Independence; (c) Modifications – frequency count	45-60 min.	Functional Skills – Self-Care, Mobility, Social Function, Caregiver Assistance, Modifications	Harcourt Assessment <a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1617-647&amp;Mode=summary">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1617-647&amp;Mode=summary</a>

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Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
Quick Neurological Screening Test-II, Second Revised Edition (QNST-II) Mutti, Martin, Sterling, & Spaulding (1998)	5-18	Screening instrument Norm-referenced, clinician administered Individually administered performance items in areas such as manual dexterity, spatial orientation, fine and gross motor movements, visual tracking, and tactile perceptual activities	20 min. to administer and score	Maturity of motor development; skill in controlling large and small muscles, motor planning and sequencing, sense of rate and rhythm, spatial organization, visual and auditory perceptual skills, balance and cerebellar-vestibular function, and disorders of attention	Therapro, Inc. <a href="http://www.therapro.com/Quick-Neurological-Screening-Test-II-2nd-Revised-Edition-QNST-II-P7648.aspx">http://www.therapro.com/Quick-Neurological-Screening-Test-II-2nd-Revised-Edition-QNST-II-P7648.aspx</a>

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Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
<p>School Function Assessment (SFA) Coster, Deeney, Haltiwanger, &amp; Haley (1992)</p>	<p>5-11</p>	<p>Criterion-referenced Judgment-based questionnaire completed by school professionals who know the student well</p> <p>Likert scale to rate items on three scales: Participation, Task Support, Activity Performance</p>	<p>1 ½-2 hrs. for full assessment; 5-10 min. for individual scales</p>	<p>Task Supports – Physical Tasks Assistance, Physical Tasks Adaptations, Cognitive/Behavioral Tasks Assistance, Cognitive/Behavioral Tasks Adaptations Activity Performance – Travel, Maintaining and Changing Positions, Recreational Movement, Manipulation with Movement, Using Materials, Setup and Cleanup, Eating and Drinking, Hygiene, Clothing Management, Up/Down Stairs, Written Work, Computer and Equipment Use, Functional Communication, Memory and Understanding, Following Social Conventions, Compliance with Adult Directives and School Rules, Task Behavior/Completion, Positive Interaction, Behavior Regulation, Personal Care Awareness, Safety</p>	<p>Pearson</p> <p><a href="http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1615-709&amp;Mode=summary">http://www.pearsonassessments.com/HAIWEB/Cultures/en-us/Productdetail.htm?Pid=076-1615-709&amp;Mode=summary</a></p>

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Name of Tool and Author	Age Range (in years)	Method of Administration/ Format	Approximate Time to Administer	Subscale	Availability
Test of Handwriting Skills-Revised (THS-R) Milone (2007)	6-19	Norm-referenced; clinician-administered Student writes letters, words, sentences, and numbers, spontaneously, from dictation, or by copying	10 min.	Write from memory, uppercase alphabet in order; write from memory, lowercase alphabet in order; dictation, uppercase letters out of order; dictation, lowercase letters out of order; dictation, single numbers out of order; copy selected uppercase letters; copy selected lowercase letters; copy words; copy sentences; write words from dictation	Western Psychological Services <a href="http://portal.wpspublish.com/portal/page?_pageid=53,108831&amp;_dad=portal&amp;_schema=PORTAL">http://portal.wpspublish.com/portal/page?_pageid=53,108831&amp;_dad=portal&amp;_schema=PORTAL</a>
Wide Range Assessment of Visual Motor Abilities (WRAVMA) Adams & Sheslow (1995)	3-17	Norm-referenced tool; clinician-administered Performance items include copying designs, matching pictures, placing pegs	15-30 min.	Visual-Motor, Visual Spatial, Fine Motor	Western Psychological Services <a href="http://portal.wpspublish.com/portal/page?_pageid=53,69947&amp;_dad=portal&amp;_schema=PORTAL">http://portal.wpspublish.com/portal/page?_pageid=53,69947&amp;_dad=portal&amp;_schema=PORTAL</a>

## Research on Motor Assessment Instruments

Study	Age Range (in years)	Sample Size	Purposes of Studies	Outcomes
Davies, Soon, Young, & Clausen-Yamaki, (2004).	5-12	11	Validity and reliability of SFA	Kruskal-Wallis: chi-square ranged from 9.28-20.55; Intraclass correlation coefficients: participation = 0.70, task supports = 0.68, activity performance = 0.73, moderate relationship between teacher and occupational therapist ratings

## Misconceptions

Myths	Realities
Because AU diagnostic criteria do not include motor and sensory characteristics, occupational therapists are not necessary/needed members of autism evaluations.	Motor and sensory issues are associated features of autism and impact functioning at a very basic level. Occupational therapists have unique training to allow evaluation of and treatment planning for motor and sensory issues (cf. Aspy & Grossman, 2007; Nayate, Bradshaw, & Rinehart, 2005; Ozonoff, et al., 2008).
Only children with handwriting challenges require assessment and intervention from an occupational therapist.	Occupational therapists are trained to evaluate and treat a range of areas, including activities of daily living, education, leisure, play, social participation and work. For children with autism, any of these may be impacted and, therefore, warrant assessment by an occupational therapist (American Occupational Therapy Association, 2002).
Because they cannot follow directions and sustain attention for long, children with autism cannot be tested using standardized motor assessments. Therapists can only use observation and interview to assess motor skill performance.	Children with autism are unique individuals and have a wide range of abilities to follow directions and sustain attention; therefore, judgments about the use of standardized motor instruments should be made on an individual basis.
Motor skills are a relative strength for children with autism compared to other areas; therefore, motor skills do not need to be assessed.	Because it appears that motor problems are inherent in autism (cf. Aspy & Grossman, 2007; Nayate, Bradshaw, & Rinehart, 2005; Ozonoff et al., 2008), a motor assessment is important to understanding the complex needs of an individual on the spectrum.

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## Resources and Materials

Dewey, D., Cantell, M., & Crawford, S. G. (2007). Motor performance in children with autism spectrum disorders, developmental coordination disorder, and/or attention deficit hyperactivity disorder. *Journal of International Neuropsychological Society, 13*, 246-256. Children with autism were impaired in motor skills.

Provost, B., Heimerl, S., & Lopez, B. R. (2007). Levels of gross and fine motor development in young children with autism spectrum disorder. *Physical and Occupational Therapy in Pediatrics, 27*, 21-36.

This study compared levels of gross- and fine-motor development in children with autism and compared them to those of children with developmental delay and children with no autism. Results showed that the motor skills of children with autism were similar to those with DD.

Vanvuchelen, M., Roeyers, H., & De Weert, W. (2007). Nature of motor imitation problems in school-aged boys with autism: A motor or a cognitive problem? *Autism: The International Journal of Research and Practice, 11*, 225-240.

Results of this study showed that all boys with autism had more difficulty imitating non-meaningful gestures than meaningful gestures compared with non-autistic boys.

Myles, B., Huggins, A., Rome-Lake, M., Hagiwara, T., Barnhill, G., & Griswold, D. (2003). Written language profile of children and youth with Asperger syndrome: From research to practice. *Education and Training in Developmental Disabilities, 38*, 362-369.

Data showed that while quantity of writing was similar, quality of writing was not as good for students with Asperger Syndrome.