



# CAS2

## Speed/Fluency Index Supplement

Jack A. Naglieri

J. P. Das

Sam Goldstein



**pro·ed**  
An International Publisher

8700 Shoal Creek Boulevard Austin, Texas 78757-6897  
800/897-3202 Fax 800/397-7633 [www.proedinc.com](http://www.proedinc.com)



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8700 Shoal Creek Boulevard

Austin, Texas 78757-6897

800/897-3202 Fax 800/397-7633

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Printed in the United States of America

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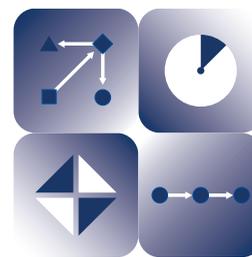


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# The CAS2 Speed/Fluency Index



Procedures for obtaining a Speed/Fluency Index from the CAS2 are described in this document. This index is based on using Expressive Attention Items 1 and 2 for examinees ages 5 to 7 years and Items 4 and 5 for examinees ages 8 to 18. The following sections will explain how to calculate the Speed/Fluency Index and then describe the psychometric properties of the index.

## CALCULATING THE SPEED/FLUENCY INDEX

The Speed/Fluency Index is calculated using the reproducible Page 2 of the CAS2 Record Form (found in Appendix C of this document). Record the time in seconds to complete Items 1 and 2 in the section designated for Speed/Fluency: Ages 5–7, or record the time in seconds to complete Items 4 and 5 in the section designated Speed/Fluency: Ages 8–18. In the example presented in Figure 1, William (age 7 years 10 months) achieved a score of 42 seconds on Item 1 and 37 seconds on Item 2. Using Tables A.1 and A.2 in Appendix A of this supplement, we find that his Item 1 and Item 2 scores both convert to a scaled score of 10. The sum of the scaled scores (20) is recorded in the space provided. Using Table B.1 of Appendix B, we find that this sum of scaled scores converts to a Speed/Fluency Index of 100.

## PSYCHOMETRIC PROPERTIES OF THE CAS2 SPEED/FLUENCY INDEX

Because the psychometric properties of the CAS2 were reviewed extensively in the *CAS2 Interpretive and Technical Manual* (Naglieri, Das, & Goldstein, 2014), this section provides only a brief review of the demographic characteristics, reliability, and validity of the Speed/Fluency Index.

### *Demographic Characteristics*

The Speed/Fluency Index is based on the normative sample described in the *CAS2 Interpretive and Technical Manual*. The procedures described in that manual resulted in a normative sample that is representative of the United States as a whole. The overall characteristics of the sample are reported in Table 1.

### *Reliability*

The study of a test's reliability centers on estimating the degree of error associated with its scores. When error variance is investigated, results are usually reported in terms of a reliability coefficient, which is a specific use of the common correlation coefficient. For tests such as the CAS2 to be considered minimally reliable, their reliability coefficients must approximate or exceed .80 in magnitude; coefficients of .90 or higher are considered the most desirable (Aiken & Groth-Marnat, 2008; Nunnally & Bernstein, 1994; Reynolds & Livingston, 2012; Reynolds, Livingston, & Willson, 2009; Salvia, Yseldyke, & Bolt, 2013). In our investigation of the Speed/Fluency Index, we calculated

## Section 5. CAS2 Interpretive Worksheet

### PASS Scale Comparisons

Compare each PASS scale index score to the child's mean PASS score using Tables A.1 and A.2 (Extended Battery) or A.3 and A.4 (Core Battery) of the Interpretive Manual.

|              | Index Score | d value | circle<br>(.05) .10 | Strength Weakness | % in sample |
|--------------|-------------|---------|---------------------|-------------------|-------------|
| Planning     | 84          | -6.3    | Sig (NS)            | ST WK             | 50.7        |
| Simultaneous | 102         | 11.7    | Sig (NS)            | ST WK             | 22.3        |
| Attention    | 96          | 5.7     | Sig (NS)            | ST WK             | 53.1        |
| Successive   | 79          | -11.3   | Sig (NS)            | ST (WK)           | 28.0        |
| PASS mean    | 90.3        |         |                     |                   |             |

### Subtest Analysis

Compare each subtest scaled score to the child's mean subtest score using Tables B.1 and B.2 of the Interpretive Manual.

|                         | Scaled Score | d value | circle<br>(.05) .10 | Strength Weakness | % in sample |
|-------------------------|--------------|---------|---------------------|-------------------|-------------|
| Planned Codes           | 7            | -.7     | Sig (NS)            | ST WK             | >25         |
| Planned Connections     | 8            | .3      | Sig (NS)            | ST WK             | >25         |
| Planned Number Matching | 8            | .3      | Sig (NS)            | ST WK             | >25         |
| Planning mean           | 7.7          |         |                     |                   |             |

|                          | Scaled Score | d value | circle<br>(.05) .10 | Strength Weakness | % in sample |
|--------------------------|--------------|---------|---------------------|-------------------|-------------|
| Matrices                 | 10           | -.3     | Sig (NS)            | ST WK             | >25         |
| Verbal-Spatial Relations | 11           | .7      | Sig (NS)            | ST WK             | >25         |
| Figure Memory            | 10           | -.3     | Sig (NS)            | ST WK             | >25         |
| Simultaneous mean        | 10.3         |         |                     |                   |             |

|                      | Scaled Score | d value | circle<br>(.05) .10 | Strength Weakness | % in sample |
|----------------------|--------------|---------|---------------------|-------------------|-------------|
| Expressive Attention | 9            | -.3     | Sig (NS)            | ST WK             | >25         |
| Number Detection     | 10           | .7      | Sig (NS)            | ST WK             | >25         |
| Receptive Attention  | 9            | -.3     | Sig (NS)            | ST WK             | >25         |
| Attention mean       | 9.3          |         |                     |                   |             |

|  | Scaled Score | d value | circle<br>(.05) .10 | Strength Weakness | % in sample |
|--|--------------|---------|---------------------|-------------------|-------------|
| Word Series                                | 7            | .3      | Sig (NS)            | ST WK             | >25         |
| Sentence Repetition/<br>Sentence Questions | 7            | .3      | Sig (NS)            | ST WK             | >25         |
| Visual Digit Span                          | 6            | -.7     | Sig (NS)            | ST WK             | >25         |
| Successive mean                            | 6.7          |         |                     |                   |             |

### First-Second Comparisons

Compare the CAS2 standard scores obtained by the same child tested twice using Tables C.1-C.5 (Extended Battery) or C.6-C.10 (Core Battery) of the Interpretive and Technical Manual.

|              | First Score | Second Score | p = .10  |
|--------------|-------------|--------------|----------|
| Planning     | 81          | 84           | Sig (NS) |
| Simultaneous | 98          | 102          | Sig (NS) |
| Attention    | 98          | 96           | Sig (NS) |
| Successive   | 77          | 79           | Sig (NS) |
| Full Scale   | 85          | 87           | Sig (NS) |

### Supplemental Composite Scores

| Subtest                        | Scaled Score |          |     |     |     |
|--------------------------------|--------------|----------|-----|-----|-----|
|                                | EF w/o WM    | EF w/ WM | WM  | VC  | NvC |
| Planned Codes                  |              |          |     |     | 7   |
| Planned Connections            | 8            | 8        |     |     |     |
| Matrices                       |              |          |     |     | 10  |
| Verbal-Spatial Relations       |              | 11       | 11  | 11  |     |
| Figure Memory                  |              |          |     |     | 10  |
| Expressive Attention           | 9            | 9        |     |     |     |
| Receptive Attention            |              |          |     | 9   |     |
| Sentence Repetition/Questions  |              | 7        | 7   | 7   |     |
|                                | EF w/o WM    | EF w/ WM | WM  | VC  | NvC |
| Sum of Subtest Scaled Scores   | 17           | 35       | 18  | 27  | 27  |
| Composite Index Scores         | 91           | 91       | 94  | 93  | 92  |
| Percentile Rank                | 27           | 27       | 34  | 32  | 30  |
| Upper<br>% Confidence Interval | 101          | 99       | 101 | 101 | 99  |
| Lower                          | 84           | 85       | 88  | 87  | 86  |

**Note:** EF w/o WM = Executive Function Without Working Memory; EF w/WM = Executive Function With Working Memory; WM = Working Memory; VC = Verbal Content; NvC = Nonverbal Content.

### Visual-Auditory Comparison

|                          | Scaled Score |
|--------------------------|--------------|
| Word Series              | 7            |
| Visual Digit Span        | 6            |
| Difference (ignore sign) | 1            |
| Circle one: .05 (NS)     |              |

### Speed/Fluency: Ages 5-7

| Expressive Attention Item       | Time in Seconds | Scaled Score |
|---------------------------------|-----------------|--------------|
| 1.                              | 42              | 10           |
| 2.                              | 37              | 10           |
| Sum of Scaled Scores            | 20              |              |
| Speed/Fluency Index Score (S/F) | 100             |              |

### Speed/Fluency: Ages 8-18

| Expressive Attention Item       | Time in Seconds | Scaled Score |
|---------------------------------|-----------------|--------------|
| 4.                              |                 |              |
| 5.                              |                 |              |
| Sum of Scaled Scores            |                 |              |
| Speed/Fluency Index Score (S/F) |                 |              |

Figure 1. Completed Page 2 of Examiner Record Form for William.

two types of reliability: content sampling (alternate form) and time sampling (test-retest). The status of the Speed/Fluency Index relative to these two sources of error variance—content and time—is discussed in this section.

**Table 1** Demographic Characteristics of the CAS2 Normative Sample

| Characteristic  | Percentage of<br>normative sample<br>( <i>N</i> = 1,342) | Percentage of<br>U.S. school-age<br>population (2011) |
|---|--|---|
| <b>Gender<sup>a</sup></b>                             |  |   |
| Male  | 51.1   | 51.1  |
| Female  | 48.9   | 48.9  |
| <b>Region<sup>b</sup></b>                             |  |   |
| Northeast   | 17.9   | 17.1  |
| South   | 38.8   | 37.2  |
| Midwest   | 19.9   | 21.7  |
| West  | 23.4   | 24.0  |
| <b>Ethnicity<sup>c</sup></b>                          |  |   |
| White   | 77.9   | 76.1  |
| Black/African American                                | 15.6   | 15.1  |
| American Indian/Eskimo/Aleut                          | 0.5  | 1.2   |
| Asian/Pacific Islander                                | 3.0  | 4.5   |
| Two or more   | 3.0  | 3.1   |
| <b>Hispanic status<sup>c</sup></b>                    |  |   |
| Yes   | 21.2   | 21.2  |
| No  | 78.8   | 78.8  |
| <b>Exceptionality status</b>                          |  |   |
| No exceptionality <sup>d</sup>                        | 86.9   | 86.0  |
| Gifted and talented <sup>e</sup>                      | 6.3  | 5.2   |
| Intellectual disability <sup>f</sup>                  | 0.1  | 0.6   |
| Deaf and hard of hearing <sup>f</sup>                 | 0.1  | 0.1   |
| Attention-deficit/hyperactivity disorder <sup>g</sup> | 6.0  | 8.6   |
| Articulation disorder <sup>h</sup>                    | 0.6  | 2.5   |
| Traumatic brain injury <sup>f</sup>                   | 0.3  | < 0.1   |
| Asperger's syndrome <sup>i</sup>                      | 1.0  | < 0.1   |
| Developmental delay <sup>f</sup>                      | 0.4  | 0.1   |
| Emotional disturbance <sup>f</sup>                    | 1.3  | 0.5   |
| Behavioral disorder <sup>j</sup>                      | 0.8  | 2.5   |
| Learning disability <sup>g</sup>                      | 4.5  | 8.2   |
| Physical or health impairment                         | 0.1  | NA  |
| Language impairment <sup>f</sup>                      | 1.4  | 1.8   |
| Autism disorder <sup>f</sup>                          | 0.4  | 0.5   |
| <b>Household income (in dollars)<sup>k</sup></b>      |  |   |
| Under 15,000  | 11.7   | 13.0  |
| 15,000–24,999   | 10.3   | 11.0  |
| 25,000–34,999   | 10.5   | 11.0  |
| 35,000–49,999   | 14.3   | 14.0  |
| 50,000–74,999   | 19.4   | 19.0  |
| 75,000 and over                                       | 33.7   | 32.0  |

*(continues)*

Table 1. (continued)

| Characteristic                           | Percentage of normative sample (N = 1,342) | Percentage of U.S. school-age population (2011) |
|--|--|---|
| <b>Educational Attainment of Parents</b> |  |   |
| Less than bachelor's degree              | 70.0                                       | 72.0  |
| Bachelor's degree                        | 19.6                                       | 19.0  |
| Graduate degree                          | 10.4                                       | 9.0   |

Note. NA = not available. Unless cited, based on data reported in the *Statistical Abstract of the United States* (130th ed.), by U.S. Bureau of the Census, 2011, Washington, DC: Author.

<sup>a</sup>Table 7. <sup>b</sup>Table 16. <sup>c</sup>Table 10. <sup>d</sup>Source: National Center for Education Statistics. Retrieved May 29, 2012, from <http://nces.ed.gov/fastfacts/display.asp?id=64> <sup>e</sup>Source: U.S. National Center for Education Statistics (2006). Table no. 48. Number of Gifted and Talented Students in Public Elementary and Secondary Schools by Sex, Race/Ethnicity, and State: 2004 to 2006. *Statistical Abstract of the United States: 2011* (p. 85) Washington, DC: U.S. Bureau. <sup>f</sup>Table 189. <sup>g</sup>Table 188. <sup>h</sup>Source: Come Unity (n.d.). Children with communication disorders. Retrieved May 29, 2012 from <http://www.comeunity.com/disability/speech/communication.html>. <sup>i</sup>Source: National Institute of Neurological Disorders and Stroke. (2012, March 20). Asperger Syndrome Fact Sheet. Retrieved May 29, 2012 from [http://www.ninds.nih.gov/disorders/asperger/detail\\_asperger.htm](http://www.ninds.nih.gov/disorders/asperger/detail_asperger.htm). <sup>j</sup>Source: American Academy of Child and Adolescent Psychiatry. (2009, March 18). Child and Adolescent Mental Illness and Drug Abuse Statistics. Retrieved May 29, 2012 from [http://www.aacap.org/cs/root/resources\\_for\\_families/child\\_and\\_adolescent\\_mental\\_illness\\_statistics](http://www.aacap.org/cs/root/resources_for_families/child_and_adolescent_mental_illness_statistics). <sup>k</sup>Table 36. <sup>l</sup>Table 231.

**Content sampling error.** Anastasi and Urbina (1997) described a procedure for estimating the content sampling error when alternate forms of a test are available. In this case, because Expressive Attention Items 1 and 2 (for examinees ages 5–7) and Items 4 and 5 (for examinees ages 8–18) are given concurrently, the correlation between the items is a reliability index that can be used to estimate content sampling error. In this study, the scaled scores were correlated at 14 age intervals. The corresponding correlations are reported in Table 2. The alternate-form immediate administration reliability coefficients provide an underestimate of reliability because the correlation of Item 1 with 2, for example, is half as long as the actual Speed/Fluency Index. The reliability coefficients were therefore corrected for length using the Spearman-Brown Prophecy formula.

The resulting reliability coefficients, provided in Table 2, were used to compute the standard error of measurement (*SEM*), which is used to estimate the confidence interval that surrounds a particular test score. The *SEM* estimates the amount of error in an individual's test score due to less-than-perfect reliability of a test. The *SEM* is based on the formula  $SEM = SD \sqrt{1 - r}$  ( $SD$  = standard deviation;  $r$  = reliability), and establishes a zone within which an individual's true score probably lies. The *SEMs* by age are also reported in Table 2. Based on the overall reliability, the standard error of measurement for the Speed/Fluency Index is 10.6.

**Time sampling error.** Reliability coefficients of the Speed/Fluency Index are based on the correlation of the item scaled scores at a single point in time. This analysis informs us about the extent to which a student's test performance varies over time. Time sampling reliability coefficients are generally estimated by the test-retest technique. The technique involves administering the test to an examinee and then re-administering it to the same examinee a week or two later. The degree of similarity between the two test scores indicates the amount of stability reliability possessed by the test. Anastasi and Urbina (1997) stated that this form of reliability "shows the extent to which scores on a test can be generalized over different occasions; the higher the reliability, the less susceptible the scores are to random daily changes in the conditions of the test takers or of the testing environment" (p. 92). A test-retest correlation was used to estimate the time sampling error of the Speed/Fluency Index.

**Table 2** Speed/Fluency Index Alternate-Form Immediate Coefficients

| Age (in years)       | Reliability | SEM  |
|----------------------|-------------|------|
| 5                    | .79         | 9.2  |
| 6                    | .70         | 10.7 |
| 7                    | .77         | 9.6  |
| 8                    | .70         | 10.7 |
| 9                    | .81         | 8.8  |
| 10                   | .58         | 12.2 |
| 11                   | .61         | 11.9 |
| 12                   | .61         | 11.9 |
| 13                   | .70         | 10.7 |
| 14                   | .65         | 11.4 |
| 15                   | .66         | 11.3 |
| 16                   | .74         | 10.1 |
| 17                   | .73         | 10.3 |
| 18                   | .74         | 10.1 |
| Average <sup>a</sup> | .71         | 10.6 |

Note. Reliability based on the correlation of Items 1 and 2 (ages 5–7) or Items 4 and 5 (ages 8+). Correlations corrected for length using the Spearman-Brown Prophecy formula.

<sup>a</sup>Fisher’s average of coefficients across all ages.

We investigated this type of reliability using a sample of 144 students divided into two age groups (5-0 through 7-11 and 8-0 through 18-11) and the combined sample. Table 3 provides information about the characteristics of the sample. The CAS2 was administered twice to the sample; the mean intervening time was 19 days. After testing was completed, the standard scores were correlated and corrected for range effects.

Correlation coefficients showing the relationship between the two testing sessions are found in Table 4. The size of the coefficients is large enough to support strongly the idea that the CAS2 Speed/Fluency Index has acceptable test-retest reliability.

### Validity

Most authors of current textbooks dealing with educational and psychological measurement—for example, Aiken and Groth-Marnat (2008); Anastasi and Urbina (1997); Miller, Linn, and Gronlund (2009); Reynolds, Livingston, and Willson (2009); and Salvia, Ysseldyke, and Bolt (2013)—suggest that individuals who develop tests should provide evidence of validity. These authors use slightly different terminology for the same concepts of validity. We chose to use Anastasi and Urbina’s designations: *content-description validity*, *criterion-prediction validity*, and *construct-identification validity*.

**Content-description validity.** Content-description validity involves “the systematic examination of the test content to determine whether it covers a representative sample of the behavior domain to be measured” (Anastasi & Urbina, 1997, p. 115). This kind of validity has to be built into the test at the time that subtests and items are conceptualized. Because the content-description validity of the CAS2 has been discussed extensively in the *CAS2 Interpretive and Technical Manual*, we will discuss only the Speed/Fluency Index here.

The concept of speed or fluency (we will use these terms interchangeably) can be measured by how fast a person responds. This can be conceptualized within the PASS

**Table 3** Demographic Characteristics of the Sample Used in the Test–Retest Study

| Sample Characteristic                    | Ages 5–7 years<br>( <i>n</i> = 39)          | Ages 8–18 years<br>( <i>n</i> = 105)  |
|--|---|---|
| Location                                 | California, Idaho, New York,<br>Ohio, Texas | California, Idaho, Massachusetts,<br>New Jersey, Nevada, New York,<br>Ohio, Texas |
| <b>Gender</b>                            |   |   |
| Male                                     | 23  | 53  |
| Female                                   | 16  | 52  |
| <b>Race</b>                              |   |   |
| White                                    | 28  | 85  |
| African American                         | 8   | 15  |
| Asian/Pacific Islander                   | 3   | 1   |
| Two or more                              | 0   | 4   |
| <b>Hispanic</b>                          |   |   |
| Yes                                      | 8   | 36  |
| No                                       | 31  | 69  |
| <b>Exceptionality status</b>             |   |   |
| No exceptionality                        | 38  | 86  |
| Gifted and talented                      | 0   | 11  |
| Learning disability                      | 0   | 2   |
| Language impaired                        | 1   | 3   |
| Asperger’s disorder                      | 0   | 2   |
| Developmental delay                      | 0   | 1   |
| Other                                    | 0   | 2   |
| <b>Household income (in dollars)</b>     |   |   |
| Under 15,000                             | 4   | 12  |
| 15,000–24,999                            | 4   | 12  |
| 25,000–34,999                            | 4   | 12  |
| 35,000–49,999                            | 6   | 17  |
| 50,000–74,999                            | 9   | 23  |
| 75,000 and over                          | 12  | 29  |
| <b>Educational attainment of parents</b> |   |   |
| Less than bachelor’s degree              | 28  | 80  |
| Bachelor’s degree                        | 7   | 17  |
| Graduate degree                          | 4   | 8   |

(i.e., Planning, Attention, Simultaneous, and Successive) theory of neurocognitive abilities following Goldberg’s (2009) description of how the right and left hemispheres of the brain acquire new information and skills. In his book *The New Executive Brain*, Goldberg explains how when a person is learning something new, use of PASS neurocognitive processes is maximized. Once the task is well learned, it can be fluently (i.e., quickly) executed because less thinking about how to solve the task is required. The transition from novel to fluent (which Goldberg calls *routinization*) is the path taken during the acquisition of everything we learn well enough to do with little effort. Fluency and speedy performance is based on instruction as well as PASS, which provides

**Table 4** Speed/Fluency Index Test—Retest Reliability at Two Age Intervals

| Age level                | First testing | Second testing | $r_c$ | $r_u$ |
|--------------------------|---------------|----------------|-------|-------|
|                          | $M$ ( $SD$ )  | $M$ ( $SD$ )   |       |       |
| 5–7 years ( $n = 39$ )   | 101.3 (11.2)  | 103.6 (11.6)   | .88   | .74   |
| 8–18 years ( $n = 105$ ) | 99.6 (16.2)   | 103.0 (16.3)   | .88   | .91   |

Note. Sample characteristics located in Table 4.4 of the CAS2 Interpretive and Technical Manual;  $M$  = mean standard score;  $SD$  = standard deviation of the standard score;  $r_c$  = corrected correlation coefficients;  $r_u$  = uncorrected correlation coefficients.

a foundation for learning. The transition from requiring greater effort to requiring less effort represents not only a change in hemispheric dominance from right to left but also greater vertical organization of the task. That is, to learn any task, an individual has to shift both cortical dominance and increase activity of the cerebellum, representing greater cortical to subcortical dominance. Cerebral activity drives the speed, force, and accuracy of the expression of what is learned.

We calculated the Speed/Fluency Index from the first two items of the Expressive Attention subtest on the CAS2. These tasks require that the student respond to very well-known stimuli (either the size of well-known animals, or reading the same words, or naming the same set of basic colors) as quickly as possible. Performance on these tasks provides a way to measure the extent to which a person has learned simple information well enough so that answering the question (e.g., *Is it a big or a little animal?* or *Is the rectangle blue or yellow?*) requires fluent retrieval of knowledge but little thinking.

**Criterion-prediction validity.** Anastasi and Urbina (1997) described criterion-related validity as “the effectiveness of a test in predicting an individual’s performance in specific activities” (p. 118). They state that performance on a test should be checked against a criterion that can be either a direct or an indirect measure of what the test is designed to predict. To be valid, a score like the Speed/Fluency Index, which is built to measure cognitive speed or fluency, should correlate strongly with established tests that measure the same ability and yield the same or similar means and standard deviations as those of the criterion tests.

In order to study the utility of the Speed/Fluency Index, we examined how the score is related to other measures of cognitive processing using the following tests:

- The *Cognitive Assessment System—Second Edition* (CAS2; Naglieri, Das, & Goldstein, 2014) is a norm-referenced test designed to measure the Planning, Attention, Simultaneous, and Successive (PASS) neurocognitive abilities of individuals between the ages of 5 and 18 years.
- The *Cognitive Assessment System—Second Edition: Brief* (CAS2: Brief; Naglieri, Das, & Goldstein, 2014) is a brief four-subtest assessment that measures ability based on the PASS theory of neurocognitive processes. It is designed for ages 4 through 18 years.
- The *Wechsler Intelligence Scale for Children—Fourth Edition* (WISC-IV; Wechsler, 2003) is an individually administered test of general ability measured by using tasks organized in four scales: Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. The test is designed for ages 6 through 16 years.

The demographic characteristics of the examinees used in this study are described in Table 5. The CAS2 and each criterion measure were administered concurrently to

each sample and the results correlated. The correlations between the Speed/Fluency Index and these criterion measures are reported in Tables 6 through 8. In these analyses, two kinds of correlations are reported—the original Pearson correlations between variables and those corrected for range instability (e.g., ranges that are too large or too small). These correlations are described in six categories by Hopkins (2002): Coefficients less than .10 are very small or trivial, from .10 to .29 are small, from .30 to .49 are moderate, from .50 to .69 are large, from .70 to .89 are very large, and of .90 and above are nearly perfect.

We anticipated that the Speed/Fluency Index would be highly correlated with the CAS2 Attention composite. As shown in Table 6, the corrected correlations between the Speed/Fluency Index and the Attention scales obtained from the CAS2 Core and Extended Batteries and the CAS2: Brief ranged from .55 to .61. This makes sense because the Speed/Fluency Index is based on the initial items of the Expressive Attention subtest; these items are used to prime the student for the condition that follows, which measures focused cognitive activity and resistance to distraction.

The correlations between the Speed/Fluency Index and the CAS2 Planning, Simultaneous, and Successive Indexes ranged from small (.27) to large (.50). As shown in Table 6, the correlations between the Speed/Fluency Indexes and the Simultaneous and Successive scales were the lowest of those obtained from the CAS2 Core and Extended Batteries and the CAS2: Brief. This is expected because the format of the Speed/Fluency Index requires very few cognitive resources.

The relationship between the Speed/Fluency Index and Processing Speed on the WISC-IV is presented in Table 7 for a sample of 35 students who were predominantly identified as having ADHD. For this sample, the Speed/Fluency Index correlated the highest with Processing Speed ( $r = .58$ ) as anticipated.

As anticipated, the magnitudes of the Speed/Fluency Index correlations with the Verbal Comprehension, Perceptual Reasoning, and Working Memory scores, which require higher level cognitive resources than a measure of processing speed, ranged from small ( $r = .29$ ) to moderate ( $r = .49$ ).

**Construct-identification validity.** Construct-identification validity, the final type of validity to be examined, relates to the degree to which underlying traits of a test can be identified and the extent to which these traits reflect the theoretical model on which the test is based. Because the Speed/Fluency Index measures speed of cognitive processing, its results should correlate only modestly with measures of higher level cognitive processing, intelligence, and general school achievement that require more complex cognitive resources.

In order to examine construct-identification validity of the Speed/Fluency Index, we examined how the score is related to measures achievement using the following tests:

- The *Test of Silent Contextual Reading Fluency—Second Edition* (TOSCRF-2; Hammill, Wiederholt, & Allen, 2014) is a group-administered measure of silent reading fluency designed for ages 7 through 24 years.
- The *Gray Oral Reading Tests—Fifth Edition* (GORT-5; Wiederholt & Bryant, 2012) are an individually administered measure of oral reading skills designed for ages 6 through 23 years.
- The *Comprehensive Mathematical Abilities Test* (CMAT; Hresko, Schlieve, Herron, Swain, & Sherbenou, 2002) is designed to assess a broad spectrum of mathematical abilities in the areas of comprehension (reasoning), calculation, and application. It is appropriate for ages 7 through 18 years.
- The *Wide Range Achievement Test—Fourth Edition* (WRAT-4; Wilkinson & Robertson, 2006) is designed for individuals ages 5 to 94 years.

**Table 5** Demographic Characteristics of the Samples Used in the Criterion-Prediction Validity Studies

| Sample Characteristic                    | Criterion measure |                            |         |          |        |      |        |
|--|-------------------|----------------------------|---------|----------|--------|------|--------|
|  | CAS2              | CAS2: Brief                | WISC-IV | TOSCRF-2 | GORT-5 | CMAT | WRAT-4 |
| Number of participants                   | 1,342             | 281                        | 35      | 110      | 51     | 46   | 53     |
| Age range (in years)                     | 5–18              | 5–18                       | 7–16    | 7–18     | 13–18  | 7–16 | 7–16   |
| Location                                 | United States     | AL, CA, GA, MI, NV, NY, TX | UT, VT  | NV, NY   | ID, TX | NY   | NV, NY |
| <b>Gender</b>                            |                   |                            |         |          |        |      |        |
| Male                                     | 686               | 139                        | 24      | 61       | 24     | 17   | 20     |
| Female                                   | 656               | 142                        | 11      | 49       | 27     | 29   | 33     |
| <b>Race</b>                              |                   |                            |         |          |        |      |        |
| White                                    | 1,046             | 209                        | 30      | 101      | 39     | 37   | 44     |
| Black/African American                   | 209               | 58                         | 3       | 8        | 8      | 8    | 8      |
| American Indian/Eskimo/Aleut             | 7                 | 1                          | 0       | 0        | 0      | 0    | 0      |
| Asian/Pacific Islander                   | 40                | 11                         | 2       | 0        | 2      | 0    | 0      |
| Two or more                              | 40                | 2                          | 0       | 1        | 2      | 1    | 1      |
| <b>Hispanic</b>                          |                   |                            |         |          |        |      |        |
| Yes                                      | 284               | 74                         | 2       | 7        | 7      | 0    | 2      |
| No                                       | 1,058             | 207                        | 33      | 103      | 44     | 46   | 51     |
| <b>Exceptionality status</b>             |                   |                            |         |          |        |      |        |
| No exceptionality                        | 1,166             | 230                        | 0       | 93       | 39     | 42   | 49     |
| Gifted and talented                      | 85                | 17                         | 0       | 3        | 3      | 3    | 3      |
| Intellectual disability                  | 1                 |                            |         |          |        |      |        |
| Deaf/hard of hearing                     | 1                 | 4                          | 0       | 2        | 0      | 0    | 0      |
| Attention-deficit/hyperactivity disorder | 81                | 16                         | 33      | 8        | 2      | 2    | 2      |
| Articulation disorder                    | 8                 | 2                          | 0       | 0        | 0      | 0    | 0      |
| Traumatic brain injury                   | 4                 | 1                          | 2       | 1        | 0      | 0    | 0      |
| Developmental delay                      | 5                 | 4                          | 0       | 2        | 0      | 0    | 0      |
| Emotional disturbance                    | 17                | 2                          | 10      | 2        | 0      | 0    | 0      |
| Behavioral disturbance                   | 11                | 0                          | 7       | 0        | 2      | 0    | 0      |
| Learning disability                      | 60                | 17                         | 5       | 5        | 0      | 0    | 0      |
| Physical or health impaired              | 1                 | 2                          | 0       | 2        | 0      | 0    | 0      |
| Language disorder                        | 19                | 4                          | 1       | 0        | 0      | 0    | 0      |
| Autism spectrum disorder                 | 17                | 1                          | 3       | 1        | 0      | 0    | 0      |
| Other                                    | 0                 | 2                          | 18      | 2        | 0      | 0    | 0      |
| <b>Household income (in dollars)</b>     |                   |                            |         |          |        |      |        |
| Under 15,000                             | 157               | 28                         | 2       | 11       | 5      | 5    | 5      |
| 15,000–34,999                            | 279               | 62                         | 6       | 26       | 9      | 11   | 13     |
| 35,000–74,999                            | 454               | 107                        | 13      | 41       | 17     | 16   | 20     |
| 75,000 and over                          | 452               | 84                         | 14      | 32       | 20     | 14   | 15     |
| <b>Educational attainment of parents</b> |                   |                            |         |          |        |      |        |
| Less than bachelor's degree              | 939               | 214                        | 22      | 87       | 31     | 36   | 42     |
| Bachelor's degree                        | 263               | 45                         | 9       | 14       | 13     | 6    | 7      |
| Graduate degree                          | 140               | 22                         | 4       | 9        | 7      | 4    | 4      |

Note. CAS = Cognitive Assessment System (Naglieri & Das, 1997); CAS2: Brief = Cognitive Assessment System—Second Edition: Brief (Naglieri & Das, 2014); CAS2: RS = Cognitive Assessment System—Second Edition: Rating Scale (Naglieri & Das, 2014); WISC-IV = Wechsler Intelligence Scale for Children—Fourth Edition (Wechsler, 2003); CTONI-2 = Comprehensive Test of Nonverbal Intelligence—Second Edition (Hammill, Pearson, & Wiederholt, 2009); PTONI = Primary Test of Nonverbal Intelligence (Ehrler & McGhee, 2008); TOSCRF-2 = Test of Silent Contextual Reading Fluency—Second Edition (Hammill, Wiederholt, & Allen, 2014); GORT-5 = Gray Oral Reading Tests—Fifth Edition (Wiederholt & Bryant, 2012); WJ-III = Woodcock-Johnson Tests of Achievement—Third Edition (Woodcock, McGrew, & Mather, 2001); CMAT = Comprehensive Mathematical Abilities Test (Hresko, Schlieve, Herron, Swain, & Sherbenou, 2002); WRAT-4 = Wide Range Achievement Test—Fourth Edition (Wilkinson & Robertson, 2006).

**Table 6** Corrected (and Uncorrected) Correlations Between CAS2 Speed/Fluency Index and Related CAS2 Measures

| CAS2 ( <i>N</i> = 1,342)                  | CAS2<br>Speed/Fluency Index | Magnitude <sup>a</sup> | CAS2 Battery <i>M</i><br>( <i>SD</i> ) |
|---|-----------------------------|------------------------|--|
| <b>Core Battery</b>                       |                             |                        |  |
| Planning                                  | .50 (.50)                   | Large                  | 100.15 (14.87)                         |
| Simultaneous                              | .35 (.35)                   | Moderate               | 100.19 (14.89)                         |
| Attention                                 | .61 (.61)                   | Large                  | 100.17 (14.97)                         |
| Successive                                | .27 (.28)                   | Small                  | 100.27 (15.43)                         |
| Full Scale                                | .58 (.58)                   | Large                  | 100.15 (14.82)                         |
| CAS2 Speed/Fluency <i>M</i> ( <i>SD</i> ) | 100.14 (15.21)              |                        |  |
| <b>Extended Battery</b>                   |                             |                        |  |
| Planning                                  | .49 (.50)                   | Moderate               | 100.02 (15.02)                         |
| Simultaneous                              | .37 (.37)                   | Moderate               | 100.00 (14.88)                         |
| Attention                                 | .55 (.55)                   | Large                  | 100.08 (14.91)                         |
| Successive                                | .39 (.39)                   | Moderate               | 100.18 (14.84)                         |
| Full Scale                                | .58 (.58)                   | Large                  | 100.10 (14.98)                         |
| CAS2 Speed/Fluency <i>M</i> ( <i>SD</i> ) | 100.14 (15.21)              |                        |  |
| CAS2: Brief ( <i>N</i> = 281)             | CAS2<br>Speed/Fluency Index | Magnitude <sup>a</sup> | CAS2: Brief<br><i>M</i> ( <i>SD</i> )  |
| Planning                                  | .51 (.39)                   | Large                  | 100.10 (13.56)                         |
| Simultaneous                              | .34 (.28)                   | Moderate               | 99.92 (15.38)                          |
| Attention                                 | .60 (.40)                   | Large                  | 103.89 (11.32)                         |
| Successive                                | .37 (.26)                   | Moderate               | 98.24 (12.96)                          |
| Full Scale                                | .62 (.49)                   | Large                  | 100.35 (13.49)                         |
| CAS2 Speed/Fluency <i>M</i> ( <i>SD</i> ) | 102.23 (11.71)              |                        |  |

Note. RCAS2 = *Cognitive Assessment System—Second Edition* (Naglieri, Das, & Goldstein, 2014); CAS2: Brief = *Cognitive Assessment System—Second Edition: Brief* (Naglieri, Das, & Goldstein, 2014).

<sup>a</sup>Magnitude of the corrected coefficients; based on Hopkins's (2002) criteria for interpreting correlation coefficients.

The correlations between the Speed/Fluency Index and these measures are reported in Table 8. In these analyses, two kinds of correlations are reported—the original Pearson correlations between variables and those corrected for range instability (e.g., ranges that are too large or too small). These correlations are described in six categories by Hopkins (2002): Coefficients less than .10 are very small or trivial, from .10 to .29 are small, from .30 to .49 are moderate, from .50 to .69 are large, from .70 to .89 are very large, and of .90 and above are nearly perfect.

The correlations between the Speed/Fluency Index and achievement are provided in Table 8. It was anticipated that the correlations between the Speed/Fluency Index and reading would be higher for measures of reading fluency (comprehension and speed) than it would be for measures of reading comprehension only, and that is exactly what was found. The Speed/Fluency Index correlated the highest with the TOSCRF-2 Silent Contextual Fluency Reading Index. The corrected correlations with the non-speeded achievement tests (GORT-5 and WRAT-4) ranged from .32 to .38 (moderate).

**Table 7** Corrected (and Uncorrected) Correlations Between the CAS2 Speed/Fluency Index and the WISC-IV

| Criterion measure            | CAS2<br>Speed/Fluency Index | Magnitude <sup>a</sup> | Criterion<br>M (SD) |
|------------------------------|-----------------------------|------------------------|---------------------|
| WISC-IV Verbal Comprehension | .29 (.32)                   | Small                  | 102.69 (17.30)      |
| WISC-IV Perceptual Reasoning | .48 (.42)                   | Moderate               | 105.26 (13.30)      |
| WISC-IV Working Memory       | .31 (.25)                   | Moderate               | 98.34 (12.46)       |
| WISC-IV Processing Speed     | .58 (.49)                   | Large                  | 91.10 (12.43)       |
| WISC-IV Full Scale           | .49 (.46)                   | Moderate               | 100.14 (14.61)      |
| CAS2 Speed/Fluency M (SD)    | 95.14 (14.29)               |                        |                     |

Note. WISC-IV = *Wechsler Intelligence Scales for Children—Fourth Edition* (Wechsler, 2003).

<sup>a</sup>Magnitude of the corrected coefficients; based on Hopkins's (2002) criteria for interpreting correlation coefficients.

**Table 8** Corrected (and Uncorrected) Correlations Between CAS2 Speed/Fluency Index and Criterion Achievement Measures

| Criterion measure  | CAS2<br>Speed/Fluency Index | Magnitude <sup>a</sup> | Criterion<br>M (SD) |
|--|-----------------------------|------------------------|---------------------|
| TOSCRF-2 Silent Contextual Reading Fluency Index (N = 110) | .62 (.49)                   | Large                  | 101.55 (12.65)      |
| CAS2 Speed/Fluency M (SD)                                  | 105.46 (12.65)              |                        |                     |
| GORT-5 Oral Reading Index (N = 51)                         | .38 (.28)                   | Moderate               | 106.57 (13.04)      |
| CAS2 Speed/Fluency M (SD)                                  | 100.24 (12.08)              |                        |                     |
| CMAT Global Mathematics Ability (N = 46)                   | .32 (.24)                   | Moderate               | 106.46 (11.47)      |
| CAS2 Speed/Fluency M (SD)                                  | 97.17 (14.17)               |                        |                     |
| WRAT-4 Math Computation (N = 53)                           | .38 (.27)                   | Moderate               | 103.81 (12.83)      |
| CAS2 Speed/Fluency M (SD)                                  | 105.28 (12.13)              |                        |                     |

Note. TOSCRF-2 = *Test of Silent Contextual Reading Fluency—Second Edition* (Hammill, Wiederholt, & Allen, 2014); GORT-5 = *Gray Oral Reading Tests—Fifth Edition* (Wiederholt & Bryant, 2012); WJ III = *Woodcock-Johnson Tests of Achievement—Third Edition* (Woodcock, McGrew, & Mather, 2001); CMAT = *Comprehensive Mathematical Abilities Test* (Hresko, Schlieve, Herron, Swain, & Sherbenou, 2002); WRAT-4 = *Wide Range Achievement Test—Fourth Edition* (Wilkinson & Robertson, 2006).

<sup>a</sup>Magnitude of the corrected coefficients; based on Hopkins's (2002) criteria for interpreting correlation coefficients.

## SUMMARY OF PSYCHOMETRIC PROPERTIES

Based on the information provided in this section, one may conclude that the Speed/Fluency Index is a reliable and valid measure of general processing speed. Examiners can interpret these scores with confidence. We encourage professionals to continue to study the tests using different samples, statistical procedures, and related measures.

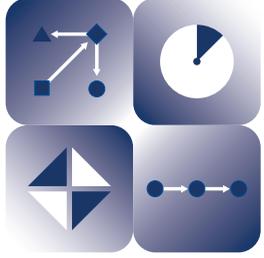
We also encourage these researchers to share their results with us so that their findings can be included in subsequent editions of the tests. The accumulation of research data will help further clarify the reliability and validity of the CAS2 and provide guidance for future revisions.



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## Converting Sums of Expressive Attention Item Raw Scores to Scaled Scores and Percentile Ranks

**Table A.1**  
**Converting Expressive Attention Item 1 Raw Score to a Percentile Rank and Scaled Score**

| Percentile rank | 5-0 to 5-2 | 5-3 to 5-5 | 5-6 to 5-8 | 5-9 to 5-11 | 6-0 to 6-2 | 6-3 to 6-5 | 6-6 to 6-8 | 6-9 to 6-11 | 7-0 to 7-5 | 7-6 to 7-11 | Scaled score |
|-----------------|------------|------------|------------|-------------|------------|------------|------------|-------------|------------|-------------|--------------|
| <1              | —          | —          | —          | —           | >175       | >164       | >150       | >131        | >114       | >101        | 1            |
| <1              | —          | —          | —          | 176-180     | 165-175    | 151-164    | 132-150    | 115-131     | 100-114    | 99-101      | 2            |
| 1               | —          | —          | 171-180    | 165-175     | 148-164    | 123-150    | 115-131    | 100-114     | 93-99      | 93-98       | 3            |
| 2               | 178-180    | 163-180    | 137-170    | 137-164     | 117-147    | 101-122    | 100-114    | 89-99       | 88-92      | 88-92       | 4            |
| 5               | 156-177    | 137-162    | 120-136    | 117-136     | 96-116     | 89-100     | 89-99      | 80-88       | 80-87      | 80-87       | 5            |
| 9               | 137-155    | 120-136    | 100-119    | 96-116      | 81-95      | 75-88      | 69-88      | 63-79       | 63-79      | 62-79       | 6            |
| 16              | 119-136    | 100-119    | 85-99      | 81-95       | 75-80      | 68-74      | 61-68      | 56-62       | 56-62      | 56-61       | 7            |
| 25              | 100-118    | 85-99      | 75-84      | 75-80       | 68-74      | 58-67      | 55-60      | 50-55       | 50-55      | 50-55       | 8            |
| 37              | 85-99      | 72-84      | 67-74      | 67-75       | 58-67      | 54-57      | 49-54      | 46-49       | 46-49      | 46-49       | 9            |
| 50              | 68-84      | 63-71      | 56-66      | 56-67       | 52-57      | 49-53      | 45-48      | 42-45       | 42-45      | 41-45       | 10           |
| 63              | 58-67      | 52-62      | 49-55      | 49-56       | 47-51      | 45-48      | 41-44      | 39-41       | 39-41      | 38-40       | 11           |
| 75              | 45-57      | 45-51      | 45-48      | 45-49       | 43-46      | 41-44      | 39-40      | 36-38       | 36-38      | 34-37       | 12           |
| 84              | 39-44      | 39-44      | 39-44      | 39-44       | 39-42      | 39-40      | 36-38      | 34-35       | 34-35      | 32-33       | 13           |
| 91              | 35-38      | 35-38      | 35-38      | 35-38       | 35-38      | 35-38      | 33-35      | 31-33       | 31-33      | 30-31       | 14           |
| 95              | 32-34      | 32-34      | 32-34      | 32-34       | 32-34      | 32-34      | 31-32      | 29-30       | 29-30      | 29          | 15           |
| 98              | 31         | 31         | 31         | 31          | 31         | 30-31      | 29-30      | 27-28       | 27-28      | 27-28       | 16           |
| 99              | 29-30      | 29-30      | 29-30      | 29-30       | 29-30      | 28-29      | 27-28      | 25-26       | 25-26      | 25-26       | 17           |
| >99             | 25-28      | 25-28      | 25-28      | 25-28       | 25-28      | 25-27      | 25-26      | 23-24       | 23-24      | 22-24       | 18           |
| >99             | 22-24      | 22-24      | 22-24      | 22-24       | 22-24      | 22-24      | 21-24      | 20-22       | 19-22      | 18-21       | 19           |
| >99             | <22        | <22        | <22        | <22         | <22        | <22        | <21        | <20         | <19        | <18         | 20           |

**Table A.2**  
**Converting Expressive Attention Item 2 Raw Score to a Percentile Rank and Scaled Score**

| Percentile rank | 5-0 to 5-2 | 5-3 to 5-5 | 5-6 to 5-8 | 5-9 to 5-11 | 6-0 to 6-2 | 6-3 to 6-5 | 6-6 to 6-8 | 6-9 to 6-11 | 7-0 to 7-5 | 7-6 to 7-11 | Scaled score |
|-----------------|------------|------------|------------|-------------|------------|------------|------------|-------------|------------|-------------|--------------|
| <1              | —          | —          | >173       | >153        | >141       | >131       | >111       | >98         | >88        | >80         | 1            |
| <1              | —          | 174-180    | 154-173    | 142-153     | 132-141    | 112-131    | 99-111     | 89-98       | 76-88      | 71-80       | 2            |
| 1               | 162-180    | 154-173    | 142-153    | 132-141     | 112-131    | 99-111     | 84-98      | 76-88       | 71-75      | 66-70       | 3            |
| 2               | 145-161    | 142-153    | 132-141    | 112-131     | 99-111     | 74-98      | 74-83      | 71-75       | 64-70      | 59-65       | 4            |
| 5               | 132-144    | 130-141    | 109-131    | 89-111      | 74-98      | 68-73      | 67-73      | 61-70       | 56-63      | 54-58       | 5            |
| 9               | 121-131    | 109-129    | 89-108     | 74-88       | 68-73      | 61-67      | 61-66      | 56-60       | 51-55      | 50-53       | 6            |
| 16              | 109-120    | 89-108     | 74-88      | 68-73       | 61-67      | 55-60      | 55-60      | 50-55       | 47-50      | 47-49       | 7            |
| 25              | 78-108     | 74-88      | 62-73      | 61-67       | 55-60      | 53-54      | 50-54      | 47-49       | 43-46      | 43-46       | 8            |
| 37              | 65-77      | 61-73      | 56-61      | 55-60       | 53-54      | 47-52      | 47-49      | 42-46       | 41-42      | 40-42       | 9            |
| 50              | 57-64      | 54-60      | 51-55      | 50-54       | 47-52      | 43-46      | 42-46      | 37-41       | 36-40      | 36-39       | 10           |
| 63              | 53-56      | 49-53      | 49-50      | 45-49       | 42-46      | 41-42      | 37-41      | 32-36       | 32-35      | 32-35       | 11           |
| 75              | 43-52      | 42-48      | 42-48      | 40-44       | 37-41      | 37-40      | 32-36      | 30-31       | 30-31      | 29-31       | 12           |
| 84              | 36-42      | 35-41      | 35-41      | 35-39       | 34-36      | 32-36      | 30-31      | 28-29       | 28-29      | 27-28       | 13           |
| 91              | 30-35      | 30-34      | 30-34      | 30-34       | 30-33      | 30-31      | 28-29      | 26-27       | 26-27      | 25-26       | 14           |
| 95              | 26-29      | 26-29      | 26-29      | 26-29       | 26-29      | 26-29      | 26-27      | 24-25       | 24-25      | 23-24       | 15           |
| 98              | 24-25      | 24-25      | 24-25      | 24-25       | 24-25      | 24-25      | 24-25      | 23          | 22-23      | 21-22       | 16           |
| 99              | 22-23      | 22-23      | 22-23      | 22-23       | 22-23      | 22-23      | 22-23      | 21-22       | 21         | 19-20       | 17           |
| >99             | 18-21      | 18-21      | 18-21      | 18-21       | 18-21      | 18-21      | 18-21      | 18-20       | 18-20      | 18          | 18           |
| >99             | 15-17      | 15-17      | 15-17      | 15-17       | 15-17      | 15-17      | 15-17      | 15-17       | 13-17      | 11-17       | 19           |
| >99             | <15        | <15        | <15        | <15         | <15        | <15        | <15        | <15         | <13        | <11         | 20           |

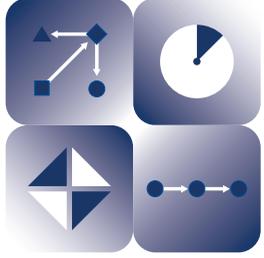
**Table A.3**  
**Converting Expressive Attention Item 4 Raw Score to a Percentile Rank and Scaled Score**

| Percentile rank | 8-0 to 8-5 | 8-6 to 8-11 | 9-0 to 9-5 | 9-6 to 9-11 | 10-0 to 10-5 | 10-6 to 10-11 | 11-0 to 11-11 | 12-0 to 12-11 | 13-0 to 13-11 | 14-0 to 14-11 | 15-0 to 15-11 | 16-0 to 16-11 | 17-0 to 17-11 | 18-0 to 18-11 | Scaled score |
|-----------------|------------|-------------|------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|
| <1              | >67        | >67         | >66        | >62         | >59          | >54           | >50           | >45           | >41           | >37           | >37           | >37           | >37           | >37           | 1            |
| <1              | 67         | 67          | 63-66      | 60-62       | 55-59        | 51-54         | 46-50         | 42-45         | 38-41         | 36-37         | 36-37         | 36-37         | 36-37         | 36-37         | 2            |
| 1               | 63-66      | 63-66       | 60-62      | 55-59       | 51-54        | 46-50         | 42-45         | 38-41         | 35-37         | 35            | 35            | 35            | 33-35         | 33-35         | 3            |
| 2               | 60-62      | 60-62       | 55-59      | 51-54       | 46-50        | 42-45         | 38-41         | 35-37         | 33-34         | 33-34         | 33-34         | 33-34         | 31-32         | 31-32         | 4            |
| 5               | 55-59      | 55-59       | 51-54      | 46-50       | 42-45        | 38-41         | 35-37         | 33-34         | 31-32         | 31-32         | 31-32         | 31-32         | 29-30         | 29-30         | 5            |
| 9               | 51-54      | 51-54       | 46-50      | 42-45       | 38-41        | 32-37         | 29-34         | 26-32         | 24-30         | 23-30         | 23-30         | 24-30         | 22-28         | 22-28         | 6            |
| 16              | 46-50      | 46-50       | 42-45      | 38-41       | 32-37        | 25-31         | 25-28         | 24-25         | 22-23         | 21-22         | 21-22         | 22-23         | 20-21         | 20-21         | 7            |
| 25              | 42-45      | 42-45       | 38-41      | 32-37       | 24-31        | 22-24         | 22-24         | 22-23         | 21            | 20            | 20            | 20-21         | 19            | 19            | 8            |
| 37              | 35-41      | 35-41       | 32-37      | 24-31       | 22-23        | 21            | 20-21         | 20-21         | 19-20         | 19            | 19            | 19            | 18            | 18            | 9            |
| 50              | 28-34      | 26-34       | 24-31      | 22-23       | 21           | 20            | 19            | 19            | 18            | 17-18         | 17-18         | 17-18         | 16-17         | 16-17         | 10           |
| 63              | 23-27      | 22-25       | 21-23      | 21          | 20           | 19            | 18            | 18            | 17            | 16            | 15-16         | 15-16         | 15            | 15            | 11           |
| 75              | 20-22      | 19-21       | 19-20      | 19-20       | 18-19        | 18            | 17            | 17            | 16            | 15            | 14            | 14            | 14            | 14            | 12           |
| 84              | 18-19      | 17-18       | 17-18      | 17-18       | 17           | 17            | 16            | 16            | 15            | 14            | 13            | 13            | 13            | 13            | 13           |
| 91              | 16-17      | 14-16       | 14-16      | 14-16       | 14-16        | 13-16         | 13-15         | 13-15         | 13-14         | 13            | 12            | 12            | 12            | 12            | 14           |
| 95              | 14-15      | 13          | 13         | 13          | 13           | 12            | 12            | 12            | 12            | 12            | 11            | 11            | 11            | 11            | 15           |
| 98              | 13         | 12          | 12         | 12          | 12           | 11            | 11            | 11            | 11            | 11            | 10            | 10            | 10            | 10            | 16           |
| 99              | 12         | 11          | 11         | 11          | 11           | 10            | 10            | 10            | 10            | 10            | 9             | 9             | 9             | 9             | 17           |
| >99             | 11         | 10          | 10         | 10          | 9-10         | 9             | 9             | 9             | 9             | 9             | 8             | 8             | 8             | 8             | 18           |
| >99             | 10         | 9           | 9          | 9           | 8            | 8             | 8             | 8             | 8             | 8             | 7             | 7             | 7             | 7             | 19           |
| >99             | <10        | <9          | <9         | <9          | <8           | <8            | <8            | <8            | <8            | <8            | <7            | <7            | <7            | <7            | 20           |

**Table A.4**  
**Converting Expressive Attention Item 5 Raw Score to a Percentile Rank and Scaled Score**

| Percentile rank | 8-0 to 8-5 | 8-6 to 8-11 | 9-0 to 9-5 | 9-6 to 9-11 | 10-0 to 10-5 | 10-6 to 10-11 | 11-0 to 11-11 | 12-0 to 12-11 | 13-0 to 13-11 | 14-0 to 14-11 | 15-0 to 15-11 | 16-0 to 16-11 | 17-0 to 17-11 | 18-0 to 18-11 | Scaled score |
|-----------------|------------|-------------|------------|-------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|--------------|
| <1              | >101       | >99         | >94        | >90         | >83          | >76           | >72           | >67           | >60           | >53           | >48           | >44           | >44           | >44           | 1            |
| <1              | 97-101     | 95-99       | 91-94      | 84-90       | 77-83        | 73-76         | 68-72         | 61-67         | 54-60         | 50-53         | 44-48         | 42-44         | 42-44         | 42-44         | 2            |
| 1               | 91-96      | 90-94       | 84-90      | 77-83       | 73-76        | 68-72         | 61-67         | 54-60         | 49-53         | 49-53         | 39-43         | 39-41         | 39-41         | 39-41         | 3            |
| 2               | 84-90      | 84-89       | 77-83      | 72-76       | 68-72        | 61-67         | 54-60         | 49-53         | 44-48         | 44-48         | 37-38         | 36-38         | 36-38         | 36-38         | 4            |
| 5               | 73-83      | 73-83       | 71-76      | 63-71       | 56-67        | 54-60         | 49-53         | 44-48         | 39-43         | 39-43         | 34-36         | 33-35         | 33-35         | 33-35         | 5            |
| 9               | 63-72      | 61-72       | 57-70      | 52-62       | 47-55        | 44-53         | 40-48         | 36-43         | 32-38         | 36-38         | 30-33         | 30-32         | 30-32         | 30-32         | 6            |
| 16              | 57-62      | 55-60       | 52-56      | 46-51       | 43-46        | 40-43         | 36-39         | 32-35         | 30-31         | 30-35         | 27-29         | 27-29         | 27-29         | 27-29         | 7            |
| 25              | 47-56      | 47-54       | 46-51      | 41-45       | 38-42        | 36-39         | 32-35         | 30-31         | 28-29         | 29            | 25-26         | 25-26         | 25-26         | 25-26         | 8            |
| 37              | 42-46      | 41-46       | 40-45      | 36-40       | 33-37        | 31-35         | 30-31         | 28-29         | 25-27         | 25-28         | 23-24         | 23-24         | 22-24         | 22-24         | 9            |
| 50              | 40-41      | 37-40       | 35-39      | 33-35       | 31-32        | 29-30         | 28-29         | 25-27         | 24            | 23-24         | 21-22         | 21-22         | 20-21         | 20-21         | 10           |
| 63              | 37-39      | 33-36       | 31-34      | 30-32       | 29-30        | 27-28         | 25-27         | 24            | 22-23         | 21-22         | 20            | 20            | 19            | 19            | 11           |
| 75              | 32-36      | 29-32       | 28-30      | 28-29       | 27-28        | 25-26         | 24            | 22-23         | 21            | 20            | 19            | 19            | 18            | 18            | 12           |
| 84              | 29-31      | 26-28       | 25-27      | 25-27       | 24-26        | 24            | 22-23         | 21            | 20            | 19            | 18            | 18            | 17            | 17            | 13           |
| 91              | 26-28      | 24-25       | 23-24      | 23-24       | 23           | 22-23         | 21            | 20            | 19            | 18            | 17            | 17            | 16            | 16            | 14           |
| 95              | 23-25      | 22-23       | 22         | 22          | 21-22        | 21            | 20            | 19            | 18            | 17            | 16            | 16            | 15            | 15            | 15           |
| 98              | 22         | 21          | 21         | 21          | 20           | 20            | 19            | 18            | 17            | 16            | 15            | 15            | 14            | 14            | 16           |
| 99              | 21         | 20          | 20         | 20          | 19           | 19            | 18            | 17            | 16            | 15            | 14            | 14            | 13            | 13            | 17           |
| >99             | 20         | 19          | 19         | 19          | 18           | 18            | 17            | 16            | 15            | 14            | 13            | 13            | 12            | 12            | 18           |
| >99             | 19         | 18          | 18         | 18          | 17           | 17            | 16            | 15            | 14            | 13            | 12            | 12            | 11            | 11            | 19           |
| >99             | <19        | <18         | <18        | <18         | <17          | <17           | <16           | <15           | <14           | <13           | <12           | <12           | <11           | <11           | 20           |





## Converting Sums of Expressive Attention Item Scaled Scores to Speed/Fluency Index Scores, Percentile Ranks, and Confidence Intervals

**Table B.1**  
**Converting Sums of Expressive Attention Items 1 and 2 Planning Scaled Scores to Indexes, Percentile Ranks, and Confidence Intervals**

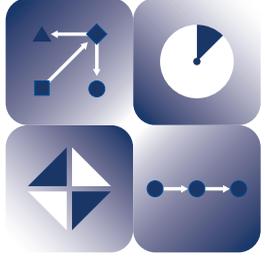
| Sum of two scaled scores | Index score | Percentile rank | Confidence interval |         |
|--------------------------|-------------|-----------------|---------------------|---------|
|                          |             |                 | 90%                 | 95%     |
| 2                        | 48          | <0.1            | 37–59               | 35–61   |
| 3                        | 51          | <0.1            | 40–62               | 38–64   |
| 4                        | 54          | 0.1             | 43–65               | 41–67   |
| 5                        | 56          | 0.2             | 45–67               | 43–69   |
| 6                        | 59          | 0.3             | 48–70               | 46–72   |
| 7                        | 62          | 0.6             | 51–73               | 49–75   |
| 8                        | 65          | 1.0             | 54–76               | 52–78   |
| 9                        | 68          | 1.6             | 57–79               | 55–81   |
| 10                       | 71          | 3               | 60–82               | 58–84   |
| 11                       | 74          | 4               | 63–85               | 61–87   |
| 12                       | 77          | 6               | 66–88               | 64–90   |
| 13                       | 79          | 8               | 68–90               | 66–92   |
| 14                       | 82          | 12              | 71–93               | 69–95   |
| 15                       | 85          | 16              | 74–96               | 72–98   |
| 16                       | 88          | 21              | 77–99               | 75–101  |
| 17                       | 91          | 27              | 80–102              | 78–104  |
| 18                       | 94          | 34              | 83–105              | 81–107  |
| 19                       | 97          | 42              | 86–108              | 84–110  |
| 20                       | 100         | 50              | 89–111              | 87–113  |
| 21                       | 102         | 55              | 91–113              | 89–115  |
| 22                       | 105         | 63              | 94–116              | 92–118  |
| 23                       | 108         | 70              | 97–119              | 95–121  |
| 24                       | 111         | 76              | 100–122             | 98–124  |
| 25                       | 114         | 83              | 103–125             | 101–127 |
| 26                       | 117         | 87              | 106–128             | 104–130 |
| 27                       | 120         | 91              | 109–131             | 107–133 |
| 28                       | 123         | 94              | 112–134             | 110–136 |
| 29                       | 125         | 95              | 114–136             | 112–138 |
| 30                       | 128         | 97              | 117–139             | 115–141 |
| 31                       | 131         | 98.1            | 120–142             | 118–144 |
| 32                       | 134         | 98.8            | 123–145             | 121–147 |
| 33                       | 137         | 99.3            | 126–148             | 124–150 |
| 34                       | 140         | 99.6            | 129–151             | 127–153 |
| 35                       | 143         | 99.8            | 132–154             | 130–156 |
| 36                       | 146         | 99.9            | 135–157             | 133–159 |
| 37                       | 148         | >99.9           | 137–159             | 135–161 |
| 38                       | 151         | >99.9           | 140–162             | 138–164 |
| 39                       | 154         | >99.9           | 143–165             | 141–167 |
| 40                       | 157         | >99.9           | 146–168             | 144–170 |

**Table B.2**  
**Converting Sums of Expressive Attention Items 4 and 5 Planning Scaled Scores to Indexes, Percentile Ranks, and Confidence Intervals**

| Sum of two scaled scores | Index score | Percentile rank | Confidence interval |         |
|--------------------------|-------------|-----------------|---------------------|---------|
|                          |             |                 | 90%                 | 95%     |
| 2                        | 46          | <0.1            | 35–57               | 33–59   |
| 3                        | 49          | <0.1            | 38–60               | 36–62   |
| 4                        | 52          | <0.1            | 41–63               | 39–65   |
| 5                        | 55          | 0.1             | 44–66               | 42–68   |
| 6                        | 58          | 0.3             | 47–69               | 45–71   |
| 7                        | 61          | 0.5             | 50–72               | 48–74   |
| 8                        | 64          | 0.8             | 53–75               | 51–77   |
| 9                        | 67          | 1.4             | 56–78               | 54–80   |
| 10                       | 70          | 2               | 59–81               | 57–83   |
| 11                       | 73          | 3               | 62–84               | 60–86   |
| 12                       | 76          | 5               | 65–87               | 63–89   |
| 13                       | 79          | 8               | 68–90               | 66–92   |
| 14                       | 82          | 12              | 71–93               | 69–95   |
| 15                       | 85          | 16              | 74–96               | 72–98   |
| 16                       | 88          | 21              | 77–99               | 75–101  |
| 17                       | 91          | 27              | 80–102              | 78–104  |
| 18                       | 94          | 34              | 83–105              | 81–107  |
| 19                       | 97          | 42              | 86–108              | 84–110  |
| 20                       | 100         | 50              | 89–111              | 87–113  |
| 21                       | 103         | 58              | 92–114              | 90–116  |
| 22                       | 106         | 66              | 95–117              | 93–119  |
| 23                       | 109         | 73              | 98–120              | 96–122  |
| 24                       | 112         | 79              | 101–123             | 99–125  |
| 25                       | 115         | 84              | 104–126             | 102–128 |
| 26                       | 118         | 88              | 107–129             | 105–131 |
| 27                       | 121         | 92              | 110–132             | 108–134 |
| 28                       | 124         | 95              | 113–135             | 111–137 |
| 29                       | 127         | 96              | 116–138             | 114–140 |
| 30                       | 130         | 98              | 119–141             | 117–143 |
| 31                       | 133         | 98.6            | 122–144             | 120–146 |
| 32                       | 136         | 99.2            | 125–147             | 123–149 |
| 33                       | 139         | 99.5            | 128–150             | 126–152 |
| 34                       | 142         | 99.7            | 131–153             | 129–155 |
| 35                       | 145         | 99.9            | 134–156             | 132–158 |
| 36                       | 147         | >99.9           | 136–158             | 134–160 |
| 37                       | 150         | >99.9           | 139–161             | 137–163 |
| 38                       | 153         | >99.9           | 142–164             | 140–166 |
| 39                       | 156         | >99.9           | 145–167             | 143–169 |
| 40                       | 159         | >99.9           | 148–170             | 146–172 |



CAS2



APPENDIX C

CAS2 Speed/Fluency Summary Form

## Section 5. CAS2 Interpretive Worksheet

### PASS Scale Comparisons

Compare each PASS scale index score to the child's mean PASS score using Tables A.1 and A.2 (Extended Battery) or A.3 and A.4 (Core Battery) of the Interpretive Manual.

|              | Index Score | <i>d</i> value | circle .05 .10 | Strength Weakness | % in sample |
|--------------|-------------|----------------|----------------|-------------------|-------------|
| Planning     |             |                | Sig NS         | ST WK             |             |
| Simultaneous |             |                | Sig NS         | ST WK             |             |
| Attention    |             |                | Sig NS         | ST WK             |             |
| Successive   |             |                | Sig NS         | ST WK             |             |
| PASS mean    |             |                |                |                   |             |

### Subtest Analysis

Compare each subtest scaled score to the child's mean subtest score using Tables B.1 and B.2 of the Interpretive Manual.

|                         | Scaled Score | <i>d</i> value | circle .05 .10 | Strength Weakness | % in sample |
|-------------------------|--------------|----------------|----------------|-------------------|-------------|
| Planned Codes           |              |                | Sig NS         | ST WK             |             |
| Planned Connections     |              |                | Sig NS         | ST WK             |             |
| Planned Number Matching |              |                | Sig NS         | ST WK             |             |
| Planning mean           |              |                |                |                   |             |

|                          | Scaled Score | <i>d</i> value | circle .05 .10 | Strength Weakness | % in sample |
|--------------------------|--------------|----------------|----------------|-------------------|-------------|
| Matrices                 |              |                | Sig NS         | ST WK             |             |
| Verbal–Spatial Relations |              |                | Sig NS         | ST WK             |             |
| Figure Memory            |              |                | Sig NS         | ST WK             |             |
| Simultaneous mean        |              |                |                |                   |             |

|                      | Scaled Score | <i>d</i> value | circle .05 .10 | Strength Weakness | % in sample |
|----------------------|--------------|----------------|----------------|-------------------|-------------|
| Expressive Attention |              |                | Sig NS         | ST WK             |             |
| Number Detection     |              |                | Sig NS         | ST WK             |             |
| Receptive Attention  |              |                | Sig NS         | ST WK             |             |
| Attention mean       |              |                |                |                   |             |

|  | Scaled Score | <i>d</i> value | circle .05 .10 | Strength Weakness | % in sample |
|--|--------------|----------------|----------------|-------------------|-------------|
| Word Series                                |              |                | Sig NS         | ST WK             |             |
| Sentence Repetition/<br>Sentence Questions |              |                | Sig NS         | ST WK             |             |
| Visual Digit Span                          |              |                | Sig NS         | ST WK             |             |
| Successive mean                            |              |                |                |                   |             |

### First–Second Comparisons

Compare the CAS2 standard scores obtained by the same child tested twice using Tables C.1–C.5 (Extended Battery) or C.6–C.10 (Core Battery) of the Interpretive and Technical Manual.

|              | First Score | Second Score | <i>p</i> = .10 |
|--------------|-------------|--------------|----------------|
| Planning     |             |              | Sig NS         |
| Simultaneous |             |              | Sig NS         |
| Attention    |             |              | Sig NS         |
| Successive   |             |              | Sig NS         |
| Full Scale   |             |              | Sig NS         |

### Supplemental Composite Scores

| Subtest                       | Scaled Score |          |    |    |     |
|-------------------------------|--------------|----------|----|----|-----|
|                               | EF w/o WM    | EF w/ WM | WM | VC | NvC |
| Planned Codes                 |              |          |    |    |     |
| Planned Connections           |              |          |    |    |     |
| Matrices                      |              |          |    |    |     |
| Verbal–Spatial Relations      |              |          |    |    |     |
| Figure Memory                 |              |          |    |    |     |
| Expressive Attention          |              |          |    |    |     |
| Receptive Attention           |              |          |    |    |     |
| Sentence Repetition/Questions |              |          |    |    |     |
|                               | EF w/o WM    | EF w/ WM | WM | VC | NvC |
| Sum of Subtest Scaled Scores  |              |          |    |    |     |
| Composite Index Scores        |              |          |    |    |     |
| Percentile Rank               |              |          |    |    |     |
| Upper                         |              |          |    |    |     |
| _____% Confidence Interval    |              |          |    |    |     |
| Lower                         |              |          |    |    |     |

**Note:** EF w/o WM = Executive Function Without Working Memory; EF w/WM = Executive Function With Working Memory; WM = Working Memory; VC = Verbal Content; NvC = Nonverbal Content.

### Visual–Auditory Comparison

|                          | Scaled Score |
|--------------------------|--------------|
| Word Series              | _____        |
| Visual Digit Span        | _____        |
| Difference (ignore sign) | _____        |
| Circle one: .05 NS       |              |

### Speed/Fluency: Ages 5–7

| Expressive Attention Item       | Time in Seconds | Scaled Score         |
|---------------------------------|-----------------|----------------------|
| 1.                              |                 |                      |
| 2.                              |                 |                      |
| Sum of Scaled Scores            |                 | _____                |
| Speed/Fluency Index Score (S/F) |                 | <input type="text"/> |

### Speed/Fluency: Ages 8–18

| Expressive Attention Item       | Time in Seconds | Scaled Score         |
|---------------------------------|-----------------|----------------------|
| 4.                              |                 |                      |
| 5.                              |                 |                      |
| Sum of Scaled Scores            |                 | _____                |
| Speed/Fluency Index Score (S/F) |                 | <input type="text"/> |