

### 3. The Academic Achievement of Youth With Disabilities in Reading, Mathematics, Science, and Social Studies

NLTS2 provides the first nationally representative data on how secondary-age youth with disabilities are faring academically. This chapter presents descriptive findings from standardized assessments of youth with disabilities in reading, mathematics, science, and social studies. It begins with a description of the six assessment subtests in these areas, and then continues with a description of performance on these measures by youth with disabilities as a group and by those who differ in their primary disability category.

#### Assessment Subtests

As noted in chapter 1, assessments of youths' academic achievement were conducted using six subtests from the research edition of the Woodcock-Johnson III (WJ III); (Woodcock, McGrew, and Mather 2001).<sup>1</sup> Two relate to reading (passage comprehension and synonyms and antonyms), two to mathematics (calculations and applied problems), and one each to science and social studies. These six subtests are described below (Mather and Woodcock 2001).

**Passage comprehension.** The research version of the WJ III passage comprehension subtest presents youth with a series of items that range in difficulty. The least difficult items present a phrase in conjunction with several graphic representations. Youth point to the appropriate picture that matches the phrase (e.g., two trees). The more difficult items are entirely text-based, address more technical topics, and require both greater vocabulary and the ability to make inferences from context. In this section of the subtest, youth read a short passage and then provide the missing key word that makes sense in the context of that passage. Youth who perform well on this test have well-developed linguistic and cognitive skills, in addition to the ability to notice and use textual information.

**Synonyms and antonyms.** The research version of this WJ III subtest assesses skills in reading words, understanding vocabulary, and supplying words with similar or opposite meanings. The first part of the subtest requires reading a word and providing a synonym (i.e., a word with the same meaning); the second requires reading a word and providing an antonym (i.e., a word with the opposite meaning).

**Mathematics calculation.** The research version of the calculation subtest assesses computation skills, ranging in difficulty from elementary (e.g., simple addition) to advanced (e.g., integrating a function). Youth are given a worksheet that presents the mathematics problems. Items are not read to the youth unless that is a typical accommodation received by the youth. Because the calculations are presented in a traditional problem format, including notation that signals the operation that is required to produce the correct result (e.g., a + for addition), youth are not required to decide about what operations to use or what data to include. Youth are required to perform addition, subtraction, multiplication, division, and combinations of these basic operations, and some geometric, trigonometric, logarithmic, and calculus operations. The calculations involve negative numbers, percents, decimals, fractions, and whole numbers. The

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<sup>1</sup> Chapter 1 of this report includes a description of the direct assessment data collection process; additional details regarding the assessment instruments and procedures are found in appendix A.

least difficult items are simple, single-digit addition problems; the most difficult require knowledge of calculus.

**Applied problems.** The research version of the WJ III applied problems subtest requires youth to analyze and solve practical mathematical problems that are read to them. To solve the problems, youth must recognize the procedure to be followed and then perform relatively simple calculations. Because many of the problems include extraneous information, the youth must decide not only the appropriate mathematical operations to use but also which numbers to include in the calculation. Item difficulty increases with complex calculations. All youth are provided with and may use calculators, pencil, and paper.

**Science.** This subtest assesses knowledge of various areas of biological and physical sciences. The items range in difficulty. Early items require a youth simply to point to the appropriate response; remaining items require a youth to respond orally to questions read to him or her.

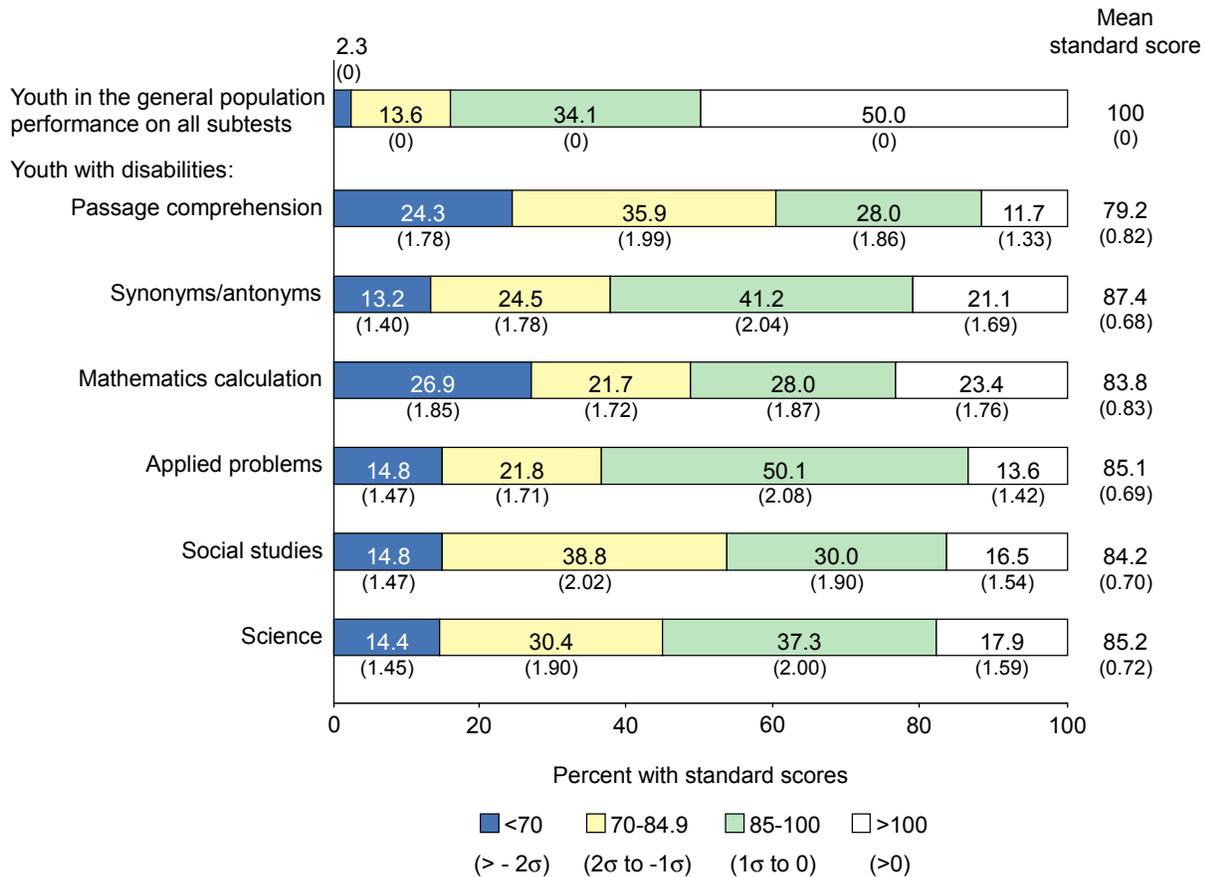
**Social studies.** The research version of the WJ III social studies subtest assesses knowledge of history, geography, government, economics, and other aspects of social studies. Similar to the science content knowledge subtest, early items require only a pointing response, whereas remaining items require a youth to respond orally to questions read to him or her. Items range in difficulty from early preschool through college.

## Youth's Academic Achievement

Scores on the WJ III subtests suggest that many youth with disabilities do not fare nearly as well on these academic assessments as peers in the general population. Figure 1 presents the distribution of standard scores for youth with disabilities and those in the general population. Direct assessment scores are reported as standard scores, which have a mean of 100 and a standard deviation of 15. In the general population, the distribution of test scores on each subtest is equally divided above and below the mean (i.e., 50 percent score above and 50 percent below) (Woodcock and Johnson 1989). In comparison, more than three-quarters of those with disabilities score below the mean across subtests. Compared with the 50 percent of youth in the general population who score 100 or below, 86 percent of youth with disabilities receive standard scores in that range on the applied problems subtest, 83 percent on the passage comprehension and social studies subtests, 82 percent on the science subtest, 79 percent on the synonyms/antonyms subtest, and 77 percent on the mathematics calculation subtest ( $p < .001$  for all comparisons).

Approximately 2 percent of youth in the general population receive standard scores that are more than two standard deviations below the mean—i.e., less than 70—a standard score range classified by WJ III as being “very low” (Woodcock and Mather 1990). Across the subtests, between 14 percent and 27 percent of youth with disabilities have scores in this range. Compared with the 2 percent of youth in the general population who score below 70, 27 percent of youth with disabilities do so on the mathematics calculation subtest, as do 24 percent on the passage comprehension subtest, 15 percent on the applied problems and social studies subtests, 14 percent on the science subtest, and 13 percent on the synonyms/antonyms subtest ( $p < .001$  for all comparisons).

Figure 1. Performance of youth with disabilities compared with performance of youth in the general population on Woodcock-Johnson III subtests



NOTE: Standard errors are in parentheses.

SOURCE: Woodcock-Johnson, *Tests of Cognitive Ability: Standard and Supplemental Batteries*, Norm Tables, 1989; U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study-2 (NLTS2), student assessments, 2002 and 2004.

Despite one out of four to one out of seven youth with disabilities scoring “very low” on these subtests, some youth are performing well. From 12 percent to 23 percent of youth with disabilities score above 100 across subtests. Youth are more likely to score above the mean on the synonyms/antonyms and mathematics calculation subtests, with 21 percent and 23 percent performing above 100 on them. Youth are less likely to perform well on the passage comprehension and applied problems subtests, with 12 percent and 14 percent scoring above the mean ( $p < .001$  for all comparisons). Youth experience the greatest difficulty with passage comprehension. On average, they receive a score of 79 on this subtest, compared with scores of 87 on the synonyms/antonyms subtest, 85 on the science and applied problems subtests, and 84 on the social studies and mathematics calculation subtests ( $p < .001$  for all comparisons).

## Disability Category Differences in Academic Achievement

Academic achievement differs considerably across disability categories (table 1). Mean standard scores range from 56 and 62 on the passage comprehension subtest for youth with mental retardation and multiple disabilities to 93, 94, and 95 on the synonyms/antonyms subtest for those with emotional disturbances, visual impairments, or other health impairments ( $p < .001$  for all comparisons). Within disability categories, performance varies across assessment subtests—youth in each category perform better in some academic areas than others.

**Other health impairment.** Average assessment scores for youth with other health impairments range from 86 to 95. They achieve their highest average score on the synonyms/antonyms subtest (95 vs. 86 to 90 across subtests,  $p < .001$  for all comparisons). Youth with other health impairments also receive higher average scores on the science subtest (90) than on the passage comprehension subtest (86,  $p < .01$ ).

**Visual impairment.** Youth with visual impairments have scores that range from 85 to 94 across subtests. They receive higher scores on the synonyms/antonyms (94) and mathematics calculations subtests (92) than on the passage comprehension subtest (85,  $p < .01$  and  $p < .05$ ). They also perform better on the synonyms/antonyms subtest than on the applied problems subtest ( $p < .05$ ).

**Emotional disturbance.** Youth with emotional disturbances receive average scores from 84 to 93. They score higher on the synonyms/antonyms subtest (93) than on all other tests (84 to 89,  $p < .001$  for all comparisons other than  $p < .01$  for science subtest). Youth with emotional disturbances also receive higher scores in science (89) and applied problems (88) than passage comprehension (84,  $p < .01$  and  $p < .05$ ).

Table 1. Mean standard scores of youth with disabilities on Woodcock-Johnson III subtests, by disability category

|                         | Other health impairment              | Visual impairment | Emotional disturbance | Learning disability | Speech/language impairment | Orthopedic impairment | Hearing impairment | Traumatic brain injury | Autism         | Deaf-blindness | Multiple disabilities | Mental retardation |
|-------------------------|--------------------------------------|-------------------|-----------------------|---------------------|----------------------------|-----------------------|--------------------|------------------------|----------------|----------------|-----------------------|--------------------|
| Subtests                | Mean standard score / standard error |                   |                       |                     |                            |                       |                    |                        |                |                |                       |                    |
| Passage comprehension   | 85.8<br>(1.10)                       | 84.7<br>(2.33)    | 84.2<br>(1.42)        | 81.9<br>(1.00)      | 81.4<br>(1.15)             | 78.8<br>(1.59)        | 75.6<br>(1.73)     | 74.1<br>(2.96)         | 69.6<br>(2.38) | 66.3<br>(3.81) | 61.5<br>(2.66)        | 55.7<br>(1.41)     |
| Synonyms/antonyms       | 95.0<br>(0.86)                       | 94.0<br>(1.89)    | 93.4<br>(1.12)        | 89.5<br>(0.81)      | 89.9<br>(0.93)             | 88.2<br>(1.23)        | 84.1<br>(1.44)     | 83.7<br>(1.95)         | 81.3<br>(2.16) | 75.5<br>(2.88) | 71.6<br>(2.11)        | 65.3<br>(1.06)     |
| Mathematics calculation | 88.2<br>(1.07)                       | 92.2<br>(2.41)    | 86.2<br>(1.22)        | 86.1<br>(1.09)      | 91.7<br>(1.14)             | 82.6<br>(1.64)        | 91.5<br>(1.42)     | 80.0<br>(2.65)         | 80.2<br>(2.39) | 77.7<br>(3.39) | 65.6<br>(2.89)        | 61.4<br>(1.43)     |
| Applied problems        | 88.4<br>(0.85)                       | 87.6<br>(2.23)    | 88.2<br>(1.06)        | 88.3<br>(0.77)      | 87.9<br>(0.98)             | 79.8<br>(1.44)        | 83.9<br>(1.32)     | 80.6<br>(2.23)         | 71.2<br>(2.36) | 72.8<br>(3.45) | 62.9<br>(2.42)        | 63.4<br>(1.31)     |
| Social studies          | 87.7<br>(0.99)                       | 88.4<br>(2.28)    | 87.8<br>(1.23)        | 86.6<br>(0.90)      | 85.6<br>(1.01)             | 84.3<br>(1.27)        | 80.5<br>(1.57)     | 79.1<br>(2.47)         | 73.9<br>(2.42) | 73.8<br>(3.03) | 67.5<br>(1.95)        | 65.1<br>(0.98)     |
| Science                 | 90.0<br>(0.94)                       | 88.8<br>(2.05)    | 89.3<br>(1.25)        | 87.6<br>(0.91)      | 85.6<br>(1.02)             | 83.4<br>(1.28)        | 75.4<br>(1.77)     | 80.0<br>(2.74)         | 75.7<br>(2.21) | 68.4<br>(3.65) | 69.3<br>(2.04)        | 67.0<br>(1.15)     |

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study-2 (NLTS2), direct assessments, 2002 and 2004.

**Learning disability.** Youth with learning disabilities have average scores between 82 and 90 across assessment subtests. They score lowest on the passage comprehension subtest (82) compared with the synonyms/antonyms (90,  $p < .001$ ); mathematics calculation (86,  $p < .01$ ), applied problems (88,  $p < .001$ ), social studies (87,  $p < .01$ ) and science subtests (88,  $p < .001$ ). The ability of youth in this category to use vocabulary skills in the synonyms/antonyms subtest is stronger than their mathematics calculation (90 vs. 86,  $p < .05$ ) or social studies skills (87,  $p < .05$ ).

**Speech/language impairment.** Youth with speech/language impairments receive their highest average assessment scores on the mathematics calculation subtest (92) and their lowest on the passage comprehension subtest (81,  $p < .001$ ). In comparison, their average score is 90 on the synonyms/antonyms subtest ( $p < .001$  compared with passage comprehension), 88 on the applied problems subtest ( $p < .05$  and  $p < .001$ ), 86 on the science subtest ( $p < .001$  and  $p < .01$ ), and the 86 on the social studies subtest ( $p < .001$  and  $p < .01$ ). The performance of youth with speech/language impairments on the synonyms/antonyms subtest is stronger than on the social studies and sciences subtests ( $p < .001$  and  $p < .01$ ).

**Orthopedic impairment.** The achievement of youth with orthopedic impairments ranges from average scores of 79 to 88 across subtests. Those with orthopedic impairments are better able to use vocabulary skills in the synonyms/antonyms subtest (88) than they are skills assessed on all other subtests. Compared with performance on the synonyms/antonyms subtest, their average score is 79 on passage comprehension ( $p < .001$ ), 80 on applied problems ( $p < .001$ ), 83 on science ( $p < .01$ ), 83 on mathematics calculation ( $p < .01$ ), and 84 on social studies ( $p < .05$ ) subtests. They also have stronger social studies than passage comprehension (84 vs. 79,  $p < .01$ ) or applied problem solving skills (84 vs. 80,  $p < .05$ ), and stronger science than passage comprehension skills (83 vs. 79,  $p < .05$ ).

**Hearing impairment.** Youth with hearing impairments receive average assessment scores that range from 75 to 92. They exhibit stronger mathematics calculation skills (92) than science knowledge (75,  $p < .001$ ), passage comprehension (76,  $p < .001$ ), social studies knowledge (81,  $p < .001$ ), and applied problems solving (84,  $p < .001$ ) and synonyms/antonyms skills (84,  $p < .001$ ). Their applied problem solving skills are stronger than their science knowledge ( $p < .001$ ) or passage comprehension ( $p < .001$ ) and their social studies knowledge is better than their science knowledge ( $p < .05$ ) or passage comprehension ( $p < .05$ ). Similar to those in almost all other disability categories, the use of synonyms/antonyms by youth with hearing impairments is stronger than their passage comprehension skills ( $p < .001$ ).

**Traumatic brain injury.** Youth with traumatic brain injuries receive average scores between 74 and 84 on assessment subtests, with no significant difference in performance across subtests other than stronger performance on the synonyms/antonyms than the passage comprehension subtest (84 vs. 76,  $p < .01$ ).

**Autism.** Average assessment scores for youth with autism range from 70 to 81. Youth with autism have better synonyms/antonyms (81) and mathematics calculation skills (80) and science knowledge (76) than passage comprehension (70,  $p < .001$ ,  $p < .01$ , and  $p < .001$ ). Their use of synonyms/antonyms also is better than their applied problem solving skills (71) and social studies knowledge (74,  $p < .01$  and  $p < .05$ ), and their mathematics calculation skills are stronger than their applied problem solving abilities (80 vs. 71,  $p < .01$ ).

**Deaf-blindness.** Those with deaf-blindness receive average assessments scores that range from 66 to 78. These youth are better able to perform mathematics calculations than understand reading passages (78 vs. 66,  $p < .05$ ). There are no other significant differences in performance across tests.

**Multiple disabilities.** Average scores for youth with multiple disabilities range from 62 to 72. They experience few significant differences in performance across subtests, other than a higher score on the synonyms/antonyms subtest (72) than on the passage comprehension (62) or applied problems (63) subtests ( $p < .01$  for both comparisons), and a lower score on the passage comprehension subtest than on the science subtest ( $p < .05$ ).

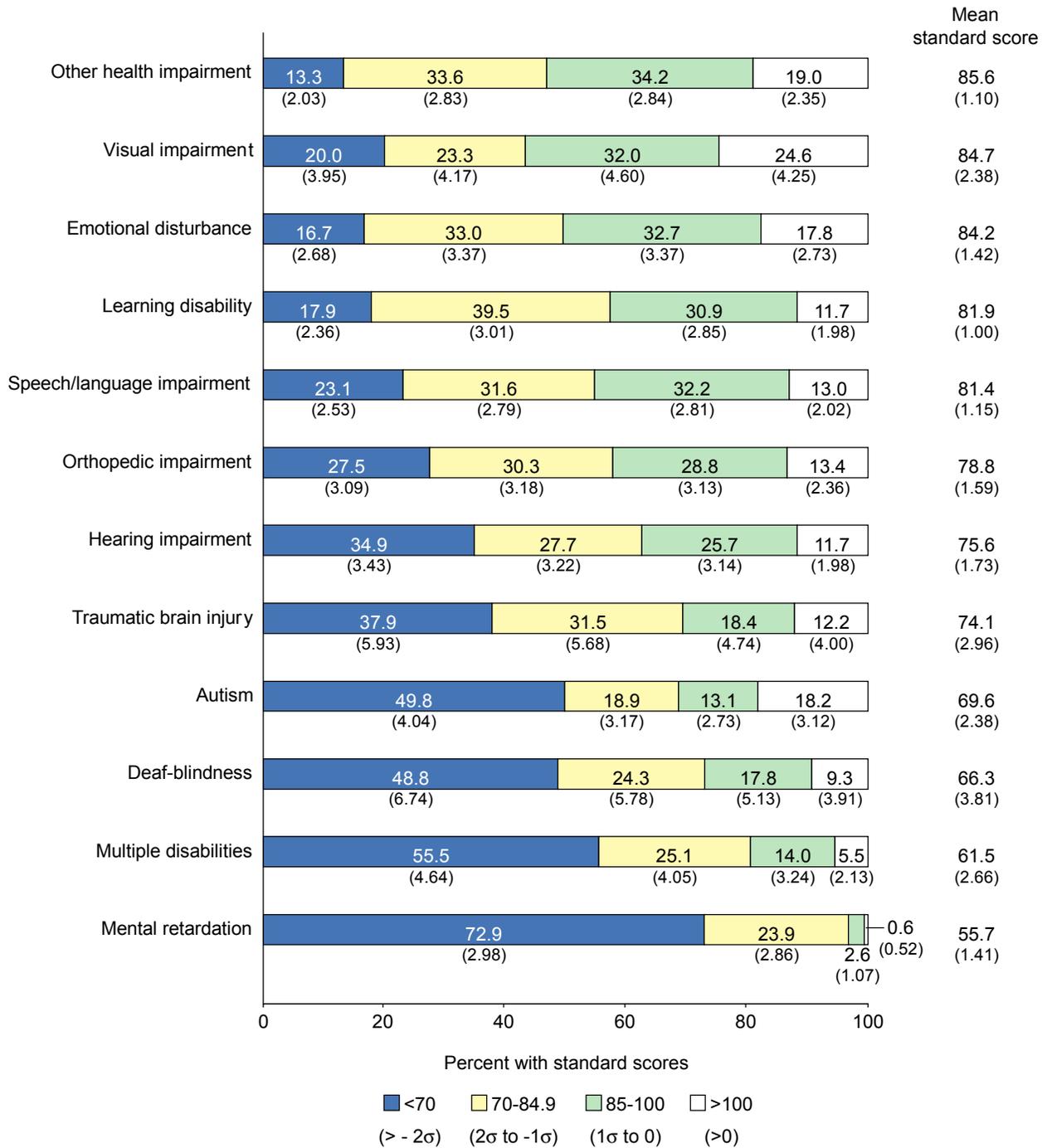
**Mental retardation.** Average scores for this group range from 56 to 67. Youth with mental retardation receive lower scores in passage comprehension (56) than in all other subtests. They receive average assessment scores of 67 in science ( $p < .001$ ), 65 in social studies ( $p < .001$ ), 65 in synonyms/antonyms ( $p < .001$ ), 63 in applied problems ( $p < .001$ ), and 61 in mathematics calculations ( $p < .01$ ). They receive higher scores on the science than the applied problems ( $p < .05$ ), and mathematics calculation ( $p < .01$ ) subtests ( $p < .01$ ) and lower scores on the mathematics calculation than the social studies ( $p < .05$ ) or synonyms/antonyms ( $p < .05$ ) subtests.

Although within each disability category, most youth score below the population mean, there is a distribution of scores such that some youth score above the mean. To illustrate, figure 2 depicts achievement on the passage comprehension subtest for youth in each disability category. In every disability category, some youth score across the distribution, including youth who have strong reading skills. For example, one-quarter of those with visual impairments perform above the mean on reading comprehension. Eighteen or 19 percent of those with other health impairments, emotional disturbances, or autism score above 100. One percent of those with mental retardation; 6 percent of those with multiple disabilities; 9 percent of those with deaf-blindness; and from 12 to 14 percent of those with speech, orthopedic, or hearing impairments; learning disabilities; or traumatic brain injuries score above the mean on the passage comprehension subtest. This pattern of variation within disability categories—with some youth in every category performing at every level—is apparent on all of the direct assessment subtests.<sup>2</sup>

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<sup>2</sup> Tables presenting within-disability category performance on the five additional subtests are included in appendix C.

Figure 2. Performance on the Woodcock-Johnson III passage comprehension subtest, by disability category



NOTE: Standard errors are in parentheses.

SOURCE: U.S. Department of Education, Institute of Education Sciences, National Center for Special Education Research, National Longitudinal Transition Study-2 (NLTS2), student assessments, 2002 and 2004.

## **Summary**

This chapter reveals that a considerable gap exists between the academic achievement of youth with disabilities and their peers in the general population in reading, mathematics, science, and social studies. Generally, the majority of those with disabilities are scoring below the mean on each subtest, although some are performing well. Chapter 4 examines factors that are independently related to these variations in assessment scores, including disability and functioning, individual and household demographics, past school experiences, and the use of accommodations.