

TECHNICAL REPORT

Boehm-3

Boehm Test of Basic Concepts • Third Edition

Ann E. Boehm, PhD

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Overview

The *Boehm Test of Basic Concepts, Third Edition* (Boehm-3) is a group administered assessment for students in kindergarten through second grade. Boehm-3 was designed to evaluate a young student's understanding of 50 important basic relational concepts integral for success in school and to identify students who many not have had the learning experiences necessary to develop an understanding of key concepts.

The basic relational concepts as defined by Boehm-3 include size, direction, and position in space, time, quantity, classification, and general.

Boehm-3 is a revision of Boehm-R, published in 1986. Enhancements in the revision include updated norms, color illustrations, concurrent development of Spanish edition, tools to assist in communication with parents, and more! The revision provides valuable information to elementary educators and educational diagnosticians, as well as speech/language pathologists, and school psychologists.

Test Design Criteria

Since the publication of Boehm-R in 1986, there have been many changes in early school assessment. This test was developed within the context of the changing environment and was devised in a format that can be translated into learning objectives, as well as being used for curriculum planning and working with parents. Outlined below are the enhancements that have been included in Boehm-3:

- Four measures provided—Raw Scores, Percent Correct, Performance Range, and Percentile
- The addition of a fourth response choice for each item to minimize guessing
- Modification and the addition of color in illustrations to appeal to students taking the test

- Increasing the diversity of people pictured in the illustrations by including diverse racial groups, individuals in non-stereotypical roles, and differently-abled individuals
- Introduction of an observation form that teachers and clinicians can use for ongoing observation of the generalized use of basic concepts across curriculum areas
- Development of a parent report form to communicate information to parents and suggestions for working with their students in the home environment
- Concurrent development of a Spanish edition with the English edition
- Enhancement of the transition from Boehm-3 Preschool to Boehm-3

Administration and Scoring

There are two parallel forms of Boehm-3; *Form E* and *Form F*. Each form addresses the same 50 concepts, in the same order, using different contexts. Administering Boehm-3 *Forms E* and *F* is simple and straightforward. Each form consists of a total of 50 pictorial items in one test booklet. Three practice items are presented, followed by 25 test items. There is a break point after the first 25 items if you wish to administer the test in two sessions. Three practice items precede the final 25 items.

Easier items are interspersed with more difficult items in order to increase a student's sense of success and enhance attention.

Most students become interested in the test and enjoy taking it, so holding the student's attention, even at the kindergarten level, is usually not difficult.

Boehm-3 results can be reported as a raw score, percent correct performance range, and a percentile. The raw score can be determined by summing the number of correct responses. Using the raw scores, the percent correct, performance range, and percentile can be obtained.

Standardization Sample

National fall norms were developed for the Boehm-3 by administering *Forms E* and *F* to students in kindergarten, first- and second-grade in October and November of 1999. National spring testing to establish norms took place in April and May of 2000. An attempt was made to test students from schools representative of the nation as a whole in terms of school district size (between 600 to more than 20,000 students), socioeconomic level of the residents of the school district, urbanicity

(urban, suburban, rural, or non-public), and geographic region. Students who received special services, but were mainstreamed in regular classrooms were included in the standardization.

The Boehm-3 standardization samples consisted of students in kindergarten, first- and second-grade classrooms. The fall standardization samples included more than 6,000 students, and the spring standardization included more than 4,000 students.

| Boehm-3 Standardization Sample by Grade and Form—Fall Testing | | | | |
|---------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Grade | Form E | | Form F | |
| | n | % | n | % |
| Kindergarten | 960 | 34.0 | 1,055 | 33.0 |
| First Grade | 982 | 34.0 | 1,105 | 35.0 |
| Second Grade | 924 | 32.0 | 1,029 | 32.0 |
| Total | 2,866 | 100.0 | 3,189 | 100.0 |

| Boehm-3 Standardization Sample by Grade and Form—Spring Testing | | | | |
|-----------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Grade | Form E | | Form F | |
| | n | % | n | % |
| Kindergarten | 813 | 34.6 | 748 | 34.1 |
| First Grade | 829 | 35.3 | 731 | 33.3 |
| Second Grade | 706 | 30.1 | 717 | 32.6 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 |

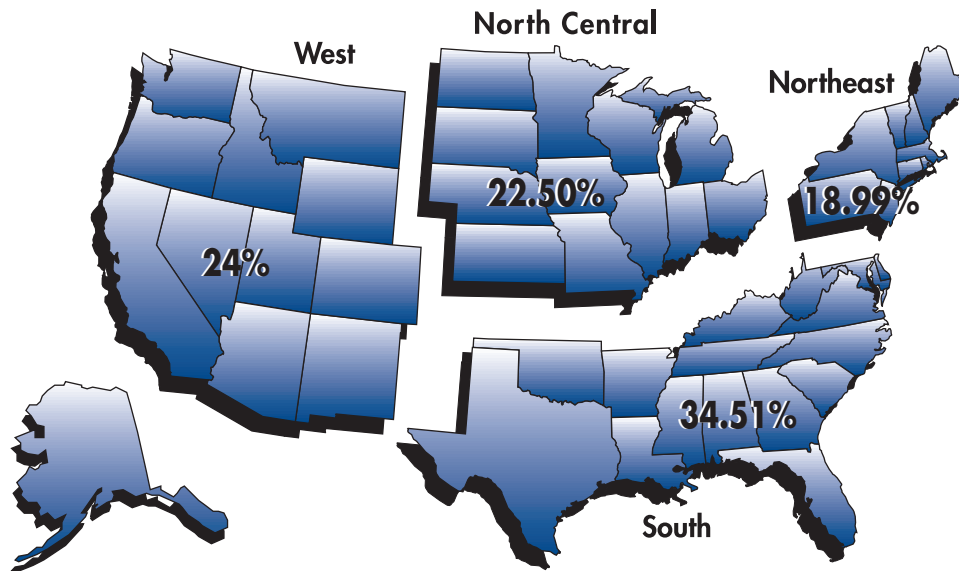
| Boehm-3 Standardization Sample by Gender and Form—Fall Testing | | | | |
|----------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Grade | Form E | | Form F | |
| | n | % | n | % |
| Female | 1,180 | 41.2 | 1,623 | 50.9 |
| Male | 1,653 | 57.7 | 1,522 | 47.7 |
| Not Reported | 33 | 1.1 | 44 | 1.4 |
| Total | 2,866 | 100.0 | 3,189 | 100.0 |

| Boehm-3 Standardization Sample by Gender and Form—Spring Testing | | | | |
|------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Grade | Form E | | Form F | |
| | n | % | n | % |
| Kindergarten | 1,174 | 50.0 | 1,098 | 50.0 |
| First Grade | 1,174 | 50.0 | 1,098 | 50.0 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 |

| Boehm-3 Standardization Sample by Race/Ethnicity and Form—Fall Testing | | | | | |
|------------------------------------------------------------------------|--------------|--------------|--------------|--------------|-------------------|
| Race/Ethnicity | Form E | | Form F | | U.S. Population % |
| | n | % | n | % | |
| African American | 462 | 16.1 | 491 | 15.4 | 16.52 |
| Hispanic | 468 | 16.3 | 475 | 14.9 | 16.32 |
| Other | 137 | 4.8 | 176 | 5.5 | 5.03 |
| White | 1,773 | 61.9 | 1,985 | 62.2 | 62.13 |
| Not Reported | 26 | 0.9 | 62 | 2.0 | — |
| Total | 2,866 | 100.0 | 3,189 | 100.0 | 100.00 |

| Boehm-3 Standardization Sample by Race/Ethnicity and Form—Spring Testing | | | | | |
|--------------------------------------------------------------------------|--------------|--------------|--------------|--------------|-------------------|
| Race/Ethnicity | Form E | | Form F | | U.S. Population % |
| | n | % | n | % | |
| African American | 400 | 17.0 | 395 | 18.0 | 16.52 |
| Hispanic | 382 | 16.3 | 314 | 14.3 | 16.32 |
| Other | 129 | 5.5 | 121 | 5.5 | 5.03 |
| White | 1,437 | 61.2 | 1,366 | 62.2 | 62.13 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 | 100.00 |

U.S. Bureau of the Census (1998). *Current population survey, October 1998: School Enrollment Supplemental File* [Machine-readable data file]. Washington, DC: U.S. Bureau of the Census (Producer/Distributor).



| Boehm-3 Standardization Sample by Region and Form—Fall Testing | | | | | |
|----------------------------------------------------------------|--------------|--------------|--------------|--------------|-------------------|
| Region | Form E | | Form F | | U.S. Population % |
| | n | % | n | % | |
| Northeast | 313 | 11.0 | 558 | 17.5 | 18.99 |
| North Central | 748 | 26.1 | 746 | 23.4 | 22.50 |
| South | 988 | 34.4 | 1,018 | 31.9 | 34.51 |
| West | 817 | 28.5 | 867 | 27.2 | 24.00 |
| Total | 2,866 | 100.0 | 3,189 | 100.0 | 100.00 |

| Boehm-3 Standardization Sample by Region and Form—Spring Testing | | | | | |
|------------------------------------------------------------------|--------------|--------------|--------------|--------------|-------------------|
| Region | Form E | | Form F | | U.S. Population % |
| | n | % | n | % | |
| Northeast | 445 | 19.0 | 415 | 18.9 | 18.99 |
| North Central | 504 | 21.5 | 496 | 22.6 | 22.50 |
| South | 802 | 34.1 | 757 | 34.5 | 34.51 |
| West | 597 | 25.4 | 528 | 24.0 | 24.00 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 | 100.00 |

U.S. Bureau of the Census (1998). *Current population survey, October 1998: School Enrollment Supplemental File* [Machine-readable data file]. Washington, DC: U.S. Bureau of the Census (Producer/Distributor).

| Boehm-3 Standardization Sample by Socioeconomic Level of the Participating School Districts and Non-public Schools and Form—Fall Testing | | | | |
|------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Socioeconomic Level | Form E | | Form F | |
| | n | % | n | % |
| Low | 1,348 | 47.0 | 1,365 | 42.8 |
| Middle | 501 | 17.5 | 694 | 21.8 |
| High | 533 | 18.6 | 702 | 22.0 |
| Non-public | 484 | 16.9 | 428 | 13.4 |
| Total | 2,866 | 100.0 | 3,189 | 100.0 |

| Boehm-3 Standardization Sample by Socioeconomic Level of the Participating School Districts and Non-public Schools and Form—Spring Testing | | | | |
|--------------------------------------------------------------------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Socioeconomic Level | Form E | | Form F | |
| | n | % | n | % |
| Low | 408 | 17.4 | 366 | 16.7 |
| Middle | 738 | 31.4 | 631 | 28.7 |
| High | 880 | 37.5 | 832 | 37.9 |
| Non-public | 322 | 13.7 | 367 | 16.7 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 |

| Boehm-3 Standardization Sample by Urbanicity and Form—Fall Testing | | | | |
|--------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Urbanicity | Form E | | Form F | |
| | n | % | n | % |
| Urban | 700 | 24.5 | 798 | 25.1 |
| Suburban | 775 | 27.0 | 1,056 | 33.1 |
| Rural | 907 | 31.6 | 907 | 28.4 |
| Non-public | 484 | 16.9 | 428 | 13.4 |
| Total | 2,866 | 100.0 | 3,189 | 100.0 |

| Boehm-3 Standardization Sample by Urbanicity and Form—Spring Testing | | | | |
|----------------------------------------------------------------------|--------------|--------------|--------------|--------------|
| Urbanicity | Form E | | Form F | |
| | n | % | n | % |
| Urban | 61 | 2.6 | 86 | 3.9 |
| Suburban | 1,407 | 59.9 | 1,219 | 55.5 |
| Rural | 558 | 23.8 | 524 | 23.9 |
| Non-public | 322 | 13.7 | 367 | 16.7 |
| Total | 2,348 | 100.0 | 2,196 | 100.0 |

Reliability and Validity

The reliability of the Boehm-3 was determined by checking internal consistency, standard error of measurement, test/retest reliability, and alternate forms reliability.

A test with a high level of internal consistency indicates that the internal structure of the test is such that results are repeatable.

The coefficient alphas for Boehm-3 ranged from .80 to .91. The Standard Error of Measurement (SEM) provides an alternative measure of reliability. The smaller the SEM, the greater level of confidence attributed to the accuracy of test scores. The SEM for Boehm-3 ranged from 1.14 to 2.43, indicating overall low variability.

| Internal Consistency Reliability Coefficients (Coefficient Alpha) and Standard Error of Measurement by Grade and Form | | | | | | | |
|-----------------------------------------------------------------------------------------------------------------------|--------|--------|--|---------------------|--------|--------|--|
| Fall | | | | Fall | | | |
| Grade | Form E | Form F | | Grade | Form E | Form F | |
| Kindergarten | | | | Kindergarten | | | |
| <i>n</i> | 960 | 1,055 | | <i>n</i> | 813 | 748 | |
| <i>r</i> | .90 | .90 | | <i>r</i> | .90 | .88 | |
| <i>SEM</i> | 2.42 | 2.43 | | <i>SEM</i> | 2.16 | 2.12 | |
| First Grade | | | | First Grade | | | |
| <i>n</i> | 982 | 1,105 | | <i>n</i> | 829 | 731 | |
| <i>r</i> | .85 | .87 | | <i>r</i> | .83 | .90 | |
| <i>SEM</i> | 1.90 | 1.87 | | <i>SEM</i> | 1.62 | 1.63 | |
| Second Grade | | | | Second Grade | | | |
| <i>n</i> | 924 | 1,029 | | <i>n</i> | 706 | 717 | |
| <i>r</i> | .80 | .80 | | <i>r</i> | .82 | .91 | |
| <i>SEM</i> | 1.35 | 1.39 | | <i>SEM</i> | 1.14 | 1.16 | |

Alternate-form reliability is reflected in coefficients of correlation between two forms of a test. It is important to note that nearly 94% of the students participating in the Boehm-3

alternate-forms study had a difference of 4 or fewer raw score points from one form to the other.

| Alternate-Form Reliability | | | | | | |
|----------------------------|--------|-----|--|--------|-----|----------|
| | Form E | | | Form F | | |
| <i>n</i> | Mean | SD | | Mean | SD | <i>r</i> |
| 216 | 46.5 | 3.5 | | 46.6 | 3.8 | .83 |

Overall test/retest reliability coefficients by grade/form ranged from .80 to .89.

A test can be said to have evidence of validity if it measures what it states that it measures. The Boehm-3 contains evidence of validity based on test content and relations to other variables.

Research outlined in the Boehm-3 *Examiner's Manual* supports the claim that a child's ability to make relational judgments using the Boehm-3 concept terms, plus their synonyms and antonyms, is basic to understanding classroom instruction, whether in the form of following teacher directions or completing curricular tasks.

Validity evidence based on relationships of other variables was compiled in five separate studies. The first study looked at the relationship between Boehm-3 and its predecessor, Boehm-R.

The correlation between Boehm-3 and Boehm-R ranged from .61 to .96. It is important to note that while both the Boehm-3 and its predecessor test 50 basic concepts, new concepts have been added to Boehm-3.

Secondly, a study was conducted to look at the relationship between Boehm-3 and the *Metropolitan Achievement Tests, Eighth Edition* (Harcourt Educational Measurement, Standardization Edition 1999), a test used to assess student achievement in the areas of sounds and print (emergent literacy

skills), mathematics, and language. The correlation between these two tests ranged from .58 to .88, indicating that knowledge of basic concepts is important for students to comply with administration directions and performance on the test tasks.

A third study involved a group of 75 kindergarten students who were administered the *Metropolitan Readiness Test, Sixth Edition* (Nurss & McGuavran, 1995). This test evaluates the early skills required in emergent reading and math. The correlation between this test and Boehm-3 ranged from .48 to .63.

The OLSAT 7[®] is used to measure thinking and reasoning by checking student performance on tasks. The moderate correlation can be expected due to the varied content of the numerous areas assessed with the OLSAT 7, suggesting that knowledge of basic concepts is related to student performance and is a component of thinking and reasoning. This further demonstrates the need to make sure students know basic concepts prior to administering tests.

The final study was a Longitudinal Study—Fall to Spring. A group of 273 kindergarten students took part in a comparison of their performance in the fall with their performance in the spring on Boehm-3. The correlation for both *Forms E* and *F* is .78, indicating that students who did well in the fall also did well in the spring.

Spanish Edition

National fall norms for the Spanish version of Boehm-3 were developed by administering *Forms E* and *F* to students in kindergarten, first, and second grade in October and November of 1999. Spring standardization took place in April and May of 2000. Bilingual teachers who were experienced in test administration were invited to participate in the standardization testing.

More than 1,200 Spanish-speaking students in the United States participated in the fall standardization and the related reliability and validity studies of the Boehm-3 Spanish edition. More than 400 Spanish-speaking students participated in the spring standardization. Gender was closely divided with 53.1% male and 46.9% female comprising the fall norms, and 47.3% male and 52.7% female comprising the spring norms.

Although considerable recruitment of examiners from all over the United States occurred, few responses were received from certain areas of the United States, particularly the Northeast region.

As a result, a large percentage of the sample consists of students from those regions of the United States that typically have large populations of Spanish-speaking students.

School districts participating in the standardization study were characterized by the socioeconomic level of the district. There were three levels: low, middle and high. The levels were determined by reviewing the income level and education of the residents within a defined school district. These classifications were designed to place 33% of the public school district population into each of the three categories. Students participating in the standardization studies that attend non-public school were placed in a fourth category.

Urbanicity can be defined as the school district's service area relative to the Metropolitan Service Area and is based on zip code information of the district. There are three primary levels of urbanicity: urban, suburban, and rural.

| Boehm-3 Spanish Standardization Sample by Region and Form—Fall and Spring | | | | | | | | | |
|------------------------------------------------------------------------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|--|
| Region | Fall | | | | Spring | | | | |
| | Form E | | Form F | | Form E | | Form F | | |
| Northeast | — | — | 29 | 6.3 | — | — | — | — | |
| South | 159 | 45.8 | 245 | 53.5 | 108 | 63.2 | 90 | 71.4 | |
| West | 188 | 54.2 | 184 | 40.2 | 63 | 36.8 | 36 | 28.6 | |
| Total | 347 | 100.0 | 458 | 100.0 | 171 | 100.0 | 126 | 100.0 | |

Columns may not total 100 due to rounding.

| Boehm-3 Spanish Standardization Sample by Soioeconomic Level of the School District and Non-public Schools and Form—Fall and Spring | | | | | | | | | |
|----------------------------------------------------------------------------------------------------------------------------------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|--|
| Soioeconomic | Fall | | | | Spring | | | | |
| | Form E | | Form F | | Form E | | Form F | | |
| Low | 101 | 29.1 | 117 | 25.5 | 21 | 12.3 | 16 | 12.7 | |
| Middle | 159 | 45.8 | 245 | 53.5 | 76 | 44.4 | 75 | 59.5 | |
| High | 5 | 1.4 | 12 | 2.6 | 74 | 43.3 | 35 | 27.8 | |
| Non-public | 82 | 23.6 | 84 | 18.3 | — | — | — | — | |
| Total | 347 | 100.0 | 458 | 100.0 | 171 | 100.0 | 126 | 100.0 | |

Columns may not total 100 due to rounding.

| Boehm-3 Spanish Standardization Sample by Urbanicity and Form—Fall and Spring | | | | | | | | | |
|----------------------------------------------------------------------------------|------------|--------------|------------|--------------|------------|--------------|------------|--------------|--|
| Urbanicity | Fall | | | | Spring | | | | |
| | Form E | | Form F | | Form E | | Form F | | |
| Urban | 57 | 16.4 | 39 | 8.5 | 35 | 20.5 | 16 | 12.7 | |
| Suburban | 159 | 45.8 | 245 | 53.5 | 67 | 39.2 | 54 | 42.9 | |
| Rural | 49 | 14.1 | 90 | 19.7 | 69 | 40.4 | 56 | 44.4 | |
| Non-public | 82 | 23.6 | 84 | 18.3 | — | — | — | — | |
| Total | 347 | 100.0 | 458 | 100.0 | 171 | 100.0 | 126 | 100.0 | |

Columns may not total 100 due to rounding.

1992–93 National Center for Educational Statistics Public Agency data tape.

Summary

Boehm-3 provides professionals involved in early elementary assessment and education with a reliable and efficient tool to evaluate basic relational concept acquisition in young students. The Boehm assessments continue to be renowned for demonstrating reliable and accurate results.

