Technical Report

Boehm-3

Boehm Test of Basic Concepts • Third Edition

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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 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 new norms, color illustrations, concurrent development of Spanish edition, tools to assist in communication with parents, and more! The revision will provide 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 to Boehm–3 *Preschool*, the individually administered test of basic concepts for children ages 3.0 to 5.11

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-pubic), and geographic region. Students who received special services, but were mainstreamed in regular classrooms were included in the standardization.

The Boehm–3 fall standardization sample consisted of over 6,000 students in kindergarten, first- and second-grade classrooms and the spring sample 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

Gender	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

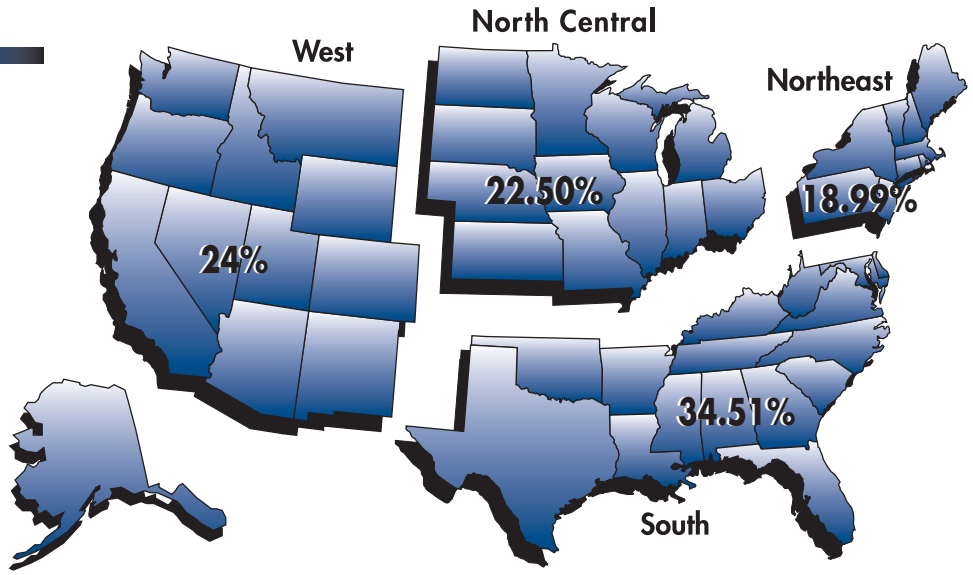
Gender	Form E		Form F	
	n	%	n	%
Female	1,174	50.0	1,098	50.0
Male	1,174	50.0	1,098	50.0
Total	2,348	100.0	2,196	100.0

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	100.0

Boehm–3 Standardization Sample by Race/Ethnicity and Form—Fall Testing

Race/Ethnicity	Form E		Form F		U.S. Population
	n	%	n	%	%
African American	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	100.0



Boehm–3 Standardization Sample by Region and Form—Fall Testing

Region	Form E n	Form E %	Form F n	Form F %	U.S. Population %
Northeast	313	11.0	558	17.5	18.99
North Central	748	26.1	746	23.4	22.50
South	988	34.4	1,025	31.9	34.51
West	817	28.5	867	27.2	24.00
Total	2,866	100.0	3,189	100.0	100.0

Boehm–3 Standardization Sample by Region and Form—Spring Testing

Region	Form E n	Form E %	Form F n	Form F %	U.S. Population %
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	100.0

Boehm–3 Standardization Sample by Socioeconomic Level of the Participating School Districts and Non-public Schools and Form—Fall Testing

Socioeconomic Level	Form E n	Form E %	Form F n	Form F %
Low	1,348	47.0	1,365	42.8
Middle	501	57.7	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 n	Form E %	Form F n	Form F %
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 n	Form E %	Form F n	Form F %
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 n	Form E %	Form F n	Form F %
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

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).

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		Spring	
Grade	***Form E***	***Form F***	***Form E***	***Form F***
Kindergarten				
n	960	1,055	813	748
r	.90	.90	.90	.88
SEM	2.42	2.43	2.16	2.12
First Grade				
n	982	1,055	829	731
r	.85	.87	.83	.90
SEM	1.90	1.87	1.62	1.63
Second Grade				
n	924	1,029	706	717
r	.80	.80	.82	.91
SEM	1.35	1.39	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.

Atermate–Forms Reliability

	Form E		*Form F*		
n	**Mean**	***SD***	**Mean**	***SD***	***r***
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, 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* 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 correlation between Boehm–3 and the *Otis-Lennon School Ability Test, Seventh Edition* (Otis & Lennon, 1996) ranged from .45 to .68. 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 strongly related to student performance and is an essential 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 51.2% male and 48.3% female comprising the fall norms, and 56.3% female and 43.7% male 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

	Fall				Spring			
	Form E		*Form F*		*Form E*		*Form F*	
Region	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
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

Boehm–3 Spanish Standardization Sample by Socioeconomic Level of the School District and Non-public Schools and Form—Fall and Spring

	Fall				Spring			
	Form E		*Form F*		*Form E*		*Form F*	
Socioeconomic Level	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
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

Boehm–3 Spanish Standardization Sample by Urbanicity and Form—Fall and Spring

	Fall				Spring			
	Form E		*Form F*		*Form E*		*Form F*	
Urbanicity	***n***	***%***	***n***	***%***	***n***	***%***	***n***	***%***
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

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).

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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.

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