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Predicting First Grade Reading and Math Achievement: The Boehm Test of Basic Concepts and Other Kindergarten Screening Measures

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PREDICTING FIRST GRADE READING AND MATH ACHIEVEMENT:
THE BOEHM TEST OF BASIC CONCEPTS
AND OTHER KINDERGARTEN SCREENING MEASURES

FINAL THESIS

Submitted to the Graduate Committee of the
Department of Education and Human Development
State University of New York
College at Brockport
in Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Education

by

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Abstract

The primary purpose of this study was to investigate the predictive validity of the Boehm Test of Basic Concepts for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a kindergarten screening program to determine the most significant predictive measures.

The subjects for the study were 177 first graders and seven repeating kindergartners in a suburban school district. Prior to kindergarten entrance all 184 subjects were screened with the Boehm Test of Basic Concepts-form A and the Kindergarten Language Screening Test. During January of their kindergarten year the Boehm Test of Basic Concepts-form B was administered. At the end of kindergarten all subjects took the Metropolitan Readiness Test-Level 11. Teachers, at mid-first grade, rated the original subjects on a one to five scale for reading and math achievement.

Pearson product moment correlations revealed that the Boehm Test of Basic Concepts, form A and B, was a good predictor of reading and math achievement at mid-first grade. There was a slightly higher correlation with the reading rating as opposed to the math

rating. A high correlation was found between both forms of the Boehm Test of Basic Concepts and the Metropolitan Readiness Test.

Stepwise multiple regressions showed that the best prediction model for reading and math achievement at mid-first grade consisted of the Metropolitan Readiness Test Pre-Reading and Quantitative scores. These two variables accounted for 59% of the reading rating variance and 53% of the math rating variance.

Results of the study indicate that the Boehm Test of Basic Concepts is a valid instrument for use as part of a kindergarten screening program.

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Chapter I

Statement of the Problem

Purpose

The primary purpose of this study was to investigate the predictive accuracy of the Boehm Test of Basic Concepts for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a school screening program to determine the most accurate predictive measures.

Questions to be Answered

The following questions were considered in this study:

1. Is the Boehm Test of Basic Concepts a valid predictor of reading achievement at mid-first grade as measured by teacher ratings?
2. Is the Boehm Test of Basic Concepts a valid predictor of math achievement at mid-first grade as measured by teacher ratings?
3. Which variable or combination of variables (Metropolitan Readiness Test, Kindergarten Language Screening Test, chronological age, and sex) is the best predictor of reading and math achievement at mid-first grade as measured by teacher ratings?

Need for the Study

Preschool screening is becoming an established educational practice in school districts across the country. Educators generally agree that there is a need to identify children who may be at risk of subsequent school failure (Piersal & Reynolds, 1981; Wendt, 1978). Parents also voice concern over the readiness of their children for formal school programs. Consequently, many educators have targeted Kindergarten entrance as an ideal time for the assessment of a child's strengths and weaknesses. Wendt (1978) notes that the premise behind early screening is the belief that early intervention and remediation of difficulties will result in greater educational success for the child. Early intervention is preventative in nature and is considered to be more effective and also less costly than later remediation.

However, in attempting to identify those pre-school children who may encounter academic problems, educators face a difficult task (Wilson & Reichmuth, 1895). Keogh (1973) points out that in seeking to identify at risk pre-school children, one is hypothesizing rather than confirming. The conditions viewed as atypical have not yet developed. Therefore Keogh advises that the emphasis in early identification be

placed on what is needed for success in the present or immediate future rather than in less reliable long-range predictions. In other words, does the child possess the necessary skills and abilities to cope successfully with the demands of a particular kindergarten or first grade program?

While educators may concur on the necessity for screening, there is much debate over appropriate screening goals, methods, and instruments. Nearly all researchers cite the need for more research into the validity and reliability of screening tests (Beech, 1981; Miesals, Wiske, & Tivnan, 1984; Wilson & Reichmuth, 1985; Wood, Powell & Knight, 1984).

The intervention of federal and state governments in mandating special educational programs has caused a proliferation of screening methods. Children may be screened as young as three years of age for retardation, learning disabilities, emotional disturbance or other handicapping conditions. The diversity and variation in educational practice has led to the need for changes in assessment techniques (Kelly & Surbeck, 1983; Wendt, 1978). Because of this variety of educational practice, a need exists for reliable and valid instruments to predict the scholastic potential of children (Dunleavy, Hansen, Szasz, & Baade, 1981).

population. Exactly what is the risk the pre-school child faces? Is it the risk of being below average, inattentive or disruptive, learning disabled, mentally deficient, or emotionally disturbed? Will these labels then require future expensive intervention? It becomes necessary, therefore, to specify the state that one is attempting to predict in order to define the at risk child and to develop appropriate screening methods.

One area that is assessed in most screening programs is language development. Language facility is considered a good predictor of future academic success (Beech, 1981). The Boehm Test of Basic Concepts was developed to measure a child's understanding of 50 basic relational concepts considered necessary for early school achievement by Boehm (1983b). Cox and Richardson (1985) also state that the young child must master the use of relational concepts (e.g. top, bottom, middle, first) in order to be an effective communicator and receiver of information. The misuse of spatial terms may handicap a child's progress in many areas.

Despite many research studies on the Boehm there is still a need for further validity studies. One major concern is the extent to which the concepts actually relate to school achievement (Estes et al., 1976). More research is also needed in the comparison

major concern is the extent to which the concepts actually relate to school achievement (Estes et al., 1976). More research is also needed in the comparison of the Boehm with other measures of first grade reading readiness (Piersal & McAndrews, 1982). Busch (1980) comments that in spite of years of research it is still not known exactly which factors contribute to reading failure. Researchers have examined various models and instruments used to predict achievement yet none have proven conclusive.

Because early decisions made about children are so significant, they should be based on a variety of valid and reliable measures. Wilson and Reichmuth (1985) suggest that accuracy of the identification of high risk individuals needs to be viewed in the context of intervention decisions. Educators need to ask these questions, What happens to those students who are identified as at risk? How much does the selection process contribute to the educational success of identified students?

Definition of Terms

Basic Concepts relational or dimensional words (e.g. right-left, first-last, behind- side, top-bottom). These concepts are assessed on the Boehm Test of Basic Concepts in four dimensions: space, quantity,

time, and miscellaneous.

Predictive Validity the accuracy with which a test indicates future learning success in a particular area as evidenced by correlations between scores on the test and future criterion measures of success.

Screening a brief assessment designed to identify children who may need further evaluation because of conditions that could limit their potential for growth; not a diagnosis.

Readiness tests usually a standardized test that measures the child's current level of skill achievement; a measure of cognitive and academic performance and growth.

Developmental Readiness Test assesses not only cognitive ability and potential but also takes into account physical, social, emotional, and language development; most concerned with the overall capacity of the child to cope successfully with the school environment; samples the domain of development tasks that all children of normal abilities should be able to perform.

Limitations of the Study

This study was limited to 184 kindergarten/first grade students in a suburban school district in western New York.

Summary

Kindergarten screening programs are widespread and increasingly popular. There is, however, great variety in the types of programs and screening instruments utilized by school districts. Researchers are concerned over the lack of validity studies for many of these screening measures. They stress the need for reliable and valid tests to assess a child's school potential.

The Boehm Test of Basic Concepts is a language screening test used to determine a child's mastery of basic relational concepts. Although the Boehm test has been researched in many areas, there is still a need for additional study concerning its predictive validity for early school achievement.

Chapter II

Review of the Literature

Purpose

The primary purpose of this study was to investigate the predictive accuracy of the Boehm Test of Basic Concepts for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a school screening program to determine the most accurate predictive measures. The first part of this chapter will review the literature relevant to the rationale, approaches, and cautions concerning early identification. Further sections will focus on the importance of basic concepts, concept development, and studies related to the Boehm Test of Basic Concepts.

Early Identification: Rationale

Early identification of students with potential learning problems is of significant concern today to educators, parents, and professionals from a variety of disciplines. Much of this interest is due to the belief that early and appropriate educational interven-

tion will prevent school problems and failure. Early screening is essentially a predictive activity, trying to identify children who may develop later difficulties even before they are exposed to school instructional programs (Badian, 1976; Glazzard, 1982; Keogh & Becker, 1973; Lindsay & Wedell, 1982; Mercer, Algozzine, & Trifiletti, 1979; Wilson & Reichmuth, 1985). De Hirsch, one of the early leaders in screening and prediction research, stated that recognizing a child's learning difficulties at an early age could avoid future remedial help (De Hirsch, 1966). Early intervention with an instructional program designed to remediate the child's deficit skill areas is a much more efficient use of the child's and the teacher's time than later remediation (Glazzard, 1977).

An additional impetus for early screening has been the enactment of Public Law 94-142. The law mandates a free and appropriate education for all handicapped children and states that all those who are handicapped will be identified and evaluated. Screening programs are designed to identify children for further diagnosis and usually target the mildly handicapped child. Severely handicapped children are most often diagnosed well before school age (Colligan, 1981; Joiner, 1977; Mercer et al., 1979; Schmidt & Perino, 1985).

Early screening as provided for by federal and state laws is based on the premise that the earlier the screening the greater the chances for success. The later the identification of problems the more costly and less effective the remediation. However, Wendt points out along with others, the great variability of types and purposes of screening measures (Wendt, 1978). For example, a survey in New York state showed that 151 different instruments were used for screening in the 177 districts reporting a screening program (Joiner, 1977).

Early Identification: Trends

Screening tests at kindergarten entrance tend to be composed of various subtests focusing on the child's development in the areas of language, visual and auditory perception, motor skills, cognitive functioning, and academic skills such as letter-recognition. Research shows that these areas have significant correlation with later academic skills particularly with reading (Lindsay, 1982).

This test battery approach was found successful in predicting academic failure (Badian, 1976; Book, 1980; deHirsch, 1966; Dunleavy, Hansen, Szasz & Baade, 1981; Gallerini, O'Regan, & Reinherz, 1982; Schmidt & Perino, 1985). Schmidt and Perino found that while the four

tasks on the Vane Kindergarten Tests all predicted school performance, the receptive language and the draw-a-man would be effective as the briefest battery. Research by Badian (1976) indicated that the abilities to name five basic geometric shapes, letter naming, name-writing, and the WIPPSI information and sentences subtests were each excellent predictors of early academic achievement. Gallerini, O'Regan and Reinherz (1982) discovered that using different variables to predict readiness for first grade was important for accurate assessment. They wanted to examine the relationships among multiple screening assessments and a child's future emotional and behavioral functioning. Another multiple assessment program, developed by Werner, was studied by Anderson (1985). The Early Prevention of School Failure (EPSE) program uses the components of screening, team conferencing, systematic remediation, plus individualized follow-up. A long term evaluation of the program showed many positive effects.

Another approach to early screening is the use of teacher completed rating scales. Because of the teacher's close daily contact with the child, the teacher becomes an important source of information concerning educational risk. Thus kindergarten and

primary teachers assume added responsibility as they are asked to identify problems before such problems are well developed (Glazzard, 1982). Most recent research studies conclude that teachers are accurate predictors of future academic achievement and support the use of teacher ratings as part of an early screening program (Becker & Snider, 1979; Fitzgerald, 1984; Glazzard, 1985; Stennett, 1983; Tollefson, Rodriguez & Glazzard, 1985; Tuunainen, 1985). Noting that most referrals originate with classroom teachers, Keogh, Tchir & Windeguth-Behn (1974) found clear support for using classroom teachers as initial screeners for identification of high risk children. Badian (1976) concluded that teacher judgments tended to be even more accurate than many formal tests.

In a long range study, Glazzard found that the Kirk Teacher Rating Scale was a significant predictor of vocabulary and reading comprehension scores in first grade achievement tests. The Gates-MacGinitie Readiness Test was a better predictor for second and third grade comprehension. Both the Kirk Rating Scales and the Gates-MacGinitie test were uniquely predictive of reading comprehension 1 to 4 years later. Glazzard concluded that for early intervention purposes the teacher rating scale was an efficient and cost effec-

tive way of identifying high risk students. She stressed that evaluation of any predictive instrument should be on a subtest or item basis to identify those variables that were the most predictive (Glazzard, 1982; 1980).

Tollefson, Rodriquez, and Glazzard reported on the results of two predictive validity studies using the Kindergarten Teacher Rating Scale (KTRS). The KTRS was found to be a significant predictor of the reading achievement of both boys and girls at the beginning of second grade. The KTRS accounted for significantly more of the variance in reading scores on the SRA tests than did the reading readiness measure used in the study. Researchers Stennett and Earl conducted a four year follow-up study on a group of 2,569 kindergarten students rated by kindergarten teachers in an early identification process (EID). They found satisfactory predictive validity for student achievement in later grades.

Most all preschool screening programs rely on a brief face to face interview session with the child. However, because of the time, cost, and logistics of such evaluative techniques, some school districts use a parent questionnaire as an alternative or supplemental measure (Colligan, 1981; Scourfield, 1982). Colligan

(1981) examined the usefulness of the Minnesota Child Development Inventory, a questionnaire completed by parents. Parental reports of the child's general development and knowledge of letters and numbers were significantly correlated with difficulty in reading and achievement test scores. Colligan also reviewed seven studies involving 1,413 kindergarten students and found strong support for the use of the questionnaire as part or all of a screening program to secure information as to potential school difficulties.

The issue of timing or readiness for school entrance has generated controversy for years among educators and psychologists. The age of the child, either chronological or developmental, and the sex of the child are the two areas of debate and concern. The concept that behavioral or developmental age not chronological age should determine a child's readiness for school was first proposed by Gesell in 1919 (Ames, 1986). Gesell Institute personnel believe that a child will experience the most success in school if started and promoted on the criterion of developmental age as measured on the Gesell School Readiness Test (May & Welch, 1986). The developmental placement theory suggests that the developmentally young child take an extra year to mature either through delayed school

entrance, a pre-kindergarten class, two years in a regular kindergarten, or a pre-first class (May & Welch, 1984).

Researchers have been concerned over the lack of validity studies concerning the Gesell readiness test. Wood, Powell, and Knight (1984) examined the Gesell test using 84 kindergarten age children and found that it was effective in predicting success or failure in kindergarten. Results also showed that chronological age within the range of 4-6 years was unrelated to eventual success or failure. May and Welch (1984) studied the results of retention based on the Gesell Readiness Test. They determined that early retention using development placement did not help retained children's scores on standardized tests at the end of the kindergarten year. However they point out that the standardized measures do not evaluate the social-emotional or motor areas of development valued by the Gesell Institute. In another study, May and Welch (1986) looked at the relationship of a child's month of birth, sex, and performance on the Gesell Screening Test to later readiness and standardized measures. The Gesell Measures proved sensitive to the different birthdate groups. This difference in test scores diminished in later grades, a catch-up finding consis-

tent with other studies (DiPasquele, Moule, & Flewelling, 1980; Miesals, Wiske, & Tivan, 1984; Shepard & Smith, 1985). However, this catch-up effect was not evident in research by Campbell (1985) of 457 seventh and eighth graders. Campbell found that younger entrants did not overcome their deficits from kindergarten. They tended to receive more remedial instruction, were retained more often, and scored below the 50th percentile more frequently than older entrants.

Supporting the birthdate effect is a study by Diamond (1983) who found that birthdate did make a difference in the number of children classified as learning disabled in Hawaii. There was a high positive correlation between the percentages of L.D. students and their months of birth. Although the birthdate effect tended to diminish in higher grades, Dipasquele et al. (1980) discovered that in the primary grades children born late in the year were referred more often to school psychologists for academic problems than children born early in the year. But Gredler (1980) and Dietz and Wilson (1985) found that differences in later academic achievement could not be attributed to birthdate. Gredler pointed out that regardless of age at entry school personnel worldwide complained of the

poor performance of younger children. He argued that carefully planned, individualized instructional programs were the primary need in schools and that school personnel should not use chronological age as the excuse for a child's lack of reading skills (Gredler, 1980).

Early Identification: Cautions

Because of the many differences in screening measures and philosophies, researchers have urged caution in the use and implementation of early identification programs. Keogh and Becker (1973) highlighted three basic areas of concern regarding early identification:

1. How valid are the identifying or predictive measures?
2. What are the implications of diagnostic data for remediation or educational intervention?
3. Do benefits of early identification outweigh possible damaging or negative effects of such recognition? (p. 6)

Satz and Fletcher (1979), Lindsay and Wedell (1982), and Wilson & Reichmuth (1985) agree that predictive accuracy and validity is a particular problem with many screening instruments. They stress

the need for more critical analysis and evaluation of early identification studies. According to Mercer, Algozzine and Trifiletti (1979), the major disadvantage of early screening is misdiagnosis based in part on the unreliability of some screening tests. Misdiagnosis is also partly due to the fact that developmental/maturational differences are great at early ages. Changes occur rapidly and inappropriate behavior at a certain chronological age may be quickly outgrown. Schmidt and Perino (1985) also concur that the reliability of testing with four and five year olds is not as secure as the testability of seven or eight year olds.

Keogh (1975) points out that there are two dimensions of risk in kindergarten and first grade, academic ability and behavioral adaptability. She found that while social-emotional factors were most often the cause of risk identification in kindergarten, academic ability was more associated with risk in first grade. However many early identification programs do not distinguish between children with academic deficits and those with social-emotional problems (Kirschbaum, 1977). Further research is needed in this area as misdiagnosis may result in false labeling which is detrimental to both the child and his family (Gallerini et al., 1982; Mercer et al., 1979). To avoid mis-

diagnosis, Miesals (1984) advocates periodic rescreening and additional in-depth diagnostic measures and interventions with at risk children. Keogh (1975) stresses that a single instrument can never be used to identify a child as at risk. Rather, a multi-faceted ongoing screening program which identifies a wide range of the child's abilities and development is the objective.

Since the overall purpose of screening must be appropriate educational programs, it is important that screening measures provide information which will lead to individualized programs for identified students (Keogh, 1975). School personnel need to clearly state their philosophy to the community. Will the child be expected to meet the school's standards at each grade level or will the program be adapted to individual needs? This stated philosophy should then determine the types of evaluative procedures used in a school (Campbell, 1985; Wendt, 1978). Most researchers emphasize the necessity for appropriate intervention programs to follow up early screening thus preventing failure of kindergarten students. It is the area of intervention decisions, what to provide for the identified child, that is the crucial issue (Book, 1980; Glazzard, 1982; Keogh, 1975; May & Welch, 1986;

Wilson & Reichmuth, 1985).

Importance of Basic Concepts

Language development is one of the important components in the early assessment of children. Nearly all screening programs whether commercially or locally designed include some form of assessment of language skills, both receptive and expressive. Achievement in school is dependent on reading and writing skills which in turn draw extensively from the child's early language background (Beech, 1981; Parker, 1983). Language deficits have widespread impact on a child's educational growth especially in reading. Skilled readers understand both the syntax and the semantics of the language (Wilig & Semel, 1980). For example, in follow-up studies of kindergarten children in the Detroit Public Schools, language development was the most significant predictor of future academic status (Lipson, 1981).

One area of language development believed to be significant for school success is the child's understanding of basic concepts. Poor comprehension of concepts hinders both a child's reception of ideas and his ability to communicate those ideas to others (Spector, 1979). Young children need to have an understanding of basic concepts in order to build a

foundation for subsequent learning and to interact effectively with their environment. Boehm, who has extensively researched the area of basic concepts, states that an understanding of basic concepts helps a child describe relationships between and among objects, locations of objects and persons, sequence of objects and events, and characteristics of objects (Boehm, 1983).

Basic concepts are defined as relational or dimensional words. They differ from nominal words especially from concrete nouns such as car, book, house (Blewitt, 1982). Relational concepts are shifting in nature. For instance, the child first in line on one occasion may be last in line on another occasion. Dimensional adjectives such as big-little, narrow-wide, tall-short, require reference to a standard that varies with the object described and the context. Thus it is a difficult and complex task for the child to form a stable internal picture of a concept that can change from one situation to another (Boehm, 1983a; deVilliers & deVilliers, 1979). Boehm (1983a) states that it is necessary for the child to make relational decisions in order to: 1. follow directions; 2. comprehend stories; 3. describe situations or events; 4. facilitate communication.

Studies have shown that when a child enters school, his mastery of basic concepts will have a significant relationship on his school achievement (Estes, Harns, Moers, & Woodrich, 1979; Piersal & McAndrews, 1982; Steinbaur & Heller, 1978). Yet the standardization data from the Boehm Test of Basic Concepts (BTBC) revealed that only two-thirds of middle-class beginning kindergartners knew the concepts top, other, and row. The norming data from the BTBC-R (1983) indicated that nearly one-half of beginning kindergartners were unable to mark the right end of the line or below the table.

Since basic concepts are prevalent in the educational environment and curriculum, children who are delayed in concept acquisition are at a disadvantage from the start of their school experience (Bracken & Cato, 1986). Research has reported that such children who lag behind in their early academic achievement tend to remain behind (Douglas, Powers & Rossman, 1986). Bracken, who has developed the Bracken Basic Concept Scale and Development Program, believes that concept deficiencies can and should be remediated through direct early teaching. Children should be taught the concepts they have not mastered.

Boehm researched the basic concepts that occurred

often in curriculum areas such as reading, arithmetic, and science and found that many children were unfamiliar with the concepts in these subject areas. She also discovered that teachers often used concept words in their directions and instructions that were unknown by many children. In another study Boehm counted the frequency with which concept words were found on sample pages from five different reading and five different math series. All 50 of the Boehm concept words were used (Boehm, 1983b).

Kaufman (1978) examined the manuals of four major mental ability tests for pre-schoolers. He was interested in discovering how many of the 50 concepts in the BTBC were included in the directions for administration. Findings showed fourteen basic concepts in the WPPSI, seven in the McCarthy Cognitive Scale, five in the Stanford-Binet, and none in the ITPA. Kaufman concluded that before a pre-school child is given an individual ability test, the examiner should obtain information about the child's knowledge of basic concepts. He should then retest at a later date after unknown concepts have been taught.

Kaplan and White (1980) analyzed a sample of 1,417 teachers' classroom directions. They examined the number of single response behaviors and the number of

qualifier statements. A qualifier statement specified conditions such as where or when and corresponded to relational words. Results showed that 41% of the terms defined as qualifiers in the study were identified by Boehm as basic concepts. These relational words also appeared frequently in the directions of curriculum materials as well as in teachers' oral directions.

Concept Development

Researchers in the field of language acquisition have been concerned with exactly how young children acquire relational concepts; upon what basis do they form word meanings (Friedman & Seely, 1976; Smith, 1977; Tomikawa & Dodd, 1980). Despite differing theories many linguists subscribe to some form of conceptual approach based on a Piagetian interpretation of conceptual development (Friedman & Seely, 1976; Smith, 1978).

One theoretical position is the semantic feature theory proposed by Clark and Clark in 1973. The Clarks' theory which is perceptually based, holds that the meaning of a referential word is composed of features such as size, shape, sound, movement, texture, and taste (Tomikawa & Dodd, 1980). Thus Clark hypothesized that children will learn a set of features (units

of word meaning associated with a word) as they learn a word. For example, big and little may both have a general feature, size, and a less general feature, space. Big also refers to more than standard extent while little refers to less than standard extent. A child may learn only one or two features initially and then later add features. Clark believed that features that are easily perceived will be learned first and that general features will be learned before specific features. Concepts are mastered through gradually accumulating features (Blewitt, 1982; Richards, 1979; Smith, 1978).

A different approach is the function based theory developed by Nelson. Nelson believed that the semantic features of referential words were functional rather than perceptual. Therefore children would extend the meanings of words by function rather than appearance. For instance ball could be extended to refer to any object that could be rolled or bounced (e.g. watermelon, tire). Research by Tomikawa and Dodd, 1980, led them to support the view that children's early concepts are perceptually based and that function played a secondary role. However they pointed out that both function and shape often coexist in the child's environment. A child who observes the perceptual

properties of objects then succeeds in grasping the functional properties.

Another aspect of concept acquisition studied by many researchers is the order of learning. Clark described the following developmental stages in the child's acquisition of concepts:

1. The child is unfamiliar with the concept.
2. The child's general experiences give him some knowledge of the concept.
3. The child partially understands the concept.
4. The child can use the most positive member of a concept pair before he will use the negative member (e.g. he will learn top before bottom).
5. The child may overextend the concept to include similar objects (e.g. big is used to denote tall).
6. The child confuses the positive member with the negative (e.g. more is used to refer to less).
7. The child understands the concept but not at all levels of complexity or in all contexts (Boehm, 1983a; Clark, 1980).

These stages of learning have generated conflicting research studies. Some researchers agree with Clark that the positive word in a pair is learned before the negative word while others find that the negative is

learned before the positive (Blewitt, 1980).

Boehm Test Studies

Because of the popularity of kindergarten screening programs, many researchers have studied the predictive validity of various screening instruments. The focus of this review is the predictive accuracy of one such screening test, the Boehm Test of Basic Concepts. The Boehm test is a 50 item pictorial test designed to assess a child's knowledge of basic concepts, concepts that are widely but often mistakenly assumed to be mastered by kindergarten and first grade. The BTBC is both criterion as well as norm referenced. Focusing on what the child needs to learn, the BTBC indicates where a child stands in relation to educational criteria (Levin et al., 1975).

Piersal (1982) comments that although the Boehm has not been well researched and has been criticized for inadequate validity, several studies indicate that the concepts it measures do predict school achievement. Research results supported using the BTBC to predict first grade achievement. The study also found a moderately high correlation between the Boehm and arithmetic skills, a finding consistent with studies by Busch, 1986; Estes et al., 1976; and Steinbauer &

Heller, 1978.

In a study with 43 second and 51 third graders, Steinbauer and Heller (1978) found that the kindergarten Boehm scores successfully predicted later SAT scores in reading, arithmetic, spelling, language, and word study skills. Busch (1980) was interested in examining the Boehm in relation to first grade reading failure. He found a .56 correlation between the Gates-MacGinitie criterion reading measure and the BTBC. Estes et al. (1976) compared beginning first grade performance on the Boehm and SAT scores at the end of first grade. They noted a .56 correlation between the BTBC and the SAT total test scores and concluded that there was support for Boehm's assertion that mastery of basic concepts was related to school achievement in early grades.

Both linguistic and cognitive abilities are involved in the BTBC, an area researched by Beech (1981) in her study of the concurrent validity of the BTBC. Beech compared Boehm results to two tests of linguistic ability and five Piagetian tasks of cognitive ability. Piaget's developmental theory describes the child's concepts of space, time, numeration, seriation, and classification. These categories correspond to the Boehm classifications of space, time,

quantity, and miscellaneous. Findings showed strong correlations with the tests of receptive language and moderate correlations with Piagetian tasks. Beech concluded that the BTBC can be used as a general measure of cognitive ability and would be most appropriately used as a kindergarten screening measure.

The Boehm has also been researched for validity within special population groups. Kavale (1982) compared test results of a group of learning disabled students and a group of normal students on the BTBC. He found that LD students showed a greater deficit in basic concept understanding. Kavale recommended that the BTBC be used as a criterion reference test for LD students in order to assess strengths and weaknesses and design instructional activities. In research with hearing-impaired students, Davis (1974) found that these students scored much lower on the BTBC than non hearing-impaired students. The degree of hearing loss significantly impacted the scores. A tactile version of the Boehm has been developed and normed for use with visually handicapped children (Caton, 1975). The Boehm has also been examined for sex differences and for sex bias (Silverstein, Morita, & Belger, 1983). No evidence of differences or bias was discovered in the test data. Items had the same order of difficulty for

both sexes. There was also little evidence of test bias in relation to social class differences.

Douglas, Powers, and Rossman (1986) compared Boehm scores for Hispanic and non Hispanic children. Their findings supported the reliability of the BTBC for both groups when interpreting the total scores. A Spanish translation of the Boehm has also been developed. This Spanish translation was found to have predictive validity and reliability in research with 1,292 children in Puerto-Rican schools (Preddy, Boehm, & Shepherd, 1984).

Summary

Early identification of students with potential learning difficulties is of major concern to educators today. Federal and state laws mandate screening for handicapping conditions based on the philosophy that appropriate early intervention will prevent school failure. There has been much research, often with conflicting results, concerning school readiness and effective predictors of academic success. Because of the great variability of screening methods, the lack of validity studies for many screening instruments, and the potential for misdiagnosis, researchers urge caution in the implementation of screening programs. The Boehm Test of Basic Concepts, a language screening

test, has proved useful in predicting early school achievement. Research supports Boehm's contention that a child's mastery of basic concepts is important for effective interactions within the school environment.

Chapter III

Design of the Study

Purpose

The primary purpose of this study was to investigate the predictive accuracy of the Boehm Test of Basic Concepts for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a school screening program to determine the most accurate predictive measures.

Methodology

Subjects

The subjects for this study were 177 first graders and 7 repeating kindergartners in a suburban school district in western New York. Prior to kindergarten entrance, all 184 students were screened in May 1985 with the Kindergarten Language Screening Test and in July 1985 with the Boehm Test of Basic Concepts-form A. During January 1986 of their kindergarten year all 184 students were administered form B of the BTBC. In May 1986 subjects were tested with the Metropolitan readiness Test-level II. The 177 first graders were rated by their teachers in reading and math achievement in mid-January of 1987. Of the 184 subjects, 91 were males and 93 were females. The sample did not include

any repeating kindergartners in the 1985-1986 school year.

Instruments

1. Kindergarten Language Screening Test (Gauthier & Madison, C.C. publications, 1978). The KLST is designed as a quick (approximately ten minute) verbal language screening instrument to assess the probability of a child's having a language deficit. It is based on verbal language skills considered normal or average for the kindergarten age child.

Test items include tasks that measure both receptive and expressive language competence. Children give oral responses to questions covering name and age, colors, counting, body parts, following commands, sentence repetition, and spontaneous speech. Data are presented in the manual for reliability and validity. Norms are available for children from 48 to 83 months of age. The KLST manual cites a 1975 study by Gibson which reports a .70 correlation between the KLST and the BTBC.

2. Boehm Test of Basic Concepts-form A and form B (Boehm, A., The Psychological Corporation, 1971). The BTBC is designed to measure children's mastery of basic relational concepts considered necessary for early school achievement. The 50 basic concepts are arranged in a pictorial multiple choice

format in two booklets of increasing difficulty. Concepts are in four classifications - space, quantity, time, or miscellaneous.

Both booklets may be given in a single session unless children are inattentive or very young. Each booklet takes approximately 15 minutes to administer. Directions are read aloud by the examiner with each child marking his/her answer choice in the booklet. The manual provides information related to reliability and validity. Percentile norms, means, and standard deviations are available for kindergarten, first, and second grades and for three socio-economic levels. Results can be used either as a criterion referenced or norm referenced test and can identify children with basic concept deficiencies or concept areas that need further whole class instruction.

3. Metropolitan Readiness Test, Level II-form P (Nurss & McGavren, 1976). The MRT is a widely used nationally normed group readiness test which assesses skills in the auditory, visual, language, and quantitative areas. A prereading composite is calculated by combining scores from the auditory, visual, and language areas. Subtests include beginning consonants, sound-letter correspondence, visual matching, finding patterns, school language, quantitative concepts, and

quantitative operations.

4. Teacher Rating Scale (designed by researcher). The teaching rating scale was completed by the eleven district first grade teachers. Teachers had an average of ten years first grade teaching experience and sixteen years total teaching experience. The median for first grade teaching was twelve years and the median for total teaching was sixteen years. Each teacher was given the following instructions:

In comparison to all other first graders, please rate each child's present achievement in both reading and math, using the following scale.

1. poor, far below average
2. weak, below average
3. average
4. above average
5. outstanding

Caution: Please do not consider the child's ability, potential, age, work habits, or behavior in your rating. Rate only his/her current level of subject mastery.

Procedure

As part of the district pre-kindergarten screening battery, the Kindergarten Language Screening Test was given individually to registrants in May, 1985. The

test was administered and scored by one of the three district speech and language therapists. Children were tested in one part of a room while parents were in the same room talking with the kindergarten teacher.

In the summer before kindergarten entry (1985) the Boehm Test of Basic Concepts-form A was administered to all 184 subjects by the same kindergarten teacher and speech therapist. Parents brought the children to school by appointment where they were tested in groups of six to eight. Results were made known immediately to parents along with suggestions concerning home activities to strengthen general language skills and concepts. Form B of the BTBC was administered to all subjects in January 1986 of the kindergarten year by the district psychometrician. Children were tested in groups of eight to twelve.

Subjects were administered the Metropolitan Readiness Test-Level II in May, 1986 by the kindergarten teacher and/or the district psychometrician. Children were tested either with the whole class or in groups of nine to twelve. For the purpose of this study all test scores were reported as raw scores. Chronological age was computed as of Sept. 1, 1985 and was reported in months.

In January, 1987 (mid-first grade) teachers rated

their students. Each of the 177 first grade subjects was rated for reading and math achievement on a one to five scale. Seven of the original subjects were repeating kindergarten.

Statistical Analysis

A correlational matrix was calculated using the Pearson Product Moment formula to determine the significant correlations among variables. Stepwise multiple regressions were then performed to determine which of the seven variables was the best predictor of mid-first grade reading and math achievement. The statistical value of the Boehm Test of Basic Concepts was especially noted. Calculations were performed using the Minitab statistical program.

Summary

The KLST and the BTBC-form A were administered to 184 original subjects before kindergarten entry. The BTBC-form A and the MRT-level II were administered during the second part of the kindergarten year. At mid-first grade 177 original subjects were rated by their teachers for reading and math achievement. Results of all tests and ratings along with age at kindergarten entry and sex were recorded. Using the Minitab statistical program, correlations among

variables and criterion measures (reading and math ratings) were analyzed related to significance. Stepwise multiple regressions were calculated to determine the best predictors of reading and math achievement at mid-first grade.

Chapter IV

Analysis of Data

Purpose

The primary purpose of this study was to investigate the predictive accuracy of the Boehm Test of Basic Concepts (BTBC-A & BTBC-B) for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a school screening program to determine the most accurate predictive measures. These variables were the Metropolitan Readiness Test-pre-reading composite (MRT-PR), Metropolitan Readiness Test-quantitative score (MRT-Q), Kindergarten Language Screening Test (KLST), chronological age at kindergarten entry (CA), and sex (S). Teacher ratings of reading (RR) and math (MR) achievement at mid-first grade were used as the criterion measures.

Findings and Interpretation

Pearson product moment coefficients of correlation were calculated among the seven predictor variables and the two criterion variables. Table 1 shows the coefficients among the predictor variables and the

criterion variables as measured by teacher ratings of mid-first grade reading and math achievement.

Table 1

Correlation Coefficients Among the Seven Predictors and Teacher Ratings of Reading and Math Achievement at Mid-First Grade.

	S	CA	BTBC-A	BTBC-B
C.A.	-0.210			
BTBC-A	0.085	*0.343		
BTBC-B	0.000	*0.310	*0.811	
R.R.	0.158	0.166	*0.590	*0.596
M.R.	0.081	0.198	*0.561	*0.578
KLST	0.157	*0.265	*0.605	*0.575
MRT-PR	0.135	0.162	*0.730	*0.726
MRT-Q	0.073	*0.257	*0.722	*0.722
	R.R.	M.R.	KLST	MRT-PR
M.R.	*0.784			
KLST	*0.457	*0.392		
MRT-PR	*0.759	*0.675	*0.588	
MRT-Q	*0.669	*0.697	*0.557	*0.779

* = significant at alpha = 0.05 level
($n = 184$)

Analysis of the data revealed that the MRT-PR and the teacher reading rating were the most highly correlated ($r = 0.759$). The next highest correlation with the reading rating was the MRT-Q ($r = 0.669$). Then followed the BTBC-B ($r = 0.596$), the BTBC-A ($r = 0.590$), and the KLST ($r = 0.457$). The correlations between chronological age and other variables and sex

and other variables were not large enough to be considered significant as predictors of the reading rating.

Among the seven variables, the MRT-Q correlated the highest with the teacher math rating ($r = 0.697$). The MRT-PR was the next highest correlation ($r = 0.675$). Other significant correlations with the math rating were the BTBC-B ($r = 0.578$), the BTBC-A ($r = 0.561$), and the KLST ($r = 0.392$). Chronological age was of low significance ($r = 0.198$) and sex was not significant. The critical value of alpha at the 0.05 level = $r = 0.1946$.

Chronological age (CA), although statistically significant with the BTBC-A ($r = 0.343$) and the BTBC-B ($r = 0.310$), is not considered significant for predictive purposes. There was a low, statistically significant correlation between CA and the KLST ($r = 0.265$) and the MRT-Q ($r = 0.257$).

Of interest in the analysis was the high correlation between the BTBA-A with both the MRT-PR and the MRT-Q ($r = 0.730$) and ($r = 0.726$) respectively. The BTBC-B had the same correlation with both the reading and math rating ($r = 0.722$).

The BTBC-A also correlated significantly with the KLST ($r = 0.605$). These two language measures were

both administered before kindergarten entry. The KLST showed a higher correlation with the reading criterion ($r = 0.457$) than with the math criterion ($r = 0.392$). Neither coefficient is considered a good predictor from a validity standpoint. The KLST did correlate significantly with the MRT-PR ($r = 0.588$) and the MRT-Q ($r = 0.557$).

The next step in the data analysis was to determine the best predictors of the reading and math rating from among the five variables with significant correlations. Stepwise multiple regressions were calculated using the following variables: MRT-PR, MRT-Q, BTBC-A, BTBC-B, and the KLST. Tables 2 and 3 show the results of the stepwise multiple regressions of teacher reading and math achievement ratings on the five predictor variables ($n = 184$).

Table 2

Prediction Model of Teacher Reading Rating
Using Stepwise Multiple Regressions on
Five Predictor Variables ($n = 184$)

	R square	Standard Error
MRT - PR	57.56%	0.670
MRT - Q	59.10%	0.660
BTBC-A & BTBC-B & KLST	59.18%	0.665

Table 3

Prediction Model of Teacher Math Rating
Using Stepwise Multiple Regressions on
Five Predictor Variables ($n = 184$)

	R Square	Standard Error
MRT - Q	48.57%	0.715
MRT - PR	53.00%	0.686
BTBC-A & BTBC-B & KLST	53.56%	0.687

For predicting reading achievement, the best single predictor was the MRT-PR ($r^2 = 57.56\%$). The best two predictors were the MRT-PR and the MRT-Q ($r^2 = 59.10\%$). Using the reading rating as a single independent variable, the prediction equation would be: $\underline{Y}' = -0.773 + 0.053 \underline{X}_1 + 0.048 \underline{X}_2$, where \underline{Y}' = the predicted RR, \underline{X}_1 = MRT-PR, and \underline{X}_2 = MRT-Q. The error in prediction would be $\underline{S} = 0.660$.

For predicting math achievement the best single predictor was the MRT-Q ($r^2 = 48.57\%$). The addition of the MRT-PR variable increased the predictability of the variance to $r^2 = 53.00\%$. With the math rating as the single independent variable, the prediction equation would be: $\underline{Y}' = -0.2781 + 0.103 \underline{X}_2 + 0.0286 \underline{X}_1$, where \underline{Y}' = the predicted MR, \underline{X}_2 = MRT-Q, and \underline{X}_1 = MRT-PR. The error in prediction would be $\underline{S} = 0.686$.

Consequently, the best prediction model for reading and math achievement at mid-first grade consisted of the Metropolitan Readiness Pre-Reading and Quantitative test scores. The regression model used only the two variables since the addition of other variables did not make a significant contribution to the predictability. The model indicates that a greater percentage of the variance of the reading rating was predictable (59%) than the math rating (53%).

Summary

The purpose of this study was to investigate the predictive validity of the Boehm Test of Basic Concepts. A secondary purpose was to examine other kindergarten screening variables in order to determine the best predictive model for reading and math achievement at mid-first grade.

Three questions were posed in Chapter I. The first question concerned the validity of the BTBC (pre and post tests) as a predictor of a teacher reading rating at mid-first grade. Pearson product moment correlation coefficients indicated that the Boehm was a valid predictor of the reading rating. The second question examined the relationship between the BTBC (pre and post tests) and the teacher math rating at mid-first grade. The correlations indicated that the

BTBC was also a good predictor of the math rating.

The third question looked at all the variables in a kindergarten screening program to determine which variables would make up the best prediction model. Stepwise multiple regressions showed that the best prediction model consisted of the Metropolitan Readiness Test Pre-Reading and Quantitative scores. These two variables accounted for 59% of the reading rating variance and 53% of the math rating variance.

Chapter V

Conclusions and Implications

Purpose

The primary purpose of this study was to investigate the predictive accuracy of the Boehm Test of Basic Concepts for reading and math achievement at mid-first grade. A secondary purpose was to examine certain other variables in a school screening program to determine the most accurate predictive measures.

Conclusions

The results of this study indicated that the Boehm Test of Basic Concepts (BTBC) was a good predictor of reading and math achievement as measured by teacher ratings at mid-first grade. Correlation coefficients equaled .590 and .596 for reading achievement (pre and post tests) and .561 and .578 for math achievement (pre and post tests). These findings lend support to the validity of the BTBC as a predictive screening measure and are consistent with the results of other research studies (Busch, 1980, Piersal, 1982, Steinbauer and Heller, 1978).

Analysis of the data to determine the best prediction model for mid-first grade reading and math achievement showed that a combination of the pre-reading and quantitative variables of the Metropolitan Readiness Test provided the best prediction model.

The highest correlations were between the MRT-PR and the reading rating (.759) and the MRT-Q and the math rating (.679).

This was not an unexpected finding since the MRT provided the most comprehensive sampling of readiness skills among the variables: testing language, listening, auditory, visual, and quantitative domains. The primary purpose of the MRT battery is to assess readiness for first grade programs. Although the BTBC did not add any significant value to the prediction model, it still is considered a good predictor with correlations of .590 and .596 for the reading rating and .561 and .578 with the math rating.

Of major interest in the study was the significant correlation between the pre-kindergarten BTBC-A and the end of kindergarten MRT-PR (.730) and MRT-Q (.722). The mid-kindergarten BTBC-B also correlated highly with the MRT-PR (.726) and the MRT-Q (.722). This indicates that while the BTBC might not be the best predictor among the variables of mid-first grade reading and math achievement, it is a very good predictor of readiness skills at the end of the kindergarten year. Thus it would be of value to include the BTBC as part of a pre-kindergarten screening program. As Boehm (1983) stated, results of the test can provide the classroom teacher with important information about individual children.

Despite the fact that the BTBC is primarily a test of receptive language, it was more highly correlated with the MRT scores than the Kindergarten Language Screening Test (KLST) which

areas. However, the subtests on the KLST were quite brief, especially the receptive language areas. The KLST showed correlations of .588 and .557 with the MRT-PR and MRT-Q scores respectively. Both measures were administered before kindergarten entry. These findings suggest that knowledge of basic concepts may play an especially important role as a predictive measure.

Another interesting observation was that chronological age was not correlated significantly for predictive purposes with any of the variables. The only correlations even statistically significant were with the language measures (BTBC-A, .343; BTBC-B, .310; KLST, .265;) and the MRT-Q (.257). The MRT-Q included questions related to the Boehm concept categories of space and quantity. This points again to the value of language in any screening battery. The lack of importance of chronological age as a predictive variable supports Busch's 1980 research conclusions which state that chronological age is unrelated to first grade achievement. Older children do not necessarily experience greater academic success than younger children.

Implications for Research

Researchers have been concerned with the validity and appropriateness of early screening instruments and nearly all suggest continued evaluation and study of such tests. Because of the many differing philosophies that underly kindergarten

programs, it is essential that there be continued research into the effectiveness not only of screening instruments but also of intervention programs resulting from use of these instruments. For example, there is a great deal of controversy concerning the concept of developmental screening and placement. More long term research needs to be undertaken to determine the value of such placement. School districts, when deciding to adopt specific screening programs, need to plan for systematic evaluation and research concerning the outcomes of such programs. Although admittedly difficult to implement due to cost and personnel demands, it would be valuable to conduct such research on both the state and local levels.

Exactly what are the essential elements of an effective screening battery? What are the most valid instruments to use? Results of this current study emphasize the importance of language, particularly knowledge of basic concepts, as a valid indicator of early school success. Isolating the receptive language dimension for further research may prove valuable in determining the role of language in kindergarten screening batteries.

Continued study of the BTBC as a predictor of school achievement is recommended. Studies assessing the results of direct concept teaching in kindergarten or pre-school are also advised. Both Kaufman (1978) and Kaplan and White (1980) point out that young children have difficulty with basic concepts. Research is needed to further examine the effects of such

difficulties on test performance and the understanding of directions.

It is also recommended that a follow up study be conducted with the original subject sample. The end of first grade (May, 1987) standardized reading and math test scores could be added as variables to the current data. Correlations could then be computed between teacher ratings at mid-year and end of the year test scores. The BTBC could be examined for predictive validity at the end of first grade.

Implications for Classroom Practice

In a study of kindergarten testing practices, Dolores Durkin (1987) identifies the two purposes of testing as 1. discovering what a child knows in relation to the contents of the instructional programs in order to determine appropriateness of such programs and 2. evaluating the results of instruction in order to make decisions concerning what instruction should come next. Durkin echoes the strong concerns of most researchers that testing should be related to instructional decisions and programs.

May and Welch (1986) argue that the readiness debate should become an issue of making the school ready for the variety of children that enter rather than attempting to make the child ready for school by adjusting factors such as chronological or developmental age. Students need to be provided with better educational opportunities as the result of any screening program.

The implications for the classroom teacher as a result of

the current study with the BTBC are many. The administration of the BTBC during the summer before kindergarten entry, gives the teacher an idea of the concept mastery of individual children and of the class as a whole. This aids in planning either whole class instruction of certain concepts or individual or small group remediation for specific children. It also gives the teacher an idea of the child's relation to others in the class concerning concept knowledge. The BTBC gives the teacher both criterion and normative information. Both Boehm (1983) and Bracken (1986) encourage direct teaching of specific concepts to children. The Boehm Resource Guide for Basic Concept Teaching is available to teachers for instructional ideas and programs.

Including the BTBC in a pre-kindergarten screening program can be used as an opportunity to involve parents in working as partners with the school in developing their child's language skills. Kindergarten teachers meet with parents and share results of the testing along with a booklet of ideas for language development. Thus communication is opened between parent and teacher before actual school entry. Post-testing results are sent home at mid-year.

Practically speaking, teachers need to be aware of the level of concept knowledge of their students in order to avoid giving confusing directions and to avoid making false assumptions of children's understanding. Gaps in concept development can hinder certain children in performance. Special attention needs to be paid to such children especially in testing and direction giving

situations. Children may understand a concept on a superficial level but may be unable to transfer it to different situations.

A teacher's understanding of the sequence of language development is important for instructional purposes, and increased communication between the speech and language specialist and the kindergarten teacher would be of value in planning interventions. This study has highlighted the language factor as predictive of future academic success. The classroom teacher's awareness of the significance of concept acquisition should directly benefit the students.

Ongoing evaluation of children is recommended to avoid the possibility of misdiagnosis of children. Multi-faceted screening programs must allow frequent opportunities for re-evaluation. The classroom teacher is the one most familiar with the child and the one who can make observations on a daily basis. Therefore it is recommended that teachers keep systematic observational records of children and that any instructional decisions take into account teacher assessments as well as test results.

Decisions that are made about children are complex, difficult, and of great importance. Pre-school and kindergarten screening programs have been beneficial to children, teachers, parents, and administrators. However, there needs to be continued evaluation of instruments and interventions to provide the best possible educational opportunity for the individual child.

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