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ABSTRACT

The Brigance K&1 test is a battery of 12 subtests widely used to identify entering kindergarten children in need of more comprehensive evaluation. To gather data on the reliability of the test, an analysis was conducted of results for 134 children from low socioeconomic backgrounds. The children were administered both the Brigance K&1 screen and a separate battery, the Kaufman Assessment Battery for Children (K-ABC), for comparison. Also, to examine both inter-rater and test-retest reliability, 37 randomly-selected children were retested a few months later on the Brigance screen using two evaluators, and all children were subsequently retested with the K-ABC. Results of the study included the following findings: (1) with respect to reliability, the inter-rater measure was found to be high, while the test-retest measure was moderate, with considerable variation between subtests; (2) a factor analysis of results showed no evidence that the 12 subtests measured distinct functionings--only 5 reliable factors emerged; and (3) a general positive correlation was found between four of these Brigance K&1 factors and three K-ABC subtests. The data contraindicate the use of the K&1 screen as a single instrument in early identification and intervention efforts. (Data tables and 14 references are included.) (BCY)

An analysis of the Brigance K & 1 screen

with

a disadvantaged pre-schoo' sample

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Abstract

The present study examined the properties of the Brigance K&1 screen with a sample of 134 preschool children preparing to enter kindergarten. Reliability estimations indicated high inter-rater agreement and moderate internal consistency and test-retest reliabilities. With respect to the dimensionality of the test, there was no factor analytic support for 12 distinct components of functioning. Only five reliable factors emerged based on 38 items. The correlation of the total factor score with the K&1 total score (derived from 71 items) was .98. This is an important consideration because the author of the screen cites the short administration time as an advantage of the instrument. Prediction/outcome analyses were also carried out to explore the test's accuracy in predicting special education status at the end of preschool. These analyses indicated a relatively high false negative rate and a moderate true positive rate. The data contraindicate the use of the K&1 screen as a single instrument in early identification and intervention efforts.

An analysis of the Brigance K & 1 screen

with a disadvantaged pre-kindergarten sample

Efforts directed at the early identification of at-risk children are motivated primarily by the assumption that early identification will lead to prevention interventions. However, a growing body of literature suggests that the early identification of young at-risk children is a highly complex process with major issues related to measurement, prediction, and the benefits of early remediation (Satz & Fletcher, 1988). Although there is a critical need for accurate early identification instruments, assessments of the reliability and validity of early screens are lacking. For example, there is considerable evidence that a number of frequently used screens lack documentation of suitable test-retest reliability (Lindsay & Wedell, 1982). In addition, even instruments with high hit rates have high misclassification rates, frequently yielding large numbers of false positive and false negative predictions (Mercer, Algozzine, & Trifiletti, 1979). An important issue that is commonly ignored involves the construct validation of these instruments. Construct validity data are sorely need to provide critical information on the cognitive, perceptual, or language domains assessed by the instrument (Hinshaw, Morrison, Carte, & Cornsweet, 1986).

The present study reports on the kindergarten form of the Brigance K&1 screen, a brief individually administered battery. This test is appropriate for preschool children entering kindergarten and has been widely used in early childhood education settings. Its primary purpose is to identify young children in need of more comprehensive evaluation. This criterion referenced screen is also considered appropriate in planning instruction for at-risk youngsters. (Brigance, 1992).

The Brigance K&1 screen, is a 12-subtest instrument that takes approximately 15

minutes to administer. Its 12 subtests measure a broad range of skills which include language, number, and motor skills, body knowledge, recognition, and ability to follow directions. However, as Helfeldt (1984, p. 822) points out, half of the subtests (i.e. Personal Data Responses, Rote Counting, Color Recognition, Picture Vocabulary) "rely heavily on background experience and rote memory." A third of the tasks (i.e. Discrimination, Visual-Motor Skills, Gross Motor Skills) appear to assess perceptual-motor skills and the remaining tasks (i.e., Verbal Directions, Syntax and Fluency) assess dimensions of cognitive functioning.

In addition to the test form, the manual provides rating scales for the examiner, teacher, and parents. The examiner's checklist allows for recording behaviors that may be the result of sensory, cognitive, motor, or emotional impairments. The teacher and parent forms ask the rater to check the presence or absence of skills some of which are also assessed by the individually administered battery. Additional categories included in the rating forms are self-help skills, social skills, and emotional/self-reliance.

The Brigance manual details scoring procedures for the instrument on which the maximum score is 100. The total score for each child is derived by summing weighted raw scores on each subtest. Weights range from 0.5 points to 5 points for the various subtests. However, the rationale for assigning a particular weight to a subtest is not made clear by the publisher. Although there are no norms provided, the manual suggests that a child with a score of 65 or less be referred for further evaluation. At the same time it is recommended that schools derive their own norms and criteria for referral. Again, the manual provides little guidance on how to proceed with the establishment of local norms.

The Brigance manual reports that the screen has undergone testing in 14 states around the country (Brigance, 1992). However, it is unclear how many students and teachers

participated in the original sample. Furthermore the characteristics of both sites and participants in the field tests are not described. Additionally, the reliability and validity information found in a technical report on the K&1 screen (Brigance, 1991) can be considered speculative at best. This is because the psychometric data reported for items on the K&1 screen are based on the performance of children on the Brigance Inventory of Early Development (IED-R) a similar, yet longer form of the test. An introductory statement at the begining of the technical report recognizes the problematic nature of this approach and states, "in that the screen measures less of these items than the IED-R, the reader is cautioned that the coefficients presented will vary dependent on the difference in the actual items addressed" (Brigance, 1991, p. 2).

Given the psychometric status of the individually administered battery, the lack of data for the parent and teacher checklists comes as no surprise. In fact, the overwhelming lack of data on this test suggests that potential test users should proceed with caution when using and interpreting of test results. Test reviewers have thus recommended that school districts, adopting this test for screening purposes, undertake extensive validation procedures in order to avoid labeling, misdiagnoses, and further unnecessary testing (Cohn, 1992; Helfeldt, 1984).

It can be concluded that aside from the brevity in administration and its apparent face validity the Brigance K&1 screen has no established psychometric qualities. However, it enjoys considerable popularity because of its attractiveness, seemingly multidimensional nature, and the claim that it can be employed as a curriculum tool (Cohn, 1992). The widespread use of this screen in the absence of validity and reliability information points to the critical need for studies that address the psychometric qualities of the instrument.

The present study provides reliability and initial validity information on the kindergarten form of the Brigance K&1 screen with a population of pre-kindergarten children screened for entrance in kindergarten in a midwestern school corporation. Because the instrument is brief and some subtests contain few items, special attention is given to the identification of reliable domains of functioning underlying the test. In addition, the present study is designed to explore the presence of developmental trends and to determine the screen's accuracy at predicting special education status at the end of preschool.

Method

Subjects

Total sample. Subjects for the study were 134 children attending a preschool program in a midwestern school corporation. In February-March of preschool, children were screened with the kindergarten form of the Brigance K&1 screen in preparation for entry into the corporation's kindergarten program. The socioeconomic status of the families of these children was low. Only 129 families had income information available. The yearly income for those families was as follows: (a) below $5,000: 57 (44%); (b) $5,000-$10,000: 34 (26%); (c) $10,000-15,000: 20 (16%); and (d) above $15,000: 18 (14%). The age distribution of the sample was from 52 to 69 months with a mean age of 61.6 (Sd=3.37) months. There were 67 boys and 67 girls. The large majority of the children, 102 (76.1%), were Caucasian, 25 (18.7%) were African-American, and 5 (3.7%) were Other.

Four-year-old subsample. Of the 134 children, 23 had ages below the recommended age cutoff for the K&1 screen at the time of the first testing. The age range of that sample was from 52 to 57 months with a mean age of 54.8 months. These children were tested with

the Brigrance Preschool Screen (intended for 4-year-old children), in February. Three months later they were retested with the Brigance K&1 screen, as they reached the recommended age for that screen. The gender distribution for that sample was 12 girls and 11 boys. The racial composition of this sample was as follows: 18 (78.3%) Caucasian, 4 (17.4%) African-American, and 1 (4.3%) Other.

Instruments

Brigance K&1 screen (Brigance, 1992). The kindergarten form of this test consists of 12 subtests that measure: knowledge of personal data (5 items), color recognition (10 items), picture vocabulary (10 items), visual discrimination (10 items), visual-motor skills (5 items), gross-motor skills (10 items), rote counting from 1 to 10 (1 item), body parts identification (10 items), ability to follow verbal directions (2 items), numeral comprehension (5 items), ability to print first name (1 item), syntax and fluency (2 items). As noted earlier, the entire battery requires approximately 20 minutes to administer. It is intended for children between the ages of 4 years 9 months and 6 years.

Each item is scored on a pass-fail basis. A raw score for each subtest is derived by summing across all items answered correctly by the child. The total score on each subtest is then calculated by multiplying the raw score with the weight assigned to that particular subtest. For the purposes of this study the factor analysis was based on the correlation matrix of unweighted raw scores for each subtest.

The Brigance screen was administered by personnel trained specifically in its administration. The testing and scoring procedures described in the test's manual were followed very carefully.

The Brigance Preschool Screen (Brigance, 1985). This instrument was administered to 23 children who had not yet reached the recommended 4 years 9 months of age at the time of the Brigance K & 1 screen administration. As noted earlier, these children were first tested with the Brigance Preschool screen and later with the Brigance K & 1 screen when they were age-eligible (approximately 2 months later). The Brigance Preschool screen is very similar to, yet shorter than its kindergarten counterpart. It is intended for children between the ages of 3 years 9 months and 5 years. It is made up of 11 subtests that measure: knowledge of personal data (4 items), knowledge of body parts (9 items), motor skills (3 items), object identification (3 items), repetition of sentences (3 items), visual-motor skills (3 items), number concepts (3 items), building a tower with blocks (5 items), matching colors (5 items), picture vocabulary (6 items), and plurals (2 items). As with the K & 1 screen no information is available on the characteristics of the participants of the field tests. There is no validity or reliability information reported for this instrument.

Brigance teacher's rating form: K & 1 screen. The teacher's rating form asks the preschool teacher to rate each child moving on to kindergarten on nine areas. These areas are intended to provide information on child's mastery of the following skills: personal data information (5 items), begining academic skills (11 items), visual and fine motor skills (9 items), dominance/laterality (3 items), self-help skills (6 items), social skills (5 items), emotional/self-reliance (6 items), speech (3 items), and physical/health status (2 items). The teacher is asked to read each item and check one of three colums: "No" (skill has not been mastered) , "Uncertain," and "Yes" (skill has been mastered). The basis on which items were grouped together under the nine categories is not made clear by the publisher. Psychometric data on the teacher's rating form are not available.

Kaufman Assessment Battery for Children (K-AB C). The K-ABC (Kaufman & Kaufman, 1983a) is a recently developed alternative to the traditional intelligence test. This battery was used because it is appropriate for children in this age range and because of its emphasis on processing areas (simultaneous and sequential) felt to be important to the development of reading skills. The authors of the scale define the two processing scales as follows: "Sequential processing places a premium on the serial or temporal order of stimuli when solving problems; in contrast, simultaneous processing demands a gestalt-like, frequently spatial integration of stimuli to solve problems with maximum efficiency (Kaufman & Kaufman, 1983b, p. 2). The K-ABC is a carefully standardized measure that yields a Mental Processing Composite (MPC) score. The short form of the test, recommended for research and screening purposes, was used in this investigation (Applegate & Kaufman, 1989; Kaufman & Applegate, 1988).

In addition to the cognitive component subscales, the K-ABC includes separate achievement subscales. Of those we used the Reading/Decoding, Riddles, and Arithmetic subtests. The Reading/Decoding subtest assesses the child's ability to identify letters and read words. . In Riddles, the child is provided with a list of characteristics descriptive of an object and is asked to infer the name of that object. The Arithmetic subtest asseses the child's knowldege and understanding of number concepts.

Both cognitive and achievement scales provide standard scores with M=100 and Sd=15.

Summary of Assessment Procedures

The Brigance K&1 screen was individually administered to children in the months of February-March. A smaller number of children under 4 years 9 months of age were tested

with the Preschool form of the test at that time. In March-April all children were tested with the K-ABC cognitive ability battery. In April a sample of 37 children were randomly selected from the original sample and retested with the Brigance K&1 screen to establish test-retest reliability data. Information on inter-rater reliability was obtained at that time by two raters who evaluated the child's performance on all subtests. Interrater reliability information was available on a total of 42 children (37 randomly selected children and 5 children who entered the program late). At about the same time the subsample of the 4-year-old children were retested with the K&1 screen. In the month of May all children were individually tested with the K-ABC achievement battery. Teachers completed the Brigance teacher's checklist in March. Teachers were not aware of the child's scores on any of the tests administered. Information about children receiving special education services was obtained from records kept by the schools' director of special services.

Results

Due to the lack of a clear rationale for the use of the item weighting procedure outlined by the test manual, only unweighted item scores were used in the analyses reported here. The correlation between weighted and unweighted scores was $r = .97$. This high correlation between the two sets of scores was a further indication that the use of unweighted scores was an acceptable approach. Additionally, a multivariate analysis of variance was used to ckeck the K&1 screen for possible gender effects. No significant gender effects were found. Therefore, all subjects were treated as one group in subsequent analyses.

Reliability

The first reliability question addressed was that of inter-rater reliability. Results of these analyses are listed in Table 1. The generally strong inter-rater reliabilities obtained on

the scoring of the Brigance K&1 Screen subtests indicate a high level of agreement between raters, and suggest that the scoring criteria for the subtests are adequately explained by the manual.

Insert Table 1 About Here

The subtests were then examined for internal consistency. Coefficient Alphas were computed for each subtest and results are listed in Table 1. The internal consistency reliability coefficients ranged from a low of .28 for the Picture Vocabulary subtest to a high of .89 for the Numeral Comprehension subtest. Coefficients for both the Personal Data and Picture Vocabulary subtests were quite low.

Finally, test-retest reliabilities were computed for each subtest and for the total K&1 score. Test-retest figures are especially important given the stated aim of the authors that this test can be used as a screening device to detect developmental problems that require further professional attention. Low test-retest reliabilities would contraindicate the use of test results for screening purposes. Test-retest reliabilities are presented in Table 1. While the overall test-retest reliability is moderate, there is considerable variation within subtests. The Picture Vocabulary subtest, for example, does not demonstrate sufficient stability over time to be used as a screening device. The same is true for the Visual Descrimination and Rote Counting subtests. These results caution the user against relying too heavily on any one subtest score when considering whether or not further referral is appropriate.

Underlying Dimensions

The Brigance K&1 Screen is divided into twelve subtests, and it is implied by its author

that each subtest measures a unique skill or ability. However, no evidence is presented in support of the underlying dimensionality of the overall screen. To address this issue, results from the current administration of th K&1 Screen were subjected to a factor analysis. Due to the low suject-to-item ratio (approximately 2 to 1) these results should be considered speculative. However, these results do provide potentially valuable insights into the structure underlying the K&1 Screen.

The K&1 Screen was analyzed using a principal components analysis with a Varimax rotation. An examination of the resulting scree plot suggested a five factor solution which accounted for 36% of the total variance. The factor pattern matrix, with item numbers, eigenvalues, and internal consistency information is given in Table 2. Items loading less than .35 on a primary factor or showing multiple cross-loadings greater than .24 were excluded from the final factor pattern matrix and were not used in calculating factor scores.

Insert Table 2 About Here

A factor with all ten items from the Visual Discrimination subtest was clearly established. This factor reflects an ability to pick out a letter or shape that does not match other letters or shapes in a given set. A second factor, including all ten items from the Color Recognition subtest was also well supported. It measures the child's ability to correctly identify the color of a presented object. The third factor encompassed a logical combination of items from the Numeral Comprhension and Rote Counting subtests. This factor reflects an ability to understand basic number concepts. The fourth factor factor included eight of the ten items from the Gross Motor Skills subtest. Collectively these items reflect an ability to

correctly imitate the body movements of an adult model. Examples of specific movements imitated include standing on one foot, hopping on one foot, and walking a straight line. The last factor was less clearly established. This factor was composed of the three most difficult items from the Visual-Motor subtest and the single item from the Prints Personal Data subtest. The three visual motor items require the child to copy an example of either a cross, square, or triangle, and the personal data item asks the child to print their own name. Both printing skills and letter knowledge skills are required for success.

Intercorrelations among the above factors are presented in Table 3. Although a number of the correlations are statistically significant, the generally low correlations indicate a fair degree of independence between factors. This is especially true for Factor IV/Gross Motor Skills which correlates significantly with just one other factor.

Insert Table 3 About Here

Based on the above results, a Total Factor Score was computed for each subject. The correlation between this factor score and the unweighted total score was r=.98. It would appear that the the Total Factor Score, based on 38 items, was as accurate at rank-ordering subjects as the unweighted Total Score computed from all 71 items.

Validity

The technical manual for the K&1 Screen discusses issues related to content validity. According to the manual, each item of the K&1 Screen was judged by a panel of experts on the degree to which it matched a particular written objective, and on its age appropriateness. The authors report acceptable results for these analyses.

Of more relevance to the present study are issues of concurrent and construct validity. The Brigance K&1 Screen, Preschool Screen, and Teacher Checklist, are promoted as instruments which can help school personnel make decisions about a child's readiness for normal classroom placement. Given this similarity of purpose across tests, a high degree of correlation would be expected between the total scores on each test. An examination of the correlation matrix in Table 3 does reveal a significantly high degree of correlation between scores on the K&1 Screen and scores on both the Preschool Screen and Teacher's Checklist. These high correlations are acceptable evidence of concurrent validity. The total score from the K&1 Screen was also compared with the MPC Score from the K-ABC. An examination of the correlation matrix in Table 3 supports a positive relationship between scores on these tests.

The construct validiy of the K&1 screen was assessed by correlating the K&1 factor scores with subtest scores from the following K-ABC achievement scales: Arithmetic, Reading, and Riddles. Evidence for construct validity would be obtained if a particular factor score from the K&1 Screen correlated highly with a subtest from the K-ABC designed to measure the same ability. For example, it would be expected that the Number Concepts factor from the K&1 Screen would correlate highly with the Arithmatic Subtest from the K-ABC. It would also be expected that the Gross Motor Skills factor, which primarily examines physical skill development, would have little relation to any subtests which primarily measured cognitive ability and preacademic achievement skills. Results of these comparisonss are listed in Table 3.

In keeping with the above predictions, the Number Concepts factor from the K&1 did have a high postive correlation with the Arithmatic subtest from the K-ABC. Contrary to

expectation, factor V (Visual Motor/Printing Skills) had a low (yet statistically significant) correlation with the K-ABC Reading/Decoding subtest. In addition, the Visual Discrimination, Color Recognition, and Visual Motor factors from the K&1 Screen also had moderare, significant correlations with the Arithmatic subtest from the K-ABC. In fact, there was a general, significant, and postive correlation between four of the five K&1 factors and three of the K-ABC subtests. This suggests that Factors I, II, III, and V, of the K&1 screen are measuring some common ability or skill. The only factor not showing this pattern was the Gross Motor Skills factor. As expected, it did not correlate significantly with any of the more cognitively oriented K-ABC measures.

Analysis of developmental trends

Scores on the K&1 screen were analyzed for age-related trends. Such trends might be expected given the stated developmental nature of the screen. For this analysis, children were divided into three groups based on age (youngest third, middle third, oldest third). Mean ages in months were, 57.58 (Sd=1.58), 61.41 (Sd=1.11), and 65.23 (Sd=1.12) for the youngest, middle and oldest groups respectively.

Trends for these three groups of children were examined through two sets of multivariate analysis of variance using (a) uweighted subtest scores; and (b) factor scores as dependent measures. Surprisingly, neither MANOVA revealed any significant age effects.

Prediction of special education status

During the school year 34 children (25%) were referred for special education services. Of those, 27 (79.4%) were receiving speech therapy, 5 (14.7%) were being evaluated for cognitive/developmental delays, 1 was physically disabled, and 1 was neurologically/ cognitively impaired. It should be noted that referrals were not made on the basis of the

child's performance on the K&1 screen because the Brigance assessment data were not available to teachers or parents until the end of the school year. For this reason it was possible to evaluate the ability of the screen to identify young children in need of special education services. A prediction/outcome matrix paradigm (Mercer, Algozzine, & Trifiletti, 1988) was used to identify hit rates, accurate, and inaccurate predictions of the K&1 screen with special education status being the outcome variable.

An example of this analysis is presented on Table 4. In this example a cutoff

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Insert Table 4 about here

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score of 65 on the K&1 screen is used as the predictor. This is based on the Brigance weighted scores system and was used here because it is recommended as a criterion for futher assessement in the Brigance manual. This classification yielded a hit rate of 80%. The true positive rate (children predicted at-risk and receiving special services) was 67%, whereas the true negative rate (children predicted not-at-risk and not receiving special services) was 92%. False positives (children predicted at-risk but not receiving special education) were 33% and false negatives (children predicted not-at-risk but receiving special education) were 18%. With respect to false negatives Mercer et. al. (1988) caution that it is important to also examine vertical proportions. This analysis provides an estimate of the proportion of children missed when the entire sample of children receiving special services is considered. We thus find that of the sample of special education children, the K&1 screen misses 59%. These are children requring intervention but who would not have been referred had Brigance scores been used as the sole indicator of at-risk status.

It is noteworthy that a Brigance score of 65 only identified 15% of the sample as needing further evaluation. However, in our sample 25% were receiving special services. We therefore carried out three additional prediction/outcome analyses to examine the accuracy of the screen when more conservative or more liberal cutoff scores are being used. These results are summarized in Table 5. It appears that a cut-off score of 65 yields the best hit

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Insert Table 5 about here

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rate. False negatives however, are quite high when this criterion is used. With the more liberal cutoff scores of 69 and 72 there is a decrease in false negatives and an increase in false positives. This would be expected given the moderate hit rate of the test. This is further exemplified by an examination of the phi coefficients. As shown in Table 5 phi coefficients ranged from .36 to .40 indicating a low-moderate association between the screening criteria and special education status.

Discussion

The analyses peformed in this study provided useful insights into the nature of the Brigance K&1 screen with a sample of preschool children. The lack of a clear rationale for the item weighting procedure used in scoring the test coupled with the high correlation between weighted and unweighted total scores contraindicated item weighting as a useful element of the test. This procedure increases the amount of time required for scoring the test, increases the probability of scoring errors, and is psychometrically unjustifiable. In addition, the high correlation of the K&1 with the Preschool screen suggests that the test is appropriate for children below 58 months of age who have been exposed to 6 months of preschool activities

and are moving on to kindergarten.

Reliability estimations with the present sample, indicated high inter-rater agreement, generally moderate internal consistency, and lower test-retest reliabilities than those found in the technical report. Two subtests, Personal Data and Picture Vocabulary, had very low alpha coefficients. This implies that these subtests are measuring a heterogeneous set of skills and that the addition of individual item scores to construct a subtest total, as outlined by the scoring manual, may not be valid. An inspection of the content of these two subtests suggests that a child's score may reflect more on the child's recent experiences than on any diagnostically relevant abilities.

In the present study five out of the 12 subtests had low or moderately low test-retest reliabilities. These data are much lower than those found in the technical report (Brigance, 1991). Although the source of the observed discrepancies is not entirely clear, it should be noted that the time interval between test and retest is not stated in the technical manual (Brigance, 1991). It must also be stressed that the reliabilities reported in the technical manual were computed from similar items used in a different, much lengthier inventory of early development. They were not derived from from a direct administration of the K&1 screen. In contrast, all reliability estimations in the present study were based on an actual administration of the K&1 Screen. Thus differences in the test-retest time interval coupled with the fact that the technical report data do not accurately reflect the characteristics of the K&1 screen, may well account for these discrepancies. Potential test users are thus cautioned against relying on the technical report data to evalauate the psychometric metrits of the K&1 screen.

With respect to the dimensional nature of the test, there was no support for 12 distinct

components of functioning as the author of the test suggests. Rather, initial evidence with our sample indicated the presense of only five reliable factors. The total factor score, based on 38 items that made up the five factors, had a correlation of . 98 with the total score derived from the entire 71-item K&1 screen. This is an important consideration, because the author of the K&1 screen cites the short administration time as an advantage of the instrument. However, the present factor analytic findings indicate that the time required to administer the screen can be further reduced, without any loss of normative information, if just those items which constitute the five factors are administered.

The small number of children in our sample and the absence of similar studies in the literature cautions that this information should be interpreted with caution. Cross-validation of the factorial nature of the test is needed to substantiate the present findings. At the same time, it is clear that the results of our factor analysis mirror those obtained in analyses of other early screens (i.e., the Metropolitan Redliness Test, SEARCH) that did not confirm the presence of multiple, narrowly defined readiness areas (e. g., Hinshaw et al., 1986; Watkins & Wiebe, 1984).

The concurrent validation procedures using the K-ABC cogntive and achievement subscales suggest that the K&1 screen is a moderate predictor of cognitive ability and preacademic achievement. The prediction/outcome analysis is also supportive of this conclusion. The K&1 manual suggests that a score of 65 should be used as as a flag for further assessment. Use of this score with the present sample would result in 59% of special needs children being missed. This high error rate is probably not acceptable to most school systems and would not support the use of this test as a single screen. Normative data must be made available to assist test users in selecting appropriate cutoff scores for referral or

further testing.

The K&1 screen is not a diagnositc instrument and should only be used to indicate that a child should probably be evaluated with more elaborate tests. This procedure would eliminate false positives (not-at-risk children incorrectly screened as at-risk). Thus the false positive error rate would be less of a concern in this case. If the false negative rate remains high the screen is less helpful in a program geared toward early prevention. The present findings indicate that lower false positive rates are obtained when a very liberal cut-off score is used, resulting in 33% of the children screened as at-risk. When this criterion is adopted, because the hit rate is less than optimal, higher false positive rates are obtained. This means that follow-up evaluations, directed to identify the truly positive children who need intervention, can be costly and time consuming. Schools might opt for this alternative if it were accompanied by low false negative rates. However, as our data suggest, with even more liberal cutoffs the test still yields a false negative rate of 38%.

These initial findings do not suggest that the K&1 screen is a more effective instrument than other available screens (for an analysis of other screens see Mercer et . al., 1988) with more clearly established psychometric characteristics. With early identification being a critical issue, further cross-validation and longitudinal research is needed to inform practitioners of the accuracy and potential uses of this screen.

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Table 1

Reliability data for Brigance K & 1 and pre-school screens

Scale Name	Inter-Rater (n=42)	Internal Consistency (n=134)	Test-Retest (n=37)	k
K&1 Screen				
1. Personal Data	.96	.39	.52	5
2. Color Recognition	.99	.79	.78	10
3. Picture Vocabulary	.92	.28	.28	10
4. Visual Discrimination	.98	.88	.42	10
5. Visual-Motor Skills	.95	.54	.44	5
6. Gross-Motor Skills	.95	.80	.49	10
7. Rote Counting	1.00	*	.32	1
8. Identify Body Parts	.89	.56	.58	10
9. Follows Directions	*	*	*	2
10. Numeral Comprehension	.89	.89	.84	5
11. Prints Personal Data	1.00	*	.65	1
12. Syntax and Fluency	.70	.66	1.00	2
TOTAL	**.97**	**.87**	**.82**	**71**
Preschool Screen				
1. Personal Data		.60		4
2. Identify Body Parts		.84		9
3. Gross Motor Skills		.22		3
4. Tells Use of Objects		.73		3
5. Repeats Sentences		.63		3
6. Visual-Motor Skills		.53		3
7. Number Concepts		.55		3
8. Builds Tower		.58		5
9. Identifies Color		.74		5
10. Picture Vocabulary		.44		6
11. Preposistions/Nouns		.27		2
TOTAL		**.82**		**46**

(* Denotes a single item scale or a scale with zero variance)

Table 2

Varimax factor pattern matrix for Brigance K & 1 screen

Subtest	Item #	Factor I	II	III	IV	V
Visual Discrimination (Alpha = .88 eigenvalue = 9.09)						
Visual Discrimination	8	**.79**	.09	.04	-.10	-.06
Visual Discrimination	9	**.78**	.07	.08	.00	.09
Visual Discrimination	6	**.77**	.03	.09	.03	.12
Visual Discrimination	7	**.74**	.00	.14	.05	.06
Visual Discrimination	4	**.73**	.09	.09	.09	-.04
Visual Discrimination	10	**.69**	.06	.04	.09	.13
Visual Discrimination	5	**.55**	.09	.04	.10	.25
Visual Discrimination	3	**.54**	.26	-.09	-.08	.04
Visual Discrimination	1	**.53**	-.04	.09	.03	.16
Visual Discrimination	2	**.50**	-.03	.14	-.09	-.12
Color Recognition (Alpha = .79 eigenvalue = 4.34)						
Color Recognition	4	.05	**.66**	.12	-.02	.08
Color Recognition	8	.03	**.63**	.02	.05	.02
Color Recognition	2	-.08	**.62**	.14	.04	.01
Color Recognition	9	.08	**.60**	.08	.07	.13
Color Recognition	7	.12	**.59**	.20	.01	-.10
Color Recognition	3	-.01	**.58**	.11	.04	.20
Color Recognition	5	.05	**.57**	.08	.06	-.01
Color Recognition	1	.13	**.55**	.04	-.02	-.18
Color Recognition	6	.13	**.55**	.04	-.02	-.18
Color Recognition	10	.17	**.37**	.25	-.02	.16
Number Concepts (Alpha = .76 eigenvalue = 3.99)						
Numeral Comprehension	4	.17	.23	**.85**	.00	.05
Numeral Comprehension	3	.20	.23	**.84**	-.05	.09
Numeral Comprehension	1	.16	.06	**.80**	.04	.00

Table 2 (cont.)

Factor						
Subtest	**Item #**	**I**	**II**	**III**	**IV**	**V**
Numeral Comprehension	2	.18	.07	**.74**	.07	.10
Numeral Comprehension	5	.02	.29	**.66**	.04	.04
Rote Counting	1	.02	.20	**.47**	.22	.11
Gross Motor Skills (Alpha = .81 eigenvalue = 3.55)						
Gross Motor Skills	9	-.07	.16	-.03	**.79**	-.14
Gross Motor Skills	4	.07	.00	.00	**.72**	.00
Gross Motor Skills	1	-.02	-.07	.24	**.70**	-.03
Gross Motor Skills	3	.07	-.01	-.03	**.70**	-.07
Gross Motor Skills	2	.07	-.09	.25	**.68**	.01
Gross Motor Skills	10	-.02	.14	.03	**.67**	.12
Gross Motor Skills	5	.06	-.02	-.12	**.48**	.08
Gross Motor Skills	6	.11	-.16	.12	**.46**	.28
Visual Motor/Printing Skills (Alpha = .61 eigenvalue = 2.63)						
Visual Motor	4	.11	.06	.18	-.09	**.69**
Visual Motor	5	.08	-.06	-.01	-.05	**.62**
Visual Motor	3	.15	.18	.07	-.05	**.49**
Prints Personal Data	1	.02	.25	.21	-.07	**.37**

Table 3

Correlations among Brigance factor scores, total K&1 score, pre-school screen, teacher's rating checklist, and K-ABC scores

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Factor I														
2. Factor II	.23**													
3. Factor III	.26**	.42**												
4. Factor IV	.12	.11	.24**											
5. Factor V	.27**	.30**	.34**	.05										
6. Total Factor Score	.66**	.65**	.80**	.42**	.52**									
7. K & 1 Total Score	.64**	.63**	.77**	.46**	.53**	.98**								
8. Brigance Pre-School Screen	.46*	.32	.50*	.07	.21	.58**	.74**							
9. Brigance Teacher's Checklist	.37**	.46**	.59**	.17*	.41**	.66**	.66**	.15						
10. K-ABC Arithmetic	.38**	.43**	.65**	.12	.35**	.65**	.64**	.49*	.46**					
11. K-ABC Riddles	.36**	.34**	.33**	.14	.26**	.45**	.45**	.43*	.33**	.40**				
12. K-ABC Reading/ Decoding	.19*	.43**	.39**	.00	.26**	.44*	.43**	.32	.31**	.63**	.33**			
13. K-ABC SIM	.40**	.22*	.36**	.09	.48**	.48**	.49**	.44**	.30**	.41**	.35**	.30**		
14. K-ABC SEQ	.28**	.32**	.47**	.15	.42**	.52**	.54**	.32	.38**	.64**	.37**	.53**	.42**	
15. K-ABC MPC	.44**	.31**	.48**	.13	.57**	.60**	.61**	.40	.40**	.53**	.38**	.36**	.83**	.71**

* $p < .05$ ** $p < .01$

Table 4

Prediction of of special education status

Special Ed. Status Brigance Prediction	Referred	Not Referred	Total
At-risk (Total score <65)	14	7	20
(Horizontal %)	(.67)	(.33)	
(Vertical %)	(.41)	(.07)	
Not at-risk (Tot. score >65)	20	93	113
(Horizontal %)	(.18)	(.92)	
(Vertical %)	(.59)	(.89)	
Total	34	100	134

Hit Rate: (14+93)/134=.80

Table 5

Prediction/outcome analysis of the K&1 screen using horizontal (H) and vertical (V) proportions.

Brigance cut-off score	% of Children below the cut-off score	Hit Rate	True Negative		False Negative		True Positive		False Positive		Phi
			H	V	H	V	H	V	H	V	
58	10	79	80	96	20	71	71	29	29	4	.36*
65	15	80	92	89	18	59	67	41	33	07	.40*
69	25	76	84	84	16	47	53	53	47	16	.37*
72	33	74	86	78	14	38	49	62	51	22	.37*

* $p<.001$