TEACHERS' JUDGMENT OF RISK: THE MCCARTHY SCREENING TEST AND THE RHODE ISLAND PUPIL IDENTIFICATION SCALE

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by

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ABSTRACT

TEACHERS JUDGMENT OF RISK: THE MCCARTHY SCREENING TEST AND THE RHODE ISLAND PUPIL IDENTIFICATION SCALE

by

John Frederick Miller

Master of Arts in Psychology

The present study investigated the relationship between the McCarthy Screening Test (MST) and the Rhode Island Pupil Identification Scale (RIPIS), as well as the ability of each of these instruments to predict kindergarten teacher's subjective judgments of their pupils as "at risk" or "not at risk" of developing a learning disability.

From a pool of approximately 150 kindergarten children, previously judged by their teachers as to risk, 30 were randomly selected who were judged as "at risk" and 30 were randomly selected who were judged as "not at risk." All 60 children were then screened with the MST and
A canonical correlation analysis between the six subtests comprising the MST and the nine, previously identified, factors which make up the RIPIS found that draw-a-design, conceptual grouping, and leg coordination on the MST were strongly intercorrelated with body perception, self concept, memory for events, memory for symbols for cognitive operations, and directional or positional constancy from the RIPIS. The MST subtests and the RIPIS factors that appear to be strongly influenced by spatial perception were those that were most strongly loaded on the canonical variate. Subtests and factors claiming to measure memory were also important in explaining the interrelationships between the instruments.

Discriminant function analysis indicated that both screening devices successfully predict teacher's judgments of risk in a strong majority of cases. Numerical memory and verbal memory from the MST and seven of the nine RIPIS factors were shown to be of importance in making the predictions. RIPIS factors and MST subtests purporting to measure memory were strongly loaded on the discriminant functions, and those subtests and factors which appear to measure spatial perception had somewhat weaker, but still significant loadings. Apparently, the two abilities measured most strongly by the screening devices are also
of major importance in determining teacher's judgments of risk.
INTRODUCTION

Children with learning disabilities are continually subjected to failure in a conventional school program. They are frequently subjected to months or even years of unsuccessful study before receiving remedial aid. During this time, failure cannot help but compound itself. Skills are demanded which have never been developed, experience is required that such children have never had and concepts must be utilized that are not as yet established. Acting-out behavior and a poor self-image are often additionally developed (Haring and Ridgway, 1967).

Learning disabilities can be remediated much more quickly at a young age when the educational lag is the shortest. Less subject matter needs to be covered (Bannatyne, 1970). Related psychological problems may not have developed.

Traditionally, the identification of children needing special education assistance has been accomplished by teacher referrals for testing. While kindergarten and early primary teachers have been shown to be quite effective in predicting future learning disabilities among those children actually referred (Keogh and Becker, 1973; Keogh, Tchir, and Windeguth-Behn, 1974), a large number of children who later do develop learning disabilities
are simply overlooked by relying on this traditional procedure.

Teachers typically refer only about 6% of the school population for psychological evaluation (Hyde, 1975; Nicholson, 1967) while there is evidence to indicate that as many as 30% of this group have at least some degree of learning disability (Spalding and Geiser, 1978).

Certain types of learning problems are frequently overlooked by teachers. In a study of grades K-3 in seven Cincinnati elementary schools, Kirschebaum, Marsh and Devoge (1977) found that those children referred: "were the most dysfunctional, evidencing excessive acting-out and learning problems" (p. 405). That is, the children referred were those who placed the most demand on the time and patience of teachers. Few moody, withdrawn children were referred, although, there is considerable evidence that such children are frequently at risk of developing learning disabilities (Goodman, 1972; Bach and Wyden, 1968; Watt and Lubensky, 1976). It was further found in the Kirshenbaum, Marsh, and Devoge study that teacher's identified a significantly greater number of boys than girls as learning disabled.

Moreover, the fact that teacher referrals have been shown to be influenced by cultural and socioeconomic factors, has led to over-representation of ethnic
minorities in special education programs (Erman and Olsen, 1966; Jones, 1972). However, other researchers have pointed out that those of lower socioeconomic status are indeed at greater risk of developing learning disabilities as they suffer greater degrees of inadequate prenatal, neonatal, and postnatal care and nutrition deficits (Kappelman, Kaplan, and Ganter, 1969; Stein and Susser, 1970).

Teachers of kindergarten and early primary children have additional responsibilities in making referrals beyond those of teachers of later grades, in that, in addition to identifying existing learning problems, they are required to predict future ones (Keogh and Becker, 1973).

A better alternative than relying solely on teacher's subjective judgments in screening for potential learning disabilities would seem to be an objective reliable, and valid screening instrument. Norms could be established to quantify potential risk. Additional areas could be measured that teachers may have overlooked. By testing more children, fewer in need of remediation would be missed.

A number of attempts have been made to develop screening instruments. One example is the First Grade
Screening Test (FGST) (Pate and Webb, 1969). This test was developed for "the purpose of screening beginning or potential first grade students for learning problems" (Hase, 1977, p. 407). The instrument consists of 27 items and can be administered individually or in groups in 45 minutes or fewer. Hase (1977) found significant agreement between the results of four previously determined subcategories for the FGST (visual motor, self-concept, reasoning, and picture vocabulary) and pre-kindergarten teacher's ratings of risk on these same four subcategories using Chi square analyses.

Telegdy (1977) undertook a factor analysis of the FGST and three other tests used for learning disabilities screening: The Screening Test of Academic Readiness (STAR) (Ahr, 1966); the Bender Gestalt Test for Young Children (BGT) (Koppitz, 1964), and the Metropolitan Readiness Test (MRT) (Hildreth, Griffiths, and McGauvran, 1965).

The STAR consists of 8 subtests: Human figure drawing, picture vocabulary, letters, picture completion, copying, picture description, relationships, and numbers. While not an intelligence scale per se, norms are provided for an IQ score on the STAR.

The BGT is made up of a series of drawings on cards, which a child is shown and asked to reproduce. The test
was mainly designed to assess neurological impairment, but considerable evidence has been gathered that potential school achievement can be assessed with some degree of accuracy using the BGT (Bryan, 1964; Keough & Smith, 1970). A single total error score has been provided by the Koppitz (1964) scoring system.

The MRT provides six subtests that sample the following areas: word meaning, listening, matching, alphabet, numbers, and copying. Bolig and Fletcher (1973) have shown the MRT to be a good predictor of success in the first grade.

Telegdy (1974) found a number of fairly strong intercorrelations among the tests. However, the three tests were shown to have somewhat different loadings on three identified factors: visual-perceptual-motor integrity, language comprehension, and abstraction of essential characteristics. The FGST was shown to be primarily loaded on the language comprehension factor, but was also found to be loaded on the visual-perceptual-motor factor. The MRT was also found to measure both of these factors, but was primarily loaded on the visual-perceptual-motor factor. The BGT measured the visual-perceptual-motor factor, but little else. The only test to measure all three areas was the STAR.
Another approach to screening is the Quick Neurological Screening Test (QNST) (Mutti, Spalding, Sterling & Crawford, 1974) which consists of 14 subtests encompassing "fine and gross motor skills, spatial awareness, eye tracking, balance, left-right discrimination, body tension, sound patterns, and various behavioral irregularities noted as part of the general observation of the child during the testing procedure" (Spalding & Geiser, 1978, p. 313). Each subject is classified as high, suspicious or normal in relation to risk of neurological deficits on each subtest. An overall cutoff score for classification as learning disabled has been suggested by the test's authors. The test was primarily intended for children in kindergarten through the sixth grade, but has been used with older children.

While it would first appear that a considerable level of expertise would be required to properly administer the QNST, Spalding and Geiser (1978) found a positive correlation of .69 between experts and minimally trained teacher's scoring of the instrument using 24 school age children as subjects.

The Rhode Island Pupil Identification Scale (RIPIS) (Novack, Bonaventura & Merenda, 1973) was designed to: "help the teacher identify children with learning problems, help the classroom teacher indicate more readily, using
the scale language, the specific aspects of the school program requiring attention, and then permit the classroom teacher or the receiving specialist, whenever necessary and whatever his expertise, to address himself more efficiently to the resolution of the specific school program as observed in its natural surroundings" (p. 98).

The RIPIS standardization sample consisted of 851 subjects in grades K-2 from seven schools in Rhode Island. The sample was considered by Novack, Bonaventura, and Merenda (1979) to be representative, in that, sexes, minority groups, socioeconomic levels and transient children from military families were proportionally represented.

Part one of the scale is made up of twenty-one items involving child behavior "observable through regular classroom activity." Part two consists of nineteen items that consider "behavior which can be evaluated through a child's written work" (p. 1). About ten minutes is required to complete the form.

Questions are stated in a negative manner and describe a child's classroom behavior, for example, "has difficulty cutting." The person completing the scale, usually the child's classroom teacher, is asked to indicate how often he or she has observed a particular behavior.
In scoring the scale, 1 point is assigned for a never response, 2 points for rarely, 3 points for occasionally, 4 points for frequently and 5 points for always. Particularly on part two of the scale, where behaviors involving written work are stressed, it is possible that teachers of younger children may have not had a chance to observe certain behaviors. For scoring purposes, the item is then treated as if it were a never response and 1 point is assigned. Scores for part one and part two and total score are obtained by simply accumulating the points assigned to the items on the applicable section of the scale. Exactly what total score denotes "at risk" is left mostly up to the scorer's discretion although a total score of 80 is suggested by the authors as a score above which potential risk is indicated.

A series of 32 principal component and factor analyses have been separately performed on part I and part II of the scale. The highly consistent results that have been found have allowed the scale's authors to provide factor scoring of the RIPIS. The factors found are as follows:

Part I - Based on classroom observations

1. Body Perception
2. Sensory Motor Coordination
3. Attention
4. Self Concept
5. Memory for Events

PART II - Based on observations of written work
1. Memory for Reproduction of Symbols
2. Directional or Positional Constancy
3. Spatial and Sequential Arrangements of Letters and Symbols
4. Memory for Symbols for Cognitive Operations

The scale items comprising each factor are listed in the RIPIS manual. To factor score the scale, points assigned to each of the listed component items are simply accumulated. Percentile norms are provided for each factor raw score. A scaling form, separate from the test protocol, allows the scorer to graph each factor percentile score so that relative strengths and weaknesses can easily be seen.

Considerably more reliability and validity research has been performed on the RIPIS than on most of the previously discussed screening instruments. Test-retest reliability analyses performed over an eight month period, using the original standardization sample, showed promising results. Correlation coefficients obtained after one month's interval were between .755 and .988. The relationship found after eight months was substantially lower (r=.532), but still significantly positive.
The decreasing relationship over time was, in the opinion of the authors, to be expected if it is assumed that "effective teaching is taking place in the classroom and educational progress is being made" (Novack, Bonaventura, & Merenda, 1979, p. 7).

Concurrent validity was established for the RIPIS by correlating RIPIS total and part 1 and 2 scores with subtest scores on the California Test of Mental Maturity (CTMM) and the Stanford Achievement Test (SAT). All obtained correlations were significant at the .05 level or less, although they were considerably higher between the RIPIS and the SAT than between the RIPIS and the CTMM.

Predictive validity was determined by comparing expected educational outcome categories as assigned by subject's teachers at the end of the school year with RIPIS results obtained at the beginning of the year. Outcome categories assigned by teachers included: "1. Promoted to the next higher grade - will experience little or no difficulty, 2. Promoted to the next higher grade - will experience some difficulty, 3. Promoted to the next higher grade - will experience considerable difficulty and 4. Not promoted" (p. 10).

An analysis of variance was performed between the mean RIPIS scores received by those pupils assigned to categories 1 and 2 by their teachers and the mean RIPIS
scores of children categorized by their teachers as in groups 3 and 4. The tests of mean differences resulted in statistical significance beyond the .001 levels for kindergarten pupils and 1st and 2nd graders.

The McCarthy Screening Test (MST) (McCarthy, 1978) was adopted from the longer McCarthy Scales of Childrens Abilities and there has been no standardization of the MST apart from the MSCA. Its stated intention is to help schools identify children between 4 and 6½ years of age who are likely to need special education assistance in the future. The MST is individually administered and it purports to measure abilities in the cognitive as well as the psychomotor domain.

The principle purpose of the MST has been stated by McCarthy (1978) as "to determine whether special (educational) treatment is needed, rather than the kind of special treatment that may be needed" (p. 4). Estimated time for testing is twenty minutes. Administration of the instrument is easily handled by the school psychologist, but one of the reasons the subtests utilized were selected from the MSCA was for their ease of administration and scoring. The subtests selected from the MSCA included the following:

1. Right-Left Orientation - measures a child's cognitive knowledge of right and left concepts.
2. Verbal Memory - evaluates a child's ability to memorize words and sentences.

3. Draw-A-Design - The presence of perceptual or other neurological disabilities is assessed.

4. Numerical Memory - short-term memory and attention span are evaluated.

5. Conceptual Grouping - measures the ability to deal logically with objects, to classify, and to generalize.

6. Leg Coordination.

To score the MST, total raw scores are determined for each of the six subtests. The subtest scores are then evaluated against norms provided at each of 3 different levels of risk, the 10th, the 20th, and the 30th percentile, the percentile level to be indicative of risk being chosen by the examiner. These percentile levels of risk correspond to the subtest raw scores of the bottom 10%, 20%, and 30% of the distribution. Exactly how many subtests failed denotes "at risk" at any of the three percentile levels has also been left up to the individual examiner, however, McCarthy (1978) has suggested that 2 subtests failed at the 20th percentile level which indicates a need for further evaluation.

A validation study reported in the test manual, which included 52 subjects, correlated the 6 subtests of the MST
with the auditory, visual, language, and quantitative skill areas of the group administered Metropolitan Readiness Test (MRT). As predicted, while significant relationships were found for several of the subtests, others showed no such significant relationship. Right-left orientation, for example, was only significantly related with the language skill area of the MRT ($r = .35, p < .05$) and leg coordination had no significant counterpart on the MRT, giving some indication that the MST measures some abilities apart from the MRT.

A good deal of research, discussed earlier, has supported the validity of the RIPIS as a measure of potential learning disabilities. Peck, Miller, and Lyle (1980) set out to further establish the concurrent validity of the MST, on which much less research has been done, by comparing results on it with results on the better validated instrument. Subjects were 60 kindergarten children, 30 of whom had earlier been judged by their teachers to be at risk of developing a learning disability, and 30 of whom were not so judged to be at risk.

A multiple regression analysis was performed with RIPIS total score as the dependent variable and the six subtests of the MST as the independent variables. A significant relationship was found between the two instruments ($r = .43, p < .05$) and 21% of the variance
in the RIPIS total scores was accounted for by the MST subtests. Thus, a relationship between the two instruments was established and the concurrent validity of the MST was supported.

No single MST subtest was found to make a statistically significant contribution to the RIPIS total score variance in the initial multiple regression analysis. A second multiple regression analysis was then performed using RIPIS total score again as the dependent variable and the MST subtest scores as independent variables as in the initial analysis. In the 2nd multiple regression, however, teachers' judgment of risk was added as an additional independent variable. The numerical memory subtest was then found to account for a significant (p < .05) proportion of the RIPIS total score variance. No other MST subtest was found to make a significant contribution to the RIPIS total scores after the effects of the numerical memory subtest were removed. In addition to the numerical memory subtest, and with the effects of all MST subtests removed, teacher's judgment of risk was also shown to be responsible for a significant part of the RIPIS total score variance.

Although the RIPIS and the MST are significantly related, as shown by the first regression analysis, 79%
of the variance in the RIPIS total scores was not accounted for by the MST subtests. In other words, the two tests are more different than they are alike. Teacher ratings also contribute to RIPIS total score variance indicating that these also play a part in accounting for RIPIS results.

The present analysis further investigated the relationship between the MST and the RIPIS in an effort to clarify the results of the Peck, Miller, and Lyle study. Although a significant relationship was found between RIPIS total scores and the scores on the MST subtests taken as a group, and the numerical memory subtest of the MST was shown to be significantly related to the RIPIS total scores in the previous analyses, no information was presented regarding the relationship, if any, between factor scores on the RIPIS and the subtests of the MST.

It was expected that several of the factor scores on the RIPIS and several of the subtests of the MST will be found to be significantly intercorrelated. This is particularly thought true of attention, memory for symbols for cognitive operations, memory for reproduction of symbols, sensory motor coordination, and memory for events on the RIPIS, and verbal memory, numerical memory,
draw-a-design, conceptual grouping, and leg coordination on the MST.

Attention is thought to play a particularly major role in the child's ability to memorize words and sentences, to hold items in short-term memory, and to deal logically with and classify objects. McCarthy (1978) has stated these three to be the assessment goals of the verbal memory, numerical memory and conceptual grouping subtests respectively. Memory for symbols for cognitive operations would also seem important in dealing logically with and classifying objects as is purported to be measured by the conceptual grouping MST subtest. Sensory motor coordination should logically be assessed by leg coordination and is also thought to play an important role in a child's ability to draw-a-design.

Teacher's subjective judgment of risk has been the method of choice in the past in referring kindergarten and early primary pupils for psychological evaluation. Peck, Miller and Lyle (1980) found that teacher's judgment of risk accounted for a significant portion of RIPIS total score variance after the effects of the MST were removed. The question of which factors of the MST are related to teacher's subjective judgment of risk was, however, not addressed in the previous study, nor was either
instrument's relationship with teacher subjective judgments analyzed by itself. This is another purpose of the present study, which seeks to determine from which of the factors of the RIPIS and from which of the subtests of the MST one can successfully predict teacher's subjective judgments of risk. This will help to further establish the concurrent validity of both instruments, as well as help understand how teachers make their judgments.

It is expected that attention, memory for events and directional or positional constancy on the RIPIS, and draw-a-design, numerical memory and conceptual grouping on the MST will be shown to be particularly predictive of teacher's judgment of "at risk" or "not at risk."

The areas purported to be measured by these factors/subtests are thought to be of considerable importance in determining a teacher's judgment of a pupil's potential success or failure in school. It is not expected that self-concept on the RIPIS or right-left orientation on the MST will be found to be particularly predictive of teacher's judgments of risk. Self concept is thought to be an area which might well be overlooked by a kindergarten or early primary teacher in making referrals for potential learning disability assessment, but which could
have a dramatic impact on future school success. Many children who have poor self concepts are quiet and withdrawn, cause little disturbance, and are often not noticed in a kindergarten classroom. A knowledge of right and left concepts is not thought to be important for success in typical kindergarten tasks, but of considerable importance for success in later grades.
METHOD

Subjects

The subject pool consisted of approximately 150 kindergarten children from 5 different classes. Each potential subject was judged by his or her teacher as "at risk" or "not at risk" of developing a learning disability. From this pool, 30 children were randomly selected who had been judged as "at risk" and 30 children randomly selected who were judged as "not at risk." The teachers used in this study had an average of 13 years teaching experience between them and no one teacher had less than five years of experience. The subjects selected ranged in age from 4 years 11 months to 6 years 1 month. The socioeconomic status of the children was from lower-middle to middle class. The schools were located in a small desert city and a suburban area just outside Los Angeles' San Fernando Valley.

Procedure

Following the selection of the 60 subjects, each subject was rated on the RIPIS by their own teacher. All 60 children were then individually given the MST by school psychology interns. The testing was completed during November and December of 1979. Various locations, outside the classroom, but within each school, were used.
for testing. Scoring of both screening devices was by procedures outlined in each instruments manual and was completed predominantly by a single school psychology intern during January and February, 1980.
RESULTS

To study the relationship between factor scores of the RIPIS and subtests of the MST, a canonical correlation analysis was performed between the set of RIPIS factor raw scores and the set of MST subtest raw scores using SPSS CANCORR (Nie, et al., 1975). The RIPIS set included all nine factor raw scores. These were body perception (RBODR), sensory motor coordination (RSMC), attention (RATTN), self concept (RSCNCPT), and memory for events (RMEMEVT) from part I of the RIPIS, and memory for reproduction of symbols (RMEMSYM), directional or positional constancy (RDIRCON), spatial and sequential arrangements of letters and symbols (RSPSEQ), and memory for symbols for cognitive operations (RMEMCOG) from part II of the RIPIS. The MST subtest set consisted of all six MST subtests: right-left orientation (MRL), verbal memory (MVERMEM), draw-a-design (MDAD), numerical memory (MNUMMEM), conceptual grouping (MCONGRP), and leg coordination (MLEGCORR). Increasingly higher RIPIS factor raw scores represent increasingly greater risk of a learning disability, while decreasingly lower RIPIS factor percentile scores mean the same thing. MST subtest scores are just the opposite of RIPIS factor raw scores, in that, the higher the MST subtest score, the lower is the
the presumed risk of a learning disability.

The assumptions of normality, linearity, and multicollinearity were examined and satisfied. No missing data were discovered, although 2 cases were identified as multivariate outliers at \( p < .01 \) and were excluded from the analysis.

The first and only significant canonical correlation between RIPIS factor raw scores and MST subtest scores was .76 (58% of variance). With all six canonical correlations included, \( \chi^2(54) = 94.88, p < .01 \). Subsequent \( \chi^2 \) tests were not significant. The first canonical correlation, therefore, accounts for all of the significant linkage between the two sets of scores.

Analysis of the first canonical variate that accompanied the first canonical correlation appears in Table 1. Shown in the table are correlations between the variables and the canonical variate, standardized canonical variate coefficients, within-set variance accounted for by the canonical variate (percent of variance), redundancy, and canonical correlation.

The hypothesis was partially supported. RMEMEV1 \( (r_c = -.54) \), and RMEMSYM \( (r_c = -.52) \) from the RIPIS, and MDAD \( (r_c = .73) \), MCONGRP \( (r_c = .62) \), and MLEGCORR \( (r_c = .45) \) from the MST, were shown to be highly related to the canonical
<table>
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<tr>
<th>RIPIS Factor</th>
<th>First Canonical Variate</th>
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<tr>
<td></td>
<td>Raw Scores Set</td>
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<tr>
<td>RBOD</td>
<td>-.51</td>
</tr>
<tr>
<td>RSMC</td>
<td>-.39</td>
</tr>
<tr>
<td>RATTN</td>
<td>-.19</td>
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<tr>
<td>RSCNCPT</td>
<td>-.46</td>
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<tr>
<td>RMEMEVT</td>
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<tr>
<td>RMEMSYM</td>
<td>-.52</td>
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<tr>
<td>RDIRCON</td>
<td>-.56</td>
</tr>
<tr>
<td>RSPSEQ</td>
<td>-.35</td>
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<tr>
<td>RMEMCOG</td>
<td>-.26</td>
</tr>
<tr>
<td></td>
<td>Percent of variance</td>
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<td></td>
<td>Redundancy</td>
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<table>
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<th>MST Subtest</th>
<th>Raw Scores Set</th>
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<tr>
<td>MRL</td>
<td>.12</td>
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<tr>
<td>MVERMEM</td>
<td>.03</td>
</tr>
<tr>
<td>MDAD</td>
<td>.73</td>
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<td>MNUMMEM</td>
<td>-.27</td>
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<tr>
<td>MCONGRP</td>
<td>.62</td>
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<td>MLEGCORR</td>
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<td></td>
<td>percent of variance</td>
</tr>
<tr>
<td></td>
<td>redundancy</td>
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<td></td>
<td>canonical correlation</td>
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</table>
variate. RSMC, RATTN, RMEMCOG, MVERMEM, and MNUMMEM were however, not found to be so related. RBOD ($r_c = -.51$). RSCNCPT ($r_c = -.46$) and RDIRCON ($r_c = -.56$), not originally thought to be an important part of the canonical variate, were found to be so.

The canonical variate of the RIPIS factor scores extracted 15\% of the variance of the MST subtest scores, while the canonical variate of the MST subtest scores extracted 13\% of the variance of the RIPIS factor scores. The two instruments have been shown to share a good deal of variance in common, but they appear to be more different than alike. Attention and cognitive memory, as construed in the RIPIS, are not strongly measured by the MST, nor are right-left orientation, verbal memory, or numerical memory, as construed in the MST, strongly measured by the RIPIS.

Two discriminant function analyses were performed. The first used RIPIS factor raw scores as predictors of teachers' subjective judgments of "at risk" and "not at risk." Predictor variables included eight of the nine RIPIS factors. The second, using a combination of hierarchical and stepwise discriminant function analysis, utilized MST subtest raw scores to predict members of the same two groups. Spatial and sequential arrangements of letters and symbols (RSPSEQ), from the RIPIS, was deleted
from the first discriminant function analysis as teachers made few responses on these items, which appear to measure areas that are not normally part of a kindergarten curriculum.

Of the original 60 cases, two were again identified as multivariate outliers with \( p < .01 \) and were deleted. No missing data were encountered. For the remaining 58 cases, evaluation assumptions of linearity, multivariate normality, and multicollinearity revealed no threat to the multivariate analysis.

One significant discriminant function was found on each of the 2 analyses. For the analysis using RIPIS factor raw scores as predictors, the direct discriminant function on RIPIS factor raw scores was found to be significant at beyond the .005 level. Forty percent of the variance in discriminating between teachers' judgments of "at risk" and "not at risk" was accounted for.

A loading matrix of correlations between predictor variables and the discriminant function, as seen in Table 2, shows that the primary variable in distinguishing between children judged as at risk and not at risk was memory for events \( (r_d = -.77) \). Memory for reproduction of symbols \( (r_d = -.60) \), body perception \( (r_d = -.53) \), sensory motor coordination \( (r_d = -.53) \), memory for symbols for
TABLE 2
RESULTS OF DISCRIMINANT FUNCTION ANALYSIS OF RIPIS FACTOR RAW SCORES

<table>
<thead>
<tr>
<th>Predictor Variable</th>
<th>Correlations of Variables with Function F(1,56)</th>
<th>Univariate</th>
<th>Intercorrelations among Predictors</th>
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<tr>
<td></td>
<td></td>
<td>RBOD</td>
<td>RSCHC RATTN RSCNCPT RMEMEVT RMEMSYM RDIRCON RMEMCOG</td>
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<tr>
<td>RBOD</td>
<td>-.53</td>
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<td>RSMC</td>
<td>-.53</td>
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<td>RATTN</td>
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<td>8.17**</td>
<td>.38 .41 1.00</td>
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<tr>
<td>RSCNCPT</td>
<td>-.27</td>
<td>3.29</td>
<td>.07 .08 .58 1.00</td>
</tr>
<tr>
<td>RMEMEVT</td>
<td>-.77</td>
<td>25.37**</td>
<td>.21 .67 .42 .23 1.00</td>
</tr>
<tr>
<td>RMEMSYM</td>
<td>-.60</td>
<td>16.21**</td>
<td>.25 .53 .55 .29 .56 1.00</td>
</tr>
<tr>
<td>RDIRCON</td>
<td>-.46</td>
<td>9.34**</td>
<td>.10 .50 .41 .34 .46 .61 1.00</td>
</tr>
<tr>
<td>RMEMCOG</td>
<td>-.51</td>
<td>12.03**</td>
<td>.15 .58 .34 .29 .73 .54 .52 1.00</td>
</tr>
<tr>
<td>Canonical</td>
<td>R</td>
<td>.64</td>
<td></td>
</tr>
</tbody>
</table>

** p .01
cognitive operations \(r_d = -0.51\), directional or positional constancy \(r_d = -0.46\), and attention \(r_d = -0.43\) all additionally aided in making the "at risk"/"not at risk" determination. The hypothesis has been supported in that all of the mentioned factor scores (RATTN, RMEMEVT, and RDIRCON) were found to significantly predict teacher judgments, however RBOD, RSMC, RMEMSYM and RMEMCOG also predicted teachers' judgments of risk. The only factor score not found to predict teacher judgments was, as hypothesized, self concept.

Using a jacknifed classification procedure for the total useable sample of 58 kindergarten children, 44 or 75.9% were classified correctly. Seventy-two and four tenths percent of the children originally judged by their teachers to be "at risk" were so classified, as were 79.3% of those pupils judged by their teachers to be "not at risk." Chance in all cases is equal to 50%, indicating a rather high agreement rate for the classification procedure.

In the second discriminant function analysis, utilizing the six subtests of the MST to predict teachers' judgments of risk, again only one significant discriminant function was found \((R = .647, p < .001)\), explaining 42% of the variance in teachers' judgments of "at risk"
TABLE 3
RESULTS OF DISCRIMINANT FUNCTION ANALYSIS OF MST SUBTEST SCORES

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Correlations of Variables with Univariate Function F(1,56)</th>
<th>Intercorrelations among Predictors</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>-</td>
<td>.67</td>
<td>1.00</td>
</tr>
<tr>
<td>MRL</td>
<td>-</td>
<td>.28</td>
<td>-0.05</td>
</tr>
<tr>
<td>MVERMEM</td>
<td>-0.39</td>
<td>8.67**</td>
<td>0</td>
</tr>
<tr>
<td>MDAD</td>
<td>0.52</td>
<td>14.92**</td>
<td>0.20</td>
</tr>
<tr>
<td>MNUMMEM</td>
<td>0.50</td>
<td>17.34**</td>
<td>-0.13</td>
</tr>
<tr>
<td>MCONGRP</td>
<td>-</td>
<td>10.42**</td>
<td>-0.05</td>
</tr>
<tr>
<td>MLEGCORR</td>
<td>-0.34</td>
<td>10.87**</td>
<td>0.37</td>
</tr>
</tbody>
</table>

Canonical R = 0.65

**p < .01
and "not at risk."

Age, hierarchically entered first into the otherwise stepwise procedure, was shown to be not significant.

An inspection of the loading matrix shows that draw-a-design (rd=−.52) and numerical memory (rd=−.50) are the primary predictor variables in distinguishing among groups. Conceptual grouping, originally believed to be a strong predictor of teacher judgments, was not found to be so.

Univariate F's for both of the primary predictors were found to be significant at beyond the .01 level, however, so were all of the other subtests shown to be significant with the exception of right-left orientation. This points up a problem common to all stepwise discriminant analyses, in that, where intercorrelations among variables are strong, only those variables with the strongest correlations with the groups being predicted may be allowed to enter the discriminant function even though the other variable(s) may also be strongly related to the predicted groups (Tabachnick & Fidell, 1980).

An inspection of the intercorrelations among MST subtests, as shown in Table 3, shows that conceptual grouping, which did not enter the discriminant function, but which was found to be significant when considered
individually is intercorrelated with both draw-a-design 
(r = .22) and numerical memory (r = .29), which were allowed 
to enter the function. By the time that conceptual 
grouping was evaluated for entry into the discriminant 
function, a good deal of its shared variance with the 
predicted groups was already taken by the other two 
variables.

Right-left orientation was found to be related to 
numerical memory (r = .21), but its relationships with 
the other four variables was effectively zero. This, and 
the fact that right-left orientation was not found to be 
significantly related to teacher's judgment of risk 
when considered by itself, indicates that, as 
hypothesized, it is of little importance in predicting 
kindergarten teacher's judgment of risk.

A jacknifed classification procedure indicated that 
little predictive value was lost by the deletion of 
conceptual grouping from the discriminant function. 
A percentage of 86.2 of the 58 cases (chance is 50%) were 
correctly classified using the classification procedure. 
A percentage of 93.1 of those pupils judged to be "not at 
risk" were so identified, as were 79.3% of those judged 
to be "at risk."
DISCUSSION

The significant canonical variate between the nine factor scores of the RIPIS and the six subtests of the MST lends additional support to the concurrent validity of the latter instrument. Fifty-eight percent of the variance of the RIPIS and the MST was explained by the canonical variate between them. An inspection of the canonical loading matrix revealed that the bulk of the relationship between the RIPIS and the MST was accounted for by body perception, self concept, memory for events, memory for the reproduction of symbols, and directional or positional constancy on the RIPIS and draw-a-design and conceptual grouping on the MST.

An examination of the structure of these particular RIPIS factors and MST subtests, indicates that the two tests share a strong spatial perception orientation. This is particularly pointed out by body perception, or the sense of position in space, and directional or positional constancy on the RIPIS, and draw-a-design, conceptual grouping, and leg coordination on the MST. The draw-a-design subtest requires an examinee to copy designs drawn previously by the examiner. Conceptual grouping requires a child to discriminate between large and small, and round and square through the manipulation
of different shaped pieces of wood. Leg coordination necessitates a number of leg movements, such as walking backwards, standing on one foot, and skipping. Examples of body perception items from the RIPIS include: "bumps into objects," and "trips over self." "Starts writing in the middle of the paper" and "mirrors/reverses letters, numbers in copying" are examples of directional or positional constancy items (Novack, Bonaventure, & Merenda, 1979, p. 34).

An examination of the correlation matrix, from which the loading matrix was derived, shows the above mentioned RIPIS factors and MST subtests to be intercorrelated. A strong (r=.68) relationship was found between the RIPIS factors; memory for reproduction of symbols and directional or positional constancy. Draw-a-design and conceptual grouping (r=.36), and draw-a-design and leg coordination (r=.31) were also found to be related.

A somewhat weaker component of the canonical variate between the RIPIS and the MST appears to be memory. Memory for events had the 2nd highest loading for the RIPIS on the canonical variate (r_c=-.54). Memory for reproduction of symbols was also strongly loaded (r=-.52). Conceptual grouping on the MST (r=.62) contains a strong memory component also, as examinees are required to remember rather complex instructions in order to
successfully manipulate the objects on this subtest.

Little interpretation can be made from the comparatively high ($r=-.46$) loading of self concept on the canonical variate except that it would seem to have a fairly strong influence on MST test performance.

A number of differences between the two screening devices were pointed out. Attention on the RIPIS had a canonical loading of only .19, numerical memory on the MST actually had a negative loading, and right-left orientation and verbal memory had canonical loadings that were effectively zero.

The canonical correlation analysis only enumerated the factors of the RIPIS and the subtests of the MST that are and are not related. Whether either of these groups of factors and subtests are related to learning disabilities can only be adequately assessed by longitudinal research comparing subtest and/or factor scores with later diagnosis (or non-diagnosis) of a learning disability. Previous concurrent and predictive validity studies on the RIPIS as a whole, and previous concurrent validity studies on the MST, as well as the current analysis, strike an encouraging note.

A further hint at the validity of the subtests of the MST and the factors of the RIPIS has been given by the discriminant function analysis between each of these
screening instruments and teacher's subjective judgment of risk.

The discriminant function, using 8 of the 9 RIPIS factor raw scores as predictors, accounted for 40% of the variance in discriminating "at risk" and "not at risk" as judged by the subject's teachers. Overall, 76% of the subjects identified by their teachers as "at risk" or "not at risk" were correctly identified using a jacknifed classification procedure derived from the discriminant function, which used RIPIS factor scores as predictors. Seventy-two percent of those pupils judged as "at risk" by their teachers were identified by the classification procedure as were 79% of those pupils judged as "not at risk" correctly identified.

The MST performed somewhat better than the RIPIS in predicting teacher's risk judgments. Overall, 86% of teacher's risk judgments of "at risk" and "not at risk" were correctly predicted using four of the six subtests of the MST as predictors. Ninety-three percent of the children judged as "not at risk" and 79% of those children judged as "at risk" were predicted correctly using the classification procedure. The superior prediction rate of the MST, particularly as to those children judged as "not at risk" by their teachers, came as somewhat of a surprise considering that the RIPIS was filled-out
by the same teachers doing the judging, and that, in the words of the scale's authors, it is based on "classroom behavior." The MST, in contrast, was administered by school psychology interns, and was derived from a psychological test.

When the results of both the RIPIS and MST discriminant function analyses are examined, it seems that teachers consider memory of great importance in making judgments of risk. All 3 of the factors of the RIPIS which purport to measure memory were strongly loaded on the discriminant function. Two of the three, memory for events and memory for symbols for cognitive operations had the highest loadings of all on the RIPIS discriminant function. Both numerical memory and verbal memory were fairly strongly loaded on the MST discriminant function.

Spatial perception also seems important to teachers. Body perception, sensory motor coordination, and directional or positional constancy were loaded on the RIPIS discriminant function as were draw-a-design and leg coordination on the MST function. The spatial perception component in teachers' judgments does not, however, seem to include right-left orientation, which had an effectively zero loading on the MST discriminant function. Self concept, as measured on the RIPIS, was also not considered to be particularly important to teachers.
It appears that what teachers see to be important in predicting future learning disabilities agrees fairly well with what the RIPIS and the MST share in common, that is, spatial perception and memory. Memory, however, seems somewhat stronger as a determinant of teachers' ratings than as a shared component of the two screening instruments.

Teachers seem to feel that some areas are important that are measured more strongly by one screening device than the other. Sensory motor coordination, for example, was more strongly loaded on the RIPIS discriminant function predicting teachers' ratings \( (r=-.53) \) than it was on the canonical variate between the RIPIS and the MST \( (r=-.39) \), as was memory for symbols for cognitive operations \( (r=-.51 \text{ on the discriminant function and } r=-.26 \text{ on the canonical variate}) \).

As mentioned earlier, a good screening instrument should contribute something in addition to predicting teachers' risk judgments. This appears to be the case with both screening devices. Self concept, for example, is a component of both the RIPIS, where it is specifically measured, and the MST, where it is not, but it does not seem to play a major role in teachers' judgments of risk. Right-left orientation, as purported to be measured by the MST, was not strongly tapped by the RIPIS, nor was it
related to teacher judgments of risk.

By using classification methods derived from the discriminant functions for the MST and the RIPIS, a high degree of accuracy was achieved in predicting teachers' risk judgments. This was particularly true of the MST where 86.2% of the cases (chance is 50%) were correctly classified using the classification procedures. However, even considering the high prediction rates, only 40% of the shared variance between the RIPIS factors and teachers' judgments of risk was accounted for by the discriminant functions. This means that 60% of the shared variance was, in both cases, not accounted for.

Although accurate in predicting teachers' judgments of risk, that both instruments are measuring something besides teacher's judgments is clear. Whether that something is important in predicting future learning disabilities is a question that can only be answered by longitudinal research comparing both screening devices with later pupil placement in a learning disabilities program. A future analysis should include sex as a variable as boys, in the past, have been diagnosed as learning disabled much more frequently than have girls. Additionally, such research should examine those cases where teacher referrals (or non-referrals) for learning disabilities evaluation are in opposition to RIPIS and/or
MST risk predictions. This type of analysis would help in constructing a clearer picture of where differences between teacher's judgments and RIPIS and/or MST risk predictions lie.

At this point in time, in view of its superior performance as a predictor of kindergarten teacher's risk judgments, the MST is the recommended screening device. It should be administered at the beginning of the kindergarten year. Children who are identified by the test as "at risk" could begin psychological assessment and remediation, if needed, much earlier than if they had to wait for their teachers to gain enough information about them to make a referral.

In conclusion, the concurrent validity of the MST has been supported both in comparison with the RIPIS and with teacher's judgment of risk. Concurrent validity of the RIPIS was established using the latter criteria, although, surprisingly, the MST was the better predictor of teacher risk judgments. This was especially true of those pupils judged by their teachers as "not at risk." What is needed now is longitudinal research evaluating the predictive validity of both screening instruments. Such research is particularly important for the MST where evidence of predictive validity is completely lacking.
REFERENCES


Spalding, N.V. & Geiser, M.C. Teacher testing with the QNST. Academic Therapy. 1978, 13, 313-321.


