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Full Name of Author · Nom complet de l'auteur

Genia Weerdenburg

Date of Birth · Date de naissance

Mar. 28 /53

Country of Birth · Lieu de naissance

Canada

Permanent Address · Résidence fixe

466-51112 Rge. Rd. 222
Sherwood Park, Alta.
T8C 1G9

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Dr. H.L. Janzen

Date

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Signature

[signature]

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PREDICTING GRADE ONE SUCCESS WITH A SELECTED KINDERGARTEN SCREENING BATTERY

by

GENIA WEERDENBURG

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

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NAME OF AUTHOR: Genia Weerdenburg

TITLE OF THESIS: Predicting Grade One Success with a Selected Kindergarten Screening Battery

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YEAR THIS DEGREE WAS GRANTED: Fall 1983

(Signed) Genia Weerdenburg ....

PERMANENT ADDRESS: 466 Hillside Park

51112 Range Road 222

Sherwood Park, Alberta

T8C 1G9

DATED: May 9, 1983

THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled 'PREDICTING GRADE ONE SUCCESS WITH A SELECTED KINDERGARTEN SCREENING BATTERY' submitted by Genia Weerdenburg, in partial fulfilment of the requirements for the degree of Master of Education.

....
Supervisor

....

....

DATE: May 9, 1983

ABSTRACT

The purpose of this investigation was to identify the best combination of tests or subtests in a psychoeducational screening battery, which would predict kindergarten children's grade one achievement. The subjects were 85 kindergarten children (48 males and 37 females), with a mean age of 70.2 months. The predictor variables in the test battery were: Pupil Rating Scale (PRS), Test of Visual Motor Integration (VMI), Visual Aural Digit Span Test (VADS), Human Figure Drawing (HFD), Evanston Early Identification Scale (EEIS), Bender Gestalt Test (Bender), and a 'global' Teacher Rating in Kindergarten (TRK). The criterion measures were: Reading (report card mark), Mathematics (report card mark), a 'global' Teacher Rating in Grade One (TR1) and the Metropolitan Readiness Test (MRT).

Correlation and stepwise regression analysis were selected as the statistical methods for analyzing the data. The results indicated that (a) different subsets of the predictor variables best predicted each of the criterion measures; (b) the Total VADS score is the most contributory variable for the Reading report card mark; (c) the 'global' Teacher Rating in kindergarten is effective in predicting academic readiness; (d) the VMI is contributory to measuring academic readiness; (e) the Bender did not contribute a significant amount to the prediction of academic readiness; (f) the PRS Verbal score can be utilized with a kindergarten population; (g) the human figure drawings

have little predictive significance in a screening battery; (h) grade one teachers 'global' rating of the girls academic readiness tended to agree with the kindergarten teacher's rating of academic readiness; (i) the PRS Verbal scale was important in predicting the MRT Language criterion for boys while the VMI significantly predicted the MRT Language criterion for girls; and (j) the VMI was important in predicting the MRT Visual criterion for boys, while the Total VADS was useful in predicting the MRT Visual criterion for girls.

Findings of this study are in general agreement with previous similar studies. Suggestions for further research were made.

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TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

TABLE OF CONTENTS (continued)

LIST OF TABLES

LIST OF TABLES (continued)

LIST OF FIGURES

CHAPTER I

INTRODUCTION

The importance of the early identification of kindergarten children who are not ready to meet the academic demands of grade one has received much attention in the past decade. The major force for this trend has been provided by the desire for educators to be involved in "preventative" rather than "remediative" action (Telegdy, 1974).

Slingerland (1969) stated that:

> "Early screening can identify children who require special placement and it can guide educators in providing the correct initial learning experience ..." (p. 248)

Similarly, Abrahamson and Bell (1979) stated that:

> "Early screening of school children with a view to appropriate placement of a program has of late, become a major preoccupation and school personnel are often faced with the problem of testing large numbers of children prior to school entry. It is necessary therefore, that a chosen test be (a) economical of the time of the examiners, (b) objective so that it may be administered by individuals with little prior training in testing, and (c) be equally effective in all school situations" (p.163)

Lipson (1981) stated that "school districts have been hard pressed to develop an efficient screening battery for the relatively short attention span of [children at the kindergarten level]". (p. 457) Telegdy (1974), Rouse (1981), Meisels (1978), Anderson, Griffin and Hunt (1978) indicated that the procedure of screening is useful since that data can be used to ask for professional involvement in the form of further in-depth individual assessment, to assist the teacher to determine what types of remedial programing or learning experiences are needed by different children and as guides to homogeneous grouping for varied instruction. Reinharz and Griffin (1977) also supported the early identification of children with learning difficulties before academic and emotional adjustment escalate and/or become firmly entrenched. Bannatyne (1971) stressed that there is much to be gained if detection and remediation takes place between the ages of four and eight - the earlier the better. Bannatyne also emphasized that it is more economical to identify children and teach them correctly in the first grade. However, even though it is agreed that early detection of learning problems is important, there is disagreement as to the best test(s) to detect these problems at an early age. Durkin (1966) appealed to educators to use every available means to evaluate readiness for academic tasks such as reading and writing, including the use of standardized readiness tests. Swanson and Payne (1981) stressed that the selection of appropriate screening devices can be considered as a keystone in the development of an identification - remediation program.

Blair and Jones (1960) observed that any test which appraises a child's capacities, achievements and attitudes provides some basis for estimating or predicting growth and achievement in the areas measured. Gallerani, O'Regan and Reinharz (1982) indicated that less emphasis should be given to collecting historical screening data. Also, since the appearance of criticisms of literature dealing with single variable studies of school readiness, (Bell and Aftanas, 1972; Hopkins and Sitkei, 1969; Robinson and Schwartz, 1973), multiple variable research has become much more common, (Kulberg and Gershman, 1973; Wallbrown, Wallbrown and Engin, 1974). For example, de Hirsch, Jansky and Langford (1966) combined the results of thirteen kindergarten tests (from an original thirty seven) into a predictive index that identified, at kindergarten age, the majority of children who failed at the end of their second year of school. The tests included represented measures of auditory/visual discrimination, language development, visual-motor integrative function, visual-auditory and visual kinesthetic memory. Satz and Friel (1974) developed a screening battery and reported successful classification of over 90% of both "high" and "low" risk students at the end of second grade. Eaves, Kendall and Chrichton (1974) reported a correlation of .95 ($p<.05$) with reading, listening and work analysis performance when they utilized a combination of the de Hirsch et al. battery, a teacher checklist and psychological assessments. It becomes apparent that single variable studies may be ineffective in detecting learning difficulties and, according to Belka and Williams (1979) the efficiency of prediction may be related to the integration abilities rather than be related to the integration of abilities rather than to specific, perhaps isolated skills.

From previous research, a need for an appropriate kindergarten screening device exists (Durkin, 1966; Swanson and Payne, 1981) however, there has been disagreement as to the best test(s) to use in such a screening device. Therefore, the main objective of this investigation is to combine the best predictors of tests into a screening battery that could be used effectively to identify children in kindergarten likely to experience academic difficulties in grade one. Once these kindergarten children have been identified, appropriate diagnostic and intervention programing could be initiated early in the first grade.

CHAPTER II

LITERATURE REVIEW

This chapter has been divided into five broad sections - academic predictions based on (a) rating scales; (b) readiness assessment; (c) visual-motor perception; (d) human figure drawings; and (e) auditory and visual integration.

Rating Scales

Many educators have felt that teacher evaluations of pupils in kindergarten are as good as, if not better than standardized test results in the placement of children or predicting their success in first grade.

Doherty and Margolis (1981) administered the Myklebust Pupil Rating Scale (PRS), the Short Form Test of Academic Aptitude IQ (SFTAA) and the Metropolitan Achievement Test (MAT) in March of grade two (N=98). Stepwise multiple regression analysis indicated that the PRS was significantly associated with reading and mathematics achievement. However, combining the SFTAA IQ's and the total PRS did not substantially increase predictive power. The addition of the IQ scores raised the multiple R (between the Total PRS and Total Reading from .70 ($p<.001$) to .71 ($p<.001$) while Total Math remained at .73 ($p<.001$). Mykelbust's PRS cutoff point for suspecting learning disabilities (Total PRS = 66) was very accurate in identifying children with mathematics difficulties and moderately accurate in identifying children with reading difficulties.

In a study conducted by Federici, Sims and Bashian (1976) the Pearson product moment correlation between the Meeting Street School Screening Test (MSSST) and the PRS for the high-risk and low-risk samples combined, was significant at .69 ($p<.01$). The correlation between the two scales for the low-risk sample was .52 ($p<.01$), and for the high-risk sample it was .39 ($p<.05$). The results suggested that the Myklebust PRS did discriminate between high-risk and low-risk children within the minority group, and that ratings for the high-risk and low-risk minority approximated ratings for white suburban samples.

Colligen (1979) stated that

> "numerous teacher checklists and screening devices available for [identifying] children who are likely to have difficulty mastering school tasks... are of doubtful reliability and validity because of restricted samples, weak criterion measures, lack of cross-validation or other faults". (p. 59)

However, Colligen continues that the PRS is one well-developed checklist for teacher use. Bryan and McGrady (1972) also support the use of the PRS as an efficient, economical and reliable method for screening children in the elementary schools.

Myklebust (1971) reported that the PRS significantly discriminated among three groups of children, representing varying degrees of learning difficulty with 2,176 third and fourth grade students. However, its use with a kindergarten population was not reported. Colligen (1979) suggested that persons developing screening batteries should consider using the PRS as a predictive instrument for screening children in kindergarten or primary grades.

Colligen (1977) had kindergarten teachers complete the PRS (N=67) and correlations (ranging from .63 to .77, $p < .001$) were found between the PRS and criteria measures (Lippincot Reading Readiness Test, Metropolitan Readiness Test and Wide Range Achievement Test - Level I) administered at the end of the kindergarten year. In order to assess the utility of the PRS, the Stanford Achievement Test was administered (N=55) with the sample group at the end of grade two. Correlational analysis yielded highly significant results with all correlations between the PRS scores and criteria measures (ranging from .53 to .72, $p<.001$). Consistent with Myklebust's (1971) findings, Auditory Comprehension was most highly correlated with the measures of reading capability (.72). The PRS scale measuring Spoken Language had the second highest degree of association with the criterion measure in reading (.62). The Spoken Language subtest had the greatest association with arithmetic computational ability (.71) and the Auditory Comprehension subtest was the second highest (.67). These correlations follow Myklebust's observations regarding the importance of auditory skills in academic learning. Similarily, Reeves and Perkins (1976) found that the Auditory Comprehension scale was most crucial in differentiating a learning disabled population.

Proger (1973) considered that the

> "major advantage of the PRS is its mode of administration ... there is also something to say in favor of indirect observation, it does not cue a child as to what is happening and test-communication factors such as sensitization are not critical in teacher rating scales". (p.317)

Proger also indicated that the PRS can serve as a meaningful screening device. The use of teacher assessments, through a structured checklist, is emerging as one of the most promising methods of early identification of children educationally at risk (Feshbach, Adelman and Fuller, 1974; Evans, 1977). The use of the teacher checklist permits a wide range of social, behavioral, cognitive and motor factors to be readily combined and assessed.

The literature dealing with teacher grades as accurate predictors of academic achievement are limited. Proger (1973), an opponent of teacher grades, inferred that grades concentrate on alleged weaknesses of subjectivism, favoritism, halo effects and ill-defined domains of behavior. Similarly, de Hirsch (1966) stated that

> "the individual kindergarten teacher's assessment of the child ... often represents an essentially subjective judgement ... moreover, not all teachers possess the training, intuition or experience that would enable them to make a reliable evaluation of a child's readiness". (p. 3)

However, teachers rely on classroom observations as a means of assessing pupil performance. Close scrutiny of the child's performance in a variety of situations such as listening to a student speak and read, written assignments, and observing student's problem solving ability or behavior can reveal aspects of the pupil's learning.

Kirk (1966), in an effort to develop a screening device for selecting bright and slow kindergarten children, hypothesized that teachers can make an accurate estimate of a kindergarten child's overall mental ability. Three groups of kindergarten teachers were asked to rate their children (N=112) on a five point scale in nine areas of ability (reasoning, speed of learning, ability to deal with abstract ideas, perceptual discrimination, psychomotor abilities, verbal comprehension, verbal expression, number and space relations, and creativity) with guidelines delineating types of situations. They were also asked to give a molar estimate as to whether the child would be a slow learner, a rapid learner or an average learner. Concurrent validity was calculated using the Stanford-Binet IQ as the criterion measure. Results indicated that correlations of IQ with teachers' molor estimate ranged from .41 to .52, ($p<.05$). The composite score (nine areas of ability) correlated .54 to .59, which provided a slightly more accurate judgement of a child's rate of intellectual development than did the teachers' molor estimate. As a result, when teachers were asked to rate the children in nine separate areas, their composite scores were better indicators of mental age than were their molar estimates.

Glazzard, Tollefson, Selders and Barke (1982) suggested that rating scales and standardized tests afford alternative approaches to identifying students who may experience learning difficulties in the first grade. Teacher evaluations using rating scales have been regarded as good predictors of academic achievement in grade one. Since teachers have the closest, most continuous relationship with the child of anyone in the school program, they would be in a position to know educationally at-risk children.

Keogh, Tchir and Windeguth-Behn (1974) emphasized the teachers key role in identifying high-risk children. They stated that early recognition of children with potential school learning problems place additional responsibility on classroom teachers in the kindergarten and primary grades, since teachers have been asked to identify problems before they become well-developed. Keogh and Becker (1973) interviewed fifty-eight kindergarten and primary grade teachers to determine their perceptions of children's behavior indicative of being educationally at high risk. Keogh and Becker indicated that teachers observations may provide insight into children's learning styles, problem solving strategies and behaviors which facilitate or interfere with success in school tasks. They also stated that this data would be useful in remedial planning rather than relying on psychometrically designed scores which serve to classify, and not explain school failure.

Ebbesen (1968) investigated the correlation between the kindergarten teachers' ranking of pupils (at the end of the year) and the pupil's actual academic achievement in the primary grades with 150 kindergarten children. The Metropolitan Achievement Test Primary I was used to indicate relative academic achievement in each of grades one, two and three. The criteria for ranking was not included in the study and it became necessary for the kindergarten teachers to rely entirely on their experiences with the children. Pearson product moment coefficients indicated that correlations between the kindergarten teacher ranking and academic achievement in grades one, two and three, respectively was .60, .54, and .52 ($p<.05$). Results indicated (a) high replicability from year to year; (b) that teacher education, professional experience and interests would have a great influence on how well the kindergarten teacher comes to know the children; and (c) predictions were useful in providing for the educational needs of pupils in the primary grades.

Ferinden, Jacobson and Linden (1970) compiled a test battery which would be valid in diagnosing potential learning disabilities at the kindergarten level. Teachers were requested to choose their students whom they believed to be high risk in the probability of developing learning problems and also to select those students whom they believed would be most capable of performing at the first grade level. A total of 67 children were studied by a school psychologist and learning disability specialists who administered a battery of tests and made clinical judgements. A total of 45 children were diagnosed as suspected potential learning problems. The subjects were tested again after exposure to grade one with the Wide Range Achievement Test (WRAT), the Evanston Early Identification Scale (EEIS), the Bender Gestalt Test (Bender) and the Metropolitan Readiness Test (MRT). The results indicated that experienced kindergarten teachers could select, with accuracy, their children who will experience difficulty at the first grade level, since the teacher-referred group scored well below the readiness level of the non-referred group on all test instruments. In conclusion, individual behavior analysis done by the teachers was effective 80% of the time. The authors also suggested that the WRAT and the EEIS could be taught to kindergarten teachers, obtaining almost 90% accuracy in prediction.

Stevenson, Parker, Wilkinson, Hegion and Fish (1976) assessed the relation of teachers' ratings of young children's abilities, classroom skills and personal-social characteristics, to achievement in school.

Teacher ratings of 146 children were obtained in the fall and spring of the kindergarten year and again in the second and third grades. The sum of four ratings (Effective Learning, Retaining Information, Vocabularly and Following Instructions) predicted achievement, nearly as well as using an additional five ratings (Handwriting, Reflective Thinking, Comprehending Discussions, Attention and Social Acceptance). Agreement over the two or three year period was highest for cognitive abilities such as learning and memory ($r=.50$ to $.83$, $p<.05$). The most important outcome of the study is the support given to the credibility of teacher evaluations. The ratings were stable and offered a valid means of predicting early scholastic progress. After only three months of observation and interaction in kindergarten, the teachers were able to make ratings that were predictive of how well the children would be doing in school over forty months later. After nine months of kindergarten, teachers' evaluations of the children were even more highly related to later performance. Therefore, teacher's perceptions seemed to accurately reflect the children's abilities.

Serwer, Shapiro and Shapiro (1972) examined the feasibility of identifying possible learning problems on the basis of teachers' ratings and comprehensive test batteries. Four different kinds of measures were used to predict first grade achievement (a) teacher ratings on 10 dimensions (gross motor clumsiness, hyperactivity, difficulty in space perception, speech disorders, language deficiency, dysrhythmia, fine motor incoordination, visual symbolic difficulty,

difficulty with numerical concepts, and poor peer relationship); (b) readiness and learning aptitude tests; (c) perceptual and motor tests; and (d) intelligence tests with the Metropolitan Achievement Test (MAT) as the criterion variable. The authors indicated that teachers' ratings were better predictors of first grade achievement than standardized test measures. Since the kindergarten (not first grade teachers) completed the rating, there was probably no 'pygmalion' effect (ie. self-fulfilling prophecy). The best predictors of the standardized tests were (a) all the number subtests, (b) the Metropolitan Readiness Test Composite rating, and (c) knowledge of letter names. Specifically, four of the test instruments proved to be non-predictive in terms of future learning in this group of 'high-risk' children - (a) Primary Mental Abilities - Verbal subtest, (b) Goodenough Harris Drawing Test, (c) Illinois Test of Pshycholinguistic Abilities, and (d) the Wepman Auditory Discrimination Test.

Margolis et al. (1981) revealed that the PRS does not accurately detect first (N=92) and second (N=130) grade children exhibiting learning difficulties. The PRS was completed by the teachers and the Cooperative Primary Tests were administered in May of the same academic year to assess academic achievement. Margolis et al., reported the correlation coefficients for the first grade (.68, p<.001) for word analysis; (.59, p<.001) for arithmetic; and (.50, p<.001) for reading and that only 17%, 6% and 17% (respectively) of the suspected learning disabled children were correctly identified using the Myklebust cut off point (Total PRS = 66). However, grade two results revealed moderate correlations (.56, $p<.001$) for word analysis; (.53, $p<.001$) for arithmetic and (.62, $p<.001$) for reading and tended to correctly identify 27%, 39% and 33% (respectively) of the children with reading and mathematics difficulties. Margolis et al. suggested that one rating scale cannot accurately predict learning disabilities by itself, but recommended that the PRS be used in a multiple regression equation with factors orthogonal to it but highly related to academic achievement.

In summary, the PRS is indicative of a stable behavioral rating instrument that is associated with reading and mathematics achievement (Doherty and Margolis, 1981). However, its employment with a kindergarten or primary population seems warranted (Colligen, 1979). Also, teachers' ratings on a 'global' or structured scale, have been reported as being excellent indicators of potential learning difficulties. (Ferinden, Jacobson and Linden, 1976; Stevenson et al., 1976; Serwer, Shapiro and Shapiro, 1972).

Readiness Assessment

In previous literature, the definition of what may constitute the term 'readiness' has been uncertain. For example, Bruner (1960) indicated that "the foundations of any subject may be taught to anyone at any age in some form ..." (p. 7), which infers that the degree of readiness is always present. In another position, Ames and Ilg (1978) believed that learning can take place only as the child reaches an appropriate level of maturation, a matter of inner forces rather than of external stimulation. Bruner would suggest that the school adapt appropriate instructional techniques so that the child may benefit from instruction. However, Ames and Ilg would advocate postponement of instruction until the child matures and is able to handle the concepts taught (Gredler, 1980). The issue of defining 'readiness' becomes apparent, since a comparison of studies of assessment techniques that deal with readiness reveals no agreed-upon definition of terms. For example, some studies indicate that cognitive skills, perceptual-motor tasks, emotional/social factors and language, taken singly or in combination, consitute 'readiness'. However kindergarten teachers may be concerned with factors such as motor control, attention span, speech and language, social maturity or even activity level. The term 'readiness' has a connotation so general that it has become difficult to ascertain which kinds or degrees of readiness are related to school success. The need for clarification is apparent, (Tyler, 1964) and is beyond the scope of this paper. For definition purposes of the present paper however, readiness will be generally regarded as involving cognitive, social, emotional and motor skills or tasks.

Mitchell (1962) suggested that

"readiness tests would appear to be a useful instrument in determining the degree of readiness for first-grade learning. The results may serve (a) as guides in homogeneous grouping for differentiated instruction, and (b) as suggestive of the types of readiness development needed by various pupil groups." (p.772)

Severson (1972) used a battery of tests to determine those children who would have difficulty in school. Severson's primary criterion measure was the Stanford Achievement Test (SAT). Results indicated that the Metropolitan Readiness Test (MRT) correlated between .65 and .70, ($p<.05$) throughout most of the studies with achievement. The Bender Gestalt Test (Bender) correlated around .19 with achievement. And the Wepman Auditory Discrimination Test was abandoned early because of extremely low correlations (.18).

Lessler and Bridges (1973) studied the problem of the early prediction of learning problems in a low socioeconomic rural school district. They investigated the predictive effectiveness of a number of tests, both singly and in combination. Group administered tests (the MRT, the Lee-Clark Reading Readiness Test (LC) and a group intelligence test, the California Test of Mental Maturity (CTMM), were given to all children (N=293) early in the first grade. The individually administered tests included the Peabody Picture Vocabulary

Test (PPVT), the Bender Gestalt Test (Bender) and the Bean Bucket Game (BB), (a measure of social maturity). The performance measures included the California Achievement Test (CAT) and Teacher Rating (TR) of overall performance, both administered in Spring of grade one and two. Correlations between the predictors and criterion variables of first grade performance indicated that the MRT was the best single predictor of the combined criterion of first grade performance as shown in TABLE I.

TABLE I

First Order and Multiple Correlations

Between Predictors and Criterion of

First Grade Performance.

PREDICTORS*	r (N=101)	PERCENT VARIANCE Accounted for by r
Analysis I		
Met alone	.74	55
Met, BB	.76	58
Met, BB, PPVT	.77	59
Met, BB, PPVT, Bender	.77	59
Analysis II		
LC alone	.65	42
LC, BB	.70	49
LC, BB, PPVT	.73	53
LC, BB, PPVT, Bender	.73	53
Analysis III		
CTMM alone	.56	31
CTMM, BB	.66	44
CTMM, BB, PPVT	.69	48
CTMM, BB, PPVT, Bender	.70	49

* In order of their contribution to the regression equation.

(p.92)

In a study comparing kindergarten teacher ratings of pupils with the results obtained from the MRT, Bolig and Fletcher (1973) considered that if teachers could predict achievement as well as, or better than the MRT, then administration of this test would not be necessary. Each kindergarten teacher rated the children on each of the six skills measured by the subtests of the MRT (verbal concepts, visual perception, listening, alphabet, numbers and copying) prior to the administration of the MRT. A scale of 1-5 was used for each rating. For example, each statement carried a description of the subtest and the rating:

1 - Almost never

2 - Seldom

3 - Sometimes

4 - Frequently

5 - Almost always

The first grade teacher followed similar instructions one year later when they tested the children on skills measured by the Stanford Achievement Test (SAT) (word reading, paragraph meaning, vocabulary, word study skills, spelling and arithmetic). The coefficients of correlations are shown in TABLE 2.

TABLE 2

Correlation Matrix: Coefficients of Correlation for the MRT, Kindergarten Ratings, the SAT, and First Grade Ratings by Sex and for the Total Sample

		KINDERGARTEN RATINGS	SAT SCORES	FIRST GRADE RATINGS
MRT Scores	Girls	.72	.75	.64
	Boys	.72	.68	.51
	Total	.76	.73	.58
Kindergarten Ratings	Girls		.66	.62
	Boys		.51	.47
	Total		.61	.55
SAT Scores	Girls			.76
	Boys			.72
	Total			.74

(p.639)

The results indicated that the MRT is more highly related with first grade success on either criterion variable than are the ratings of kindergarten teachers. The use of the MRT score as a predictor of first grade success may be preferable for either sex, but is more preferable for boys. The differences between ratings for boys and girls seem to indicate a teacher bias favoring girls.

Maitland, Nadeau and Nadeau (1974) studied early school screening practices, the specific tests employed, and the use made of the test results. Results indicated that the MRT was the most commonly used test as an effective predictor of early school achievement (Lessler and Bridges, 1973; Severson, 1972). Maitland et al. also maintained that

> "school districts and teachers would derive maximum benefit from the MRT by administering it at the beginning of first grade rather than at the end of kindergarten. Given when the child enters first grade, it contributes more to understanding the child and to individualize his instruction." (p.648)

When it is administered at the end of the kindergarten year the test usually only corroborates teacher judgement and/or provides support for the teacher's opinion.

Book (1974) investigated the early identification of potentially high-risk children in the area of reading achievement by following a group of 725 children from kindergarten through to the second grade. End-of-kindergarten predictive measures were the Slosson Intelligence Test (SIT), Bender Gestalt Test (Bender) and the MRT. Criterion measures included the reading level completed at the end of the first and second grade. Each child was assigned to one of six diagnostic categories as to the degree of readiness for specific programs. For example:

1) Children whose IQ scores were 80 or less, MRT scores of 47 or less, and Bender error scores of ten or more: Consideration for placement in classes for educable mentally retarded.

2) IQ scores of 81 through 93, MRT scores of 48 or less, and Bender error scores of ten or more: Consideration for extended readiness programs and/or classes for the neurologically handicapped.

3) IQ scores of 94 or higher, MRT scores below 48, and Bender error scores of ten or more: Consideration for extended readiness programs and/or classes for the neurologically handicapped.

4) IQ scores of 94 or higher, MRT scores below 48, and Bender error scores of nine or less: Consideration for extended readiness programs and/or tutorial programs.

5) IQ scores 94 or higher, MRT scores from 49 through 57, Bender error scores of nine or less: Consideration for extended readiness programs.

6) IQ scores of 94 or higher, MRT scores 58 or higher, and Bender error scores of nine or less: Consideration for enrichment programs.

The results indicated a significant correlation between the end of first grade reading achievement and the diagnostic categories to which the child was assigned (r=.99, p<.001) and similar results were obtained at the end of grade two. Book reported that it was possible to combine the results of the three tests to obtain an efficient predictive index of reading achievement.

Telegdy (1975) examined the effectiveness of selected readiness tests to predict first grade success. Four tests, the Screening Test of Academic Readiness (STAR), Bender Gestalt Test (Bender), First Grade Screening Test (FGST) and the MRT were administered at the end of the kindergarten year to 56 children. One year later, the subjects were reassessed with two standardized achievement tests as the criterion measures (Wide Range Achievement Test (WRAT) and the Gray Oral Reading Test (GORT)) yielding five measures. Correlation coefficients were computed to reveal the predictive validity of which of the four tests best predicted actual first grade achievement. Stepwise multiple regression procedures were employed to arrive at the best subset of predictor variables. TABLE 3 presents the combinations of the four subtests that were identified as best predictors for each criterion measure.

TABLE 3

Subsets of Best Predictor Variables

for each of the Five Criterion Measures

(the order of predictors is random)

CRITERION MEASURE	BEST PREDICTORS
WRAT Reading	STAR Letters, BGT, HFT, MRT Alphabet
WRAT Spelling	STAR Letters, BGT, FGST, MRT Alphabet
WRAT Arithmetic	FGST, Picture Completion, Copying, Teacher Predictors of Arithmetic
GORT Passage	STAR Letters, BGT, HFD, MRT Alphabet
GORT Comprehension	BGT, MRT Alphabet, Teacher Prediction of Reading and Spelling

(p.8)

From TABLE 3 different subtests best predicted the five measures. Telegdy stated that this was to be expected since different skills are involved in Reading, Spelling or Arithmetic. Telegdy's study is noteworthy in that he employed a multiple item predictor battery and used the multiple regression technique. The technique produced the set of best predictors. However, Teledgy did not include the 'weights' assigned to the predictor variables.

Randel, Fry and Ralls (1977) compared the predictive effectiveness of a prescreening inventory (ABC Inventory) and the MRT, both administered in kindergarten to 62 children. The Primary Mental Abilities Test (PMA) was administered in May of the first grade year. The criterion measures were the Stanford Achievement Test, Primary I Battery (SAT-1) administered in grade one and the Stanford Achievement Test, Primary III Battery (SAT-3) administered in grade three. A stepwise multiple regression procedure was used to assess the effectiveness of the ABC and MRT in predicting SAT-1 reading. The MRT score ($R = .34$, $p<.01$) was the first variable that entered into the equation and accounted for 11% of the variance in predicting first grade SAT reading scores. In a stepwise multiple regression predicting the SAT-3 score, the MRT was again entered first ($R=.57$, $p<.01$) and accounted for 26% of the variance. The PMA accounted for an additional 6% of the variance. No other predictors made a significant contribution. The results indicated that the MRT was a good predictor of both first and third grade reading performance, but not as high as has been previously reported (Bolig and Fletcher, 1973).

Tokar and Holthouse (1977) investigated the concurrent validity of the Auditory, Visual, Language, Pre-reading skills composite and Quantitative area subtest of the 1976 edition of the MRT, Level II, Form P (Nurss and McGauvram, 1976) for N=41, administered in October of their first grade year. Based on classroom observations during kindergarten, teachers rated pupils in the general readiness categories such as auditory awareness, visual awareness, mathematics readiness, awareness of alphabet, awareness of number symbols and pre-reading readiness skills (ie. child's ability to match, select and name letters of the alphabet). The scores of the five subtests of the MRT were positively related to teacher ratings on the six readiness categories. All correlation coefficients were significant at .05 level and greater than .32. The only nonsignificant (.23) correlation was between the teachers' rating of pupils in number awareness and the raw score obtained on the visual subtest of the MRT.

Nagle (1979) also examined the validity of the MRT, Level II, Form P, 1976 Edition to predict achievement of first grade pupils and whether sex differences existed in the predictive validity of the MRT. In September of the first grade, 176 children were administered the MRT. Eight months later the same children were tested on the Total Reading and Mathematics sections of the Stanford Achievement Test, Primary Level I, Form A (SAT). Results indicated that correlations between the MRT Pre-reading Composite ($r=.67$, $p<.01$) and Quantitative subtest ($r=.70$, $p<.01$) scores with their corresponding SAT Reading and SAT Mathematics revealed that the MRT predicts first grade reading and mathematics achievement equally well. Critical ratio test for independent correlations to determine sex differences indicated that the MRT Pre-reading Composite score/SAT Total reading correlation was $Z=2.02$, ($p<.05$). Therefore, the MRT may be a valid predictor of reading achievement for males rather than for females. Mathematical achievement was predicted equally well for males and females.

Reynolds (1979) factor analyzed the response of 322 beginning first grade students to the six subtests of the MRT (1969 Edition). Reynolds stated that when other tests have been included in a predictive battery, the MRT tends to split into two factors - a reading readiness or language factor and a visual-motor factor. However, when the MRT was factored alone, Reynolds presented a single factor (General Readiness) and she indicated that only the use and interpretation of the MRT Total test score would be appropriate to predict early school achievement.

Swanson, Payne and Jackson (1981) examined the predictive validity of the MRT (1976, Edition) and the individually administered Meeting Street School Screening Test (MSSST) relative to a first grade reading achievement test administered at the end of the school year (Metropolitan Achievement Test, MAT). Two chronologically consecutive samples of first grade pupils in grade one (N=72) and grade two (N=64) were administered the tests. Pearson product moment correlations between the MAT criterion measure and the MRT scales and MSSST subtests were computed. Validity coefficients ranged from .73 to .84 with 84% of the possible validity coefficients for the MRT and 81% of the coefficients for the MSSST being equal to or greater than .60. Swanson et al., concluced that either instrument supports validity data.

However, one must consider the advantages of an individually or group administered test and the amount of administration time for each instrument when making a selection.

In summary, readiness tests would appear to be useful instruments in determining the degree of readiness for first grade learning. The results may serve as suggestive of the types of readiness development needed by various pupil groups. One such test, the Metropolitan Readiness Test (MRT) has shown generally moderate validity in predicting first grade academic achievement (Bolig and Fletcher, 1973; Randal, Fry and Ralls, 1977; Telegdy, 1975; Book, 1974). Similarily, the 1976 Edition of the MRT supports equal validity data (Nagle, 1979; Reynolds, 1979; Swanson, Payne and Jackson, 1981).

Visual-Motor Perception

In a study conducted by Bryan (1964), the importance of visual perception in reading development of primary age children was established. Bryan purports that in the first grade, visual perception scores were found to have predictive value for reading readiness, reading comprehension and reading vocabulary. At grade two, visual perception scores had greater predictive value for reading comprehension but less for reading vocabulary. However, in grade three, intelligence scores had more value in predicting reading success. Bryan emphasized that there is a need to test visual perception at kindergarten and grade one in addition to the testing of reading readiness and intelligence.

Belka and Williams (1979) utilized a battery of tests in the (a) perceptual-motor domain, (b) perceptual domain, and (c) cognitive domain to predict cognitive achievement of 189 children from pre-kindergarten to grade one. Belka and Williams defined the domains as follows:

> "a) perceptual - motor domain is that set of behaviors which involve overt motor behavior but which requires the reception and analysis of specific sensori-perceptual information for skillful or controlled execution...
>
> b) the perceptual domain, or those behaviors which primarily emphasize the reception, analysis, and interpretation of concrete sensory data with motor components used only as a means of obtaining a measure of the adequacy of the perceptual behavior c) the cognitive domain, or behavior which require processing and interpretation of symbolic and semantic information ..." (p.134)

Results indicated that a regression equation for predicting cognitive performance of kindergarten children explained 75.1% of the variation between perceptual and perceptual-motor tasks and the MRT with the Bender Gestalt Test being the single most important contributor. In predicting cognitive performance of first grade children, 60.5% of the variance accounted for perceptual behaviors. With the second grade population, 52.3% of the variance was accounted for by cognitive tasks. Therefore, there may be an age related change towards cognitive performance. At the younger age, a good predictive relationship existed between perceptual-motor and perceptual domains and later cognitive development. However, by the first grade, the relationship had decreased and by the second grade the predictive power was closely related to cognitive measures. Belka and Williams made the recommendation that auditory perceptual abilities should also be considered for inclusion in any early childhood assessment screening program.

Larsen and Hammill (1975) examined sixty studies that investigated the relationship between certain visual perceptual abilities and school learning. Previous literature that employed correlational statistical procedures purported that visual skills (visual discrimination, spatial relations, visual memory and auditory-visual integration) were mandatory to academic achievement and that many children failed in school due to visual-perceptual deficits. Larsen and Hammill's review of the research failed to validate these assumptions and stated that the relationship of visual perception to school achievement is minimal and should be re-evaluated.

In a study conducted by Lessler, Schoeninger and Bridges (1970), the Lee-Clark Reading Readiness Test (Lee-Clark), the Bender Gestalt Test (Bender) and the Peabody Picture Vocabulary Test (PPVT) were utilized to determine its effectiveness in the prediction of first grade performance (N=216). The predictive battery was administered in September and October of first grade. In April, two criterion instruments were employed (a) teacher rating of overall performance using a three point scale ranging from 'average or better', 'marginal' to 'inadequate' and early in May the (b) California Reading Test (CRT), was administered. The authors noted that, using the Pearson product moment correlations between the predictor and criterion measures, the Lee-Clark was the best single predictor of both the reading test and teacher ratings. However, a multivariate analysis of variance determined that the Bender and Peabody contributed very little (r=.035 to .197, $p<.05$) to the prediction of the criterion beyond that achieved by the Lee-Clark. This finding may seem unexpected due to the importance of receptive vocabulary and visual-motor coordination in learning to read.

In a longitudinal study conducted by Keogh and Smith (1967), the utility of the Bender as a basis for prediction of school performance in the upper elementary grades was examined. The study was based on data collected three times - in the spring of kindergarten, the third and the sixth grade with 73 subjects as the final sample. School achievement was evaluated by the California Achievement Test (CAT) at the third grade and the Iowa Test of Basic Skills (ITBS) at the sixth grade. Results indicated that the girls were better at the Bender in kindergarten than were boys but the boys were better than the girls on achievement scores at grade three with no difference at grade six. The relationship between the kindergarten Bender and sixth grade achievement were high and consistent for both boys and girls (in Grade one the Pearson product moment correlation coefficient for the kindergarten Bender and standardized reading achievement test was .30; in grade three it was reported as .29 and in grade six an $r=.51$, ($p<.05$). Keogh and Smith also indicated that the Bender was less discriminating at the third grade, therefore, has less utility as a predictive screening instrument at the third grade than in kindergarten. The authors recommended the inclusion of the Bender in a predictive battery since the Bender was predictive for both good and poor achievement at the sixth grade. Even at the sixth grade, the kindergarten Bender accounted for 50% of the variance in predicting reading achievement scores.

Contrary, Dibner and Korn (1969) evaluated the predictive validity of the Bender with teacher ratings as the criterion measure. The subjects were 492 males and females, kindergarten through fourth grade. The teacher ratings, taken at the end of each school year consisted of ratings on a five point scale in the areas of (a) general adequacy of school performance; (b) arithmetic; (c) reading; (d) general intelligence; (e) emotional control; and (f) prediction of success in the next grade, if promoted. Findings concluded that boys demonstrated slower perceptual-motor development (t=2.43, p<.02) than girls in kindergarten. Teacher's ratings correlated highly with ratings of children's academic performance in the higher grades (r=.70 to .85). Results also indicated that the Bender is as good a predictor of future school performance of kindergarten children as are their teachers' ratings. However, its value as a predictive tool diminishes rapidly above the first grade.

Keogh and Smith (1970) examined the predictive utility of the Bender and the teachers' rating for identification of 'high risk' and 'high potential' children. In the spring of kindergarten, teachers rated the children on a five point scale of reading readiness from 'totally lacking in reading abilities' to 'ready to begin now'. Criterion measures were provided by the Stanford Reading Test at grade two and the California Achievement Test at grades three to five. The authors indicated that a combination of kindergarten Bender scores and teacher ratings predicted third and fifth grade achievement (r=.61 to .71, p<.05). However, early identification was more accurate for the high potential than the high risk child. In other words, children who were successful on the Bender tended to be successful achievers throughout the elementary school years.

Reynolds, Wright and Wilkinson (1980) examined the predictive validity of the Test for Auditory Comprehension of Language (TACL) and the Beery Test of Visual Motor Integration (VMI) - both singly and in combination for a group of 89 kindergarten students. Koppitz (1975) had recommended that a preschool screening battery include both a verbal and nonverbal measure with the inference of greater accuracy in the prediction of later academic success. The TACL and VMI were also chosen with respect to the brief administration time as well. Two years later, at the end of the first grade, all children were administered the SRA Achievement Series, yielding a total composite score in addition to the subscores in Reading, Language Arts and Mathematics. The TACL and VMI both showed moderate correlations (.54 and .53, respectively, $p<.001$) with the composite achievement measure over the two year period. However, the proportion of variance accounted for by the predictors ranged from 3% to 8% and did not appear to be of any great practical utility. The authors suggested that other combinations of brief verbal and nonverbal measures should be investigated in order to determine the most efficient screening battery available.

Lehman and Breen (1982) conducted a study to evaluate whether the Beery Test of Visual-Motor Integraion (VMI) and the Bender Gestalt Test (Bender) actually measure identical skills. The subjects consisted of 125 pupils from kindergarten, grade one, grade two and grade three. Correlated t tests, correlation coefficients and coefficients of determination were computed to determine the degree of comparability. The Bender consistently yielded a higher mean age performance level than did the VMI, ranging from 6.8 to 11.2 months difference. The degree of shared variance (62% in first grade, 72% in second grade and 50% in third grade) remained unaccounted for, thereby suggesting that the two tests have relatively little similarity. Results indicated that the Bender and VMI are not comparable and that individuals should consider their appropriateness when assessing visual-motor integration in children. Porter and Binder (1981) examined children age six to nine years of age, evaluating their level of visual-motor performance using the Bender and VMI. The Pearson product moment correlation coefficient between the child's level of visual-motor performance, as determined by the Bender and VMI was $r=.62$, ($p<.05$), a significant relationship between the two instruments. However, the coefficient of determination was .38 therefore, 62% of the variance was unaccounted for. The authors also concluded that although the VMI and Bender share some common variance, the instruments also measure different constructs in reference to the assessment of a child's level of visual-motor development. Lehman, Breen, Porter and Binder did not state what the "unaccounted" variance actually measured, however, suggested that further research be conducted to determine what other factors are present in the Bender and VMI.

A review of research regarding the Bender Gestalt Test as a psychometric instrument for the prediction of school achievement was investigated by Buckley (1978). The author reported that over an eleven year span (1966-1977), school screening procedures employing the

Bender for diagnosis should carefully reconsider its use since there has been no conclusive evidence that the instrument can be used to predict school achievement. As summarized in TABLE 4, many studies failed to confirm its use as a valid predictor of scholastic aptitude with the kindergarten, primary and elementary population.

In summary, Bryan (1964), Belka and Williams (1979) stressed the importance of testing visual perception at the kindergarten and grade one level, in addition to reading readiness. However, the predictive utility of visual perceptual tests are at odds. Larsen and Hamill (1975) failed to assign any significance to visual perceptual performance; Lessler, Schoeninger and Bridges (1970) have no utility for the Bender while Reynolds, Wright and Wilkinson (1980) have no utility for the Beery Test of Visual-Motor Integration. A review of reported literature by Buckley (1978) indicated that no conclusive evidence has been established as to the Bender's performance to predict school achievement. Keogh and Smith (1967, 1970) reported that the Bender, administered in kindergarten is predictive of achievement at the sixth grade level while Dibner and Korn (1969) stated the Bender has no utility above the first grade. Both studies by Lehman and Breen (1982) and Porter and Binder (1981) indicated that the Bender and the Beery Test of Visual Motor Integration measure different constructs in addition to visual-motor integration, and therefore, can both be used in a screening battery.

TABLE 4

Prediction of Reading/School Achievement
with the Bender Gestalt Test

AUTHOR/DATE	GRADE OR AGE	SPECIAL POPULATION	NUMBER SUBJECTS	SCORING	DID BENDER PERFORMANCE CORRELATE SIGNIFICANTLY WITH READING OR GENERAL ACHIEVEMENT?		DID RESEARCHERS CONSIDER FINDINGS ADEQUATE TO PERMIT INDIVIDUAL DIAGNOSIS?
Blakslee, 1972	1st	—	83	not stated	reading	yes	no
Connor, 1968-69	2nd	—	60	Koppitz	reading	no	no
Coy, 1974	3rd	—	51	Koppitz	read/arith	no	no
Dibner & K., 1969	k-4th	—	492	Koppitz	general	yes	yes
Edmunds, 1970	k-1st	—	200	Plenk	reading	vocab-yes compre-no	no
				Koppitz	reading	no	no
Giebink & B., 1970	2nd	—	142	Koppitz	reading	no	no
Hartlage, 1970	6-14 yr.	dyslexic	81	Koppitz	reading	no	no
Henderson et al., 1969	7 yr.	—	203	Koppitz	read/arith.	yes	no
Keogh, 1965	3rd	—	127	Koppitz	reading	no	no
				Keogh-Smith	reading	no	no
Keogh & S., 1967	k,3,6th	—	73	Koppitz	general	yes	yes
Koppitz, 1973	k-8th	—	43	Koppitz	general	yes	no
Lessler et [illegible] 1970	1st	—	154	not stated	reading	no	no
Mlodnosky, 1972	1st	econ.depriv.	93	Koppitz	reading	yes	no
Norfleet, 1973	1st	—	311	Koppitz	reading	yes	yes
Obrzut et al., 1972	1,3,6th	—	239	Koppitz	reading	no	no
Paul, 1971	6-13 yr.	lrn. dsabl.	91	Koppitz	reading	yes	no
Schoolcraft, 1973	1st	rural	824	Koppitz	reading	yes	not stated
Silberberg & F., 1968	1-3rd	—	146	Koppitz	reading	no	no

(p.330)

Human Figure Drawings

The Human Figure Drawing (HFD) has been used in the past by educators, public health personnel, mental health agencies and pediatricians as a quick indicator of the maturational level of children. Therefore, the HFD has been added into the battery of measures, that are correlated with grade one achievement, to examine the amount of contribution to the accuracy of diagnosis.

Hofmann (1957) reported that kindergarten children's drawings indicate a readiness level for first grade. Hofmann examined 428 drawings by eighteen kindergarten children and stated that the "nature" of the drawing yielded predictive information. He indicated that successful performance depended mainly on the totality of the child's development - the degree of integration of the mental, physical, emotional and social dimensions.

In a study conducted by Colligen (1967), evidence indicated that children with learning difficulties produced drawings significantly different from normal achievers. He concluded that children with learning difficulties tended to draw human figures showing fewer characteristics of maturity, detail, and lifelikeness than do normal achievers.

Strahl (1972) investigated the feasibility of using human figure drawings collected in kindergarten for prediction of learning performance in the first grade. He examined the HFD of 61 first grade children and their HFD when they attended kindergarten, and scored them by a self-developed scale, Human Figure Evaluation Scale (HFES). Concurrent validity data indicated that the lower one-third of scores (children who were rated as having and continue to have the least successful learning experiences) from the HFES for first grade drawings agreed with the first grade teachers' selection of the lower one-third learners ($p<.001$). The lower one-third of scores from the HFES for kindergarten drawings did not agree with the lower one-third of total scores from the MRT (administered in the kindergarten year). Strahl concluded that the HFES should provide useful data concerning the child's developmental growth and that the MRT also be used in conjunction with one another since the HFES measures global development and the MRT measures readiness skills.

Shipp and Louden (1964) set out to determine how well the Draw-A-Man-Test (DAMT) administered in the first school week in grade one to 115 students, would predict general achievement in the first grade. Achievement was measured by the Gray-Votaw-Rogers Primary Achievement Test, which included subtests in reading comprehension and vocabulary, spelling, arithmetic reasoning and computation, and was administered at the end of the first grade school year. Correlations were computed with the DAMT raw score and total achievement score having a correlation of .51, ($p<.05$). Shipp and Louden concluded that the DAMT, as scored in accordance with the Goodenough Harris scoring instructions, has some value as a predictor of general achievement in the first grade.

Szasz, Baade and Paskewicz (1980) hypothesized that the combined use of the Koppitz Developmental and Emotional score of the HFD can improve the prediction of school readiness. Koppitz (1968) had indicated that the developmental items were primarily related to age and maturation and they could be used to assess a child's general level of mental maturity. The subjects were 141 kindergarten students who were group administered the HFD. At the end of the school year, the MRT (Level II, Form Q, 1976) was administered. Multiple regression analysis indicated that the Developmental Score yielded a multiple correlation coefficient of .43 ($p<.001$) and accounted for approximately 19% of the variance. The Emotional Score yielded a multiple correlation coefficient of -.26 ($p<.01$) and accounted for approximately 7% of the variance. When the two variables were used in combination to predict the MRT score, the multiple correlation coefficient was .43 ($p<.001$) and 19% of the variance was accounted for. Szasz et al., indicated that the scoring systems do not predict readiness as measured by the MRT. Secondly, readiness hit rate data indicated that the Developmental Score correctly identified 74% of kindergarten children and Emotional Score correctly identified 64% of kindergarten children. When both the Developmental and Emotional Score were combined (readiness = adequate Developmental or Emotional Score; nonreadiness = poor Developmental and Emotional Score) the hit rate data were identical to the Developmental Score above 74%. Szasz et al., concluded that the use of both the Developmental and Emotional Score are highly correlated and their use in combination adds nothing to prediction.

Data from the Szasz, Baade and Paskewicz (1980) study was made available to explore the use of the HFD for use as an early kindergarten predictor of a child's nonreadiness for first grade, (Dunleavy, Hansen, Szasz and Baade, 1981). Results indicated that the HFD Developmental Score cutoff point, (less than or equal to 3), was most selective for prediction of the nonreadiness classification. The cutoff point classified 42% of the nonready and 90% of the ready children as defined by the MRT score criterion with only 10% of misclassification of the academically ready children. Dunleavy et al., indicated that the Koppitz HFD classification procedures became more useful, the greater the proportion of academically nonready children in the population. Pate and Nichols (1971) reported that the Koppitz method of scoring the HFD is a valuable tool in screening children ages five through twelve.

In one of the earliest studies by Koppitz (1959), scores for 143 first grade students on the HFD and the individually administered Bender were collected at the beginning of the school year. The Metropolitan Achievement Test (MAT) scores, taken at the end of the year were correlated with the Bender scores and the HFD scores taken earlier. The multiple correlations for achievement, visual perception and HFD yielded a correlation of .65, ($p<.05$). Koppitz concluded that the instruments are valuable in predicting first grade achievement and suggested that a measure of verbal intelligence might further increase the accuracy of prediction.

Dillard and Landsman (1968) investigated whether the Evanston Early Identification Scale (EEIS) had predictive ability and could identify those children referred for special help because of academic, perceptual and/or emotional difficulties in the primary grades. The subjects were 117 (36 referred, 81 nonreferred) fourth and fifth grade children. Those with HFD from kindergarten were included in the study. Subjects having a total score of five or less on the EEIS were predicted not to experience learning problems, while a score of six or more were predicted to experience difficulty in school. It was found that the mean scores on the HFD differed significantly and that the referred group had higher scores on the EEIS than did the nonreferred children. Dillard and Landsman concluded that the EEIS was a valuable tool in identifying children who would experience school difficulty. However, they cautioned that the EEIS be used only as a very gross screening device.

Hartman (1972) examined the HFD (as scored by the Goodenough Harris technique) when it was employed as a measure in a battery which included the Wechsler Intelligence Scale for Children (WISC) and the Bender to assess body image immaturity in learning disabled children. Hartman indicated that body image is a concept used to explain spatial correlations and disturbances as sometimes found in children with learning disabilities. Staffen and Frierson (1967) defined body image as

> "awareness of one's own body (conscious mental picture or subconcious knowledge of one's position in space and time). It includes the impressions one receives from internal signals as well as feedback resulting from contact with others." (p.490)

Hartman examined three groups of children (average, reading/language disabled and visual-motor disabled) ranging from six to eight years of age (N=100). When the multiple regression technique was used to predict the Draw-A-Man scores of the children in the two different groups of learning disabilities, it was found, in each case, that their mean actual score was not significantly different from their mean predicted score. The results indicated that the HFD does not provide a valid increment to the battery which contained the WISC and the Bender, suggesting that the HFD may not reflect body image immaturity.

A review of literature by Scott (1981) indicated that the Human Figure Drawing, as scored by the Goodenough Harris technique, has little practical utility as a screening device and predictor of academic achievement. As can be seen in TABLE 5, reading-related skills showed generally low correlations with HFD scores (range -.09 to .56), as did arithmetic skills (range -.05 to .40, $p < .05$).

In summary, the human figure drawing has been used extensively as an informal and/or formal screening device to detect children with possible learning difficulties (Colligen, 1967; Hofmann, 1957; Strahl, 1972; Shipp and Louden, 1964; Koppitz, 1959; Dunleavy, Hansen, Szasz and Baade, 1981; Dillard and Landsman, 1968). However, the literature examined has opposing views as to its applicability in a screening battery. The utility of the HFD by the Goodenough Harris or Koppitz methods of scoring have been reported as being invalid (Hartman, 1972; Szasz, Baade and Paskewicz, 1980; Scott, 1981).

Auditory and Visual Integration

Koppitz (1977) suggested that a meaningful psychoeducational screening battery should include measures of intersensory integration, sequencing and recall. Koppitz defined intersensory integration as involving the integration of two different sense modalities (eg. auditory presentation of stimuli and written recall). Intrasensory integration involves the stimuli and responses both being given in the same sense modality (eg. auditory presentation of stimuli and oral

TABLE 5
Summary of Studies Correlating the
Goodenough Harris Draw-A-Person Test
with Measures of Academic Achievement

REFERENCE	SUBJECTS	AGE (years)	INTERVAL	MEASURE AND r
Dudek, Goldberg, Lester, & Harris (1969)	103, middle-SES suburban kindergarten children	NR		California Achievement Test:
			1 year	.25 - .29
			2 years	.30 - .31
Dunn (1967)	90, middle-SES suburban children, Grades 1-6	NR	0	Iowa Test of Basic Skills: Arithmetic: -.05 Spelling: .06 Language Skills: .03
Eaves, Kendall, & Critchton (1972)	25, normal controls	5	9 months	Name printing: .55 Daniels Word Recognition II: .50
	25, minimally brain-damaged or immature children	5	0	Daniels Word Recognition I: .56
Hall & Chansky (1971)	46, economically disadvantaged black first graders	NR	7.5 months	Daniels Word Recognition: Flash: .21 Untimed: .25 Informal Reading Inventory: Word Recognition (error): -.31 Comprehension (error): -.26 Stanford Achievement Test: Word Reading: .21 Paragraph Meaning: .05 Work Study Skills: .43
Panther (1967)	44, kindergarten children	NR	4 months	Metropolitan Achievement Test: Reading: .34
Serwer, Shapiro & Shipiro (1972)	46, kindergarten children with suspected learning problems	NR	1 year	Metropolitan Achievement Test: Word Knowledge: .05 Word Discrimination: -.09 Reading: -.07 Arithmetic: .06
Stevenson, Parker, Wilkinson, Hegion, & Fish (1976)	255 middle-SES white boys and girls	4.4		Wide Range Achievement Test:
			0	Reading: .30 - .35
			1 year	.30 - .35
			2 years	.30 - .43
			3 years	.20 - .30
			0	Arithmetic: .30 - .40
			1 year	.28 - .38
			2 years	.30 - .32
			3 years	.15 - .22

Note: GH - Goodenough Harris Drawing Test; SES = socioeconomic status; NR = not reported; ns - not significant

(pp. 496-497)

oral recall, or visual presentation of stimuli <u>and</u> visual or written recall).

Johnston and Myklebust (1967) indicated that

> "reading and writing involve both visual and auditory memory for letters and sounds and for the sequence of sounds and symbols." (p.150)

and therefore its measure in a screening battery for reading achievement would be considered essential.

In the earliest studies of cross-modal functioning, Birch and Belmont (1964) studied the hypothesis that children with reading difficulties experience visual-auditory impairments. Birch and Belmont examined 150 poor readers and 50 average readers, nine and ten years of age, and found that children with reading difficulties had problems in transferring from one sensory modality to another and that good readers received higher auditory-visual integration scores than did the poor readers. Similar results were substantiated by Beery (1967) despite certain differences in the original Birch and Belmont procedure.

A study of Bruininks and Mayer (1979) investigated a number of kindergarten measures having predictive value with later school achievement and the identification of kindergarten abilities related to sixth grade achievement in reading comprehension, spelling, language usage and arithmetic. The kindergarten abilities investigated included visual perception and visual sequential memory, auditory perception and auditory sequential memory, visual motor integration and several intelligence factors. Results indicated that several tests of auditory skills were related to sixth grade achievement. Auditory sequential memory was related to sixth grade achievement in reading comprehension and spelling. However, performance on tests of visual perception, visual sequential memory and visual motor integration was non-significant in terms of being related to later school achievement. Larsen and Hammill (1975) also concluded the same after reviewing a number of correlational studies involving visual perceptual abilities and school learning.

Whiton, Singer and Cook (1975) also investigated the importance of auditory-visual intrasensory integration as compared with auditory-visual intersensory integration skills for reading acquisition in 64 first grade boys. Reading acquisition was measured by the Primary Reading Profiles, Level I, a test assessing (a) an aptitude for reading; (b) auditory association; (c) word recognition; (d) word attack; and (e) reading comprehension. Results supported the hypothesis that the ability to integrate sensory information across different modalities was an important skill for reading acquisition.

Similarly, Reilly (1971) investigated the relationship of auditory-visual integration as they relate to sex and reading success in 225 subjects in grades one to four. Results had shown that auditory-visual integration ability was closely related to comprehension scores than vocabulary. Reilly also concluded that auditory-visual integration ability occurs in stages and that it appears later for males, not reaching significance until second grade. Girls developed auditory-visual integration skills earlier but it leveled off by grade four. Reilly suggested that a particular focus on developing the auditory-visual integration skills of males should begin at the kindergarten and first grade level.

Amoriell (1979) examined the child's ability to manipulate sequential stimuli within and between the auditory and visual modalities with 105 third grade children judged to be experiencing severe reading difficulties and average or above readers. The abilities measured were (a) visual sequential memory for letters; (b) auditory sequential memory for letter sounds; (c) visual-auditory integration; (d) auditory-visual integration; and (e) total perception (sum of the four perceptual assessments). An analysis of variance indicated that there was a difference among disabled and average readers on the test of visual sequential memory for letters and that the perceptual tests could be utilized for diagnostic purposes in locating inter or intra sensory deficits related to reading deficits.

Derevensky (1977) examined literature regarding the relationship between cross model functioning and reading achievement. Derevensky noted that

> "during the ages of five through seven, a significant series of changes are occurring, both in character, integration and inter-relationship of the various sensory systems. The development of such sensory integration skills appear to be a particularly important prerequisite for formal learning. The interrelatedness and acquisition of the auditory and visual modalities may be viewed as essential to the reading process." (pp. 234-235)

Katz and Deutsch (1964) explored the efficiency of auditory and visual learning and related it to age and reading levels. Auditory, visual and combined auditory visual learning tasks were administered to 48 males in grades one, three and five, who were either good or poor readers. The Gates Advanced Primary Reading Test was administered to all third and fifth grade children. An analysis of variance revealed that good readers remembered more items and that memory for auditory stimuli was poorest for all subjects whereas, their visual learning skills were almost equivalent to the good readers. This evidence was especially pronounced in the first grade group. Katz and Deutsch emphasized the importance of early diagnosis of potentially poor readers and that additional training in attending to auditory materials would be essential in the primary grades.

Reilly (1972) also emphasized the screening of students' auditory-visual integration skills prior to teaching reading which would provide an index to reading readiness. In his study, involving 225 children in grades one to four, auditory-visual integration ability was found to be related to reading success, however it was dependent on sex and socioeconomic background.

In a study of 285 first graders, McNinch (1971) explored the predictive relationship between auditory perception and later reading achievement. Auditory perceptual tasks, a readiness test and intelligence test was administered at the beginning of the year, followed by a standardized reading achievement battery at the end of the year. Results emphasized that girls mature perceptually more rapidly than boys and require less training on auditory skills than boys. A stepwise regression model revealed that when the auditory perceptual variables were used to predict the total reading score, auditory memory accounted for 50% of the variance.

In summary, research indicated that intersensory and intrasensory skills are important for the acquisition of reading achievement (Birch and Belmont, 1964; Beery, 1967; Whiton, Singer and Cook, 1975; Amoriell, 1979; Derevensky, 1977). However, other studies suggest that intrasensory and not intersensory skills may be better indicators of reading acquisition. McNinch, (1971); Bruininks and Mayer, (1979) indicated that auditory memory is more important in the prediction of reading. Katz and Deutch (1964) indicated that cross sensory integration was important for reading in first grade but by the third and fifth grade, poor auditory perception was the major characteristic of poor readers.

Summary

In summary, rating scales, readiness assessments, visual-motor perception, human figure drawings and auditory/visual integration measures have been used in the past to assess academic readiness in kindergarten children for grade one. The Pupil Rating Scale (PRS) has been used extensively with elementary school children (Doherty and Margolis, 1981) and has been referred to as a "well-developed checklist". However, its utility with the kindergarten population has yet to be substantiated. Another form of rating scale, referred to in this investigation, has been the kindergarten teacher's 'global' rating. The teachers therefore rely on their own experience, intuition and understanding of the child to assess academic readiness. Ebbesen, (1968); Keogh, Tchir and Windeguth-Behn, (1974) have referred to the predictive efficiency of such a scale in determining academic readiness. Therefore, these two predictive measures have been incorporated into the present investigation as being efficient rating scales.

The Metropolitan Readinss Test (MRT) has been shown to be a useful instrument in determining academic readiness for grade one. The 1976 Edition of the MRT supports moderate validity data (Nagle, 1979; Reynolds, 1979; Swanson, Payne and Jackson, 1981) and for this reason the MRT will be used as a criterion measure to determine academic readiness for grade one.

The assessment of visual-motor performance at the kindergarten and grade one level has been stressed as being important to determine academic readiness for grade one (Bryan, 1964; Belka and Williams, 1979). The Bender Gestalt Test (Bender) and/or the Beery Test of Visual Motor Integration (VMI) have been used in the past with conflicting results as to their utility in a kindergarten screening battery. Therefore, both tests have been employed in the present study to assess their contribution in a screening battery.

Human figure drawings have also been utilized in preschool, primary and elementary grades to assess the maturational level of a child. However, the literature indicates that there is conflicting evidence as to its practical utility in predicting academic readiness. For this reason, two well known scales, the HFD scale and the Evanston

Early Identification Scale (EEIS) have been incorporated into the measures to predict academic readiness for grade one.

The importance of auditory and visual integration processes has been stressed in the acquisition of reading skills (Whiton, Singer and Cock, 1975; Amoriell, 1979; Derevensky, 1977). Therefore, the Visual Aural Digit Span Test (VADS), which measures intersensory integration, sequencing and recall, has also been incorporated into the predictive battery as being useful in predicting academic readiness for grade one.

The main objective of the study was to combine the best predictors of tests into a screening battery that could efficiently and effectively identify children in kindergarten likely to experience academic difficulties in grade one. It is anticipated that the above psychoeducational measures will provide such a battery.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

The following chapter presents the characteristics of the subjects used in the study, the instrumentation, procedure, statistical method and the research questions.

Subjects

A total of 85 kindergarten children, 48 males and 37 females between the ages of 61 and 77 months with a mean age of 70.2 months, took part in the study. The children were selected from three English taught kindergarten classrooms in the Sherwood Park Catholic School District. The children were of middle to high socioeconomic background from the Hamlet and surrounding rural areas. The criteria for exclusion from the study were based on the following (a) any child repeating kindergarten during the time the study was undertaken was not included since that child would have had an extra year to develop readiness skills for grade one; (b) any child with a visible physical or mental handicap was not included since the study was aimed at the 'typical' kindergarten population; and (c) French Immersion kindergartens. Therefore, the subjects selected for the study were not from a randomized procedure which makes generalization to a population more limited. Originally, 92 children had been sampled. However, before completed data could be gathered, two children had moved out of the province during the summer months, one child transferred to a grade one French Immersion classroom, and four had transferred to another school district to attend either kindergarten or grade one. As a result, criteria data were unavailable for the above group and these children were therefore deleted from the study.

Instrumentation

Since the study required the predictive assessment of academic achievement, the following criteria and rationale were used for the intruments chosen.

Pupil Rating Scale (PRS) (Myklebust, 1971):

The PRS is a screening instrument that taps five areas of behavior: (a) Auditory Comprehension (PRSA) - comprehending word meanings, following instructions, comprehending class discussion, retaining information, (b) Spoken Language (PRSS) - vocabulary, grammar, word recall, storytelling and relating experiences, formulating ideas, (c) Orientation (PRSO) - judging time, spatial orientation, judging relationships, knowing directions, (d) Motor Coordination (PRSM) - general coordination, balance, manual dexterity, and (e) Personal-Social Behavior (PRSP) - cooperation, attention, organization, social acceptance, responsibility, assignment completion, tactfulness.

The two subscales requiring receptive and expressive language (Auditory Comprehension and Spoken Language) can be summarized in a single score representing verbal (PRSV) facility. A score representing nonverbal (PRSN) capabilities can be obtained by summing the remaining three subscales - Orientation, Motor Coordination, and Personal-Social Behavior. Provision is also made for an overall total score, however, the total score was not used in the present study in order to determine if any scale of the PRS is more predictive of the total score than the other subscales. This information could identify which areas of classroom behavior are more sensitive or of greater importance in differentiating among children. Therefore, the PRS yielded seven scores in this investigation, one score for each of the five subtests, one verbal and one nonverbal score derived from a combination of the five subscores.

On each item within the five subscales of the PRS, the teacher was told: "The ratings are made on a five point scale. A rating of 3 is average, ratings of 1 or 2 are below average, and ratings of 4 or 5 are above average." The points earned for each of the subtests were used in the predictive measures.

Bryan and McGrady (1972) stated the following advantages of the PRS.

"(a) it is economical in money and time

(b) it involves the teachers

(c) it allows for intensive evaluation of ... each child

(d) it covers areas not usually testable, and

(e) it may identify specific areas of disability despite a child's overall adequate performance." (p. 201)

Finally, the PRS does not require any specialized training to deem its use effective.

The PRS manual (Myklebust, 1971) includes information regarding reliability and validity through correlation and discriminant analyses with data obtained from cognitive, achievement and psychoeducational variables. Correlational analysis were ascertained between (a) items on the scale (range .64 to .98, $p<.05$) for the Total PRS score, (b) ratings and verbal, perceptual, spatial, and nonverbal intelligence (range .10 to .35, $p<.05$), and (c) ratings and educational achievement as measured by word knowledge, word discrimination, reading, spelling and arithmetic (range .06 to .53, $p<.05$). The PRS showed the greatest relationship with reading, spelling and arithmetic. To explore the adequacy of the PRS with other tests, discriminant analysis with forty nine psychoeducational variables revealed that the PRS was most effective in differentiating between good learners and those having minor deficiencies ($F=55.78$, $p<.01$).

Whereas Myklebust studied a third and fourth grade sample, the present investigation focused on the kindergarten population for two principal reasons. First, there has been insufficient validity data supporting its employment at this level. Secondly, if the function of an instrument is to detect academic difficulties at an early stage, then a screening instrument at the kindergarten or primary level becomes increasingly important.

Evanston Early Identification Scale (EEIS) (Dillard and Landsman, 1967)

The EEIS is a simple screening device for identifying those children who can be expected to have difficulty in school. The EEIS is not a diagnostic instrument, as children who perform poorly may have possible emotional or perceptual problems. The child is required to draw the figure of a person. The figure is scored through the use of a ten item weighted scale resulting in either a low risk (0-4 points), middle risk (5-7 points) or high risk drawing (8-21 points). It is indicated for use between the ages of 5 years 0 months to 6 years 3 months and can be either group or individually administered.

The EEIS scale was chosen for the following reasons (a) the applicability of its use with the kindergarten population, (b) its feasibility in terms of time and financial resources, (c) as a comparison with another Human Figure Drawing scale, and (d) its brevity and ease of scoring.

The EEIS manual (Dillard and Landsman, 1967) indicates a Pearson product moment correlation of .97 for inter-rater reliability. Validity data reported that referred and nonreferred children can be significantly differentiated on the basis of their EEIS score and Kuhlmann - Anderson IQ's in grade two. A mean IQ of 105.06 for the referred group (with a mean 8.2 EEIS score) and a mean IQ of 112.8 score for the non-referred group (with a mean 2.6 EEIS score) was reported.

Human Figure Drawing (HFD) (Koppitz, 1968)

The HFD can be used either as a group test or as an individual test and is appropriate for children since it requires no reading, takes a short time and is an enjoyable task for most children five to twelve years of age. The HFD lends itself to multiple interpretations since scoring systems are available to assess emotional and developmental ability independently. However, for the present research the developmental scale was utilized, employing the Pate and Nichols (1971) scoring guide. Thirty developmental items were categorized as expected and exceptional. For each expected item omitted, one point was subtracted and for each exceptional item included, one point was added. The HFD Score, indicative of the level of Mental Ability was used as the predictive index, as follows:

HFD Score	Level of Mental Ability
8 or 7	High Average to Superior (IQ 110 upward)
6	Average to Superior (IQ 90-136)
5	Average to High Average (IQ 85-120)
4	Low Average to Average (IQ 80-100)
3	Low Average (IQ 70-90)
2	Borderline (IQ 60-80)
1 or 0	Mentally Retarded or functioning on a retarded level due to serious emotional problems (IQ less than 70)

Validity data was provided by a separate comparison of the Stanford-Binet IQ and the HFD and the WISC and the HFD for age levels six to twelve. Pearson product moment correlations with the Stanford-Binet correlated from .55 to .63, ($p<.01$) while WISC scores correlated from .45 to .80, ($p<.01$) with the HFD scores. Therefore, the Developmental Score can be used with some confidence as a method of assessing the mental maturity of children. Reliability statistical analysis for the HFD was not provided in the Koppitz manual.

Bender Gestalt Test (Bender) (Koppitz, 1963)

The Bender is a copy form instrument consisting of nine geometric figures and is one of the most widely used tests of visual-motor perception (ability to perceive the shape and size of figures and to translate what is perceived into an integrative whole through the use of eye-motor coordination).

> The Seventh Mental Measurement Yearbook (Buros, 1978) stated the "Bender Gestalt Test should be included in every diagnostic examination of children from age five because of its unique contribution to the evaluation of perceptual-motor functioning". (p. 395)

Koppitz (1963) suggested that good school achievement can be predicted if a child does well on the Bender at the beginning of first grade.

Pearson product moment correlations for inter-scorer realiability were reported as statistically significant and ranged from .88 to .96. Test score reliability, using the Rank Correlation Coefficient (for the test-retest method after four months from initial administration) was reported as ranging from Tau = .547 to .659, ($p<.001$). Therefore, the Developmental Scoring system is reliable and can be used with considerable confidence. Validity data were reported for referred and nonreferred children experiencing poor school achievement. Chi-square analysis determined for first and second graders (11.7), third and fourth graders (9.1) and all subjects (14.2), indicated that the Bender Developmental Score can differentiate between students with or without learning difficulties.

The test was individually administered and the developmental age equivalent performance in months was used as the predictive measure.

Developmental Test of Visual-Motor Integration (VMI) (Beery, 1982)

The VMI is a structured instrument in that the child is to copy up to twenty-four geometric forms within specified page positions, locations, and boundary requirements. The geometric forms are arranged in order of increasing difficulty and can be administered to children in the age range of two to fifteen. It takes about 10 minutes to administer and minimal training is required. Forms are scored on a pass/fail basis until three consecutive errors have been made. Specific scoring guidelines and criteria are provided in the manual. The test was group administered for the purposes of the study. The VMI was

> "designed primarily to serve as a regular classroom screening instrument that helps prevent learning and behavioral disorders through early identification of difficulties". (Beery, 1982, p. 13)

More specifically, it can be used to measure the degree to which visual perception and motor behavior are integrated.

Concurrent validity correlations between the VMI and readiness tests have averaged about .50, however, reading and other academic achievement tests correlations have been higher for the primary grades than for the upper grades ranging from .51 to .73. Beery (1982) reported that the VMI, in combination with a test of auditory-vocal assocation, best predicted achievement, however, predictive correlations appear to decline as children move up the grade levels. Inter-rater reliability correlations were reported as ranging from .58 to .99. Split-half reliability ranged from .66 to .93 as reported in the manual, (Beery, 1982).

The rationale for the inclusion of the VMI in the present psychoeducational battery was to (a) compare its utility as a predictive indicator of academic achievement with the Bender Gestalt Test which purports to measure visual-motor integration; (b) use the norms (Beery, 1982) which have not been referred to in previous research; and (c) warrant its applicability for use with inexperienced examiners. The percentile equivalent of raw scores obtained for the child's chronological age was used as the predictive measure.

Visual Aural Digit Span Test (VADS) (Koppitz, 1977)

Koppitz (1977) emphasized the use of the VADS test as a screening device for school beginners since it assesses intersensory integration, sequencing and recall and correlates well with reading, spelling and arithmetic. Koppitz also suggested that the VADS test, Bender and HFD can form a useful screening battery for the end of kindergarten and beginning first grade.

The VADS involves the reproduction of two to seven digit series however, eliciting eleven subscores as follows:

VADS Subtests

(1) Aural-Oral (AO)	measures integration of auditory perception, sequencing and recall
(2) Visual-Oral (VO)	measures visual oral integration, sequencing and recall
(3) Aural-Written) (AW)	measures auditory-visual integration, sequencing and recall

(4) Visual-Written (VW) measures intrasensory integration of visual input and written expression, sequencing and recall.

VADS Combination Scores

(5) Aural Input or AI (AO & AW)

(6) Visual Input or VI (VO & VW)

(7) Oral Expression or OE (AO & VO)

(8) Written Expression or WE (AW & VW)

(9) Intrasensory Integration or Intra (AO & VW)

(10) Intersensory Integration or Inter (VO & AW)

(11) Total VADS Test Score or Total (AO & VO & AW & VW)

Reliability, (Koppitz, 1977), by the test-retest method over a period ranging from one day to fifteen weeks, was reported for a group of six to ten year olds and eleven to twelve year olds with learning difficulties. Pearson product moment correlations between the eleven subtest scores were reported as ranging from .74 to .92 ($p<.001$) and .72 to .90 ($p<.001$), respectively, for each group. Therefore, VADS test scores are reported as reliable over a three to four month period for children with learning difficulties. Validity data (Koppitz, 1977), was reported with the VADS test administered at the end of kindergarten with grade three achievement scores. All VADS scores were able to differentiate between high and low achieving elementary school children.

The age percentile derived for each of the eleven subtests was used as the predictive measure in the statistical analysis.

Metropolitan Readiness Test Level II, Form P (MRT) (Nurss and McGauvran, 1976)

The MRT was selected because of its wide use and its established reliability and validity. The MRT manual (Nurss and McGaurvran, 1976) reports a split-half reliability of .94 and an alternate form reliability of .87. Validity studies reported in the manual indicate correlations of .70 and .69 between the MRT and the total reading scores of the Metropolitan Achievement Test and the Stanford Achievement Test, respectively. These validity studies correlated MRT scores obtained at the beginning of the first grade and achievmeent scores obtained at the end of the first grade. Secondly, the MRT, Level II, Form P was routinely administered to all grade one classes in the Sherwood Park Catholic School District in September as part of its regular testing program.

The MRT, Level II, Form P measure the skills needed in beginning reading and mathematics and includes eight subtests: two auditory (beginning consonant and sound-letter correspondence); two visual (visual matching and finding patterns); two language (school language and listening) and two quantitative (quantitative concepts and operations). The Pre-Reading Skills Composite summarizes performance on the Auditory, Visual and Language Skill areas.

For the purpose of the present study, the stanine obtained in each subtest (Auditory, Visual, Language, Pre-Reading Composite, and Quantitative) was used as a criterion measure in the statistical analysis.

Procedure

Upon ascertaining those students who were eligible for inclusion in the study, the predictor battery (PRS, VMI, VADS, HFD, EEIS, and the Bender) was administered in May, 1982 of the kindergarten year. In addition, the kindergarten teacher was asked to designate a 'teacher rating' (TRK) of either (1) or (2) for each child using the following guidelines: (1) this child will be ready for grade one in September, 1982 or (2) this child will NOT be ready for grade one in September, 1982. The kindergarten teachers were not provided with specific criteria on which to evaluate readiness. Therefore, the ratings represented a 'global' opinion by the teacher.

The kindergarten teacher was then asked to complete the PRS for each child. To reduce the possibility of computional errors on the subsections of the PRS, kindergarten teachers were instructed not to add the item ratings. The teachers were requested to rank each PRS item according to the manual directions and they were encouraged to draw upon behavior observed from September to May of the academic year.

The VMI was group administered by the author, to each kindergarten classroom in accordance with the test manual's recommendations and scored by the author using the Beery (1982) criteria and norms.

The HFD was also group administered by the author, whereby each child was given an 8 1/2" by 11" sheet of blank paper and was instructed to "Please draw someone, draw anyone that you wish. Draw just one person". The HFD was then scored by the author using the Koppitz (1968) Developmental scoring criteria and the Pate and Nichols (1971) protocol; as well as the EEIS (Dillard and Landsman, 1967) scoring system.

The VADS and the Bender were both individually administered and scored by the author in accordance with manual directions. (Koppitz, 1963, 1977).

In September, 1982 of the grade one year, the MRT scores were collected for each child particpating in the study. The MRT was group administered by the classroom teacher. The teachers were trained in appropriate administration and procedures of the MRT and therefore the results can be deemed reliable and valid. The MRT protocols were then scored by other school personnel who were also trained in the scoring of the MRT.

In November, 1982 the report card marks for reading and mathematics were obtained from the grade one teacher. Also, the grade one teachers were instructed to rate the student as to whether (1) this child will be ready for grade two in September, 1983, or (2) this child will NOT be ready for grade two in September, 1983. Again, the grade one teachers were not provided with specific criteria on which to evaluate 'readiness' for grade two.

Statistical Method

The purpose of this study was to investigate the predictive effectiveness of a number of psychometric tests and observations as a useful instrument for screening children entering grade one.

In order to predict future performance, the common procedure is to correlate the scores on the predictive tests with the scores on the criteria variable(s). The key to the predictor and criterion variables are provided in APPENDIX A. A summary of descriptive statistics (N, mean and standard deviation) of each variable is included in APPENDIX B.

Pearson product moment correlation coefficients were then computed for all variables using the Pearson Corr (Nie et al., 1975) statistical package (APPENDIX C). A criterion for predictive usefulness was needed and .40 was used as the cut-off point between coefficients viewed as having practical predictive utility and those without. Guilford (1978) suggested that coefficients which range from .3 to .8 represent

> "the level of validity coefficients usually found for useful predictive instruments in psychology and education practice". (p. 358)

However, Garrett (1954) suggested that only coefficients of .4 or above are useful. He described coefficients ranging from:

"<.20	slight, almost negligible reliability
.20 to .40	low correlation, definite but small reliability
.40 to .70	moderate correlation, substantial reliability
.70 to .90	high correlation, marked reliability
.90 to 1.00	very high correlation, very high reliability"

(p. 176)

A stepwise multiple regression analyses (MULRIO) was then computed to determine the ranking of the predictor variables (Harley, 1981). This procedure selects from the total number of variables being considered those which make the highest contribution towards predicting the criterion variable. The variables are entered into the model, one at a time, beginning with the variable having the highest coefficient of correlation with the criterion measure. Then at each stage the variable in the model is checked by partial 'F' to determine its individual contribution to the predictive battery.

Research Questions

Previous research had indicated a need for an effective psychoeducational battery to predict academic readiness for grade one. However, there has been disagreement as to the best possible instruments to use in a screening battery to determine academic readiness. Therefore, the following questions were generated to clarify or substantiate certain differences in the research or add another perspective to predicting academic readiness for grade one.

1. What are the best subsets of the predictor variables that would result in the most effective prediction of each criterion? The eight criterion variables in this study were: Reading (report card mark), Mathematics (report card mark), TR1, MRT Auditory, MRT Visual, MRT Language, MRT Composite and MRT Quantitative scores.

2. Is the PRS a valid screening instrument for use at the kindergarten level? If so, is there a subtest of the PRS that would be indicative of grade one academic readiness?

3. Is the kindergarten teacher's 'global' rating an adequate predictor of grade one academic readiness?

4. Which of the two tests of visual motor integration (VMI and/or Bender) would be the best instrument to utilize in a screening battery to predict academic readiness?

5. Which of the two human figure drawing scoring techiques (HFD and/or EEIS) would be the best instrument to utilize in a screening battery to predict academic readiness?

6. Is visual and auditory integration, as measured by the VADS, an important instrument in a psychoeducational battery to predict academic readiness?

7. Are the best subset of predictors for each criterion measure the same for males and females when predicting grade one academic readiness?

The results of the statistical analysis will be discussed in the following chapter.

CHAPTER IV

RESULTS

Descriptive Statistics

A summary of the descriptive statistics of the variables in the study is presented in APPENDIX B. Included in this appendix is an abbreviated listing of the predictor and criterion variables, the number of subjects in the study, the mean and the standard deviation of the variables. The total number of subjects for which complete test scores were obtained was 85 (48 males and 37 females). The mean age at the time of testing (May of the kindergarten year) was 70.2 months with a standard deviation of 3.85.

The Pearson product moment correlation coefficients between the predictor variables and the criterion variables are shown in APPENDIX C. Analysis of the data indicated that the highest correlation was between the criterion, Reading (report card mark) and the Total VADS score. This correlation was .650. Also yielding a high correlation of .630 to the criterion measure Reading (report card mark), was the WE subtest of the VADS test. This was followed by a correlation of .610 between Reading (report card mark) and the VW subtest of the VADS test. Next in order were correlations of .609 with Reading (report card mark) and the VW subtest of the VADS test. The MRT Composite criterion yielded a correlation of .603 with the WE subtest of the VADS test.

A preliminary stepwise regression was computed for the total twenty three predictor variables with each of the eight criterion variables in order that (a) variables that were not significant at p = .05 level could be eliminated from the predictive index and (b) a short, but efficient test battery could be derived for each criterion. A total of nine predictor variables were then included for further stepwise regression analysis with each criterion variable. The nine predictor variables were: Teacher Rating in Kindergarten (TRK), Developmental Test of Visual Motor Integration (VMI), Pupil Rating Scale - Verbal (PRSV), Written Expression (WE), Total Visual Aural Digit Span Test (Total VADS), Aural Input (AI), Visual-Oral (VO), Aural-Oral (AO), Pupil Rating Scale-Spoken Language (PRSS). The abbreviated form of each predictor variable will be used throughout this chapter.

Research Questions

1. What are the best subsets of the predictor variables that would result in the most effective prediction of each criterion? The eight criterion variables in this study were: Reading (report card mark), Mathematics (report card mark), TR1, MRT Auditory, MRT Visual, MRT Language, MRT Composite and MRT Quantitative scores.

TABLE 6 shows the stepwise regression procedure for the criterion variable, Reading (report card mark). Using the stepwise regression procedure, the first variable to enter the equation was the Total VADS, accounting for 42.2% of the variance. This was followed by the second variable, PRSV, which raised the percentage of variance to 49.2. When the VMI was added to the index, it raised the percentage of variance to 52.8. The final variable to enter into the model, significant at the .05 level, was the TRK, which increased the percentage to 54.5. Therefore, the four variables, Total VADS, PRSV, VMI and TRK accounted for 54.5% of the variance in the criterion variable Reading (report card mark). The remaining variables added an additional 1.20% to the predictive index.

TABLE 7 shows the stepwise regression analysis of the nine predictor variables with the Mathematics (report card mark). The first variable to enter into the model was the Total VADS test again, however, it accounted for only 29.0% of the variance. This was followed by the second variable TRK, which raised the percentage of variance to 34.1. The final variable to enter into the model was the VMI, bringing the total percentage of variance accounted for, to 36.7. These variables were significant at the .05 level. Therefore, the three variables, Total VADS, TRK and VMI accounted for 36.7% of the variance in the Mathematics report card mark. The remaining variables added another 3.20% variance to the predictive index.

TABLE 6

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH READING REPORT CARD MARK

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	60.664	<.001	42.2	---
2	PRSV*	11.226	<.001	49.2	7.00
3	VMI*	6.244	<.001	52.8	3.60
4	TRK*	2.870	<.028	54.5	1.70
5	PRSS	.845	<.522	54.9	0.40
6	WE	.665	<.678	55.3	0.40
7	AI	.457	<.863	55.6	0.30
8	AO	.225	<.985	55.7	0.10
9	VO	.000	<1.000	55.7	0.00

Note: N = 85
* denotes variables significant at p = .05

TABLE 7

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MATHEMATICS REPORT CARD MARK

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	33.902	<.001	29.0	---
2	TRK*	6.412	<.003	34.1	5.10
3	VMI*	3.311	<.024	36.7	2.60
4	PRSS	2.088	<.090	38.3	1.60
5	AI	1.024	<.410	39.1	0.80
6	PRSV	.321	<.924	39.4	0.30
7	VO	.285	<.958	39.6	0.20
8	WE	.150	<.996	39.7	0.10
9	AO	.259	<.983	39.9	0.20

Note: N = 85

* denotes variables significant at p = .05

TABLE 8 shows the stepwise regression analysis of the nine predictors with the Teacher Rating in Grade one. The first variable to enter into the equation was TRK, accounting for 35.4% of the variance, followed by AI which raised the percentage of variance accounted for to 47.3. When the VMI was added to the model, the percentage of variance was 50.9. The fourth and final significant predictor to enter (p = .05) was VO which raised the percentage of variance to 52.7. The four variables, TRK, AI, VMI and VO contributed 52.7% of the variance with the Teacher Rating in Grade one criterion measure. The remaining variables added an additional 1.00% of the variance to the predictive index.

TABLE 9 shows the stepwise regression procedure of the nine predictor variables with the Metropolitan Readiness Test Auditory score. The first variable to enter into the model was the WE subtest of the VADS test, accounting for 35.4% of the variance, followed by TRK, which raised the percentage of variance accounted for to 40.7. The final variable (significant at the .05 level) to enter into the equation was the VMI, raising the percentage of variance to 43.3. Therefore, the three variables, WE, TRK and VMI accounted for 43.3% of the total variance, with the remaining variables adding only 2.80% of the variance to the model.

TABLE 10 shows the stepwise regression procedure of the nine predictor variables with the Metropolitan Readiness Test Visual score.

TABLE 8

STEPWISE REGRESSION ANALYSIS: NINE

PREDICTORS WITH TEACHER RATING IN GRADE 1

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	TRK*	45.485	<.001	35.4	---
2	AI*	18.469	<.001	47.3	11.90
3	VMI*	5.969	<.001	50.9	3.60
4	VO*	2.967	<.024	52.7	1.80
5	PRSS	1.014	<.415	53.3	0.60
6	AO	.504	<.804	53.6	0.30
7	WE	.149	<.994	53.6	0.00
8	PRSV	.096	<.999	53.7	0.10
9	Total VADS	.027	<1.000	53.7	0.00

Note: N = 85

* denotes variables significant at p = .05

TABLE 9

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MRT AUDITORY SCORE

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	45.566	<.001	35.4	---
2	TRK*	7.307	<.001	40.7	5.30
3	VMI*	3.676	<.015	43.3	2.60
4	VO	2.311	<.065	44.9	1.60
5	PRSV	.590	<.707	45.3	0.40
6	PRSS	.788	<.582	45.8	0.50
7	AO	.213	<.981	46.0	0.20
8	AI	.128	<.998	46.1	0.10
9	Total VADS	.072	<1.000	46.1	0.00

Note: N = 85
* denotes variables significant at p = .05

TABLE 10

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MRT VISUAL SCORE

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	VMI*	26.992	<.001	24.5	---
2	WE*	14.011	<.001	35.6	11.10
3	PRSV*	5.283	<.002	39.5	3.90
4	TRK*	2.552	<.045	41.4	1.90
5	VO	1.960	<.094	42.8	1.40
6	AI	.452	<.842	43.1	0.30
7	Total VADS	.155	<.993	43.2	0.10
8	AO	.001	<1.000	43.2	0.00
9	PRSS	.000	<1.000	43.2	0.00

Note: N = 85

* denotes variables significant at p = .05

The first variable to enter into the model was the VMI, accounting for 24.5% of the variance, followed by WE, which raised the percentage of variance to 35.6. When the PRSV was added to the model, the percentage of variance accounted for became 39.5. The final variable to enter into the equation at a .05 level of significance was TRK, which raised the percentage of variance accounted for to 41.4. Therefore, the four variables, VMI, WE, PRSV and TRK accounted for 41.4% of the variance for the MRT Visual score, with the remaining variables adding only an additional 1.80% of the variance to the predictive index.

TABLE 11 shows the stepwise regression procedure of the nine predictor variables with the Metropolitan Readiness Test Language score. The first variable to enter into the model was the PRSV, accounting for 21.3% of the variance. When the TRK was added to the model, the variance accounted for was raised to 24.6%. The variables are significant at p = .05 level. Therefore, the only two variables predictive of the MRT Language criterion was [illegible]d TRK with a total variance of 24.6%. The remaining variables [illegible]d an additional 3.20% of the variance to the equation.

The stepwise regression analysis for TABLE 12 shows the predictors with the Metropolitan Readiness Test Composite score. The first variable to enter into the equation was the WE, (a subtest of the VADS test) accounting for 36.3% of the variance, followed by the PRSV, which raised the percentage of variance to 46.9. The next variable to enter

TABLE 11

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MRT LANGUAGE SCORE

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	PRSV*	22.506	<.001	21.3	---
2	TRK*	3.605	<.032	24.6	3.30
3	AO	2.175	<.097	26.6	2.00
4	VMI	.307	<.873	26.9	0.30
5	AI	.209	<.958	27.1	0.20
6	WE	.111	<.995	27.2	0.10
7	Total VADS	.474	<.851	27.6	0.40
8	VO	.170	<.994	27.8	0.20
9	PRSS	.001	<1.000	27.8	0.00

Note: N = 85

* denotes variables significant at p = .05

TABLE 12

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MRT COMPOSITE SCORE

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	47.318	<.001	36.3	---
2	PRSV*	16.390	<.001	46.9	10.60
3	VM1*	9.088	<.001	52.3	5.40
4	TRK*	3.668	<.009	54.4	2.10
5	VO	1.984	<.090	55.5	1.10
6	PRSS	.166	<.985	55.6	0.10
7	AO	.104	<.998	55.6	0.00
8	AI	.394	<.992	55.9	0.30
9	Total VADS	.001	<1.000	55.9	0.00

Note: N = 85

* denotes variables significant at p = .05

into the equation was the VMI, bringing the percentage of variance to 52.3. The final variable, significant of the .05 level, entering into the model was TRK, which raised the percentage of variance accounted for to 54.4%. Therefore, the four variables, WE, PRSV, VMI and TRK accounted for 54.4% of the variance with the MRT Composite score, and the remaining variables added an additional 1.5% to the predictive measure.

The first variable to be entered into the stepwise regression model of the nine predictors with the Metropolitan Readiness Test Quantitative score (TABLE 13) was the PRSV, accounting for 25.7% of the variance. The second variable entering into the equation was TRK, raising the percentage of variance to 32.8. When the VMI was added to the model, the percentage of variance increased to 35.2. The variables are significant at p = .05 level. Therefore, the three variables, PRSV, TRK and VMI accounted for 35.2% of the variance with the MRT Quantitative criterion, with the remaining variables adding only an additional 3.10% of the variance to the predictive index.

In summary, to the question as to which subset of predictors of academic readiness best predicts each of the eight criterion measures, the following TABLE 14 summarizes the data.

From TABLE 14 it becomes evident that the predictor variable, TRK, appears in all eight criteria measures, however, variable in terms of

TABLE 13

STEPWISE REGRESSION ANALYSIS: NINE PREDICTORS WITH MRT QUANTITATIVE SCORE

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	PRSV*	28.759	<.001	25.7	---
2	TRK*	8.592	<.001	32.8	7.1
3	VM1*	3.078	<.032	35.2	2.4
4	AI	.844	<.501	35.9	0.70
5	AO	.405	<.844	36.2	0.30
6	PRSS	.414	<.868	36.6	0.40
7	Total VADS	.266	<.965	36.8	0.20
8	VO	.981	<.457	37.6	0.80
9	WE	.848	<.575	38.3	0.70

Note: N = 85

* denotes variables significant at p = .05

TABLE 14
SUMMARY OF STEPWISE REGRESSION
ANALYSIS OF THE BEST PREDICTORS
FOR EACH CRITERION VARIABLE
(In order of Contribution to Model)

CRITERIA	BEST PREDICTORS*	% OF VARIANCE ACCOUNTED FOR BEST PREDICTORS
Reading (report card mark)	Total VADS, PRSV, VMI, TRK	54.5
MRTC	WE, PRSV, VMI, TRK	54.4
TR1	TRK, AI, VMI, VO	52.7
MRTA	WE, TRK, VMI	43.3
MRTV	VMI, WE, PRSV, TRK	41.4
Mathematics (report card mark)	Total VADS, TRK, VMI	36.7
MRTQ	PRSV, TRK, VMI	35.9
MRTL	PRSV, TRK	24.6

Note: * denotes contribution to be significant at p = .05

its contribution with each criteria variable. The TRK contributed significantly with the Teacher Rating in Grade One. The second predictor variable to appear in seven criteria measures (however not in MRTL) was the VMI, contributing most significantly with the MRT Visual criterion measure. The PRSV appeared in five criterion measures, being most contributory to the MRT Quantitative and MRT Language criterion measure. The WE becomes evident in three criterion measures, however, being most significant with the MRT Composite criterion measure. The Total VADS was evident in two criterion measures, the Reading and Mathematics report card marks, contributing most significantly in each criterion measure. The AI and VO (subtests of the VADS test) were both evident in one criterion measure, the TR1. The PRSS and the AO subtest of the VADS were eliminated from the predictive index since its contribution was not evident at a significant level of .05.

Therefore, the results from this analyses indicate that (a) different subsets constitute best prediction of each criterion variable, (b) the Total VADS is the most contributory (accounting for 42.2% of the variance) predictor variable with the Reading report card mark, (c) the TRK is effective in predicting academic readiness using the Teacher Rating in Grade one as the criterion measure (accounting for 35.4% of the variance); (d) the VMI is contributory to measuring visual perception skills by the MRT Visual criterion measure (accounting for 24.5 of the variance); and (e) the PRSV accounts for

25.7 and 21.3 percent of the variability using the MRT Language and MRT Quantitative (respectively) criterion measures.

2. Is the PRS a valid screening instrument for use at the kindergarten level? If so, is there a subtest of the PRS that would be indicative of grade one academic readiness?

From the preliminary stepwise regression analysis, the only subscores of the Myklebust Pupil Rating Scales that were regarded as significant at the .05 level were the PRSS and the PRSV. The PRSS was then eliminated from the nine predictor variables in the final stepwise regression procedures, since its contribution to the predictive index was not significant at a .05 level. However, the PRSV (which is the Total score of the PRS Auditory Comprehension and the PRS Spoken Language subtest) was first entered into the stepwise regression model for the MRT Language (accounting for 21.3% of the variance) criterion measure and the MRT Quantitative (accounting for 25.7% of the variance) criterion measure. The PRSV also becomes contributory to the MRT Composite, MRT Visual and Reading (report card mark) criterion variables, however, in combination with another variables.

Therefore, the PRS Verbal score can be considered as being effective in applying the rating scale with kindergarten children, in the present study.

3. Is the kindergarten teacher's 'global' rating, an adequate predictor of grade one academic readiness?

The teacher's rating in kindergarten (TRK) as a predictor of academic readiness, was evident in all eight criterion measures, either singly or in combination with other predictors. The TRK accounted for 35.4% of the variance, alone, when the TR1 criterion variable was utilized. The fact that the TRK is a 'component' in all eight criterion measures, indicates its usefulness in a predictive screening battery.

4. Which of the two tests of visual motor integration (VMI and/or Bender) would be the best instrument to utilize in a screening battery to predict academic readiness?

From the stepwise regression analysis, the VMI was evident as either accounting for a large proportion of the variance alone, (24.5% with the MRT Visual score) or in combination with other predictor variables. It was evident in seven of the eight criterion variables. However, in order to compare the amount or degree of contribution to a predictive index, a stepwise regression analysis was performed with the VMI and the Bender.

A stepwise regression analysis with the VMI and Bender against the TR1 criterion measure (TABLE 15) shows the VMI accounting for 18.2% of

TABLE 15

VMI AND BENDER WITH TR1 CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	VMI*	18.459	<.001	18.2	---
2	Bender	.265	<.768	18.5	.30

Note: N = 85

* denotes variables significant at p = .05

the variance. The Bender did not even enter into the model at a statistically significant level. However, its addition to a predictive battery with the VMI would only add an additional .3% to the variance. Again, a stepwise regression analysis of the VMI and Bender, using the MRT Composite as the criterion measure (TABLE 16) indicated that the VMI accounted for 22.4% of the variance, while the Bender did not enter into the equation at a significant level. It's addition would bring the percentage of variance to 22.7%. It becomes evident that the VMI would be the best visual motor instrument to use in a predictive screening battery.

5. Which of the two human figure drawing scoring technique (HFD and/or EEIS) would be the best instrument to utilize in a screening battery to predict academic readiness.

It becomes questionable whether to even include the human figure drawings as part of a predictive screening battery for grade one academic readiness. First of all, in the preliminary stepwise regression analysis, neither the EEIS or the HFD entered into the model as contributing at a statistically significant level. A stepwise regression analysis was computed to determine the contribution each scale made if used in isolation. TABLE 17 shows the stepwise regression procedure with the HFD and EEIS and the TR1 criterion measure. The only variable to enter into the equation at a .05 level of significance was the EEIS, accounting for 9% of the variance. The

TABLE 16

VMI AND BENDER WITH MRT COMPOSITE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	VMI*	23.970	<.001	22.4	---
2	Bender	.272	<.763	22.7	.30

Note: N = 85
* denotes variables significant at p = .05

TABLE 17

HFD AND EEIS WITH TR1 CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	EEIS*	8.223	<.005	9.0	---
2	HFD	.000	<1.000	9.0	.00

Note: N = 85
* denotes variables significant at p = .05

HFD did not contribute any additional percentage to the variance. When a stepwise regression analysis was computed with the HFD and EEIS and the MRT Composite criterion measure (TABLE 18), the HFD was the first and only variable to enter into the equation at a .05 level of significance, accounting for 7.6% of the variance. The inclusion of the EEIS added another .90% to the variance. It therefore becomes apparent that the HFD and the EEIS instruments and scoring systems contribute very little in terms of their predictive utility in a screening battery.

6. Is visual and auditory integration, as measured by the VADS, an important instrument in a psychoeducational battery to predict academic readiness.

From TABLE 6 and TABLE 7, the Total VADS contributed most significantly (42.2% of the variance with the Reading report card mark and 29.0% of the variance with the Mathematics report card mark) to the predictive index. The auditory and visual integration processes are important in the subjective marking of report card marks, reflecting the child's success and/or failure on these tasks. Similarly, from TABLE 14, the WE, AI and VO were also evident as contributing significantly (p = .05) in predicting the MRT Auditory and TR1 criterion measures. Its inclusion in a predictive screening battery appears to be warranted.

TABLE 18

HFD AND EEIS WITH MRT COMPOSITE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	HFD*	6.788	<.011	7.6	---
2	EEIS	.858	<.428	8.5	.90

Note: N = 85

* denotes variables significant at p = .05

7. Are the best subset of predictors for each criterion measure the same for male and females when predicting grade one academic readiness?

In regards to the existence of sex differences among the predictive index and criterion measures, a number of predictive measures appear to be the same regardless of sex. It should be noted, however, that the .001 level of significance was chosen to determine the degree of contribution to the predictive index for the following reasons (a) 'gross' differences in predictive variables for either sex would be considered more significant than 'minute' detail; (b) for its practical utility in recommending an economical screening battery to predict academic readiness for grade one that would be significant for both males and females; and (c) its implication in future 'educational programming' with regard to sex differences in learning styles.

The following format will be followed to examine the question of sex differences in variables for academic readiness in grade one: boys/girls with Mathematics (report card mark); boys/girls with Reading (report card mark); boys/girls with MRT Composite; boys/girls with TR1; boys/girls with MRT Language; boys/girls with MRT Visual; boys/girls with MRT Quantitative; boys/girls with MRT Auditory criterion measures.

(a) Boys/Girls with Mathematics (report card mark)

The stepwise regression procedure in APPENDIX D1 (boys with the Mathematics report card mark) and APPENDIX D2 (girls with the Mathematics report card mark) indicate that the Total VADS accounts for 27.7% and 31.6% (respectively) of the variance. The variable is significant at the p = .001 level. For the Mathematics (report card mark) criterion measure, the major contributory variable, Total VADS is the same for both sexes.

(b) Boys/Girls with Reading (report card mark)

In regards to the stepwise regression analysis with the Reading report card mark for boys (APPENDIX D3) and girls (APPENDIX D4), the first variable entering into the model is different for each sex.

The WE predictor variable enters first into the model for boys, accounting for 36.3% of the variance (p = .001). However, for girls, the Total VADS enters into the equation, with a 48.0% variance accounted for (p = .001). Therefore, for the boys, a single skill (written expression) accounts for the majority of the predictive index, while the girls require a total battery (aural-oral, visual-oral, aural-written, visual-written) to be predictive of the reading report card mark. It should be noted, however, that the WE is a subtest of the Total VADS, and therefore, the same test, Visual Aural Digit Span

Test, can be utilized for each sex to predict academic readiness for grade one. Analysis thus indicates that for the reading criterion measure, sex differences are not pronounced as to the best 'test' predictor for academic readiness in grade one.

(c) Boys/Girls with MRT Composite

APPENDIX D5 and APPENDIX D6 show the stepwise regression procedure for boys and girls (respectively) with the MRT Composite criterion measure. The WE variable enters into the model first for both sexes. However, 26% of the variance is accounted for boys, while 47.2% of the variance is accounted for the girls. For the boys, the PRSV enters into the equation, raising the variance accounted for to 37.9% (p = .001). For the girls, however, the VMI enters into the equation (accounting for 57.6% of the variance). Following, the PRSV enters into the equation for girls as well (p = .001). Therefore, the subset of predictors are identical for boys and girls. The addition of the VMI as a significant predictor variable for the girls is the only major difference.

(d) Boys/Girls with TR1

APPENDIX D7 and APPENDIX D8 show the stepwise regression analysis procedure for boys and girls (respectively) using the TR1 criterion.

For the boys the Total VADS first enters into the equation, accounting for 27.4% of the variance (p = .001). The TRK is added to the model, raising the percentage of variance to 44.9%. When the VMI was entered into the equation, the percentage of variance increased to 52.7% (p = .001). However for girls, the TRK entered into the model first, accounting for 51.8% of the variance (p = .001). The next variable to be entered into the model for girls was AO, raising the variance to 56.8%.

It appears that the kindergarten teacher's rating of girls academic readiness tends to agree with the grade one teacher's prediction. However, auditory-visual processing skills, TRK and visual perceptual skills tend to contribute to the grade one teacher rating criterion for boys.

(e) <u>Boys/Girls with MRT Language</u>

APPENDIX D9 and APPENDIX D10 show the stepwise regression procedure for boys and girls (respectively) with the MRT Language criterion. For the boys, the first and only significant variable entering into the equation was PRSV, accounting for 25.9% of the variance (p = .001). However, for the girls, the VMI entered into the model first (21.1% of variance) with the WE entering second, raising the variance to 30.9% (p = .001). It becomes evident that verbal skills are contributory to the prediction of MRT Language criterion for boys while the visual perceptual skills are more applicable for the girls.

(f) Boys/Girls with MRT Visual

In comparing the boys (APPENDIX D11) and girls (APPENDIX D12) with the MRT Visual criterion measure, a difference exists as to which variable(s) best predicts the criterion measure. For the boys, the VMI enters into the model first, accounting for 26.9% of the variance (p = .001). The first and only significant variable to enter into the equation for girls was the Total VADS, accounting for 40.1% of the variance (p = .001). Thus, it appears that visual perception skills are important in predicting the MRT Visual criterion for the boys while visual-auditory integration processes are important for the girls.

(g) Boys/Girls with MRT Quantitative

APPENDIX D13 and APPENDIX D14 show the stepwise regression procedure for boys and girls (respectively) with the MRT Quantitative criterion measure. The first and only significant variable to enter into the model for boys was the PRSS, accounting for 21.3% of the variance (p = .001). However, the first variable to enter into the equation for the girls was TRK, accounting for 36.0% of the variance (p = .001) followed by PRSV, raising the percentage variance accounted for to 48.5% (p = .001). In the analysis, PRS Spoken Language contributed most highly in accounting for the variance with the MRT Quantitative criterion. However, for the girls, the TRK and the PRSV (which was the total score of Auditory Comprehension and Spoken Language) contributed significantly to predicting the MRT Quantitative criterion measure. However, it should be noted that since the PRSS is a subscore of the PRSV, the battery would be the same for each sex when predicting academic readiness.

(h) <u>Boys/Girls with MRT Auditory</u>

APPENDIX D15 and APPENDIX D16 show the stepwise regression analysis for boys and girls (respectively) with the MRT Auditory criterion measure. The first and only significant variable to enter into the equation for both boys and girls was WE (a subtest of the VADS), significant at the .001 level. However, for the boys, the WE accounted for 28.3% of the variance, while for the girls, WE accounted for 43.4% of the variance. Therefore, the WE predictor variable is the same variable for both sexes in predicting the MRT Auditory criterion measure.

In summary, there are no major sex differences, (p=.001) for the following criterion measures: Mathematics (report card mark); Reading (report card mark); MRT Composite; MRT Quantitative and MRT Auditory. Contrary, major sex differences were evident for the TR1, MRT Language and MRT Visual criterion measures. With reference to the TR1 criterion measure, the TRK was the most contributory predictor variable for the girls indicating that the teacher rating in kindergarten tends to agree with the teacher rating in grade one. However, for the boys, the Total VADS, TRK and the VMI were the most contributory in predicting the TR1 criterion measure. With regards to the MRT Language criterion measure, the PRS Verbal score contributed highly in predicting the MRT Language criterion measure for boys, while the VMI contributed highly for the girls. In the final criterion variable, MRT Visual, the VMI accounted for a significant portion of the variance for the boys, with the Total VADS being a major contributor in predicting the MRT Visual score for the girls.

Summary

A stepwise regression analysis procedure was utilized to determine which predictor variables made the highest contribution towards predicting the criterion variables. Results indicated that the Total VADS, PRSV, VMI and TRK (54.5% of the variance accounted for) were the best predictors for the criterion variable, Reading report card mark. The variables were significant at the .05 level. In predicting the MRT Composite criterion, the WE, PRSV, VMI and TRK accounted for 54.4% of the variance, significant at the .05 level. The TRK, AI, VMI and VO subtests best predicted the TR1 criterion, accounting for 52.7% of the variance, significant at the .05 level. The WE, TRK and VMI best predicted the MRT Auditory criterion measure, accounting for 43.4% of the variance, significant at the .05 level. The subset VMI, WE, PRSV and TRK best predicted the MRT Visual criterion accounting for 41.4% of the variance, significant at the .05 level. In predicting the Mathematics report card mark, the Total VADS, TRK and VMI were the best subset of predictors, accounting for 36.7% of the variance, significant at the .05 level. The PRSV, TRK and VMI were entered into the model, accounting for 35.9% of the variance in predicting the MRT Quantitative criterion. The variables are significant at the .05 level. The PRSV and TRK were both found to be predictive of the MRT Language criterion, significant at the .05 level, and accounting for 24.6% of the variance. Therefore, the results indicate that different subsets of the predictor variables contribute in varying weights in predicting each of the eight criterion measures. (See TABLE 14).

The results also revealed that: (a) the Total VADS is the most contributory (accounting for 42.2% of the variance) predictor variable with the Reading report card mark; (b) the Teacher Rating in Kindergarten is effective in predicting academic readiness (accounting for 35.4% of the variance) using the Teacher Rating in Grade One as the criterion measure; (c) the VMI is contributory to measuring visual perception skills (accounting for 24.5% of the variance) using the MRT Visual criterion measure; (d) the Bender did not contribute to the predictive model (at a .05 level of significance); (e) the PRSV accounted for 25.7 and 21.3 percent of the variability using the MRT Language and MRT Quantitative (respectively) criterion measures; (f) the HFD and EEIS was not statistically significant; (g) no significant sex differences were evident at the .001 level for boys and girls with the Mathematics (report card mark), Reading (report card mark), MRT Composite, MRT Quantitative and MRT Auditory criterion measures; (h) the grade one teachers 'global' rating of the girls academic readiness tended to agree with the kindergarten teacher's rating of academic readiness, however, the VADS, TRK and VMI were useful in the prediction of academic readiness for the boys; (i) the PRS Verbal scale was important in predicting the MRT Language criterion for boys, while the VMI was required to predict the MRT Language criterion for the girls; and (j) the VMI was important in predicting the MRT Visual criterion for boys, while the Total VADS was significant in predicting the MRT Visual criterion for the girls.

The following chapter will discuss the relationship of the above findings to previous research and suggest recommendations for further research.

CHAPTER V

DISCUSSION AND CONCLUSIONS

Introduction

In the past, educators have searched for screening instruments which would identify kindergarten children who would experience academic difficulties in grade one. Most important, individuals involved in screening procedures have been concerned with the predictive efficiency of the screening instruments and economy in terms of administration time, cost and the training of personnel. The results of this study provide an effective and economical psychoeducational battery to assess the academic readiness of kindergarten children entering first grade. Three instruments: Visual Aural Digit Span Test (VADS), Developmental Test of Visual Motor Integration (VMI) and the Pupil Rating Scale - Verbal score (PRSV), as well as the 'global' kindergarten teacher's rating can provide the educator with an efficient battery for academic screening. With an introduction to the scoring and interpretation techniques associated with the VADS, VMI and PRSV, a kindergarten teacher can easily administer the screening battery. All of these instruments can be administered within a relatively short period of time at minimal cost and amount of training.

Relation of Findings to Previous Research

The rating scale instruments that were utilized in the present study were a structured behavior checklist (PRS) and a 'global' teacher rating based on non-specified criteria. The findings of the investigation indicated that both assessment measures could be used with the kindergarten population, offering a stable, predictive measure of academic readiness when used in combination with the other tests. Studies supporting the use of a structured rating scale with kindergarten children was also reported by Colligen, (1977); Sevenson, Parker, Wilkinson, Hegion and Fish, (1976); and Serwer, Shapiro and Shapiro, (1972). The results of the present investigation indicated that the PRS Verbal score would be the best indicator of the MRT Quantitative and MRT Language criteria. It should be indicated that the PRS Verbal score is comprised of the two subtests, Auditory Comprehension and Spoken Language. Colligen (1977) had reported that the Spoken Language subtest had the greatest association with mathematics computational ability (.71, $p<.001$) followed by the Auditory Comprehension subtest (.67, $p<.001$). The MRT Quantitative subtest measures counting, simple mathematics operations and basic mathematics concepts. Thus, the present findings are similar as those reported by Colligen, however, not as highly correlated (.479, $p<.001$ for Spoken Language and .478, $p<.001$ for Auditory Comprehension). Since the PRS Verbal score is an adequate measure to predict academic readiness for first grade, then that portion of the test need only be administered.

The kindergarten teacher's 'global' rating was also found to be indicative of academic readiness for first grade. Similar evidence that teacher judgement is an accurate predictor of first grade achievement was presented by Bryan and McGrady, (1972); Ebbesen, (1968); and Ferinden, Jacobson and Linden, (1970).

The Metropolitan Readiness Test (MRT) has been widely used as a valid instrument for assessing academic readiness. The use of the MRT Composite score has been useful in previous literature in predicting early school achievement (Reynolds, 1979). For purposes of this study, the MRT Composite score may be used as a valid criterion measure for assessing academic readiness. The MRT Composite score, as a primary criterion measure, has been related to the teacher rating in kindergarten and as corroborating predictions of academic readiness for grade one (Tokar and Holthouse, 1977). However, in the present investigation, the TRK played a minor role in academic prediction with WE, PRSV and VMI ($p<.001$) being more important than TRK ($p<.05$).

The MRT is oriented strongly to visual-perceptual abilities and language comprehension (Leton, 1963; Telegdy, 1973). Results of the present study indicated that the WE, (Written expression) which is a visual motor task and PRSV, which emphasizes language comprehension, tend to be valid predictors of the MRT Composite score for both sexes. However, the VMI (a visual-motor perception instrument) was also evident for the girls as a predictor for the MRT Composite score. It becomes apparent that the same skills are being utilizied in both the predictor set and criterion variable.

In previous research, Bryan (1964) referred to the importance of testing visual perception at first grade. The results of the present study indicated that the VMI would be useful in a prediction battery. However, the present findings indicated that the Bender's contribution to a psychoeducational battery was minimal and recommended against its use in a screening battery. These findings are consistent with Buckley (1978) who stated that there is no conclusive evidence of the Bender's utility in a screening battery for academic readiness. Similarly, Lessler, Schoeninger and Bridges (1970) also stated that the Bender's contribution was minimal. Reynolds, Wright and Wilkinson (1980) stated that the VMI was a poor instrument in the detection of visual-motor perception difficulties. Yet, the VMI was significant in a screening battery for academic readiness in the present investigation. This study's findings are also contrary to the belief that both the Bender <u>and</u> the VMI are important in academic screening (Lehman and Breen, 1982; Porter and Binder, 1981).

Even though the Bender and the VMI have been reported to measure identical skills, namely visual-motor perception, the Bender did not contribute significantly in an academic screening battery. One reason may be due to the 'mode' of presentation of each instrument. For example, the VMI was structured in that the child had a boxed in area in which to duplicate the form, with three forms to a given page. With reference to the Bender, the child was asked to draw the figure in front of them, on an 8 1/2" x 11" sheet of blank paper. No guidelines or directions, as to 'where' the child should draw the figure were given. Therefore, there may be a possibility that young children, at a kindergarten level, perform better on a structured task than on an unstructured one. During the administration of the Bender, the author observed that the majority of kindergarten children asked where they should draw the form on the paper.

Beery (1982) stated that the forms on the Bender were originally designed by Wertheimer (1923) and have been used primarily with the adult population. Even though Koppitz developed a scoring guide for children, most of the figures were reported by Beery as being

> "too difficult for young children [and] only two of the Wertheimer forms were found to have adequate developmental characteristics for inclusion in the VMI sequence." (p. 15)

Similarly, one would also need to examine the scoring criteria of both the VMI and Bender. How do they compare? Is the criteria more structured for one instrument than the other? These questions need to be addressed when examining the difference and/or similarities between two instruments that purport to measure identical skills. However, in the present study, the predictive power of the Bender in an academic screening battery was not impressive.

A number of studies have referred to the importance of the human figure drawing in a kindergarten screening battery for grade one academic readiness (Hofmann, 1957; Colligen, 1967; Strahl, 1972; Pate and Nichols, 1971; Shipp and Louden, 1964). However, the present study does not corroborate the findings and indicated that the human figure drawing contribution to a screening battery is minimal. The present investigation supports the contention that the human figure drawing does not provide an educationally useful contribution in a screening battery (Hartman, 1972; Scott, 1981).

Intersensory integration, sequencing and recall processes as measured by the Visual Aural Digit Span Test were important in predicting academic readiness for first grade. Similar results were also reported by Whiton, Singer and Cook, 1975; Reilly, 1971, 1972; Amoriell, 1979; Derevensky, 1977; McNinch, 1971.

In predicting the individual criterion measures, Reading (report card mark) and Mathematics (report card mark), the Total VADS score (AO + VO + AW + VW) was the most important contributor at a .001 level of significance. The Total VADS score accounted for 42.4% of the variance in predicting the Grade One Reading (report card mark) while only 29.0% of the variance was accounted for in the Mathematics (report card mark). Skills such as the integration of auditory and visual perception and oral recall; auditory and visual perception and written recall are important factors in the acquisition of reading for the Grade One teacher. Koppitz (1977) reported that of the four subtests (AO, VO, AW and VW), the Visual-Oral (VO) subtest was most closely related to reading since it involved the integration of visual symbols with sounds and the recall of visually presented symbol sequences. Koppitz also reported, however, that the VADS combination scores had a higher correlation with school achievement than did the four subtest scores in isolation.

In the prediction of the MRT Composite score, the Written Expression (WE) combination score (AW + VW) accounted for 36.3% of the variance. Written Expression on the VADS test involved fine motor coordination. When evaluating the 'nature' of the tasks on the MRT, the child was required to draw a line from the lower left-hand corner to the right-hand corner; match letters, numerals and letter like forms; and locate formation of letter groups, words, numerals or separate a pattern visually from the context in which it was placed. These tasks involve fine motor and visual perception abilities. Also, a factor analysis had indicated that the MRT was oriented strongly to visual-perceptual abilities and language comprehension (Leton, 1963; Telegdy, 1973) which may also reveal why the WE combination score was significantly related to the MRT Composite score. The WE combination score also became evident at a statistically significant level in the MRT Auditory and MRT Visual score. However, it is important to note that in the MRT Visual criterion mesaure, the VMI alone accounted for 24.5% of the variance with the WE bringing the percentage of variance for to 35.6. Possibly the VMI measures additional skills, as well as visual perception, in predicting a specific criterion measure rather than the composite criterion measure. Nevertheless, visual motor integration becomes important in readiness type tasks. Koppitz (1977) also reported no statistically significant differences between the VADS test scores and sex. Similar findings were reported in the present study.

Limitations of the Study

One of the problems of prediction is that the age range from five to seven is one of transition (de Hirsch, 1972):

> "Piaget describes the way children at this age move back and forth between the preoperational and concrete stages. Children's performance, therefore, even from one day to the next is less reliable and less consistent than during later years. Within a few months a lagging child might forge ahead and a precocious one might slow down. It is obvious that uncontrolled variables including family crises, extended

illness and frequent changes in teachers, all interfere with prediction". (p. 59)

Therefore, the issue of prediction is an important one when dealing with a kindergarten population. Fluctuations in emotional, social, home environment and/or physical variables may affect the child's performance on a battery of tests with kindergarten age children.

A replication of this study may be undertaken with a larger sample size and a sample of children of different socioeconomic backgrounds. The results of the present investigation can only be generalized to a middle to upper socioeconomic background.

Also, no attempt was made to monitor the effectiveness of a teacher. This variable was beyond the scope of the present study. Similarly, no effort was made to compare predictions from individual teachers since the main concern was for the total data to serve as either the predictive or criteria function.

Finally, a stepwise regression procedure was used as the best method to analyze the data. The important point to note, however, is the amount of variance accounted for in the independent variables. For some variables, an instrument may account for a relatively small proportion of tha variance. As a result, a large percentage of the variance is unaccounted for. Therefore, the question to be asked is what 'other' factors may influence academic readiness?

Implications of the Study

The purpose of screening has been mainly to identify those children in need of individual attention. Zietlin (1976) defined screening

> "as a short procedure [used] to identify those children who might have the characteristics of high risk learners". (p. 11)

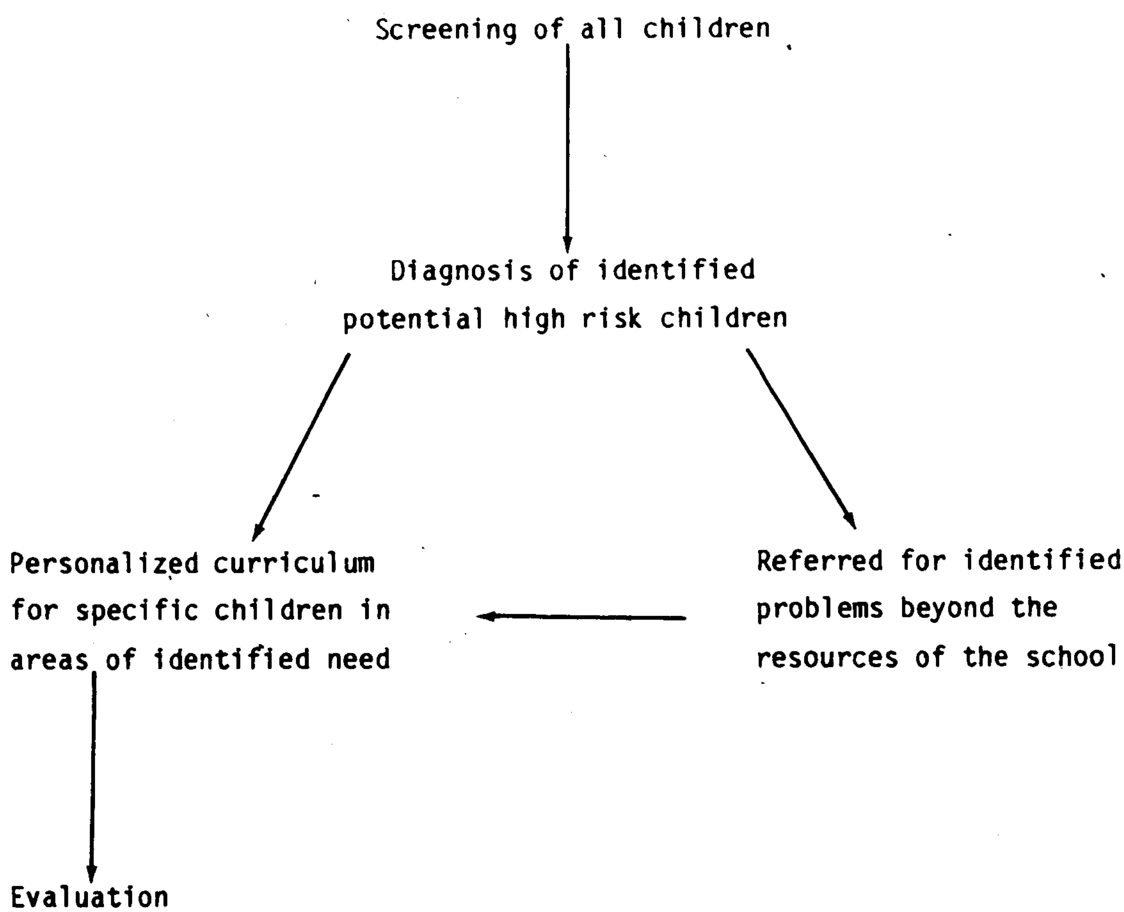
and she suggested the following uses of a screening program:

> "(a) to identify children who may have special learning needs
> (b) to refer identified children for further assessment; and
> (c) to identify children who may need to be observed over a period of time to determine if they need special help or are just immature in their development". (p. 15)

It becomes apparent that the 'end product' of an effective screening program is the implementation of an educational program for a child who may experience academic difficulties. FIGURE A delineates a procedure of a screening program (Zietlin, 1976). An effective screening program cannot just 'stop' at screening. An effective

FIGURE A

A SCREENING PROGRAM



(p. 14)

screening program begins first with a psychoeducational battery of tests which best predicts academic readiness for the first grade. Book (1980) stated that

> "unless the end result of the screening is a more effective education program for the child, even the minimal costs involved do not justify its use as a means of identifying children". (p. 158)

Suggestions for Further Research

If the kindergarten teachers are particularly sensitive in determining which children may develop learning difficulties in the first grade, then it would be necessary to examine what the teachers believe to be 'academic readiness' traits. In the present research, the kindergarten teacher was simply asked to give a 'global' estimate as to whether the child would be ready/not ready for grade one. No additional 'criteria' were given to the teacher. Since teachers, no doubt, are trained to view children in different ways, then it would be valuable to examine what these general or specific traits are in terms of observable domains.

Secondly, with the use of the stepwise regression procedure, 'other' factors influence academic readiness if a percentage of variance is unaccounted for in a screening battery. This investigation calls for further research in utilizing the test combinations reported, along with the examination of other tests and/or observations which may further enhance the predictive effectiveness of an academic screening battery. Hunt and Kirk (1974) suggested the need for criterion - referenced tests of specifiable and teachable units. Hunt and Kirk illustrated the value of criterion references tests as

> "(a) they are directly linked to the attainment of the individual, independent of others in the group ... or class
>
> (b) they are, if devised within the school, directly interpretable in terms of the demands of a relevant teacher
>
> (c) they emphasize short-term needs rather than long term predictions and therefore give direction for teaching in the immediate future". (p.p. 107-108)

The inclusion of criterion-referenced tests may increase the percentage of variance accounted for in a screening battery.

One variable which may be included in the psychoeducational battery is an intelligence test. This variable was not controlled for in the present investigation. In a concluding remark, Hedges (1977) stated that

> "It is sad but true that one can obtain IQ scores on children in elementary school and the correlation between the letter grades the children receive and their IQ scores will be high ... we would do well to have an estimate of [the] child's IQ.". (p. 15)

Also, many of the predictive measures involve tasks which may be 'similar'. In other words, the tests may be measuring the same thing. If this is the case, a factor analysis of the variables could be computed to identify the specific skills being tapped as well as the percentage of variance accounted for by each factor.

The present study examined the predictive effectiveness of academic readiness for grade one using a selected psychoeducational battery. Would this same battery be effective in identifying potentially 'gifted' children?

Summary

The present study examined several tests which can identify kindergarten children's readiness for Grade One. The three instruments: the Visual Aural Digit Span Test, the Developmental Test of Visual Motor Integration, and the Pupil Rating Scale -Verbal score, as well as the kindergarten teacher's 'global' rating, all contribute to an adequate screening device for identifying children who are not academically ready for first grade. The Bender Gestalt Test and the Human Figure Drawings were abandoned due to their relatively insignificant contribution in a psychoeducational screening battery. No matter how effective a screening battery, one should be aware that this is only the first step towards the final goal, which is providing diagnosis and programing for those children who may experience academic difficulties in grade one.

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APPENDIX A

KEY TO VARIABLES

APPENDIX A

KEY TO VARIABLES - PREDICTOR VARIABLES

1.	Sex	Male or Female
2.	Age	Chronological age recorded in months
3.	TRK	Teacher rating in Kindergarten (May)
4.	PRSA	Pupil Rating Scale - Auditory Comprehension Subscore
5.	PRSS	Pupil Rating Scale - Spoken Language Subscore
6.	PRSO	Pupil Rating Scale - Orientation Subscore
7.	PRSM	Pupil Rating Scale - Motor Coordination Subscore
8.	PRSP	Pupil Rating Scale - Personal-Social Behavior Subscore
9.	PRSV	Pupil Rating Scale - Verbal Score
10.	PRSN	Pupil Rating Scale - Nonverbal Score
11.	VMI	Developmental Test of Visual Motor Integration
12.	AO	Visual Aural Digit Span Test - Aural - Oral
13.	VO	Visual Aural Digit Span Test - Visual - Oral
14.	AW	Visual Aural Digit Span Test - Aural - Written
15.	VW	Visual Aural Digit Span Test - Visual - Written
16.	TOTAL	Visual Aural Digit Span Test - Total Score
17.	AI	Visual Aural Digit Span Test - Aural Input
18.	VI	Visual Aural Digit Span Test - Visual Input
19.	OE	Visual Aural Digit Span Test - Oral Expression
20.	WE	Visual Aural Digit Span Test - Written Expression
21.	IAI	Visual Aural Digit Span Test - INTRA Sensory Integration
22.	IEI	Visual Aural Digit Span Test - INTER Sensory Integration
23.	HFD	Human Figure Drawing - Koppitz System
24.	EEIS	Evanston Early Identification Scale
25.	BENDER	Bender Gestalt Test for Young Children

APPENDIX A

KEY TO VARIABLES - CRITERION VARIABLES

26.	READ	Reading Report Card Mark - November, Grade 1
27.	MATH	Mathematics Report Card Mark - November, Grade 1
28.	TR1	Teacher Rating in Grade 1 (December)
29.	MRTA	Metropolitan Readiness Test - Auditory Subscore
30.	MRTV	Metropolitan Readiness Test - Visual Subscore
31.	MRTl	Metropolitan Readiness Test - Language Subscore
32.	MRTC	Metropolitan Readiness Test - COMPOSITE Score
33.	MRTQ	Metropolitan Readiness Test - Quantitative Subscore

APPENDIX B

SUMMARY OF DESCRIPTIVE STATISTICS

APPENDIX B
SUMMARY OF DESCRIPTIVE STATISTICS

VARIABLE	N	MEAN	STANDARD DEVIATION
SEX	85	1.4354	0.4987
AGE*	85	70.2000	3.8508
TRK	85	1.2353	0.4267
PRSA	85	12.8118	2.0089
PRSS	85	15.4235	2.0781
PRSO	85	12.5059	1.7500
PRSM	85	9.3765	1.5038
PRSP	85	25.0000	3.1244
PRSV	85	28.2235	3.8153
PRSN	85	47.0235	4.6776
VMI	85	66.3529	29.3605
AO	85	58.3176	25.1065
VO	85	45.9059	28.2879
AW	85	59.3412	22.6067
VW	85	48.3882	24.8640
TOTAL	85	53.5529	24.1052
AI	85	62.0000	23.0217
VI	85	48.3176	25.6307
OE	85	50.5647	27.5160
WE	85	52.9765	23.4744
IAI	85	53.4000	24.1386
IEI	85	56.2471	22.9388
HFD	85	5.1765	1.1668
EEIS	85	1.2588	0.5153
BENDER	85	76.5529	11.5382
READ	85	5.6353	1.4297
MATH	85	5.8706	1.3344
TR1	85	1.2118	0.4110
MRTA	85	5.7647	1.8234
MRTV	85	5.4941	1.9187
MRTL	85	5.4118	2.0077
MRTC	85	5.5294	1.7834
MRTQ	85	5.4471	1.6147

* chronological age recorded in months

APPENDIX C

PEARSON CORRELATION COEFFICIENTS:

INTERCORRELATIONS OF PREDICTOR VARIABLES AND CRITERION VARIABLES

APPENDIX C

PEARSON CORRELATION COEFFICIENTS: INTERCORRELATIONS OF PREDICTOR VARIABLES AND CRITERION VARIABLES

	SEX	AGE	TRK	PRSA	PRSS	PRSO	PRSM	PRSP	PRSV	PRSN	VMI	AO	VO	AW	VW	TOTAL
SEX		.078	-.263*	.178*	.119	.004	-.015	.290*	.161	.225*	-.070	.118	.000	.127	.140	.105
AGE			-.145	.067	-.076	.013	.001	.027	-.006	-.010	-.388*	-.242*	.021	-.039	.035	-.041
TRK				-.406*	-.275*	-.225*	-.307*	-.411*	-.362*	-.474*	-.244*	-.154	-.247*	-.332*	-.229*	-.315*
PRSA					.752*	.414*	.150	.486*	.933*	.515*	.320	.166	.423*	.520*	.379*	.434*
PRSS						.199*	.090	.323*	.938*	.311*	.328*	.260*	.361*	.442*	.383*	.435*
PRSO							.316*	.368*	.318*	.713*	.150	-.039	.080	.245*	.032	.094
PRSM								-.005	.126	.429*	.083	.081	.074	.048	-.034	.080
PRSP									.427*	.794*	.282*	.174	.137	.365*	.279*	.272*
PRSV										.435*	.344*	.230*	.414*	.512*	.408*	.463*
PRSN											.305*	.118	.163	.382*	.190*	.253*
VMI												.291*	.228*	.378*	.262*	.320*
AO													.481*	.473*	.481*	.720*
VO														.613*	.690*	.845*
AW															.675*	.812*
VW																.859*
TOTAL																

NOTE: N = 85   * denotes significant at p <.05

	AI	VI	OE	WE	IAI	IEI	HFD	EEIS	BENDER	READ	MATH	TRI	MRTA	MRTV	MRTL	MRTC	MRTQ
SEX	.143	.106	.013	.106	.097	.071	-.175	-.027	-.080	.125	.032	-.223*	.127	.053	.033	.019	.022
AGE	-.083	.000	-.044	.163	-.072	-.168	-.260*	.346*	-.115	-.013	-.020	-.005	.100	.028	.048	.087	.056
TRK	-.328*	-.276*	-.243*	-.338*	-.259*	-.296*	.035	.099	-.201*	-.404*	-.385*	.595*	-.418*	-.376*	-.337*	-.432*	-.431*
PRSA	.390*	.429*	.352*	.463*	.341*	.455*	.233*	-.228*	.196*	.486*	.368*	-.427*	.453*	.457*	.433*	.566*	.478*
PRSS	.414*	.424*	.362*	.431*	.356*	.418*	.308*	-.259*	.177	.517*	.406*	-.399*	.353*	.425*	.429*	.511*	.479*
PRSO	.145	.078	.072	.145	.057	.116	.014	-.055	.140	.037	-.038	-.118	.183	.120	.069	.123	.134
PRSM	.141	.039	.153	.056	.134	.039	.036	-.066	.088	.142	.155	-.304*	.172	.178	.204*	.187*	.268*
PRSP	.316*	.250*	.169	.346*	.249*	.224*	.078	-.244*	.213*	.272*	.266*	-.362*	.263*	.203*	.078	.218*	.217*
PRSV	.429*	.454*	.380*	.477*	.374*	.463*	.283*	-.260*	.186*	.535*	.413*	-.441*	.427*	.469*	.462*	.574*	.507*
PRSN	.328	.211*	.189*	.315*	.226*	.231*	.039	-.220*	.242*	.249*	.216*	-.399*	.337*	.261*	.168	.277*	.311*
WMI	.372*	.286*	.249*	.310*	.292*	.334*	.446*	-.540*	.575*	.442*	.357*	-.427*	.369*	.495*	.259*	.473*	.355*
AO	.828*	.560*	.805*	.485	.814*	.561*	.283*	-.290*	.124	.431*	.351*	-.339*	.351*	.262*	.256*	.360*	.204*
VO	.595*	.891*	.850*	.713*	.682*	.844*	.260*	-.138	.175	.541*	.485*	-.441*	.515*	.435*	.251*	.526*	.291*
AW	.814*	.709*	.604*	.844*	.665*	.821*	.245*	-.287*	.173	.595*	.456*	-.494*	.513*	.399*	.265*	.514*	.347*
VW	.611*	.905*	.658*	.893*	.827*	.736*	.150	-.184*	.122	.610*	.464*	-.397*	.524*	.395*	.252*	.530*	.266*
TOTAL	.862*	.941*	.907*	.892*	.913*	.896*	.276*	-.271*	.182	.650*	.539*	-.514*	.578*	.471*	.307*	.594*	.331*

NOTE: N = 85 * denotes significant at $p < .05$

	AI	VI	OE	WE	IAI	IEI	HFD	EEIS	BENDER	READ	MATH	TRI	MRTA	MRTV	MRTL	MRTC	MRTQ
AI		.682*	.821*	.758*	.841*	.736*	.233*	-.305*	.217*	.568*	.451*	-.521*	.504*	.396*	.318*	.518*	.371*
VI			.824*	.861*	.831*	.887*	.253*	-.207*	.165	.609*	.515*	-.438*	.540*	.456*	.242*	.549*	.292*
OE				.699*	.864*	.781*	.269*	-.207*	.179	.539*	.475*	-.458*	.499*	.422*	.295*	.521*	.280*
WE					.805*	.759*	.131	-.148	.183	.630*	.511*	-.486*	.595*	.469*	.305*	.603*	.363*
IAI						.719*	.229*	-.257*	.177	.598	.434*	-.439*	.517*	.378*	.296*	.523*	.264*
IEI							.302*	-.306*	.173	.580*	.485*	-.440*	.472*	.457*	.229*	.507*	.296*
HFD								-.592*	.329*	.396*	.275*	-.178	.193	.285*	.111	.275*	.217*
EEIS									-.363*	-.339*	-.228*	.300*	-.239*	-.251*	-.116	-.242*	-.126
BENDER										.331*	.247*	-.203*	.301*	.301*	.054	.314*	.293*
READ											.768*	-.637*	.734*	.609*	.289*	.754*	.530*
MATH												-.557*	.570*	.639*	.380*	.689*	.585*
TRI													-.584*	-.512*	-.323*	-.577*	-.557*
MRTA														.582*	.313*	.822*	.554*
MRTV															.512*	.852*	.596*
MRTL																.623*	.541*
MRTC																	.702*
MRTQ																	

NOTE: N = 85 * denotes significant at p <.05

APPENDIX D

STEPWISE REGRESSION ANALYSIS

D1	Boys with Mathematics Report Card Mark Criterion
D2	Girls with Mathematics Report Card Mark Criterion
D3	Boys with Reading Report Card Mark Criterion
D4	Girls with Reading Report Card Mark Criterion
D5	Boys with MRT Composite Criterion
D6	Girls with MRT Composite Criterion
D7	Boys with TR1 Criterion
D8	Girls with TR1 Criterion
D9	Boys with MRT Language Criterion
D10	Girls with MRT Language Criterion
D11	Boys with MRT Visual Criterion
D12	Girls with MRT Visual Criterion
D13	Boys with MRT Quantitative Criterion
D14	Girls with MRT Quantitative Criterion
D15	Boys with MRT Auditory Criterion
D16	Girls with MRT Auditory Criterion

TABLE D1

BOYS WITH MATHEMATICS REPORT CARD MARK
CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	17.586	<.001	27.7	---
2	TRK	4.611	<.015	34.4	6.7
3	PRSS	3.318	<.028	39.0	4.6
4	VMI	1.187	<.330	40.6	1.6
5	AI	1.453	<.225	42.6	2.0
6	PRSV	1.586	<.176	44.7	2.1
7	VO	.086	<.999	44.9	.2
8	AO	.029	<1.000	44.9	.0
9	WE	.129	<.999	45.1	.2

Note: N = 85
* denotes variables significant at p = .001

TABLE D2

GIRLS WITH MATHEMATICS REPORT CARD MARK CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	16.178	<.001	31.6	---
2	TRK	2.540	<.094	36.4	4.8
3	PRSV	.583	<.631	37.5	1.1
4	VO	.406	<.803	38.3	.8
5	VMI	.343	<.883	38.9	.6
6	PRSS	.036	<1.000	39.0	.1
7	AO	.006	<1.000	39.0	.0
8	WE	.002	<1.000	39.0	.0
9	AI	.000	<1.000	39.0	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D3

BOYS WITH READING REPORT CARD MARK
CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	26.209	<.001	36.3	---
2	PRSV	5.671	<.006	43.4	7.1
3	VMI	2.488	<.073	46.5	3.1
4	TRK	1.716	<.164	48.5	2.0
5	Total VADS	1.542	<.197	50.3	1.8
6	VO	.325	<.920	50.7	.4
7	AI	.101	<.998	50.8	.1
8	AO	.139	<.997	51.0	.2
9	PRSS	.016	<1.000	51.0	.0

Note: N = 85

* denotes variable significant at p = .001

TABLE D4

GIRLS WITH READING REPORT CARD MARK
CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	32.309	<.001	48.0	---
2	PRSS	5.340	<.010	55.1	7.1
3	VMI	4.702	<.008	60.7	5.6
4	VO	.959	<.443	61.8	1.1
5	TRK	.161	<.975	62.0	.2
6	AI	.155	<.986	62.0	.0
7	AO	.125	<.996	62.8	.4
8	WE	.055	<1.000	62.4	.0
9	PRSV	.004	<1.000	62.4	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D5

BOYS WITH MRT COMPOSITE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	16.173	<.001	26.0	---
2	PRSV*	8.577	<.001	37.9	11.9
3	TRK	2.797	<.051	41.6	3.7
4	VMI	2.509	<.056	44.8	3.2
5	VO	1.662	<.165	46.9	2.1
6	PRSS	.076	<.998	47.0	.1
7	AI	.131	<.995	47.2	.2
8	AO	.144	<.996	47.4	.2
9	Total VADS	.010	<1.000	47.4	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D6

GIRLS WITH MRT COMPOSITE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	31.285	<.001	47.2	---
2	VMI*	8.334	<.001	57.6	10.4
3	PRSV*	6.823	<.001	64.9	7.3
4	TRK	1.613	<.195	66.5	1.6
5	PRSS	.387	<.854	67.0	.5
6	Total VADS	.324	<.919	67.3	.0
7	VO	.029	<1.000	67.3	.0
8	AO	.013	<1.000	67.4	.1
9	AI	.007	<1.000	67.4	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D7

BOYS WITH TR1 CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	17.400	<.001	27.4	---
2	TRK*	14.222	<.001	44.9	17.5
3	VMI*	7.266	<.001	52.7	7.8
4	PRSV	1.784	<.150	54.6	1.9
5	VO	1.536	<.199	56.2	1.6
6	AI	1.608	<.170	57.8	1.6
7	AO	2.368	<.040	60.2	2.4
8	PRSS	.061	<1.000	60.2	.0
9	WE	.070	<1.000	60.3	.1

Note: N = 85

* denotes variables significant at p = .001

TABLE D8

GIRLS WITH TR1 CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	TRK*	37.608	<.001	51.8	---
2	AO	3.532	<.040	56.3	4.5
3	Total VADS	.513	<.676	57.0	.7
4	VO	.662	<.623	57.9	.9
5	AI	.688	<.636	58.8	.9
6	PRSS	.281	<.941	59.2	.4
7	PRSV	1.628	<.167	61.3	2.1
8	VMI	.013	<1.000	61.4	.1
9	WE	.005	<1.000	61.4	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D9

BOYS WITH MRT LANGUAGE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	PRSV*	16.073	<.001	25.9	---
2	TRK	1.722	<.190	28.6	2.7
3	VMI	1.297	<.287	30.7	2.1
4	PRSS	1.577	<.198	33.1	2.4
5	VO	.627	<.680	34.1	1.0
6	WE	1.558	<.184	36.5	2.4
7	AO	.225	<.977	36.9	.4
8	AI	.308	<.959	37.4	.5
9	Total VADS	.089	<1.000	37.5	.1

Note: N = 85

* denotes variables significant at p = .001

TABLE D10

GIRLS WITH MRT LANGUAGE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	VMI*	9.342	<.001	21.1	---
2	WE	4.832	<.014	30.9	9.8
3	PRSV	1.141	<.347	33.2	2.3
4	VO	1.010	<.417	35.2	2.0
5	TRK	.463	<.801	36.2	1.0
6	Total	.144	<.989	36.5	.3
7	AI	.485	<.838	37.5	1.0
8	PRSS	.021	<1.000	37.6	.1
9	AO	.003	<1.000	37.6	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D11

BOYS WITH MRT VISUAL CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	VMI*	[illegible].969	<.001	26.9	---
2	TRK	[illegible].546	<.037	32.3	5.4
3	VO	2.523	<.070	36.0	3.7
4	PRSS	1.372	<.260	37.9	1.9
5	AI	1.465	<.222	40.0	2.1
6	PRSV	.274	<.946	40.4	.4
7	AO	.144	<.994	40.6	.2
8	WE	.010	<1.000	40.7	.1
9	Total VADS	.001	<1.000	40.7	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D12

GIRLS WITH MRT VISUAL CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	Total VADS*	23.411	<.001	40.1	---
2	TRK	7.669	<.002	51.1	11.0
3	PRSV	1.981	<.136	53.9	2.8
4	VMI	1.694	<.176	56.2	2.3
5	PRSS	.277	<.922	56.6	.4
6	VO	.070	<.998	56.7	.1
7	AI	.073	<.999	56.8	.1
8	WE	.014	<1.000	56.8	.0
9	AO	.003	<1.000	56.8	.0

Note: N = 85

* denotes variables significant at p = .001

TABLE D13

BOYS WITH MRT QUANTITATIVE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	PRSS*	12.474	<.001	21.3	---
2	TRK	5.435	<.008	29.8	8.5
3	VO	.982	<.410	31.3	1.5
4	AO	.830	<.514	32.6	1.3
5	PRSV	1.184	<.333	34.5	1.9
6	Total VADS	.215	<.970	34.8	.3
7	AI	.475	<.847	35.6	.2
8	WE	.118	<.998	35.6	.0
9	VMI	.034	<1.000	35.8	.2

Note: N = 85

* denotes variables significant at p = .001

TABLE D14

GIRLS WITH MRT QUANTITATIVE CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	TRK*	19.703	<.001	36.0	---
2	PRSV*	8.258	<.001	48.5	12.5
3	AI	2.162	<.111	51.7	3.2
4	Total VADS	3.887	<.011	56.9	5.2
5	WE	1.436	<.239	58.8	1.9
6	VMI	1.529	<.203	60.8	2.0
7	AO	.265	<.962	61.2	.4
8	VO	.280	<.967	61.6	.4
9	PRSS	.064	<1.000	61.7	.1

Note: N = 85

* denotes variables significant at p = .001

TABLE D15

BOYS WITH MRT AUDITORY CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	18.114	<.001	28.3	---
2	TRK	4.031	<.025	34.2	5.9
3	VO	2.065	<.119	37.1	2.9
4	VMI	1.163	<.341	38.8	1.7
5	AO	.218	<.953	39.1	.3
6	Total VADS	.124	<.993	39.3	.2
7	PRSV	.100	<.998	39.4	.1
8	PRSS	.285	<.967	39.8	.4
9	AI	.014	<1.000	39.9	.1

Note: N = 85

* denotes variables significant at p = .001

TABLE D16

GIRLS WITH MRT AUDITORY CRITERION

STEP NO.	VARIABLE	F VALUE	p LEVEL	% VARIANCE ACCOUNTED FOR	% VARIANCE ADDED
1	WE*	26.837	<.001	43.4	---
2	VMI	4.766	<.015	50.4	7.0
3	PRSV	1.068	<.376	51.9	1.5
4	PRSS	.504	<.733	52.7	.8
5	VO	.636	<.674	53.6	.9
6	TRK	.475	<.822	54.3	.7
7	AI	.469	<.849	55.1	.8
8	AO	.011	<1.000	55.1	.1
9	Total VADS	.020	<1.000	55.1	.1

Note: N = 85

* denotes variables significant at p = .001