MEASURED VISUAL MOTOR SKILLS AS PREDICTORS OF READING AND ARITHMETIC ACHIEVEMENT

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VICKIE R. CARTER

MEASURED VISUAL MOTOR SKILLS

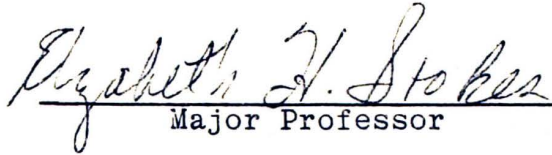AS PREDICTORS OF READING AND ARITHMETIC ACHIEVEMENT

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A Research Paper

Presented to

the Graduate Council

Austin Peay State University

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In Partial Fulfillment

of the Requirements for the Degree
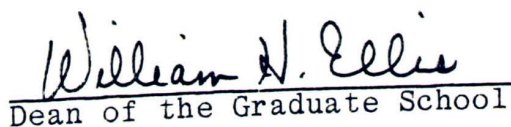
Master of Arts

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by

Vickie R. Carter

September, 1982

To the Graduate Council:

I am submitting herewith a Research Paper written by Vickie R. Carter entitled "Measured Visual Motor Skills as Predictors of Reading and Arithmetic Achievement." I recommend that it be accepted in partial fulfillment of the requirement for the degree of Master of Arts, with a major in psychology.

Elizabeth H. Stokes
Major Professor

Accepted for the Graduate Council:

William N. Ellis
Dean of the Graduate School

ACKNOWLEDGEMENTS

I would like to express my sincere appreciation to Dr. Elizabeth Stokes for her invaluable assistance, guidance, and continued patience during the entire course of this research.

A special thank you is extended to Dr. Garland Blair for his assistance with the computer and in analyzing the data.

To my husband and my family, I extend appreciation for their love and continued support of my efforts to complete my Master's program and this paper.

TABLE OF CONTENTS

LIST OF TABLES

Chapter 1

INTRODUCTION

Visual perception is generally believed to play a significant role in school learning, especially in learning the beginning skills of reading and arithmetic. The attainment of a certain level of maturity in visual-motor perception is considered necessary before a child can learn beginning skills in these two areas (Koppitz, 1963, p. 61). Much of the instruction at kindergarten level is geared to meeting the readiness criteria for first grade and therefore kindergarten teachers devote a considerable amount of time to the development of visual-perception skills. If this is an important skill in school readiness then it should be of value to determine if measurement of this skill would be useful in predicting which children may need additional opportunity for development before entering first grade.

The Bender Visual Motor Test (BVMGT) developed by Lauretta Bender (1938) has been widely used in measuring visual-motor perception of young children from ages 3 to 11. Koppitz (1963, pp. 3-4) cites the many uses of the BVMGT including screening for school readiness as well as diagnosing reading and learning problems, evaluating emotional difficulties, and diagnosing mental retardation.

1

Koppitz in her more recent book (1975, p. 1) describes
the transition of the Bender Test from a primarily clinical
diagnostic tool to its present most prevalent use as a
developmental test of visual-motor perception for children
entering school and children having learning problems.
In contrast to many others she sees the test as a measure
of visual-motor integration rather than a measure of
visual perception or motor coordination. She contends
that although a child with a poor Bender reproduction may
have a problem in any one or all of the three areas above,
the majority of children with poor scores are demonstrating
the lack of development in the higher integrative skills.

Koppitz (1963) published her developmental scoring
system for the BVMGT after having used it many years in
clinical practice and recognizing the need for an objective
method of scoring. Her experience with children who had
school learning problems and emotional difficulties had
caused her to see perceptual problems as a major reason
for their difficulties. Her search for a short test of
visual-motor perception which would be valuable in identify-
ing these children led to investigative studies of the
BVMGT. The response of colleagues to her publication of
these studies led her to write her first book describing
the results of both her research and that of others with
the BVMGT. However, she saw the major value of her book

as the presentation of an objective scoring system for the BVMGT which she had standardized on more than 1200 public school children. She later (1975) published a second volume describing the application of and continued research with the Bender Test.

Although this writer was unable to find verification for this statement, it is her opinion from reading the professional literature, attending professional meetings, her university training, and discussion with professional persons in the field that the Koppitz developmental scoring system is the most widely used method of evaluating the performance of young children on the BVMGT, and that Koppitz is one of the leading authorities on the Bender Test. Therefore most of the justification for this study is based on her work.

In the summary of the research conducted from the use of the Bender with children for the 20 years prior to the publication of her first book, she concluded the research to that time showed the BVMGT was useful in screening for school readiness (Koppitz 1963). However, she considered it more useful if it were combined with other standardized measures of school readiness. She suggested that it was especially useful for those who were exceptional and either needed earlier further development before entering school or were ready for an accelerated program. In reviewing

the research on the Bender Test as a predictor of school achievement she concluded that Bender scores obtained at the beginning of first grade had predictive value for both standardized achievement test scores and teacher ratings at the end of the first grade. Beginning second grade Bender scores showed higher correlation with achievement test scores at the second and third grades but only with teacher ratings at the end of the second grade. The Bender scores of third grade children correlated highly with teacher ratings but fourth grade Bender scores did not. In discussing beginning kindergarten Bender scores, she suggested they had some value in identifying those children who would be rated highly by the teachers at the end of the year. However, she suggested that supplementary measures were needed to identify children who would do poorly in school. Her reasoning was that visual-motor perception during the kindergarten year matures greatly and a poor Bender score at the beginning of the year does not necessarily predict that the child will not be successful in kindergarten (Koppitz, 1963, p. 61).

Koppitz (1963) investigated reading and arithmetic achievement of 174 children who were divided into four groups and tested with the Bender Test at the beginning of the first or second grade. The Metropolitan Achievement

Test given later in the child's school career, either at the end of that year and up to the end of the third grade, was used to divide children into groups of high or low achievers in reading and/or arithmetic. Although no certain individual item was found that was able to predict problems in reading or arithmetic, the total score was significantly related to achievement in both these areas at the second and third grades with the Bender scores more closely related to arithmetic than reading achievement. In evaluating her findings she emphasized that there were other intervening factors such as emotional problems, delayed maturation, or cultural factors that might cause a child who scored well on the Bender at one point to be poor achievers at a later time. However, children who scored poorly on the Bender Test might either have perceptual problems or be low in intelligence. She suggested good Bender scores along with high intelligence would be of particular value in identifying gifted children who were ready for an accelerated program at the time they entered kindergarten.

In her 1975 book Koppitz reviewed the research which had been conducted with the Bender Test and its predictive ability for arithmetic and reading achievement since the publication of her first work in 1963. Again, she concluded after analyzing the research that there was

general agreement that the total score was a better pre-
dictor than any single Bender Test item. She agreed
there was not a one-to-one relationship between the Bender
Test total score and readiness and arithmetic achievement.
In examining 54 reported research studies during the period
between her first and second publications, she found 46
with statistically significant correlations between Bender
Test scores and reading and/or arithmetic at the .05 level
or higher and only 8 which were not significant. Even
though she says there was no question of a positive
relationship between Bender Test scores and achievement,
she pointed out that most of the correlations were too
low to be of real value to school psychologists in
predicting how well a child would do in school. Her own
nine-year study (Koppitz, 1973) of Bender Test scores and
school achievement does provide some help with this
problem. She felt the data did show that children with
good Bender Test scores at the time they enter school
tend to do well in school. The reverse did not hold true.
Children with poor scores did not necessarily fail to
learn in school. However, children who did fail
were more likely to have poor Bender Test scores, whether
their poor performance on the test was due to low intel-
lectual ability to specific learning problems. Again,
she pointed out that some children with poor Bender Test

performance at kindergarten or even first grade level were simply chronologically young or slower in maturation. Given time, they might achieve at the average or even at the superior level. In addition to this group, there were some children who really did have a visual-motor perception or intersensory integrative problem. Those children who had such problems but had the advantage of being bright with good language ability, adequate experiences and encouragement from the adults in their lives might overcome these problems without special help. Those without such advantages, however, might not be able to overcome their perceptual-motor deficiencies and be poor school achievers.

Koppitz admits that she may have overestimated the effect of visual-motor integration in school achievement in her earlier publications. Although she recognized the effect of other factors earlier, both her later research and that of other persons have made her more aware of the equal importance of other factors, "especially language development, oral-visual integration, sequencing, recall of symbols and information, and concept formation" (p. 60). She also points out that the child's family background, chronological age, attitudes and sex may influence achievement and one must consider all of these factors as important when predicting school progress.

Perhaps her recognition of other factors was influenced by the research done by persons such as Giebink and Birch (1970). She included them as having done two studies showing non-significant findings in comparing the BVMGT with achievement in her review of the 54 studies (Koppitz, 1975). She does not elaborate on their disagreement nor mention that they found a very low significant correlation (r = +.29) between BVMGT scores when children were tested in kindergarten and retested in first grade. They suggest caution in considering perceptual motor functioning as stable or causative in determining reading ability. They questioned any predictive statements being made about reading achievement on the basis of Bender Test Scores.

Since the review of the literature by Koppitz (1975) other researchers have found significant correlations between Bender scores and school achievement. Snyder, Massong, and Ashmore (1980) administered the BVMGT and the Metropolitan Achievement Test to 84 first grade children in the last month of the school year. They found significant correlations between the total Bender score and total reading and total mathematic scores. They suggested, however, that the memory sub-scores were of additional value in assessing potentially learning disabled children.

Carter, Spero, and Walsh (1978) in their study of

three age groups of elementary children, roughly 6-, 7- and 8-year olds, found the Bender scores successful in discriminating between low and average achievers in vocabulary, math concepts and math-problem solving groups. However, it did not discriminate between low and average reading comprehension groups. In general, they felt their study supported other research showing a relationship between Bender scores and achievement in both mathematics and reading recognition.

Larsen, Rogers, and Sowell (1976) investigated the diagnostic usefulness of parts of the Illinois Test of Psycholinguistic Abilities, the Wepman Auditory Discrimination Test, and the BVMGT with 30 normal and 59 learning disabled children. They found only the BVMGT diagnostically differentiating between the two groups as compared to reading achievement on the Stanford Reading Achievement Test. However, they contended the differences in the groups were probably not great enough to use any of the tests investigated for diagnostic purposes for large groups of children. They concluded there is little support in the research literature for the acceptance that measured visual perception skills are essential to academic achievement.

Rust, Rousseau, and Ashmore (1982) investigated the efficiency of the Otis-Lennon Mental Ability Test, the

Metropolitan Readiness Test, the BVMGT, and Visual Memory Technique for the prediction of first grade reading and arithmetic achievement for 147 children. The scores on these predictive instruments were compared with arithmetic and reading scores on the Stanford Achievement Test administered during the last month of school. The Metropolitan Readiness Test and the Otis-Lennon were found to be the best predictors of both mathematics and reading achievement. However, the BVMGT also showed a significant correlation with both achievement areas. They concluded, on the basis of stepwise regression equations, that including the BVMGT significantly increased the predictive power of the test battery.

Other studies reported by Buckley (1978) cite literature that fails to confirm the Bender as a valid predictor of reading and school achievement. So there are still contradictory findings on the value of the BVMGT in predicting school success.

The stability of Koppitz scores on the BVMGT was examined in a study conducted by Wallbrown and Fremont (1980). The test-retest reliability of the Bender was computed for a sample of 84 reading disabled children. Significant correlations on Bender total scores were at the .001 level, r = .83. Since the BVMGT is used in psychological assessment on a regular basis it is important

to establish reliability studies that support the use of such an instrument as this. They further supported the findings of Koppitz by placing the emphasis of evaluating Bender protocols in the total error score rather than on any of the four different error categories.

Purpose of the Study

The BVMGT is widely used to measure abilities considered by many educators to be important in school achievement. Early intervention for exceptional children, at either end of the continuum, is also considered important. There is conflicting data on the value of the BVMGT in predicting success in school although most research to the present time supports the use of the Bender Test for selecting children in need of special programs. It would be of value to continue to investigate the value of the BVMGT.

The specific purpose of this study is to investigate the correlations of scores earned by children on the BVGMT at the kindergarten level with later achievement in the elementary school. Achievement will be measured by teacher given grades in reading and during the first three years. Standardized achievement test scores in reading and mathematics earned by the children at the end of the third grade will also be examined to determine their relationship with kindergarten BVMGT scores. The total BVMGT score will be used as Koppitz (1963, 1975)

sees this score as more predictive than scores on individual items.

Hypotheses

1. There is a significant correlation between total BVMGT scores earned at the end of kindergarten and reading grades given by teachers in the

    a. first grade

    b. second grade

    c. third grade

2. There is a significant correlation between total BVMGT scores and standardized total reading achievement test scores earned at the end of the third grade.

3. There is a significant correlation between total BVMGT scores and standardized total arithmetic achievement test scores earned at the end of the third grade.

Chapter 2

METHOD

Subjects

The subjects involved in this study were twenty-six
elementary school children, (9 boys and 17 girls). All
of the subjects attended St. Bethlehem Elementary School,
in the Clarksville-Montgomery County School System, in
St. Bethlehem, Tennessee. The students in this study were
participants in an original sample of 43 students in a
longitudinal study begun in 1978 during the spring semester
and the summer of their kindergarten year by Stokes,
Glasgow, Marrero, and James and Janis Tramill (Note 1).
The mean age of the subjects was 6-0.

In the original sample signed parental consent was
obtained in order to use data on their school performance
in a longitudinal study. It was understood at that time
that the parents would be notified prior to any further
contact with the students involving testing or research.
Two school psychologists, one faculty member, and two
graduate students in the Psychology Department of Austin
Peay State University, Clarksville, Tennessee, administered
the tests. Students from two kindergarten classes at
St. Bethlehem Elementary School were included in the
original sample. Forty-three students were in the initial

sample, however, only twenty-six students are included in this study. The follow-up data on some individuals were not available as they were no longer enrolled in the school. A copy of the parent notification form for the present study is in the Appendix. The school grades and achievement data were gathered by another graduate student, Marcia Till, and the parents were notified on April 16, 1981. Since this study did not involve the acquisition of any further data, the parents were not informed of this study.

Description of the Instruments

The two tests used in the study were the Bender Visual Motor Gestalt Test and the California Achievement Test.

The BVMGT (Bender, 1938) is designed for individual or group administration to students age 5-0 through 10-11 years old. The instrument is a series of nine geometric designs each printed on 4" by 6" cards. A raw score is obtained for the number of errors made by students and a total error score is used to give an age equivalent score. A perfect reproduction earns a score of 0. The higher the score the poorer the performance of the child.

The purpose of the test is to provide a screening measure of the development of visual-motor integration skills in children entering school and for those who

may have learning problems. The test is easy to administer and is less time consuming than other tests that have been incorporated into large test batteries.

The developmental scoring system developed by Koppitz (1963) is based primarily on a maturational basis. Very young children are expected to have more difficulty drawing the designs than would a child of say 10 years of age. Therefore, she has developed through research and studies the approximate number of errors earned for each age child 5-0 through 10-11. A mean error score and standard deviation is reported for each year level. From this data, one may estimate whether a child is below or above the expected range for his/her age range in visual-motor integration skills. This can be particularly important in identifying exceptional children at either end of the continuum of exceptionality.

A correlational study of the stability of the Koppitz scores (Wallbrown and Fremont, 1980) reported a test-retest reliability of the Bender as .83. This reported coefficient is consistent with Koppitz's (1975, p. 28) summary of nine test-retest reliability studies ranging from .50 to .90. All but one of the coefficients was significant at the .01 level and that one was significant at the .05 level. She concluded that "results from these nine studies indicate that the total Developmental Bender

Test scores of normal elementary school children were reasonably stable and that the Bender Test scores are quite reliable" (p. 29).

The California Achievement Test (CAT) is a group administered series of test batteries that are designed to measure reading and arithmetic achievement. The tests may be used with children in kindergarten through the twelfth grade. There are five different scores available: raw scores, grade equivalents, national percentile ranks, national stanines, and scale scores.

The CAT, Form C (CAT/C) was used in this research study. Within the standardization sample internal consistency for the CAT/C, Level 13, raw scores reached .96 for Total Reading and .96 for Total Mathematics. The Kuder-Richardson Formula 20 was used to derive these correlations. The test-retest reliability correlations over a period of a six-month interval for CAT 13/C, scale score units were .87 for Total Reading and .84 for Total Mathematics.

The validity of the CAT is in terms of the development of content for the series. A concurrent validity coefficient of .82 was obtained for CAT/C, Level 13, ($N = 1,357$), with the Short Form Test of Academic Aptitude listed in the CAT Technical Bulletin 1 (1979).

Only the scores on the Total Reading section and the

Total Mathematics section of the CAT 13/C were used for this study. The Total Reading section is a composite of two subtests, reading vocabulary and reading comprehension. Both subtests are timed and the scores from each yield a total reading score for the student. The Total Mathematics section is composed of Mathematic Computation and Mathematic Concepts and Application. These subtests are also timed and the scores yield a Total Mathematics score. Only the Total Reading and Total Mathematics scores are used for statistical purposes in this study.

Procedure

The total BVMGT score earned by each child in the kindergarten year in 1978 was correlated with the reading grades given by the teachers at the end of the first, second, and third grades. The letter grades given by the teachers were given a value of 0 to 4, with an F having a value of 0. The correlation of the total BVMGT scores with standard scores earned in total reading and arithmetic on the California Achievement Test (CAT), Form C, Level 12 and 13 in the Spring of 1981 was determined. All of the children but one took Level 13 and were given the test in the regular school testing program at the end of their third grade year. One child had been retained and was given Level 12, which is the appropriate test for second grade children.

Koppitz's (1963, 1975) Developmental Scoring System was used to score the BVMGT. Children are given one point for each error they make. There is a total of 28 errors which may be scored. Different types of errors may be scored on each item presented although some errors are scored on more than one card. The following categories of errors are scored: rotations, distortions, integration failures, and perseveration.

Administration and Scoring

The Bender Tests were administered by one of the five persons who conducted the original study. Each child was administered the BVMGT by the same person who administered the other tests used in the study. The BVMGT's were scored independently by two of the persons who conducted the original study. Those protocols on which there was disagreement were rescored by the author of this paper who made the decision on which scoring to accept.

The California Achievement Tests were administered by the students' classroom teachers. The tests were then scored by computers for the school system. The Total Reading and Total Mathematics standard scores as recorded on the child's cumulative record were the scores used for the study.

Chapter 3

RESULTS

The Pearson-product moment correlation coefficients were used for Hypothesis 1-3. The coefficients were computed by using the Bender total score as the predictor variable, the Total Reading and Total Arithmetic scores of the California Achievement Test and school grades in reading for the first through the third grade.

Scores from the kindergarten administration of the BVMGT to the 26 subjects with a mean age of 6-0 years yielded a mean score of 8.9, SD of 3.6.

Hypothesis 1 stated that there is a significant correlation between total BVMGT scores earned at the end of kindergarten and reading grades given by teachers in the first, second, and third grade. Table 1 (see page 20) lists the correlations for each grade.

Hypothesis 1 is supported as all three correlation coefficients were significant for total Bender scores and reading grades. The most highly significant correlation was with first grade reading achievement.

Hypothesis 2 stated that there is a significant correlation between total BVMGT scores and standardized total reading achievement test scores earned at the end of the third grade. The hypothesis is supported as shown in Table 2 (see page 20).

Table 1

Correlation Coefficients of BVMGT Total

Score with School Grades in Reading

Grade Level	M Reading Grade	r
First	2.9	-.69**
Second	3.1	-.41*
Third	3.0	-.33*

*p < .05

**p < .005

Table 2

Correlation Coefficients of BVMGT Total

Score with California Achievement Test Scores

at Third Grade Level

Subject	M Score	r
Total Reading	426.1	-.41*
Total Arithmetic	415.9	-.43*

*p < .05

A scatterplot of the CAT Total Reading scores and the total Bender scores graphically illustrated that the child with the poorest Bender score had the lowest achievement test score.

Hypothesis 3 states that there is a significant correlation between total BVMGT scores and standardized total arithmetic test scores earned at the end of the third grade. The hypothesis is supported as shown in Table 2. Thus, all three hypotheses were supported, with the total Bender score earned at the kindergarten level showing a significant relationship with achievement in later grades, as measured by standardized achievement test scores and teacher given school grades.

Chapter 4

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate the predictive validity of the Bender Gestalt test (BVMGT) for school achievement in reading and arithmetic. The subjects were 26 children to whom the Bender-Gestalt Test was administered at the end of their kindergarten year. Teacher-given grades in reading for the first three grades and standardized test scores in reading and arithmetic at the end of the third grade were used as measures of achievement.

Significant correlations between the Bender total scores and reading grades were found for all three years. The highest correlation was with first grade reading grades. One child had an exceptionally high error score on the Bender performance, which definitely resulted in a higher negative correlation. When this score was eliminated from the correlational analysis the correlation coefficients dropped some, but were still significant, -.53, -.25, and -.34 for first, second, and third grades respectively. These findings are consistent with those reported by Koppitz (1975) in her evaluation of research studies conducted between 1965 and 1973. She summarized the findings of these studies by stating that the evidence would make it impossible to deny a positive relationship between scores on the Bender and school achievement.

Significant correlations between total Bender scores and third grade standardized achievement test scores in both reading and arithmetic were found. These findings support the findings of Koppitz (1975) and other research reported by her. Later studies by Snyder et al. (1980) and Rust et al. (1982) also reported significant correlations between Bender total scores and standardized test scores in these two major subject areas. The findings in this study have demonstrated that kindergarten Bender scores are significantly related to achievement even after three years in school. A number of studies have shown Bender scores predictive of achievement after one year, but few studies have followed children for three years.

A number of the other research studies have involved learning disabled children or other special subgroups as their sample. This study originally involved all the children from two kindergarten classes which would be considered representative of an average sample. It would still be assumed to be representative of an average group of children although some of the children have moved and this sample did not include all of the children in the original group. Correlations using all children would be expected to be lower than those using extreme groups. The fact that the correlations were significant with this average group after three years gives even stronger support

to the Koppitz's (1963, 1975) contention that the Bender Gestalt Test is useful as a screening device and/or predictor of school achievement.

One would need to follow Koppitz's caution that the Bender should not be used alone as a screening device. Neither is visual-motor integration the only important factor in determining school achievement. However, Rust et al. (1982) found that the inclusion of the Bender Test significantly increased the predictive power of a test battery which included a measure of intelligence and readiness. Larsen et al. (1976) do not support the use of any measure of visual perceptual skills as a screening device for academic achievement. However, in their investigation of three measures, they found only the Bender differentiated between a group of normal and learning disabled children.

The results of this study lends support to those who feel the Bender Gestalt test can be a useful tool for prediction of future school achievement. This study did not specifically investigate whether children with extreme scores did well or poorly in school. More research needs to be conducted to determine if those children with good performance on the Bender at the kindergarten level might profit from an accelerated program as indicated by extremely high achievement in later grades. Continued research to locate a battery of tests and other factors influencing

school achievement is important. If early intervention for
exceptional children is useful, as is believed by many
educators, the search for a better way of identifying such
children must continue to be sought.

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1. Stokes, Elizabeth H. Personal Communications in
March, 1981.

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APPENDIX

April 16, 1981

TO: Parents of Third Grade Children in McCarthy-WISC-R Study at St. Bethlehem Elementary School

FROM: Elizabeth H. Stokes, Department of Psychology, APSU

We appreciate your cooperation in allowing your child to take part in the study of the McCarthy Scales of Children's Abilities during his/her kindergarten year, and of its correlation with the Wechsler Intelligence Scale for Children - Revised during the first grade year. As you remember, we asked for permission for your child to be in the study so we could follow him through the next few years of school.

The time has come for the next stage of the study, which will not require the children's direct participation. A graduate student will re-score parts of the kindergarten McCarthy Scales according to three short forms of the test. These short forms will be compared with the children's grades and California Achievement Test scores to see which is the best predictor of achievement. This information could be very helpful in future screenings of kindergarten children to find areas of need for special help.

As before, the children's results will be looked at as part of a group study. No individual will be identified. Such a study is valuable in finding out which of these are most useful. We thank you again for your help and for your child's help.

Please call me at 648-7233 or Mrs. Bell at 645-4449 if you have any questions or objections. Otherwise, we will assume that you are willing for us to continue working with your child's test results, and to obtain grades and CAT scores from the cumulative record for use as group data in the study.