A Comparison of Standardized Measures of Achievement and Ability with Locally Normed Curriculum Based Measures of Reading in a High Achieving District

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A COMPARISON OF STANDARDIZED MEASURES OF ACHIEVEMENT
AND ABILITY WITH LOCALLY NORMED CURRICULUM BASED
MEASURES OF READING IN A HIGH ACHIEVING DISTRICT

A DISSERTATION SUBMITTED
TO THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
DEPARTMENT OF CURRICULUM, INSTRUCTION AND
EDUCATIONAL PSYCHOLOGY

BY
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CHICAGO, ILLINOIS

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CHAPTER I

INTRODUCTION

In a climate of educational reform, a growing portion of the educational community currently regards performance based assessment as a meaningful measure of a student’s knowledge and/or skills. Distinguished from nationally normed tests of achievement which are designed to measure acquisition of general knowledge structures without particular attention to a student’s curriculum, performance assessment procedures are designed to measure a student’s knowledge and/or skills relative to the specific curriculum in which he or she is situated.

Proponents of performance based assessment have criticized traditional norm-based achievement assessment for several reasons. Wiggins (1993) claims that standardized tests are not linked to the real world and are too narrowly constructed. Others (Paris, Lawton, Turner & Roth, 1991) argue that student learning involves motivation, content, and the context in which the learning takes place - all
factors which have strong effects on learners and factors which are not directly measured by normed tests. Many (Good & Salvia, 1988; Shapiro & Derr, 1987) attack the lack of curricular and instructional validity of normed achievement tests since they claim these measures do not adequately reflect the content and/or the curriculum taught.

On the other hand, some researchers have criticized performance based assessment on the grounds that its validity standards are less stringent than those validity standards applied to nationally normed tests. The criticisms include a call for additional research to support the adequacy of this form of assessment as well as claims that it will have positive effects on student learning and instruction (Messick, 1994). Also, when high individual stakes are involved, many (Baker, O'Neil & Linn, 1993) believe that strong evidence should be required to substantiate the validity of these measures.

Researchers (Baker, O'Neil & Linn, 1993; Shavelson, Baxter & Pine, 1992) have called for validation of alternative assessment to include evidence regarding the degree to which the performance on a specific task transfers to new problem solving situations and/or the fairness of the assessment. Other areas of concern for validity have included content quality, cognitive complexity, meaningfulness for students and teachers, cost, and
comprehensiveness of content coverage and performance-based assessment compared to cognitive ability.

Performance based assessment also poses questions concerning equity in education if the use of assessments does not undergo a change as well. Should assessments not be used merely to determine student placement, or should assessments be used to drive meaningful instruction? To that end, the insurance that educational funding is equitable insuring all school districts equal access to highly trained teachers becomes necessary. Equitable allocation of resources and the enhancement of teaching are considered issues of prime importance if performance based assessments are found to effectively contribute to the goals of educational reforms (Darling-Hammond, 1994).

In discussing proposals to mandate a national testing policy which would include performance assessment, Madaus (1994) stated that all assessments make inferences about a person's probable performance relative only to a particular domain. He expressed concern that the correctness of these inferences for different groups within the society and about the decisions made about individuals in terms of classifications and descriptions relative to assessment results be carefully monitored and evaluated.

Support for assessment based in the curriculum exists in federal case law. The court found in Debra P. v. Turlington (1979, 1981, 1984) that denying a student a high
school diploma on the basis that a student had not passed a minimum competency test was unconstitutional since the test covered material not taught to students in the school's curriculum.

Performance based assessments received favorable reviews in a study of parents' attitudes toward this type of assessment (Shepard & Bliem, 1995). Although parents strongly supported nationally standardized tests, parents rated performance assessment very favorably.

Curriculum Based Measurement (CBM) falls under the conceptual umbrella of performance based measurement and its proponents contend that it corrects the flaws of traditional norm-based assessments in the following ways. This measurement system provides a method of assessing the proficiency of student performance in various basic skills. CBM utilizes material taken directly from the school curriculum and norms are developed from data collected in the school district in which the student learns. CBM employs repeated measurements in data collection. This feature lends reliability to the developed norms. CBM also provides baseline data for future measurement, information to guide instruction, and norms which may be used to determine eligibility for special education services when a student's performance appears to be significantly discrepant from his or her peers (Knutson & Shinn, 1991; Shinn & Hubbard, 1992). CBMs have adequate discriminant and
treatment validity. The measures are sensitive to change in reading progress and longitudinal change (Shinn, Good, Knutson, Tilly & Collins, 1992). In sum, the use of CBM to identify students for special education programs has been reported as a successful practice (Shinn, Tindal, & Stein, 1988).

When utilized for special education qualification, CBM bases need for academic intervention solely upon performance demonstrated via CBM and does not take into account ability or standardized achievement measures. It should be noted that the federal definition of a learning disability does not specify operational procedures for eligibility purposes. However, general practice has been to establish a discrepancy between ability and achievement. A survey conducted by Mercer (1985), found that 84% of states use the ability-achievement discrepancy formula. Educators and researchers disagree about whether this method adequately provides a tool for accurate identification of a learning disability (Algozzine, 1983; Galagan, 1985; Merrell, 1990; Wilson, 1985). Others consider the resources spent to address eligibility rather than intervention a misallocation of funds (Reschly, 1988).

Within the context of the CBM model, only the difference between what is expected of the student relative to the typical mainstream student in his or her school or district and his or her actual performance is considered to
be relevant to making eligibility decisions. The mainstream environment in which the student functions replaces the expectation via ability measures obtained most often through the administration of intelligence tests. The former model implies that the problem exists within the environment and the latter model implies that the problem rests within the child. According to the CBM model, eligibility is conferred when the student's academic discrepancy from the mainstream student performance is considered so severe that the student's academic needs cannot be accommodated within the regular education mainstream environment (Shinn, 1989).

RATIONALE AND OVERALL PURPOSE

Since CBM derives norms solely from local data and does not take into account ability measures when determining eligibility, factors in a particular district may serve to influence eligibility. For instance, a student in a high achieving district may perform in a manner which is significantly discrepant from the local norm, but not from national norms and the student's ability level as measured by individual or group cognitive tests standardized on a national population.

Conversely, in low achieving districts, the use of local CBM norms may fail to identify students who may be entitled to special services because those norms are skewed
to reflect as average, what might be lower achievement on a nationally normed population. Using curriculum based measurement in place of nationally normed tests may result in guaranteeing that a flat percentage of students will be served per district under special education and labelled disabled based only on a local standard. Numbers of students who need services might be over or underestimated. Such a system of eligibility could serve to perpetuate the unequal distribution of services in education that exists in our American schools today.

This study was designed to address the possibly of obtaining skewed norms when considering the performance of students in a high achieving district relative only to their peers. When looking at both local and national norms test scores for the same student, do locally normed CBM scores and nationally normed group achievement test scores yield significantly different results? In addition, are group ability test scores more closely aligned with nationally normed achievement scores than with local CBM scores in such a district? Or do CBM scores follow a similar slope with ability scores? When relied upon exclusively for special education eligibility, CBM scores in a high achieving district, may present biased data which would impose a learning disabilities label on a student who, if enrolled in another district, would not be considered eligible for these services. Furthermore, in the distribution of services,
students in lower achieving districts may not have the benefit of eligibility if this standard prevails.

This study was also designed to investigate the relationship between normed achievement tests and curriculum based measures; the merits of each have been previously discussed. While normed based tests give a picture of student functioning on a broad basis, the local norms and the curricula relevance of CBM provide another view of student progress. The results of this study may serve to provide a baseline for future comparisons of these different measures of achievement.
CHAPTER II

LITERATURE REVIEW

HISTORY AND RATIONALE OF CURRICULUM BASED MEASUREMENT

Performance based assessment, under which curriculum based measurement claims its validity, derives much of its impetus from behavioral and cognitive theories of learning and current research. These theories and accompanying research regard knowledge in two ways: as procedural or knowing how, as opposed to declarative knowledge or knowing what (Andre, 1986). Cognitive psychologists consider procedural knowledge to be best acquired within the context of the student's familiar knowledge (Glaser, 1984). Given this perspective, the assessment of reading skills as a procedural knowledge component might be best assessed, as proponents of performance based assessment contend, within the classroom context of the students' regular school curriculum.
Cognitive psychologists, however, also recognize the value of assessing the transfer of reading skills to new material. They contend that the problem of the general transfer of procedural skills learned in one context to new problem solving situations still remains (Glaser, 1984). In this view, performance based assessment may not give information about a student's achievement beyond highly specialized curriculum based knowledge (Fuchs & Deno, 1994).

Educators provide distinctions between types of tests and define the purpose of testing. Carver (1974) identified two distinct dimensions of tests (psychometric and edumetric). He described the psychometric dimension of tests as measuring between-individual differences and an edumetric dimension as measuring the extent to which a test identifies within-individual growth. The psychometric property exists in norm referenced tests and the edumetric property exists in teacher-made or curriculum based tests. Although Carver contended that all testing reflects both dimensions to some extent, he described tests in general as performing one job better than the other. Given these distinct differential properties, performance based assessment would be considered more edumetric than psychometric.

The origins of Curriculum Based Measurement (CBM), a system designed to measure student achievement, can be
traced to Deno and Mirkin who received funding in 1977 to investigate methods of special education decision making with learning disabled students. Their research efforts led to the identification of reliable and valid measures of student performance within the context of the curriculum of the school (Deno, Mirkin & Chiang, 1982). Others, expanded the work of Deno and Mirkin and developed specific curriculum based methods of assessment. (Fuchs, Fuchs & Maxwell, 1988; Marston, Mirkin & Deno, 1984; Shinn, 1988; Shinn & Hubbard, 1992).

CBM measures are designed to provide a data base for making educational decisions which include eligibility determination for special services and data for use in monitoring student progress. During a CBM reading probe, students are instructed to read aloud from basal readers for one minute and the number of words read is recorded systematically including the number of errors the student makes. Norms may be developed periodically in order that students may be compared to their peers and across grade levels in the curriculum in a particular school and/or school district. CBM reading measures have been reported to have high correlations to standardized test scores of reading comprehension (Deno, Mirkin & Chiang, 1982). Furthermore, correlations between oral reading CBM samples and tests of reading comprehension were found to be similar
regardless of the difficulty of the basal series from which the probes were drawn (Fuchs & Deno, 1992).

Deno (1982) developed the CBM system on the basis that assessment and decision-making are curriculum referenced. The school curriculum in this type of assessment serves as the sole basis for determining achievement levels. Individual monitoring for student progress on the basis of achievement in the curriculum takes place within the context of the CBM process. Finally, it should be noted that an individual's performance remains referenced only in relationship to peer performance in the local curriculum (Shinn, 1989).

CBM has been tied to developmental reading models. Potter and Wamre (1990) identified CBM as closely aligned with the reading model developed by Chall (1983) and the model of automaticity in information processing put forth by LaBerge and Samuels (1974). Chall's model looks at reading skills as a development beginning with decoding, progressing to fluency, and resulting finally in comprehension. For LaBerge and Samuels, attention, visual memory, phonological memory and semantic memory are the components which, when operating, result in automatic decoding, fluency, and comprehension. It should be noted that both of these models look at reading skills as developing from decoding to comprehension rather than from the whole language approach which emphasizes whole word meanings. The whole language
approach is widely used in American schools today, but it is not without its critics who contend that this philosophy is not effective for all learners (Pressley, 1993; Simner, 1993). The development of fluency, beginning with decoding skills is the focus of CBM and a lack of fluency as well as low phonemic awareness have been identified as an area of deficiency for poor readers (Schuerholz et al, 1995). In a climate of whole language approaches to reading, students with reading difficulties may not be supported in the regular classroom with the appropriate decoding skills they need to become fluent readers (Adams, 1990; Shankweiler, 1991).

Knutson and Shinn (1991) outlined CBM's conceptual ties to behavioral, ecological, and problem-solving assessment models of learning. They related CBM to behavioral models which employ direct and frequent measurement of important behaviors as they occur in the natural environment. They contend that CBM has features of an ecological model which utilizes the analysis of problematic behavior within the context of the interactions between students and other classroom variables such as curriculum and instruction. Finally, Knutson and Shinn describe the properties of a data-based, problem-solving model in which a reliable and valid data base is generated and used to make problem solving decisions when students are unsuccessful in general education.
CURRICULUM MATCH AND CBM CONTENT VALIDITY

The issue of lack of overlap between specific curricula and standardized achievement tests remains central to the validity concerns of standardized tests raised by CBM proponents. Research projects designed to address this issue have yielded conflicting results.

The research conducted by Shapiro and Derr (1987) involved predicting the score a student would receive on a particular standardized test involving word recognition based on whether that word was contained in a specific curriculum. Their results indicated poor overlap between four individual achievement tests and five first and second grade basal readers. The authors conceded, however, that their study did not take into account that standardized achievement tests may tap generalized reading skills.

Other researchers investigated the influence of students' particular curriculum on their performance on norm-referenced tests. Overall the results appear to be mixed. Mehrens (1986) studied the relationship between students' performance on the California Achievement Test and the match with their individual curriculum in grades three and six as determined by district reading specialists' ratings. The students in the study were instructed in various curricula. Results indicated that the match of
curricula was not a significant factor in students' performance.

In another study, Good and Salvia (1988) found that curriculum bias affected students' scores on four reading achievement tests (The Peabody Individual Achievement Test, Wide Range Achievement Test, California Achievement Test, Metropolitan Achievement Test). The first two tests are individually administered tests and the latter tests are group administered tests. In this study, involving students in grades three and four, students had been instructed in the same curriculum and curriculum content validity was predicted by counting the number of words taught in the student's curriculum and correlating it with the number of times the words appeared in the normed tests. The subtests utilized for the study involved vocabulary and word recognition and decoding skills. The results indicated that the content validity of the test, as determined by the students' curriculum, was a positive predictor of performance.

Another study which was designed to examine the curriculum overlap question was conducted by Bell, Lentz, and Graden (1992). The researchers examined the individual achievement test scores of 181 first and second grade students on subtests of reading decoding with curriculum overlap. Their results supported the findings of Good and Salvia (1988). Taken together, these results support the
notion that a strong curriculum influence exists in standardized test performance at these grade levels in decoding skills. It is important to point out that the transfer of reading skill learned in the curriculum to new situations was not considered in this study or in the previous studies conducted related to this issue.

In a recent study, Martens, Steele, Massie, & Diskin (1995) examined the overlap between four basal series and the phonetic analysis subtest of the Woodcock-Johnson Reading Mastery Test, The California Achievement Test, and the Diagnostic Reading Scales. The results of the study supported the findings of Good & Salvia (1988) and Bell, Lentz, and Graden (1992). The conclusions indicated that reading programs differed in the sequence of phonetic skills taught, that scores differed across programs for a given test and that scores differed across programs for a given grade level. The study was conducted utilizing a systematic comparison of phonetic skills taught in a series with how those skills were tested in a given achievement test assuming a hypothetical student had mastered all the skills in the basal series and had answered correctly questions pertaining to those skills which had been taught. No allowance for transfer of skill to new situations was provided, since performance of actual students was not utilized.
TECHNICAL ADEQUACY - CBM AS A VALID MEASURE OF READING

Research has been conducted to establish the technical adequacy of CBM measures. CBM has been criticized for a number of technical short-comings. In an overview of the research literature, Shinn, Tindal and Stein (1988) described a number of studies which were crafted to correlate CBMs with students' performance on basal reader series tests as well as with individually normed tests. These significant correlations are offered as evidence for the validity of CBM as a valid measure of reading.

Investigators also undertook the task of reviewing behaviors which represented possible valid representations of achievement in reading. They then developed measurement procedures for taking data on the identified behaviors and correlated the results collected with highly respected standardized measures considered to be technically adequate in terms of their psychometric properties (Deno, Mirkin, & Chiang, 1982). Results indicated a strong correlation between one minute oral reading probes and comprehension normed referenced tests in three studies designed to investigate their inter-relationships. The randomly selected sample sizes were 33, 45, and 66 students ranging from first to sixth grade who were enrolled in both regular and special education classes. The reading materials were limited to third and sixth grade materials.
Additionally, significant differences between the special and regular education students were found on the reading aloud measures as well as between the formal and informal measures. This finding supported the utility of using CBM for establishing eligibility for special education.

In a recent study, Jenkins and Jewell (1993) examined further, the validity of reading aloud or CBM and normed referenced achievement tests, the Gates-McGinitie, and Metropolitan Achievement Tests. They focused their investigation on the relationship between the measures on a grade-by-grade basis rather then across grades as many earlier investigators had done. They argued that this was a valid comparison of the relationship between the measures. They found that the correlation between the measures was strong, but declined steadily as years in school increased. They hypothesized that normed tests in the primary grades emphasized the decoding aspect of reading while normed tests in the intermediate grades placed more emphasis on language comprehension and word knowledge.

A subsequent study was crafted to address the question, "Is fluency rapid decoding?" (Shinn, Good, Knutson, Tilly & Collins, 1992). For both third and fifth graders, the relationship between CBM measures and reading comprehension was validated along with other factors of reading including decoding.
Research has also demonstrated a high correlation between basal reading series reading mastery tests which are designed to measure reading comprehension and CBM reading probes (Shinn, 1989). A number of researchers have reported a positive relationship between CBM measures and nationally standardized tests of reading with correlations as high as .80 (Deno, Mirkin, Chaing, 1982; Fuchs, Fuchs, & Maxwell, 1988).

Another aspect of test validity was investigated by Fuchs & Fuchs (1986) who analyzed 27 standard achievement test manuals for information concerning the appropriateness of using those tests with children identified with disabilities. They found little information concerning the inclusion of students with disabilities in the sample of indicators. That is to say that it is not clear whether or not the tests were reliable and valid for students with disabilities.

CBM AND SPECIAL EDUCATION ELIGIBILITY

Many educators have proposed that CBM offers an efficient method for identifying eligible students for special education services. The inadequacy and high cost of current system have been cited as reasons to embrace CBM as a valid measure to determine disability.

Several researchers claim that the ability-achievement discrepancy formula does not meet the needs of individuals,
especially those who narrowly miss the cut-offs for qualification and yet may be considered low achievers (Deno, Mirkin & Chiang, 1982). Others (Wilson, 1985) contend that the clinical judgment of the multidisciplinary team will address the small numbers of students who do not meet the traditional formula and that abandoning the ability discrepancy model will create additional ambiguities and misunderstanding. Wilson (1985) and Mercer (1985) also found significant differences between low achievers and learning disabilities students using the ability-achievement discrepancy formula.

On the other hand, Ysseldyke, Algozzine & Epps (1983) found that 47% of students identified as learning disabled did not meet any of the 17 criteria established for identification. Moats & Lyon (1993) concluded that a student may be considered learning disabled in one state and not another. Others (Ysseldyke, Algozzine, Richey & Graden, 1982) who criticize the utility of the standard identification practice have given evidence that multidisciplinary teams ignore data anyway and have shown that teacher referral is a positive predictor of who will receive special education services 78% of the time. Accommodating individual learning differences within the regular classroom has been suggested as a solution to
eliminating the rising identification rates and over-identification rates of students with a learning disability (Gelzheiser, 1987).

The utility of using group achievement tests as the sole determination for special education eligibility was investigated by Stone, Cundick, and Swanson (1988). Using a large sample of students from two districts (1,434 and 1,011), they recorded percentile scores on the reading portion of the Stanford Achievement Test, ranked each district separately and found validation in both districts that students who were receiving special education services all scored below a 5th percentile cut-off. At the 10th percentile cutoff, 97% of the regular education students and 71% of the special education students were represented. The possibility of using group scores was considered favorably in the light that the cost of assessment to determine special education eligibility is expensive.

Rodden-Nord & Shinn (1991) examined the range of reading skills within classrooms and across grades. Using curriculum-based measures of oral reading and word list probes, the researchers administered a third grade reading passage and a first through fourth grade word list to 2,812 students in grades one through six. Special education students were eliminated from the sample. Results indicated that the range of reading skills within grades was broad, especially in the upper grades. The results also revealed
that the number of students who might be considered academically deviant on this basis could comprise a considerable number of students who have the potential of overloading special education classes. The authors of this study suggested that the referred student could very possibly be instructed within the regular classroom with reform of regular education approaches to instruction.

To that end, one midwestern school district regularly refers students for intervention rather than for eligibility determination. In this spirit, the trend is to merge regular education and special education by changing the determination of eligibility for instructional services from a perspective of needs as opposed to entitlement (Graden, Zins, & Curtin, 1988).

In keeping with the identification of needs rather than a focus on special education eligibility, many educators have valued CBM as a screening tool for students who may require academic interventions. Utilized in this manner, CBM identifies students in an efficient manner. The process is similar to the preschool screening process in which students who have developmental skills discrepant from the norm are identified. In the classroom situation, CBM proponents contend that identifying local performance discrepancies among students utilizing CBM also eliminates the potential for teacher bias when individual referrals are
made. Furthermore, the implementation of a screening process insure identifying an environmental disability as opposed to one which is within the child (Shinn, 1989).

Another benefit derived from utilizing CBM is the ability to monitor student progress often and quickly. This process yields information pertinent to whether or not students may need further intervention beyond the treatment instituted as a result of the screening process (Shinn, 1989).

Despite the positive qualities CBM offers as a potent screening tool and in progress monitoring, the problem of possible skewed norms remains. A systematic review of the literature indicated that a study comparing curriculum based assessment reading norms in a singular district with group achievement scores or with group ability tests has not been conducted. In a recent study, Wilson & Schendel (1992) found that CBMs, The Iowa Test of Basic Skills (ITBS), and teacher ratings were good predictors of current reading instruction groups for nondisabled and mildly disabled students 76% of the time. However, since this study was a multidistrict one and the difficulty of curricula varied and local norms were not developed, comparisons between local CBMs and ITBS scores were not possible. Considering the fact that CBM norms are developed specifically on performance of district students, and the reasons these
norms are created is to make educational decisions, the comparison of these norms with national norms on a local level appears to be a meaningful pursuit at this time.
CHAPTER III

METHOD

This study was designed to investigate the relationship between curriculum based measurement scores and scores on nationally standardized tests of achievement and ability among students in a high achieving school district.

The following null hypotheses were tested:

1) There is no relationship between standard scores of locally normed CBM reading probes and standard scores of nationally normed group achievement tests of reading.

2) There is no relationship between standard scores of nationally normed group cognitive ability tests and standard scores of locally normed CBM reading tests.

3) There is no relationship between standard scores of group reading achievement tests and standard scores of group cognitive ability tests.
SAMPLE

The data sets used in this study were collected in the Spring, 1994. The sample consisted of students who attended suburban elementary schools in a school district near Chicago, Illinois. The district encompasses an area in which the average household income is $81,740. The racial, ethnic mix in this area is predominantly white (non-Hispanic).

The sample included 300 randomly selected students in grades 2, 4, and 5. Data collected included scores from a series of individually administered curriculum based reading probes, The Iowa Test of Basic Skills, and The Cognitive Abilities Test. It should be noted that all of these standardized tests were administered in April and May, 1994. The curriculum based norms were developed from three reading probes administered on three days within the same week, utilizing a standardized practice method described by Shinn (1989).

INSTRUMENTATION

CBM MEASURES

The CBM measures were collected during the first week of May, 1994. Students were selected randomly from student rosters of second, fourth, and fifth grade students. Students who were receiving special education services or were in the gifted program were eliminated from the sample. Local norms were designed to reflect the achievement
expectations for regular education students.

Students were asked to read for one minute on three separate days from three passages randomly selected from the basal reading series in which they were instructed at their grade level. Second grade students read from a series published by MacMillan and the fourth and fifth graders read from a series published by Scott Foresman (See Appendix A). The selections were randomly selected. The completed reading samples were collected and scored by the school psychologist and resource teachers. The norms were developed by the school psychologist. Each sample was given a score of words per minute (WPM) and the number of errors was systematically recorded for all participants.

COGNITIVE ABILITIES TEST

The Cognitive Abilities test (CogAT) is a group administered test of developed ability in verbal, quantitative, and nonverbal reasoning. The CogAT includes a primary battery which was administered to the second graders in this study and a multilevel edition which was administered to the fourth (Level B) and fifth (Level C) graders.

In the primary battery, items are read one at a time by the test administrator and students choose answers which they mark in booklets. The test was administered in three sessions and the pace was adjusted to suit the group. The
battery was designed to measure the extent to which a student has developed the following skills: the ability to comprehend oral English; the ability to follow directions; the ability to hold material in short-term memory; the possession of effective strategies for scanning pictorial and figural stimuli to obtain specific or general information; possession of a store of general information and verbal concepts; ability to compare stimuli and detect similarities and differences in relative size position, quantity, shape, and time; ability to classify, categorize or order familiar objects; and the ability to use quantitative and spatial relationships and/or concepts. The scores provided by the test are standard scores, percentiles, and stanines by age and percentiles and stanines by grade (Thorndike & Hagen, 1987).

The multilevel edition of the CogAT is also divided into a Verbal, Quantitative, and Nonverbal batteries. Data are reported in each area, but a composite score in this edition as well as in the primary battery, is not given in order not to give a misleading picture of the cognitive development of an individual whose cognitive skills in one area are much more highly developed than in other areas. In the multilevel battery, students complete three independent subtests. Thirty minutes is allowed for each subtest.

The Verbal battery requires the student to use verbal concepts to solve verbal tasks using inductive and abstract
verbal reasoning. The authors indicate that this area of
cognitive development is highly correlated with success in
school. The Quantitative battery requires students to solve
problems using quantitative concepts using flexibility with
these concepts and inductive reasoning. The test authors
state that this area is a good predictor of academic
success. The Nonverbal battery measures inductive and
abstract reasoning using neither words nor numbers. This
battery is more useful as an assessment of students who do
not speak English since verbal stimuli are not used in this
test (Thorndike & Hagen, 1987).

The standardization of the Cognitive Abilities Test was
carried out in spring, 1984 and fall, 1985. A tryout sample
for the items developed consisted of 48,000 students in
schools in all regions of the country. Items were tried out
with small groups of minority students at each level to
eliminate items that were biased toward under-represented
groups. A sample was drawn from a representative number of
public (89.1%), Catholic (7%) and private, non-Catholic
(3.9%) students. The sample was representative of
geographic region, district enrollment, socio-economic
status and the 1980 census data. The final number of
students who met the criteria for inclusion in the
standardization groups consisted of 3,007 in the second
grade, 1,442 in the fourth grade, and 1,471 in the fifth
grade. Reliability coefficients ranged from .84 to .92 for
second grade, .92 to .95 for fourth grade and .91 to .93 for fifth grade. Standard errors of measurement (the fluctuation of scores) were reported to be $2/3 +/− 1$ SEM of the true score; $19/20 +/− 2$ of the "true" score; $997/1000 +/− 3$ of the "true" score (Thorndike & Hagen, 1987).

Reviews of the CogAT are somewhat mixed (Conoley & Kramer, 1989). Reservations about its validity have been raised in similar ways in which reservations about most ability tests are addressed. The CogAT was standardized on the same sample as the Iowa Test of Basic Skills (ITBS) and the Tests of Achievement and Proficiency, and its norms show high correlations to these instruments which were designed to measure school achievement. All things considered, the CogAT appears to be a predictive measure of school achievement. The technical properties of the ITBS are discussed below.

THE IOWA TEST OF BASIC SKILLS

The Iowa Test of Basic Skills (ITBS) is an achievement battery designed to measure basic skills in the areas of reading, language arts, math, social studies, and science. It should be noted that the ITBS was not designed to measure school outcomes related to reasoning, problem solving, and creativity. As noted above, norms were developed from a sample which is the same sample of students used for the standardizations of the Cognitive Abilities Test. Extensive
try-out sessions for individual test items were conducted to control for possible bias (Hieronymus & Hoover, 1986).

Development of the Iowa Test of Basic Skills was completed with measures to establish its content validity. Of special concern for this study are the Word Analysis subtest for grade 2 and the Vocabulary and Reading subtests for grades 2, 4, and 5. The Word Analysis test was part of the battery for second graders. In this test, a variety of skills involving sound-letter association, phonetic analysis, and word structure are represented. Stimuli consist of a variety of pictures, oral language, written language and nonsense words (Hieronymus & Hoover, 1986).

The Vocabulary subtest was included for all grade levels in this study. In the development of this section, considerations in content area and concept development were made. The content consideration refers to the inclusion of words from seven general categories representing required reading in elementary school. The area of concept development refers to the inclusion of items which addresses the part that parts of speech play in language (Hieronymus & Hoover, 1986).

For the second graders, the Vocabulary test consisted of applying decoding skills in order to identify a word that related to a picture and then selecting a word which meaningfully completed a sentence. For grades four and five,
the items consisted of a word in context followed by four possible definitions.

The Reading subtest was included for all grades. The grade 2 test involved the selection of a word which completed a sentence and a section which required answering expressed or implied ideas in a passage. The grade 4 and 5 Reading subtests included passages varying in length from a few sentences to a full page. Material chosen represented material encountered by pupils in their everyday reading in and outside of school. Emphasis in these subtests was upon inferential comprehension.

The reliability coefficients (spring standardization) for these subtests with the standard errors of measurement appearing in parentheses were as follows: Grade 2 - Word Analysis .85 (3.0); Vocabulary .83 (2.4); Reading .92 (3.2); Grade 4 - Vocabulary .89 (2.5); Reading .92 (2.9); Grade 5 - Vocabulary - .91 (2.6); Reading - .92 (3.0) (Hieronymus & Hoover, 1986). Finally, it should be noted that reviewers of the ITBS have given it high marks for its high reliability, good norms, and content validity (Conoley & Kramer, 1989).

DESIGN AND STATISTICAL ANALYSIS

Descriptive and inferential statistical analyses were employed to analyze the data collected to test the hypotheses. In addition to a correlational matrix which was
generated to determine the relationships among the variables, a series of multiple regression analysis procedures were completed to determine the predictive relationships among the variables. The regression equations are depicted below:

\[
\begin{align*}
BX_1 + BX_2 + BX_3 + BX_4 &= Y_1 \\
BX_1 + BX_2 + BX_3 + BX_4 &= Y_2 \\
BX_1 + BX_2 + BX_3 + BX_4 &= Y_3
\end{align*}
\]

For second grade students, \(Y_1, Y_2, Y_3\) represented the CBM measures on three days for each student. The \(X_1, X_2, X_3, X_4\) represented the ITBS Word Analysis subtest scores, the ITBS Vocabulary subtest scores, the ITBS Reading subtest scores, and the CogAT Verbal subtest scores respectively.

The regression analyses for fourth and fifth grades are depicted below:

\[
\begin{align*}
BX_1 + BX_2 + BX_3 &= Y_1 \\
BX_1 + BX_2 + BX_3 &= Y_2 \\
BX_1 + BX_2 + BX_3 &= Y_3
\end{align*}
\]

The \(Y_1, Y_2, Y_3\) represented the three days of CBM measures and \(X_1, X_2, X_3\) represented the ITBS Vocabulary subtest scores, the ITBS Reading subtest scores, and the CogAT Verbal subtest scores respectively.

The CBM scores were converted to z-scores for each grade level. These scores represent a student’s standing within the school district. The Cognitive Abilities Test and the Iowa Test of Basic Skills scores were converted to standard scores utilizing tables in the respective manuals.
for each grade level. These standard scores reflect a student's performance based on a national standing.

During data collection, CBM and standardized testing scores for individual students in one school were inadvertently separated. All scores were utilized for developing meaningful district CBM norms. In all other statistical analyses of the data sets used in this study, the scores for the school which were separated were eliminated from the sample for each grade. When missing data are a subset of a random sample of the whole sample, deletion has been viewed as a reasonable procedure (Tabachnick and Fidell, 1989).

First of all, to test for the existence and strength of a linear relationship between the variables, a set of correlational procedures were applied to the data set. A Pearson correlation was utilized to compare the standard scores of all the variables (CBM z-scores for 3 days for grades 2, 4, and 5; ITBS z-scores, CogAT z-scores). In addition, correlations were performed on CBM measures with and without the deleted data set (see above) for reliability comparisons to verify that the missing data set was a representative subset of the entire sample.

Multiple regression analysis was then employed to determine the best variable predictor of CBM. A regression analysis was applied to all variables for each day of CBM across all grade levels.
Several other analyses were performed. A 5% cut-off for each day of CBM was arbitrarily determined at each grade level for the purpose of establishing special education eligibility as a standard practice measure. Z-score comparisons were made with the ITBS and CogAT measures to examine differences.

Finally, a t-test was performed on the CBM data comparing the performance of boys and girls across grade levels.
CHAPTER IV

RESULTS

RESULTS RELATED TO TESTING NULL HYPOTHESIS I

An examination of the Pearson correlations appearing in Table 1 related to testing null Hypothesis I provide support for the high reliability of CBM as a measure of reading fluency.

TABLE 1
PEARSON CORRELATIONS UTILIZING THE PARTIAL SAMPLE

<table>
<thead>
<tr>
<th>GRADE 2</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N=88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBM DAY 1</td>
<td>1.0000**</td>
<td>.8400**</td>
<td>.8027**</td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.8400**</td>
<td>1.0000**</td>
<td>.8165**</td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.8027**</td>
<td>.8165**</td>
<td>1.0000**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 4</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N=84</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBM DAY 1</td>
<td>1.0000**</td>
<td>.8006**</td>
<td>.8579**</td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.8006**</td>
<td>1.0000**</td>
<td>.8194**</td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.8579**</td>
<td>.8194**</td>
<td>1.0000**</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 5</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N=88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBM DAY 1</td>
<td>1.0000**</td>
<td>.8646**</td>
<td>.8522**</td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.8646**</td>
<td>1.0000**</td>
<td>.8660**</td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.8522**</td>
<td>.8660**</td>
<td>1.0000**</td>
</tr>
</tbody>
</table>

2-tailed significance ** = .001

36
Pearson correlations appearing in Table 2 represent the findings from an analysis utilizing the full randomized sample in the study. It should be noted that the results appear to be similar to the correlations of the sample in which one school was deleted. That is to say that these results confirm the notion that the sample with the one school data set deleted is a representative subset of the full sample.

### TABLE 2

**CBM PEARSON CORRELATIONS UTILIZING THE FULL RANDOMIZED SAMPLE**

<table>
<thead>
<tr>
<th></th>
<th>GRADE 2</th>
<th></th>
<th>GRADE 4</th>
<th></th>
<th>GRADE 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N=104</td>
<td></td>
<td>N=99</td>
<td></td>
<td>N=104</td>
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<tr>
<td>CBM DAY 1</td>
<td>CBM DAY 2</td>
<td>CBM DAY 3</td>
<td>CBM DAY 1</td>
<td>CBM DAY 2</td>
<td>CBM DAY 3</td>
</tr>
<tr>
<td>CBM DAY 1</td>
<td>1.0000**</td>
<td>.8396**</td>
<td>.8108**</td>
<td>1.0000**</td>
<td>.8283**</td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.8396**</td>
<td>1.0000**</td>
<td>.8325**</td>
<td>.8283**</td>
<td>1.0000**</td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.8108**</td>
<td>.8325**</td>
<td>1.0000**</td>
<td>.8706**</td>
<td>.8469**</td>
</tr>
</tbody>
</table>

2-tailed Significance ** - .001
An examination of the CBM correlations appearing in Table 3 with the Iowa Test of Basic Skills indicates that there are linear relationships between the variables with only a few exceptions. It should be noted that the strength of these relationships vary across comparative categories.

The Reading subtest of the Iowa Test of Basic Skills is hereafter referred to as Comprehension in this manuscript.

**TABLE 3**

**CBM AND IOWA TEST OF BASIC SKILLS PEARSON CORRELATIONS**

<table>
<thead>
<tr>
<th>GRADE 2</th>
<th>N=88</th>
<th>WORD ANALYSIS</th>
<th>VOCABULARY</th>
<th>COMPREHENSION</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.2526</td>
<td>.3974**</td>
<td>.3714**</td>
<td>.5840**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.2556</td>
<td>.5012**</td>
<td>.4499**</td>
<td>.5414**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.2076</td>
<td>.4537**</td>
<td>.4150**</td>
<td>.4844**</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 4</th>
<th>N=84</th>
<th>VOCABULARY</th>
<th>COMPREHENSION</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.2883*</td>
<td>.4843**</td>
<td>.5254**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.2764</td>
<td>.4290**</td>
<td>.5143**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.2501</td>
<td>.4586**</td>
<td>.5977**</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 5</th>
<th>N=88</th>
<th>VOCABULARY</th>
<th>COMPREHENSION</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.3256*</td>
<td>.4211**</td>
<td>.4267**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.2971*</td>
<td>.3480*</td>
<td>.3785**</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.2927*</td>
<td>.3482*</td>
<td>.3611*</td>
<td></td>
</tr>
</tbody>
</table>

2-tailed Significance ** = .001

For the second grade sample, CBM measures and Word Analysis, a measure of reading decoding, yielded low correlations. These correlations were found to be nonsignificant. Vocabulary and Comprehension subtests were
found to be moderately correlated. Spelling was found to most strongly associated with CBM. These correlations were in the moderately high range.

An examination of the fourth grade correlations provide support for the notion that there is a moderately high relationship among CBM, Spelling, and Comprehension. Vocabulary was significantly correlated on only one of the three CBM measures. However, this correlation was relatively low.

The correlation values related to the fifth grade sample indicated that there was a moderate relationship among CBM, Spelling, and Comprehension and a low correlation with Vocabulary.

Given the findings reported above, the null hypothesis was rejected. That is to say that there was a moderately high correlation among CBM, Spelling, and Comprehension within each of the three grades examined. This finding provides support that there is a relationship between CBM and standardized achievement tests.
RESULTS RELATED TO TESTING NULL HYPOTHESIS II

An examination of the Pearson correlations of the CBMs appearing in Table 4 to subtests of the Cognitive Abilities Test indicate varied relationships across the three grades.

TABLE 4
CBM AND COGNITIVE ABILITIES TEST PEARSON CORRELATIONS

<table>
<thead>
<tr>
<th>GRADE 2</th>
<th>N=88</th>
<th>COGAT VERBAL</th>
<th>COGAT QUANTITATIVE</th>
<th>COGAT NONVERBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.1474</td>
<td>.3088*</td>
<td>.1192</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.2014</td>
<td>.2708</td>
<td>.1919</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.2218</td>
<td>.2158</td>
<td>.2350</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 4</th>
<th>N=84</th>
<th>COGAT VERBAL</th>
<th>COGAT QUANTITATIVE</th>
<th>COGAT NONVERBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.4387**</td>
<td>.2430</td>
<td>.1309</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.4255**</td>
<td>.2145</td>
<td>.0750</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.4213**</td>
<td>.2526</td>
<td>.0907</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GRADE 5</th>
<th>N=88</th>
<th>COGAT VERBAL</th>
<th>COGAT QUANTITATIVE</th>
<th>COGAT NONVERBAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM DAY 1</td>
<td>.2843*</td>
<td>.2296</td>
<td>-.0146</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 2</td>
<td>.2827*</td>
<td>.1788</td>
<td>-.0653</td>
<td></td>
</tr>
<tr>
<td>CBM DAY 3</td>
<td>.2473</td>
<td>.1919</td>
<td>-.0517</td>
<td></td>
</tr>
</tbody>
</table>

2-tailed significant ** = .001

The relationships at the second grade level are weak with one exception. The Quantitative subtest of the CogAT was found to be moderately high and significantly correlated with one measure of CBM.

For the fourth grade sample, the results indicated that there was a moderately high relationship between CBM and the Verbal subtest of the CogAT on all three days of assessment.
Low correlations between the Verbal and Quantitative subtests of the Cognitive Abilities Test (CogAT) and CBM were found for the fifth grade sample. A negative relationship between CBM and the Nonverbal subtest was clearly evident.

Given the absence of a consistent relationship between CBM and the CogAT in all grades, the second null hypothesis was not rejected.
RESULTS RELATED TO TESTING NULL HYPOTHESIS III

The Pearson correlations appearing in Table 5 were used to identify significant relationships between subtests of the Iowa Test of Basic Skills and the Cognitive Abilities Test (CogAT). It should be noted that the tests were standardized on the same population.

TABLE 5

IOWA TEST OF BASIC SKILLS AND COGNITIVE ABILITIES TEST
PEARSON CORRELATIONS

<table>
<thead>
<tr>
<th></th>
<th>GRADE 2</th>
<th></th>
<th></th>
<th></th>
<th>GRADE 4</th>
<th></th>
<th></th>
<th></th>
<th>GRADE 5</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>N=88</td>
<td>COGAT VERBAL</td>
<td>COGAT QUANTITATIVE</td>
<td>COGAT NONVERBAL</td>
<td>N=84</td>
<td>COGAT VERBAL</td>
<td>COGAT QUANTITATIVE</td>
<td>COGAT NONVERBAL</td>
<td>N=88</td>
<td>COGAT VERBAL</td>
<td>COGAT QUANTITATIVE</td>
<td>COGAT NONVERBAL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WORD ANALYSIS</td>
<td>.4174**</td>
<td>.3873**</td>
<td>.3019*</td>
<td>VOCABULARY</td>
<td>.4896**</td>
<td>.2712</td>
<td>.2258</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOCABULARY</td>
<td>.5470**</td>
<td>.5234**</td>
<td>.3976**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPREHENSION</td>
<td>.3623**</td>
<td>.3794**</td>
<td>.3394*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPELLING</td>
<td>.2593</td>
<td>.3071*</td>
<td>.2091</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOCABULARY</td>
<td>.4640**</td>
<td>.4329**</td>
<td>.2716</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>COMPREHENSION</td>
<td>.6426**</td>
<td>.5270**</td>
<td>.4926**</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>SPELLING</td>
<td>.4640**</td>
<td>.4329**</td>
<td>.2716</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2-Tailed Significance: * - .01 ** - .001

For the second grade sample, moderately high correlations were found for all measures of the CogAT among Word Analysis, Vocabulary, and Comprehension measures. Low correlations were found for Spelling with the Verbal and Nonverbal subtests of the CogAT.
The correlations found for the fourth grade sample supported the notion that there was a moderately high relationship between Vocabulary, Comprehension, and Spelling with the Verbal subtest of the CogAT. Comprehension and Spelling were found to be significantly correlated with Quantitative subtest. In addition, Comprehension was found to be significantly related to the Nonverbal subtest.

An examination of the data set related to the fifth grade sample indicated that there were high relationships among the Verbal subtest of the CogAT, Vocabulary, and Comprehension. A moderately high relationship with Spelling was also documented. The ITBS correlations with the CogAT Quantitative subtest were found to be moderately high as were the correlations with the Vocabulary and Comprehension subtests and the CogAT Nonverbal subtest.

Taken together, these findings confirm that there was an overall strong relationship between the cognitive measures and the standardized achievement measures. Given these findings, null hypothesis number three was rejected.
MULTIPLE REGRESSION ANALYSES

In addition to what was reported above, a multiple regression analysis was conducted to examine the contribution of all the variables, the standardized achievement variables, and the cognitive ability variables to each day of CBM. These multiple regression results are summarized in Table 6.

| TABLE 6 |
| REGRESSION ANALYSIS PREDICTING CBM ON THREE DAYS |

<table>
<thead>
<tr>
<th>GRADE 2</th>
<th>R²</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALL VARIABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>.39131</td>
<td>7.43892**</td>
</tr>
<tr>
<td>Day 2</td>
<td>.38423</td>
<td>7.13127**</td>
</tr>
<tr>
<td>Day 3</td>
<td>.32010</td>
<td>5.44790**</td>
</tr>
<tr>
<td>All ITBS Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>.36699</td>
<td>12.12283**</td>
</tr>
<tr>
<td>Day 2</td>
<td>.37928</td>
<td>12.67888**</td>
</tr>
<tr>
<td>Day 3</td>
<td>.31372</td>
<td>9.59976**</td>
</tr>
<tr>
<td>All CogAT Measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day 1</td>
<td>.09832</td>
<td>3.08934</td>
</tr>
<tr>
<td>Day 2</td>
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<td>2.43114</td>
</tr>
<tr>
<td>Day 3</td>
<td>.07600</td>
<td>2.33036</td>
</tr>
</tbody>
</table>

SIGNIFICANT VARIABLES IN MULTIPLE REGRESSION EQUATIONS

| ALL VARIABLES |
| Day 1 SPELLING | .493572 | 4.812*** |
| Day 2 SPELLING | .369294 | 3.555** |
| Day 3 SPELLING | .335688 | 3.097* |

| ITBS VARIABLES |
| Day 1 SPELLING | .506846 | 4.946*** |
| Day 2 SPELLING | .374466 | 3.667** |
| Day 3 SPELLING | .333185 | 3.125* |

***<.0001  ** <.001  * <.01
### TABLE 6 CONTINUED

REGRESSION ANALYSIS PREDICTING CBM ON THREE DAYS

<table>
<thead>
<tr>
<th>GRADE 4</th>
<th>R2</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL VARIABLES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 1</td>
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<td>8.08268</td>
</tr>
<tr>
<td>DAY 2</td>
<td>.37640</td>
<td>7.74610**</td>
</tr>
<tr>
<td>DAY 3</td>
<td>.44788</td>
<td>10.41060**</td>
</tr>
<tr>
<td><strong>ITBS VARIABLES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 1</td>
<td>.32952</td>
<td>13.10631**</td>
</tr>
<tr>
<td>DAY 2</td>
<td>.29431</td>
<td>11.12148**</td>
</tr>
<tr>
<td>DAY 3</td>
<td>.38329</td>
<td>16.57374**</td>
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<tr>
<td><strong>CogAT VARIABLES</strong></td>
<td></td>
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<tr>
<td>DAY 1</td>
<td>.21457</td>
<td>7.28483</td>
</tr>
<tr>
<td>DAY 2</td>
<td>.22432</td>
<td>7.71193</td>
</tr>
<tr>
<td>DAY 3</td>
<td>.21500</td>
<td>7.30348</td>
</tr>
</tbody>
</table>

**SIGNIFICANT VARIABLES IN THE REGRESSION EQUATIONS**

<table>
<thead>
<tr>
<th><strong>ALL VARIABLES</strong></th>
<th><strong>BETA</strong></th>
<th><strong>T</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1 SPELLING</td>
<td>.364355</td>
<td>3.206*</td>
</tr>
<tr>
<td>DAY 2 SPELLING</td>
<td>.382146</td>
<td>3.336*</td>
</tr>
<tr>
<td>DAY 3 SPELLING</td>
<td>.494435</td>
<td>4.587***</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>ITBS VARIABLES</strong></th>
<th><strong>BETA</strong></th>
<th><strong>T</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1 SPELLING</td>
<td>.370910</td>
<td>3.285*</td>
</tr>
<tr>
<td>DAY 2 SPELLING</td>
<td>.396349</td>
<td>3.422*</td>
</tr>
<tr>
<td>DAY 3 SPELLING</td>
<td>.510881</td>
<td>4.718***</td>
</tr>
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</table>

***<.0001  
** <.001
* <.01
TABLE 6 CONTINUED

REGRESSION ANALYSIS PREDICTING CBM ON THREE DAYS

<table>
<thead>
<tr>
<th>GRADE 5</th>
<th>R2</th>
<th>F</th>
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<tbody>
<tr>
<td>ALL VARIABLES</td>
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<tr>
<td>DAY 1</td>
<td>0.36366</td>
<td>7.81035***</td>
</tr>
<tr>
<td>DAY 2</td>
<td>0.26986</td>
<td>5.05128**</td>
</tr>
<tr>
<td>DAY 3</td>
<td>0.25702</td>
<td>4.72782**</td>
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<tr>
<td>ITBS VARIABLES</td>
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</tr>
<tr>
<td>DAY 1</td>
<td>0.29490</td>
<td>11.98971***</td>
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<tr>
<td>DAY 2</td>
<td>0.20304</td>
<td>7.30334**</td>
</tr>
<tr>
<td>DAY 3</td>
<td>0.19684</td>
<td>7.02576**</td>
</tr>
<tr>
<td>CogAT VARIABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 1</td>
<td>0.13538</td>
<td>4.43639**</td>
</tr>
<tr>
<td>DAY 2</td>
<td>0.15379</td>
<td>5.14924*</td>
</tr>
<tr>
<td>DAY 3</td>
<td>0.12952</td>
<td>4.21580*</td>
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</tbody>
</table>

SIGNIFICANT VARIABLES IN THE REGRESSION EQUATION

<table>
<thead>
<tr>
<th>ALL VARIABLES</th>
<th>BETA</th>
<th>T</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAY 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COMPREHENSION</td>
<td>0.504148</td>
<td>3.677**</td>
</tr>
<tr>
<td>SPELLING</td>
<td>0.324800</td>
<td>3.278*</td>
</tr>
<tr>
<td>ITBS VARIABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPELLING</td>
<td>0.291558</td>
<td>2.798*</td>
</tr>
<tr>
<td>DAY 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPELLING</td>
<td>0.314368</td>
<td>3.028*</td>
</tr>
<tr>
<td>DAY 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPELLING</td>
<td>0.362646</td>
<td>3.746**</td>
</tr>
<tr>
<td>CogAT VARIABLES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DAY 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VERBAL</td>
<td>0.355894</td>
<td>2.947*</td>
</tr>
</tbody>
</table>

*** <.0001
**  <.001
*   <.01

On each day of CBM for all grades with the exception of one day for grade 4, the F tests for the ITBS variables were
found to be significant at the .001 level. This finding indicates that the overall relationships among the CBMs and the ITBS test were not due to chance.

In grade 5, the CogAT variables were found to be significantly related to CBM at the .01 and .001 level of significance. The finding indicates that the ITBS measures account for 19% to 37% of the total variance, with the contribution decreasing as the grade level increased.

Additionally, considering all variables and the ITBS variables, Spelling was found to be a significant variable in the multiple regression equation for each grade on all three days of assessment. In addition, Comprehension was found to be significant for one day of fifth grade.

Finally, it should be noted that only one CBM in grade 5 (the Verbal subtest variable) was found to be significantly related to the CogAT subtest variable.
ADDITIONAL FINDINGS

A fine-grained examination was made of the Iowa Test of Basic Skills z-scores for students who meet the 5% CBM reading cut-off for special education eligibility. A summary of these results is presented in Table 7.

**TABLE 7**

Nationally Norm Referenced Iowa Test of Basic Skills Z-scores For Students Who Met the CBM 5% Cut-Off for Eligibility.

(Each student listed met the 5% cut-off on at least two of the three probes.)

**Grade 2**

<table>
<thead>
<tr>
<th>Student</th>
<th>Word Analysis</th>
<th>Vocabulary</th>
<th>Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>#1</td>
<td>+1.0</td>
<td>+.2</td>
<td>+.4</td>
</tr>
<tr>
<td>#2</td>
<td>+1.8</td>
<td>+1.6</td>
<td>+.6</td>
</tr>
<tr>
<td>#3</td>
<td>+.1</td>
<td>-.4</td>
<td>0</td>
</tr>
<tr>
<td>#4</td>
<td>-.1</td>
<td>-.1</td>
<td>-.4</td>
</tr>
<tr>
<td>#5</td>
<td>-.8</td>
<td>-1.1</td>
<td>+.1</td>
</tr>
</tbody>
</table>

**Grade 4**

<table>
<thead>
<tr>
<th>Student</th>
<th>IOWA Z-Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vocabulary</td>
</tr>
<tr>
<td>#1</td>
<td>-.4</td>
</tr>
<tr>
<td>#2</td>
<td>+.1</td>
</tr>
<tr>
<td>#3</td>
<td>-.5</td>
</tr>
<tr>
<td>#4</td>
<td>+.9</td>
</tr>
</tbody>
</table>

**Grade 5**

<table>
<thead>
<tr>
<th>Student</th>
<th>IOWA Z-Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vocabulary</td>
</tr>
<tr>
<td>#1</td>
<td>+.2</td>
</tr>
<tr>
<td>#2</td>
<td>+1.0</td>
</tr>
<tr>
<td>#3</td>
<td>+.9</td>
</tr>
<tr>
<td>#4</td>
<td>-1.2</td>
</tr>
<tr>
<td>#5</td>
<td>-.4</td>
</tr>
</tbody>
</table>

Students who were eligible under the 5% cut-off in all three grades were found to be within the average range or above average the ITBS test of reading comprehension.
With the exception of one student in grade 2 and one student in grade 5, Vocabulary and Word Analysis scores were in the average or above average range.
A comparison of the mean CBM scores for boys and girls for each day of CBM for all grades was made using a t-test. The results appear in Table 8.

**TABLE 8**

P VALUES FOR DIFFERENCES BETWEEN MEAN STANDARD SCORES OF BOYS AND GIRLS FOR ALL VARIABLES.

<table>
<thead>
<tr>
<th></th>
<th>Grade 2</th>
<th>Grade 4</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBM-Day 1</td>
<td>.267</td>
<td>.002**</td>
<td>.007**</td>
</tr>
<tr>
<td>CBM-Day 2</td>
<td>.221</td>
<td>.004**</td>
<td>.006**</td>
</tr>
<tr>
<td>CBM-Day 3</td>
<td>.038</td>
<td>.015</td>
<td>.004**</td>
</tr>
<tr>
<td>ITBS Vocabulary</td>
<td>.261</td>
<td>.905</td>
<td>.664</td>
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<tr>
<td>ITBS Reading</td>
<td>.204</td>
<td>.064</td>
<td>.353</td>
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<tr>
<td>ITBS Spelling</td>
<td>.199</td>
<td>.012</td>
<td>.002**</td>
</tr>
<tr>
<td>CogAT Verbal</td>
<td>.595</td>
<td>.078</td>
<td>.798</td>
</tr>
<tr>
<td>CogAT Quantitative</td>
<td>.256</td>
<td>.831</td>
<td>.587</td>
</tr>
<tr>
<td>CogAT Nonverbal</td>
<td>.415</td>
<td>.079</td>
<td>.683</td>
</tr>
<tr>
<td>Age</td>
<td>.095</td>
<td>.181</td>
<td>.566</td>
</tr>
<tr>
<td>ITBS Word Analysis</td>
<td>.265</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Less than 1% chance that the observed mean differences are equal.**

MEAN Z-SCORES FOR GIRLS AND BOYS FOR VARIABLES WITH SIGNIFICANT DIFFERENCES

**GRADE 4**

<table>
<thead>
<tr>
<th></th>
<th>CBM Day 1</th>
<th>CBM Day 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>.4167</td>
<td>.3643</td>
</tr>
<tr>
<td>B</td>
<td>-.2548</td>
<td>-.2381</td>
</tr>
</tbody>
</table>

**GRADE 5**

<table>
<thead>
<tr>
<th></th>
<th>CBM Day 1</th>
<th>CBM Day 2</th>
<th>CBM Day 3</th>
<th>SPELLING</th>
</tr>
</thead>
<tbody>
<tr>
<td>G</td>
<td>.4191</td>
<td>.2787</td>
<td>.2851</td>
<td>G 1.0234</td>
</tr>
<tr>
<td>B</td>
<td>-.3409</td>
<td>-.3023</td>
<td>-.3116</td>
<td>B .5386</td>
</tr>
</tbody>
</table>
Significant differences between boys and girls on the CBM mean scores were found for two days of CBM in grade 4 and on all three days of CBM for grade 5. A significant difference was also found between the ITBS spelling scores in grade 5. Girls scored higher than boys on all measures.
CHAPTER V

DISCUSSION

The overall purpose of this study was to document the existence of a possible relationship between local norms of curriculum based measurement (CBM) in a high achieving district with nationally normed tests of achievement and ability. There appears to be a current growing shift in practice from using nationally constructed to locally constructed norms with respect to evaluating student achievement and qualifying students for special education.

It should be noted that because the results support the notion that CBM is a highly reliable measure, the reliability of the CBMs was not of concern when determining the validity of CBM as a measure of reading comprehension.

CBM AND ACHIEVEMENT MEASURES

Hypothesis I was designed to document the existence of a relationship between CBMs and a nationally normed group test of achievement. Researchers (Deno, Mirkin, Chaing, 1982; Fuchs, Fuchs, & Maxwell, 1988) have provided evidence
to support the validity of CBMs by correlating students' CBM performance to nationally normed tests of reading comprehension. These nationally normed tests are considered by CBM proponents to be inadequate and invalid for assessing student knowledge since these tests are not directly related to the curriculum in which the students learns. In this study, the findings both support the relationship to nationally normed achievement tests and also raise some questions regarding factors which are reportedly measured by CBMs.

Previous researchers correlated CBMs with standardized measures of reading comprehension with results ranging from .54-.91. These relationship values were considerably higher than those obtained in this study which was designed to relate CBMs and the Iowa Test of Basic Skills (ITBS), a group achievement test. While the Comprehension subtest of the ITBS showed a linear relationship with CBM for each grade, the strength of the relationships was found to be in the moderate range. (.34 -.48).

CBM correlations with the ITBS Spelling subtest, however were somewhat higher .52 -.59 for Grade 4, .48 -.58 for Grade 2, and .37 -.42 for Grade 5. Of all the achievement variables, Spelling was found to be the strongest and most consistent predictor of CBMs at each grade level for every CBM measure. The sequential nature of spelling most likely accounts for this strong relationship.
The relationship between ability as measured by intelligence tests and success in school is well established in the literature. It should be noted that the definition of a learning disability as a discrepancy between ability and achievement differs from the CBM definition which regards a discrepancy in performance between students and local peers as sufficient.

The results of this study confirmed the existence of a positive relationship between CBMs and ITBS reading scores. A positive relationship was also confirmed between the ITBS and the abilities measured by the Cognitive Abilities Test (CogAT). It is important to point out that the relationship between the CBMs and the CogAT was weak. This finding raises a number of questions concerning the possible factors which may be measured by nationally normed achievement tests and tests of cognitive ability but not measured by CBM. It is certainly possible that these factors may measure those skills utilized by students to transfer of knowledge to new domains of knowledge.

The results of this study provide confirmation for the notion that there is a negative relationship between CBMs and performance on the nonverbal portion of the CogAT for the fifth grade sample. While the relationship was not
found to be significant, the correlation was clearly in the negative direction. Tasks on the CogAT nonverbal subtests require skills involved in interpreting charts and graphs and drawing conclusions based on this information. Such tasks may involve what Kaufman (1983) defined as simultaneous information processing which involves evaluating many stimuli at once as opposed to one stimulus at a time, which has been cited as a skill considered to be very important with respect to decoding words. Students who are adept at this type of problem solving may not read aloud fluently with adequate speed compared to their peers, yet their comprehension skills may be average or above. In the study at hand, it was found that students who lag behind peers in reading fluency, had average to above average scores on nationally normed tests of reading. Given this finding, it should be noted that CBM may not be a valid measure of reading comprehension for those students who process information in a wholistic rather than a sequential fashion.

**CBM AND ELIGIBILITY FOR SPECIAL EDUCATION**

Eligibility for special education services because of a learning disability has been established by a federal definition as the discrepancy between ability and
achievement. CBM proponents redefine the definition as a discrepancy between a student's performance and performance of his or her local peers and view the disability as environmental as opposed to within the student. Utilizing this definition, CBMs could be used to identify students who are performing below the average performance levels of their peers.

As noted earlier, this study was designed to examine students in a high achieving district and their performance on CBM measures in which they were compared to peers as well as their performance on nationally normed tests of ability and achievement. The results indicated that most students who would be deemed to have a learning disability in this district would most likely not qualify as having a disability in a more homogeneous district whose population was more reflective of the national population. Students who met the 5% cut-off for eligibility in this district scored within the average range on nationally normed tests of reading. These results raise some concerns with respect to determining whether a student has a disability when it appears that the disability determination may be relative to where a student lives.

DeMeritt (1994) described the state of the field relative to learning disability identification as ironic. In city school systems where the incidence of disabilities
is expected to be high given factors such as crack babies, poor prenatal care, and welfare, etc., 9 to 10% of students are identified as learning disabled. In the suburbs where people have greater access to good medical care, nutrition, as well as educational advantages, as many as 25% of the students are identified as learning disabled. DeMeritt attributes a lack of knowledge concerning the continuum of abilities within and among people may be a contributing factor to this situation.

The philosophy of CBM is focused on problem solving within the environment as opposed to looking at the problem within the child. While this is a positive approach to problem solving, students are still regarded as having a disability. That disability in some cases is ironically created by the environment. Such a situation should be investigated before CBM is embraced as an exclusive method for identifying children who need intervention in reading.

Traditionally, intelligence tests and nationally normed referenced tests have been utilized to determine discrepancies between ability and achievement and nationally normed instruments were used to determine whether or not a discrepancy existed. The results of this study indicated that scores of nationally normed achievement tests for students who would qualify under the CBM standard for reading were within the average range for all three grades examined. In a high achieving district such as the one
examined in this study, multiple measures of achievement including nationally normed tests would most likely be more appropriate in determining realistic, meaningful discrepancies.

INCLUSION AND CBM

While CBM has been offered as an alternative delivery system to bridge the gap between regular and special education, its use for eligibility purposes based on local norms may promote an opposite outcome of that objective. Under CBM, students may be identified as having a disability regardless of whether or not the academic discrepancy, such as the one described in this study, is truly meaningful.

A possible misuse of CBM in a high achieving district may be to separate rather than include students who do not meet unrealistic expectations.

LOCALLY NORMED CBM AND EQUITY ISSUES

This study demonstrated the likely possibility that students in a high achieving district may be identified as having a learning disability because the performance of their peers places them at a disadvantage. If they lived elsewhere, it is unlikely that their level of achievement would be recognized as a deficit.

CBM as the sole measure of eligibility for a learning disability may create inequities. If a disability is
environmental, as CBM proponents contend, then it would appear that a low achieving district in comparison to a high achieving district would be experiencing factors which would foster an atmosphere of environmental disability. The CBM model of discrepancy would fail to reflect the range of those possible disabilities since a 5 to 10% cut-off, based on local norms, for each local district is recommended as the eligibility requirement. The potential for continuing the current inequities between high and low achieving districts exists under the CBM identification system. When funding for special education is tied to identification of students who have disabilities, the use of local norms for identification would contribute to inequitable funding, favoring high achieving over low achieving districts. A situation may result in what DeMeritt (1994) refers to as "welfare" to the suburbs, especially wealthy suburbs.

While the multidisciplinary team currently reports and considers data beyond academic performance when determining eligibility for a learning disability (ie. classroom environment, social developmental history, poor teaching, etc.), proponents of CBM take the position that the CBM is the only necessary decision making tool when considering academic discrepancy since the disability is considered environmental. CBM as the sole measure in that discrepancy model appears to be inadequate, given the possibility of skewed norms as demonstrated in this study, as well as a
limited sample of behavior. Multiple measures, including standardized and local performances would appear to provide a fairer analysis of this discrepancy model.

POSSIBLE FUTURE RESEARCH BASED ON THE FINDINGS OF THIS STUDY

The findings of this study suggest that additional research is needed to increase our understanding of CBM and its contribution to identifying students in need of intervention.

It is recommended that a similar study be conducted in a low achieving district. The findings from this type of study would provide a picture of students and their CBM standing relative to their district and their standing relative to national norms. Such an investigation would provide the opportunity to determine whether or not a district may be at-risk for neglecting to identify students who need assistance when those students are compared only to local peer performance.

It is also recommended that an effort be made to design studies which focus on identifying factors which are measured by nationally normed tests of achievement and ability, but not by CBM, as indicated in this study. These investigations would most likely give a fuller perspective relative to CBM and its multivariant properties.
The utilization of CBM for identification purposes has resulted in a lower identification of boys than other methods have produced and therefore CBM has been considered a fairer method of assessment. In this study, no differences between boys and girls were noted for second grade students, however, at fourth and fifth grades, CBM scores were significantly higher for girls than boys. The sex difference property may differ from district to district.

CBM has been promoted as an alternative to nationally normed testing because it among other things, reduces the cost of assessment. Group achievement tests, are also efficient measures of assessment and provide a national picture. Group achievement tests have been shown to be accurate in discriminating between at-risk and learning disabled students (Wilson, Schendel & Ulman, 1992).

A positive relationship between CBM and reading comprehension has been demonstrated in this study and in additional research. The merits of CBM as a valuable tool for monitoring student progress and for assisting in IEP designs have been demonstrated in the literature as well. The results of this study indicate, however, that CBM may not give a meaningful picture of student achievement in a high achieving district. Consideration should be given to multiple measures of assessment when evaluating the meaning of CBM assessment in individual districts.
APPENDIX A
CBM Probe - Day 1 - Grade 2
Willie wanted someone to hug. That’s what he wanted more than anything.

But no one hugged Willie. Not anymore.

Not even his daddy when he dropped Willie and his friend Jo-Jo off at school. Now, he just patted Willie on the head and said, "See you around, Son."

Every day Jo-Jo rode to school in the linen truck with Willie and his daddy. And when Willie used to hug his daddy good-bye, Jo-Jo would turn his head and laugh. "What did not do that for? Man, that’s silly," Jo-Jo would say once they had crawled out of the truck.

So Willie stopped hugging his daddy. He never hugged his mama or his sister anymore either. And when they tried to hug Willie, he turned away. But Willie wanted someone to hug. That’s what he wanted more than anything.

At school he watched as Miss Mary put her arms around some boy or girl. It didn’t look silly. Except when she tried to hug Jo-Jo. Jo-Jo made a big commotion what make everyone laugh. He wriggled and squirmed, and shrieked, "Help! Help! I’m being mugged! Help!"

At night Willie watched his sister pull her teddy bear to her and hug it. She looked so safe and happy lying there with her arms around the bear.

CBM Probe - Day 2 - Grade 2
"Amelia Bedelia," said Mrs. Rogers, "you have been here a long time."

"Oh, Mrs. Rogers," said Amelia Bedelia, "Are you tired of me?"

"Of course not," said Mr. Rogers. "We want to have a party for you. We want to meet your family."

"Now that is nice," said Amelia Bedelia.

"Who would you like to invite?" asked Mrs. Rogers.

"I'll get my family album," said Amelia Bedelia. "You can help me decide."

"Good idea," said Mr. Rogers. Amelia Bedelia got her album.

"This is my daddy," said Amelia Bedelia. "He is a telephone operator."

"Then he helps people make calls," said Mr. Rogers.

"He does not!" said Amelia Bedelia. "He operates on telephones."

"I see," said Mr. Rogers.

"This is my mama," said Amelia Bedelia. "She is a loafer."

"You mean she does nothing," said Mrs. Rogers.
"Certainly not," said Amelia Bedelia. "She works hard. She makes dough into loaves of bread. That's what a loafer does."

"I see," said Mrs. Rogers.

"This is Uncle Albert," said Amelia Bedelia. "He is a big-game hunter."

"You mean he kills wild animals?" asked Mrs. Rogers.

"Why would he do that!" said Amelia Bedelia. "He hunts big games. He has one so big it takes up a whole room."

"I see," said Mrs. Rogers.

"Cousin Edwards is a horse racer," said Amelia Bedelia.

"Oh, he is a jockey," said Mrs. Rogers.

"I don't think so," said Amelia Bedelia. "Cousin Edward races horses. He almost won once. but he tripped and fell."

"I see," said Mr. Rogers.

CBM Probe - Day 3 - Grade 2
This is something I learned in school. The whole body is mostly water.

We think we’re solid, but we’re not. You can tell sometimes from your blood and tears and stuff that what you’re like inside isn’t what you’re like outside, but usually you’d never know.

Also, the whole earth is mostly water—three-quarters ocean. The continents are just little stopping places. And using water—streams and rivers and oceans—anybody could put a message in a bottle and send it all the way around the world.

That was my secret project.

I had a bottle with a cork. I had paper and a ballpoint pen. I wrote a message: *Whoever finds this bottle, please write or call me and tell me where you found it.*

I put down my address and phone number. Then I corked the bottle and carried it down to the river.

I threw the bottle as far out as I could. It splashed, bobbed up and floated. I watched it go out of sight.

I kept thinking about my secret project.

Maybe my bottle was on the way to Hawaii.

Maybe it was on the way to France.

Maybe it was on the way to China.

Maybe I would write letters to the person who found it, and we would become friends. I would go visit the person where he or she lived.

I could see myself in Rio de Janeiro, dancing in the streets.

I could see myself in India, riding on an elephant.

I could see myself in Africa, taming wild lions.

CBM Probe - Day 1 - Grade 4
In the town of Alto, Ohio, there lived a boy named Lentil.

Lentil had a happy life except for one thing. He wanted to sing—but he couldn't!

It was most embarrassing, because when he opened his mouth to try, only strange sounds came out.....And he couldn't even whistle because he couldn't pucker his lips.

But he did want to make music, so he saved up enough pennies to buy a harmonica.

Lentil was proud of his new harmonica and he decided to become an expert. So he played a lot, whenever and wherever he could.

He used to play almost all the way to school. Down Vine Street to the corner of Main, past the finest house in Alto, which belonged to the great Colonel Carter. Then...past the drugstore, the barber shop, and the Alto Library, which was a gift of the great Colonel Carter, by the Methodist Church, through the Carter Memorial Park, and around the Soldiers and Sailors Monument that the Colonel had build there.

Then Lentil would stuff his harmonica into his pocket and take a short cut up the alley behind the hardware store so he would not be late for school.

People would smile and wave hello to Lentil as he walked down the street, because everyone in Alto liked Lentil's music; that is everybody but Old Sneep. Old Sneep didn't like much of anything or anybody. He just sat on a part bench and whittled and grumbled.

CBM Probe - Day 2 - Grade 4
Every single day of my life I practice on my violin. Even on Saturdays and Sundays. It takes a lot of my time. Mostly, I don’t mind because I like my violin. But sometimes I get sick of it. Then, I feel like quitting. Last Tuesday was one of those times.

I was waiting for the bus. I saw these kids skateboarding and having fun. I thought how I’d like to be able to go home, have a snack, and play around till dinnertime. Instead, I was waiting for the bus to take my to my violin lesson. Yuck.

That day, when the bus pulled up, I thought about not getting on. But then I did. I showed the driver my pass and started back to my usual seat. As I got close, I saw a man sitting in it. But there was an empty seat next to him. As I sat down I saw he had a violin case too. We smiled at each other.

"What a coincidence, huh?" he said, pointing to his own case. "How long have you been playing?"

"Two years," I answered. "How about you?"

"Oh, let’s see." The old man paused and leaned his head back. "Going on about seventy-five years, now. Give or take a few.

"Seventy-five years! Wow! That’s almost forever," I exclaimed.

"Nothing's forever, but you’re right, it is a long time." The old man smiled and patted his case. "We’ve done well for each other, this old fiddle and me. We’ve had some good fun together. Do you have fun with yours?"

"Most of the time, I said with a sigh. "But it’s sure hard sometimes." I thought about the hour I had to practice each day.

CBM Probe - Day 3 - Grade 4
I smashed face first into Ryan's butterfly mobile. That's how I knew I was at the crib. I felt for him and lifted him out, but we didn't get far. He was caught in the mobile, his arm or his head; I couldn't get him loose.

"Mom!" I yelled, though I knew she wasn't there. I grabbed the mobile and pulled it from the ceiling.

Tornado was close, and I knew it. Both my ears had popped, and all the drains in the house were sucking like monsters.

Arthur was at the bottom of the stairs, waiting. Thank God he'd found the flashlight! I jumped the last half-flight to the floor.

"Hurry!" I screamed. I swung into the doorway of the bathroom with Arthur right behind me. We crawled into the shower and sat on the floor.

"Shine it here, on Ryan," I gasped. "He's caught in this thing. By now Ryan was kicking and screaming, and his eyes were big in the light.

Once we got the mess of strings free of Ryan's sweaty nightshirt, Arthur kicked the mobile against the wall by the toilet.

"I have to go home!" he cried. "They won't go to the basement. Mama never does.

The beam of light bounced around the blackness of the bathroom as Arthur scrambled to his feet, but I grabbed and held on to him.

"You can't go! It's here! Can't you feel it?"

The siren quit again as I pulled him back down and threw my leg over him. The flashlight clattered to the floor and rolled away from us.

We heard it next. The lull. The deadliest quiet ever, one that makes you think you might explode. The heat in the room built until I couldn't get my breath.

My first interest in animals and nature came very early in life. As a child we had pets around the house. I had tropical fish and the care of a rabbit. My grandfather raised chickens. As a result, I became concerned with the treatment of animals.

Years later my wife and I gave our four children a dog. The family named him Two Bits. Over the years we've adopted four cats. I believe the cats sparked another interest in me. I discovered that each cat has quite a different and unique personality. Clorox was the smartest; Brillo, the most playful; Midnight, the most clever; and Shadow, the funniest (especially as a kitten). These differences got my attention. I became even more fascinated with animals and nature.

I have worked on many projects involving the drawing of animals, but Turtle in July by Marilyn Singer presented me with the opportunity to zero in on each animal's personality. I was excited about this project. The poems were written so as to give a sense of the attitude and physical qualities of each animal. My challenge was to do paintings of each animal that would reflect, enhance, and give life to the poems. The first step in envisioning an animal is for me to put myself inside the creature—for me to pretend to be that particular animal. For example, the "March Bear", I thought about how it moves (slowly or quickly), where it lives, what it eats, and so on.

The research comes next. I have a large library of nature books and magazines. I also keep a scrap file made up of clippings of animals and nature.

CBM Probe - Day 2 - Grade 5
Pa stopped the wagon in front of the livery barn and the dog climbed into Jane's calico lap. Pa shook his head. "That's a fine-looking dog, but he belongs to someone here in Lone City. We can't take him with us." Pa climbed to the ground. "Hand him to me, sister."

Sadly, Jane handed down the dog. His tail started wagging, stirring up a breeze, and he began to lick Pa's face-red beard and all.

"Now don't you go trying to break our hearts," Pa said. "you can't come along. You belong here in Lone City. No get along home."

Pa mounted the wagon seat once more, and the dog sat in the hot dust. His tail was still.

"Git up, Hocus. Git up Pocus."

Pa was silent a long time. The young 'uns had always wanted a dog, he knew, but it would only be another mouth to feed. There was no place in the show for a dog. All the animals earned their keep; Hocus and Pocus pulled the wagon, Madam Sweetpea gave fresh milk, and the rabbits popped out of hats. A dog was just a dog.

Jane tried not to look back. No one said a word, and there wasn't a smile on even one of the five faces. The wagon creaked and swayed along the rutted trail, and finally a sign appeared:

Cactus City -- One Mile

It was Mama who broke the silence, when she glanced behind to make sure Madam Sweetpea was still tied to the wagon.

"Look—he's following us," she exclaimed.

They all turned to look. The dog was indeed following in Madam Sweetpea's tracks.

Pa stopped the wagon and strode to the dog.

"Now see here, little dog. You don't belong to us. You go along home."

CBM Probe - Day 3 - Grade 5
Mrs. Jane Tabby could not explain why all four of her children had wings.

"I suppose their father was a fly-by-night," a neighbor said, and laughed unpleasantly, sneaking round the dumpster.

"Maybe they have wings because I dreamed, before they were born, that I could fly away from this neighborhood," said Mrs. Jane Tabby. "Thelma, your face is dirty; wash it. Roger, stop hitting James. Harriet, when you purr, you should close your eyes part way and knead me with your front paws; yes, that's the way. How is the milk this morning, children?"

"It's very good, Mother, thank you," they answered happily. They were beautiful children, well brought up. But Mrs. Tabby worried about them secretly. It really was a terrible neighborhood, and getting worse. Car wheels and truck wheels rolling past all day--rubbish and litter--hungry dogs--endless shoes and boots walking, running, stamping, kicking--nowhere safe and quiet, and less and less to eat. Most of the sparrows had moved away. The rats were fierce and dangerous; the mice were shy and scrawny.

So the children's wings were the least of Mrs. Tabby's worries. She washed those silky wings every day, along with chins and paws and tails, and wondered about them now and then, but she worked too hard finding food and bringing up the family to think much about things she didn't understand.

But when the huge dog chased little Harriet and cornered her behind the garbage can, lunging at her with open, white-toothed jaws, and Harriet with one desperate mew flew straight up into the air and over the dog's staring head and lighted on the rooftop--then Mrs. Tabby understood.

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VITA

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