THE RELATIONSHIP BETWEEN STUDENTS’ PERFORMANCE ON THE COGNITIVE ABILITIES TEST (COGAT) AND THE FOURTH AND FIFTH GRADE READING AND MATH ACHIEVEMENT TESTS IN OHIO

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A Dissertation

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ABSTRACT

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The purpose of this quantitative study was to examine the relationship between students' performance on the Cognitive Abilities Test (CogAT) and the fourth and fifth grade Reading and Math Achievement Tests in Ohio. The sample utilized students from a suburban school district in Northwest Ohio. Third grade CogAT scores (2006-2007 school year), 4th grade Reading and Math Ohio Achievement Test scores (2007-2008 academic year), and 5th grade Reading and Math Ohio Achievement Test scores (2008-2009 school year) were utilized in this study.

Pearson Correlation was utilized to examine the relationship between the test scores. Secondly, the researcher examined whether the correlation coefficients between CogAT and fourth and fifth grade Ohio Achievement Test scores differ by CogAT performance level (below average, average, above average). Additionally, a linear regression test was utilized to determine whether the composite scores from the CogAT can predict proficiency on the fourth and fifth grade Ohio Achievement Tests in Reading and Math.

The correlation coefficient on all four achievement tests indicated strong positive significant relationships between scores on each achievement test and scores on the
CogAT for the entire sample (n=292), while three of four of the coefficient correlations were weak for the below average group. The average group generated the strongest correlations of the CogAT with all the OATs examined. The above average group generated moderate correlations. Predictions for future academic achievement are stronger with the above average and average groups, while weaker for the below average group. In general, students who score approximately 93-95 on the CogAT in 3rd grade are likely to achieve a proficient level on the 4th and 5th grade OAT for Reading and Math. The range of CogAT scores necessary to predict accelerated and advanced levels increases greatly. In addition, higher CogAT scores were necessary to achieve accelerated or advanced for Reading (4th and 5th) in contrast to the Math (4th and 5th).

Overall, the results indicate the CogAT is significantly related to the fourth and fifth grade Reading and Math achievement tests, which indicates cognitive ability, and can be used to predict future academic achievement, while supporting the importance of making data-driven decisions.

Professional development is a major policy application that is necessary to understand CogAT score reports and provide teachers with applicable, practical, and meaningful methods for teaching to a diverse group of students.

Future study opportunities could determine if a relationship exists between teacher interventions implemented in the classroom and future academic success on achievement tests, while another study could focus on the impact of teacher
performance on student success on future achievement tests. Additional studies could be conducted to determine the correlations between the CogAT and other states achievement tests to see if a significant relationship exists.
DEDICATION

This dissertation is dedicated to my family: Steven, Beverly, and Kyle. Your support, understanding, and commitment to my education have been unwavering. Without your guidance and unconditional love, I would not be the man I am today and it would not have been possible to finish this doctoral program.
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CHAPTER I. INTRODUCTION

Introduction to the Problem and Rationale

Over the past several decades, educational reform has been instrumental in guiding instructional practices. In 1983, *A Nation at Risk* was published which “was a more general call to arms and left the manner of implementation of its recommendations to the education community” (Hunt, 2008). Since the initial report, a primary theme in the field of education has been the focus on individual student learning (Hunt, 2008), while No Child Left Behind is a standardized accountability measure with “recent interest in the performance of the various subgroups in the school population” (Hunt, 2008, p. 584). Moreover, the ancestry of the highly prescriptive No Child Left Behind Legislation originates from *A Nation at Risk* (Seed, 2008).

Federal requirements, such as those that come from the No Child Left Behind Act (2001), require each school district and school building to maintain a level of excellence while meeting Adequate Yearly Progress (AYP) each year. All schools must show substantial growth yearly in student achievement, graduation rates, and attendance in order to meet the AYP indicators. Additionally, schools are also measured by subgroups that are comprised of student populations in various categories, all of which must show growth in math and reading. When schools focus on data from achievement tests only, the effort is guided by how to look better on these evaluations (Bernhardt, 2003). The No Child Left Behind legislation “judges schools primarily on the
percentage of children who perform at the ‘proficient’ level on state tests” (Olson, 2004, p. 14).

Under the No Child Left Behind legislation, schools often are not credited for the academic growth students achieve throughout the year because the focus is primarily on whether or not students pass achievement tests (Olson, 2004). However, in Ohio, the Value Added component has been a new addition to the State Report card, which each school and district in the state receive (Ohio Department of Education, 2010). “Value-added methods track the growth of each student in a school over time from the child’s starting point. Such methods also can provide schools with diagnostic information about the rate at which individual children are learning in particular subjects and classrooms, making it possible to target assistance to students or teachers or areas of the curriculum that need help” (Olson, 2004, p. 14). This information can be paramount when meeting the individual needs of students with varying ranges of academic ability.

More specifically, students who require additional classroom support can receive supplemental services, while students requiring enrichment services can be accelerated. Value Added measurements are helpful to teachers because they identify individual students who are struggling with the curriculum as well as encourages teachers to implement instructional modifications (Misco, 2008). Value Added empowers school districts to determine which “schools could be low in achievement but high in student growth or equally troubling, high in achievement but low in student growth” (Lasley,
Given this information, it becomes even more important that schools help achieving students maintain high levels of academic performance in order to show academic growth from year to year on standardized assessments. Additionally, teachers can identify and support students at risk of not passing the state achievement tests as well as accelerate students with higher academic abilities to achieve growth throughout the academic year.

With the accountability measures such as No Child Left Behind, Value Added, and the State Report cards, districts are provided with data on student achievement and growth. However, these assessment data are among the many different types of data teachers examine and analyze throughout the year. Other forms of academic data, which are beneficial and can assist improvement (Schmoker, 2003), include baseline tests given at the beginning of the year to indicate initial student content knowledge, progress monitoring data obtained from short-cycle assessments given once a quarter, and classroom assessments over content learned within a particular unit. Additionally, teachers collect and analyze data on student behavior including the number of students with office referrals or the number of phone calls home regarding misbehavior. Killion and Bellamy (2000) share, “Because data abound, schools must become data savvy. Everyone needs to understand what information is available about the school and its students and what data are relevant to the school’s immediate needs” (p. 27). Given the large amount of data that is collected, teachers need to understand the importance of
each type of data and know when to use each type effectively to make successful data-driven decisions in the classroom. Love (2004) comments, “Schools are gathering more and more data, but having data available does not mean the data are used to guide instructional improvement. Many schools lack the process to connect the data they have with the results they must produce” (p. 23) and could end up in “analysis paralysis” (Bernhardt, 2003). Districts are often inundated with the data, which is why “over analysis can contribute to overload-the propensity to create long, detailed, ‘comprehensive’ improvement plans and documents that few read or remember.

Because we gather so much data and because they reveal so many opportunities for improvement, we set too many goals and launch too many initiatives” (Schmoker, 2003, pp. 23-24).

Another data source collected at the elementary level includes the results of the Cognitive Abilities Test, which many schools use only for the purpose of identifying students for the gifted and talented program. Ohio Administrative Code § 3301-51-15 indicates several ways students can be identified as gifted. The Administrative Code states students that “scored at least two standard deviations above the mean, minus the standard error of measurement, on an approved standardized group intelligence test have met the criteria for receiving gifted education services.” One standardized test used by many schools to test cognitive ability is Form 6 of the Cognitive Abilities Test (CogAT) (Lohman & Hagan, 2001). Lohman and Hagen (2003) describe the CogAT as
“a measure of each student’s level of cognitive development that captures important information not represented in school grades or in other measures of school achievement. For example, CogAT scores help identify academically gifted students” (p. 1). In the state of Ohio, a student must achieve a score of 129 on the CogAT in order to qualify for the Gifted and Talented Program. Many districts “still base identification of gifted students primarily on one measure of cognitive ability because using a single measure is less costly and consumes less time even though each test may operationally define cognitive ability differently” (Tyler-Wood, 1991, p. 63). The CogAT seems like a prudent choice to use to identify gifted students, given the guidelines of the Ohio Administrative Code. Furthermore, using a single measure is less time consuming and costs less.

The standardized assessments, such as the CogAT, can be used to determine which students qualify for the gifted program; however, “as long as we use them only as a means to rank schools and students, we will miss their most powerful benefits (Guskey, 2003, p. 11). The CogAT could be used to help guide instruction that will “lead to better-taught students” (Popham, 2003, p. 51) through a differentiated curriculum aimed at meeting the individual academic needs of all students. The results from the CogAT could be examined by administrators, teachers, and tutors to hopefully determine which students are at-risk for failing the fourth and fifth grade Ohio Achievement Tests (OAT) (now referred to as the Ohio Achievement Assessments) as
well as identifying students who require a more rigorous academic curriculum in order to be challenged at school.

Research has been conducted on how the CogAT can be used to predict achievement as well as differentiate instruction. According to the CogAT, Form 6, Research handbook (2002), “CogAT scores obtained at one point in time predict achievement several years later” (p. 99). Furthermore, Lohman and Hagen also authored the Interpretive Guide for Teachers and Counselors (2003), which details how scores from the CogAT can be used to differentiate instruction. Lohman and Hagen describe the principles for adapting instruction by “building on strengths, focusing on working memory, scaffolding wisely, emphasizing strategies, and diverse grouping” (p. 83-84). Although there has been research relating the CogAT scores with the Iowa Test of Basic Skills (ITBS), ultimately, there has not been any research correlating the scores on the CogAT with the Ohio Achievement Tests. Given the widespread administration of the CogAT across Ohio, the limited use and interpretation of its data, and the paucity of research on the relationship between CogAT scores and OAT scores, further research is necessary to explore the additional uses of this data source. The current study aims to explore the relationship between cognitive ability and academic achievement, with the focus of utilizing CogAT scores to predict future academic achievement. Furthermore, the current study, examining the relationship between scores on the CogAT test and scores on the fourth and fifth grade Reading and Math
Ohio Achievement Tests, details the importance of using scores from a cognitive abilities test to differentiate instruction in order to provide an individualized instructional program adapted to meet the needs of each student.

**Purpose of the Study**

The purpose of this study is to determine whether the composite scores on the Cognitive Abilities Test (CogAT) significantly relate to achievement scores on the fourth and fifth grade Ohio Reading and Math tests in Ohio. Additionally, this study seeks to understand what composite scores on the CogAT are necessary to predict a score in the proficient range, the accelerated range, and the advanced range on the fourth and fifth grade Ohio Achievement Tests in Reading and Math. The participants in the study included 324 students in a suburban public school who were third graders in 2006-2007 and the same students who were fourth graders in 2007-2008 and fifth graders in 2008-2009. In third grade the students completed the CogAT test; while in fourth and fifth grade these same students took the Ohio Achievement Tests in Math and Reading. A correlational research design was utilized using Pearson correlation to determine whether the scores between the CogAT and the achievement tests are significantly related. Additionally, a linear regression was used to predict what scores are needed on the CogAT to achieve a proficient, accelerated, or advanced score on the Ohio Achievement Tests.
Research Questions

1. Do composite scores on the Cognitive Abilities Test (CogAT) significantly relate to scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio?

2. Do CogAT composite scores significantly relate to fourth and fifth grade Ohio Achievement Test scores for performance levels (below average, average, above average)?

3. What composite scores on the CogAT are necessary to predict a proficient score, an accelerated score, and an advanced score on the fourth and fifth grade Ohio Achievement Tests in Reading and Math?

Theoretical Framework

Reasons for the recurring rise and fall of different theories of intelligence are many (Lohman & Rocklin, 1993, p. 6). Throughout the years, researchers such as Binet have supported theories that facilitate the notion of intelligence as a unitary component. Lohman (1989) shares, “Binet’s test was originally designed to predict performance in school. Whatever larger purposes he may have hoped the test might serve, or that others have actually used tests for, it is clear that intelligence tests have always been most heavily used as measures of scholastic aptitude” (p. 6). Other researchers such as Gardner (1983) and Snow (1981) have posited theories describing multiple components associated with tasks involved in life experiences. Lohman and Rocklin (1993) assert
that, “as long as there is controversy over method, or differences in the social, political, and personal philosophies of individuals, there will be controversy about the nature of human abilities” (p. 6).

Snow’s theory about aptitude was utilized to frame this study because the CogAT “measures developed abilities, not innate abilities” and scores are “influenced by both in-school and out-of-school experiences” (Lohman & Hagen, 2003, p. 1).

Lohman (2006) shares, “The central construct is that of aptitude, by which Snow meant the degree of readiness to learn and perform well in a particular situation or domain” (p. 36). Snow’s construct can be applied to the current study as the composite score on the Cognitive Abilities Test (CogAT) would indicate the degree of readiness to perform academic tasks. These scores signify the level of cognitive processing of individual students at the third grade level. A student with a higher degree of readiness to perform tasks within the classroom would point toward a higher level of cognitive processing, while a student with a lower degree of readiness would designate a lower level of cognitive processing. Additionally, Shavelson, Roeser, Kupermintz, Lau, Ayala, Haydel, Schultz, Gallagher, and Quihuis (2002) state, “By aptitudes, Snow meant all these characteristics (e.g., experience, ability, knowledge, motivation, and regulatory processes) that an individual brings to and cobbles together to perform in a particular situation (p. 79).
Kyllonen and Lajoie (2003) share three main themes of Snow’s work. The first theme addressed the importance of aptitude in teaching viewed through cognitive and affective lenses. “A second theme was Snow’s strongly held belief that instruction ought to be adapted to accommodate the aptitudes of individual learners, in a formulation known as aptitude–treatment interactions or ATIs” (Kyllonen & Lajoie, 2003, p. 80). Snow therefore posits that the aptitude of the student must be matched with the correct instructional environment so that individual student may be successful in academic ventures. Cronbach and Snow (1977) describe the importance of matching aptitudes and learning situations in order to capitalize on strengths, compensate, and remediate. Teachers must be able to find ways in order to match the aptitudes of students with the appropriate teaching mechanisms in order for the student to be successful. Snow and Lohman (1984) remark, “Outer instructional environments can be chosen or designed to capitalize on strengths and compensate for weaknesses in the inner environments of differing students” (p. 356).

Kyllonen and Lajoie (2003) present the third theme of Snow’s work which highlights aptitude as a process, not simply as a single summative assessment score. As students learn new concepts and encounter new instructional methods, the learning process is fluid and ever-changing. School personnel and administrators must take the time to explore the underlying themes found by examining standardized assessments and not focusing only on the scores.
Lohman (2006) continues, “Aptitudes for learning are therefore tied both to what must be learned (i.e., What kind of expertise do we aim to develop?) and to the learning context (i.e., How are students expected to learn?)” (p. 36). Students are developing expertise by learning the academic content, which is tested on the fourth and fifth grade Ohio Math and Reading Achievement Tests, with high expectations for student learning within the educational context aimed at meeting individual needs. Snow (1998) notes the importance of educational circumstances used to encourage learning. Within the framework of the current study, it is possible that students scoring high on the CogAT test would develop higher level thinking skills in order to score in the advanced or accelerated range on the fourth and fifth grade Reading and Math Achievement Tests. The higher cognitive scores would hopefully indicate higher reasoning abilities that can be used to predict future academic successes in the classroom and on achievement tests. Differentiated instruction within the classroom, as well as the support of a Gifted and Talented Program, can guide the learning expectations for these students. On the other hand, students with lower composite scores on the CogAT must also be expected to receive a proficient score in order to pass the achievement tests according to standards set forth by the state of Ohio. Lohman (2006) shares, “Aptitudes for learning typically include prior knowledge and skill in the domain, the ability to reason in the symbol system(s) used to communicate new knowledge, interest in the domain, and persistence” (p. 36). Snow posited students’ academic performance on achievement
tests was attributed to a combination of demographic background and previous intelligence knowledge (Shavelson, Roeser, Kupermintz, Lau, Ayala, Haydel, Schultz, Gallagher, & Quihuis, 2002).

**Significance of the Study**

This study is significant as the results may guide teachers in additional uses of CogAT data. Generally, the data are currently used to indicate whether a student has a cognitive ability level to be considered academically gifted; however, “an undifferentiated label such as ‘gifted’ does not usefully guide educational programming for a group that contains a mix of both high accomplishment and high-potential students” (Lohman, 2005, p. 334). It is possible that by further examining scores on the CogAT to predict scores on the achievement tests, teachers will be able to identify students who are at risk of not passing the achievement tests. Additionally, teachers may differentiate classroom instruction designed to meet the needs of gifted and talented students in order to achieve a year’s worth of growth on the Value Added measure as well as achieving Adequate Yearly Progress with higher level ability students. Although Lohman and Hagen (2003) remark, “The first and most important use of CogAT scores is to help teachers adapt instructional goals, methods, and materials to the individual needs of students” (p. 2), CogAT results are not being examined for that purpose in the present study. Lohman and Hagen (2003) describe effective instructional methods that assist students in becoming active participants in
the learning process by empowering students to build on strengths and approaching problems by using self-monitoring techniques that can allow students to be successful at any given ability level. Lohman and Hagen (2003) reiterate the benefits of scaffolding and sequencing instruction to help students be successful.

The data from the CogAT test might also be used to identify students who are at-risk of failure on the Ohio Achievement Tests. Taken a step further, the data may also be utilized to determine intensity and duration of individual intervention services for students in the at-risk category of failing the Achievement test. Furthermore, the scores from the CogAT can be used to “identify students whose levels of academic achievement are substantially lower or higher than expected given their CogAT scores” (Lohman & Hagen, 2003, p. 2).

This study is significant because the results could promote policy change to support a school culture where the vision promotes data collection and examination. Hord and Sommers (2008) mention, “The vision dictates the parameters of decision making about teaching and learning in the school. As it reflects shared values and beliefs, the vision will focus staff members on how they spend their time, what topics they discuss, and how resources may be distributed” (p. 10). An administrator reading the findings of the research in this study will understand the importance of creating and sustaining a culture which values the rigorous examination of the CogAT data in an effort to individualize instruction to help children succeed in the classroom and on the
Ohio Achievement Tests. “In sum, CogAT assists educators in helping more students achieve by giving teachers dependable information on each student’s reasoning abilities and by giving teachers sound advice on how to use that information to structure learning” (Lohman, 2004, p. 4). Ultimately, the students are the benefactors of this study due to the overarching focus on ensuring students achieve annual academic growth.

The results from this study can be applied to various educational settings including suburban, urban, and rural school districts as well as public and parochial schools. These results are broad enough where individual schools and populations can “identify multiple ideas and information sources” (Hord & Sommers, 2008, p. 88) and use the results in a meaningful manner to effectively communicate with one another. The setting or geographical location should not impact the degree in which schools study the data from the CogAT and subsequently develop action plans to meet the needs of individual students.

Definitions

The terms used throughout this study are:

*Ability:* Competency in undertaking a task.

*Achievement:* Academic accomplishment of content learned throughout the school year as measured by the Ohio Achievement Tests.
Adequate Yearly Progress: A piece of the No Child Left Behind legislation that requires school districts as well as individual schools to show yearly progress on the number of students who are proficient.

Aptitude: The degree of readiness to learn and to perform well in a particular situation or domain (Corno, Cronbach, Kupermintz, Lohman, Mandinach, Porteus, et al., 2002).

Cognitive Abilities Test (CogAT): A standardized test used to measure the cognitive abilities of a student at a given point in time.

CogAT Performance Levels: Below Average (Score of 0-83), Average (Score of 84-116), and Above Average (Score of 117+) on the CogAT.

Differentiated Instruction: Academic instruction designed to meet the individual needs of each student.

Gifted and Talented Program: Program designed to enrich grade level academic content to ensure students are challenged through higher level thinking processes.

No Child Left Behind (NCLB): Federal mandate which indicates student learning through standardized accountability measures that increase on a yearly basis (20 U.S.C. § 6301, et seq).

Ohio Achievement Tests: Standardized tests given to each student in 3rd-8th grade designed to measure what a student knows in reading and math.
Value Added: An accountability measure focusing on student academic growth from year to year versus only identifying whether the students are proficient on an achievement test.

Assumptions and Limitations

This study has several assumptions. First, this study assumes each student who completed the CogAT and the Ohio Achievement Tests gave his or her best effort on each test. Secondly, another assumption of this study is that the CogAT and the Ohio Achievement Tests have been proven to be valid and reliable standardized assessments. The third assumption of this study is that the data have been managed appropriately and without error.

This study has several limitations. This study utilized a convenience sample using one suburban school district in Northwest Ohio. The generalizability is problematic since a convenience sample is being utilized. Fraenkel and Wallen (2006) state, “In general, convenience samples cannot be considered representative of any population . . .” (p. 100). Furthermore, teacher interventions are another limitation. This study does not account for the individual teacher interventions that were implemented within the classroom to help students become successful learners between the administration of the CogAT and the achievement tests. Such interventions could impact student achievement scores and subsequently impact the relationship between the CogAT and the Ohio Achievement Tests. Additionally, the quality of teacher
performance, including quality and quantity of classroom instruction each student received, was also not addressed within this study. Teachers have varying knowledge of differentiated instruction as well different instructional strategies which could impact student performance on the Ohio Achievement Tests. Additionally, another limitation could be teachers teaching to the Achievement Test. The CogAT tests for individual student cognitive abilities, while the achievement tests indicate mastery of academic content taught throughout the school year. A teacher would be more likely to teach to the achievement tests given that the results from these assessments are directly linked to teacher performance. Furthermore, although Socio-Economic Status of the district is described, and the ethnic backgrounds of the participants are identified, the study does not take into consideration the impact of these two variables on the results of this study.
CHAPTER II. LITERATURE REVIEW

Introduction

This chapter begins by describing the history of intelligence theories and various intelligence tests used in Europe and the United States. A brief description of the background of the Cognitive Abilities Test (CogAT) is also included in this section. The next part of the chapter is devoted to gaining a deeper understanding of the relationship between cognitive ability and achievement. The chapter continues by examining the predictive validity of cognitive ability to forecast achievement in math and reading. Finally, the chapter ends with a description of the various ways that scores from the CogAT can be used to differentiate instruction, including interventions, for all students.

History of Intelligence Theories and Testing

Over the years, there have been many different theories describing intelligence and cognitive abilities. Lohman (1997) emphasizes, “good writing and research by early developers of intelligence tests is not only much larger, but much more variegated than our simple summaries suggest” (p. 3).

The study of intelligence has early roots in research conducted by Charles Spearman (1904) and started before the study of psychology began (Gottfredson & Saklofske, 2009). Gottfredson and Saklofske (2009) share an explanation of Spearman’s work as a “two-factor intelligence model describing specific or ‘s’ factors (akin to
primary factors) and a second-order general factor or ‘g’” (p. 183). Spearman described general factor g as a single distinctive feature of intelligence. Vernon (1961) described a “factor-analytic model” (Lohman & Hagen, 2002, p. 1) using broad ranging to precise factors. Horn and Cattell (1966) posited a theory of crystallized and fluid intelligence. Cattell described fluid intelligence (Gf) as the ability to understand information precisely across various disciplines, while crystallized intelligence (Gc) is acquired through life experiences and education (Lohman & Hagen, 2003).

In the 1980s, Snow (1981) proposed an aptitude-based approach to studying intelligence that highlighted the importance of the degree of readiness to perform a certain task (Lohman, 2006), while Gardner (1983) shared the theory of multiple intelligences where a student could be intellectually advanced in a variety of ways in both academic and non-academically focused traits. Moving further toward the present, Sternberg (1998) proposed a triarchic theory comprised of a contextual theory, experiential theory, and a componential theory. Lohman (2005) shares, “The contextual theory addresses the abilities a particular culture values as indicants of intelligence (p. 4), while “The experiential theory addresses the relative novelty of the task chosen as an indicant of intelligence” (p. 4) and “The componential theory considers the cognitive processes a person uses to solve a task” (p. 4).

Two commonly used intelligence tests utilized are the Weschler Intelligence Scale and the Stanford-Binet IQ test. Boake (2002) states, “In their origins, the Wechsler
subtests represent the major pre World War I approaches to cognitive assessment” (p. 400). The Weschler Intelligence Scales, one of the longest used intelligence tests, has maintained basic integrity without major improvements (Boake, 2002). Henry Herbert Goddard brought the intelligence test of Alfred Binet to America and it was introduced to various parts of society such as education and the military (Turtle, 1999). According to the Riverside Publishing website, “The SB5 provides comprehensive coverage of five factors of cognitive ability: fluid reasoning, knowledge, quantitative reasoning, visual-spatial processing, and working memory” and can be used with children as well as adults to derive an IQ score.

The CogAT is another test used to measure cognitive abilities and is the measurement of intelligence used for the current study. Lohman and Hagen (2003) state, “The authors of the Cognitive Abilities Test (CogAT) believe the factor-analytic models provide the best theoretical framework for developing a test of general cognitive abilities” (p. 1) and based the CogAT on revisions to Vernon’s (1961) hierarchical abilities model and Cattell’s (1987) fluid-crystallized abilities model. “The major concept taken from Vernon’s model and applied to the construction of CogAT is the three-strata structure with a general reasoning factor, G, dominating all others and with major group factors dominating the more specific factors” (Lohman & Hagen, 2003, p. 1). In 1993, Carroll studied the work of Horn and Cattell and noted, “Reasoning abilities are at the core of human cognitive competence” (Lohman & Hagen,
Carroll also indicated that reasoning abilities may be divided into 3 parts: sequential reasoning, quantitative reasoning, and inductive reasoning, with the CogAT measuring all three parts (Lohman & Hagen, 2003).

**Relationship Between Cognitive Ability and Achievement**

The connection between cognitive ability and achievement has been studied for many years by many different researchers. Leeson, Ciarrochi, and Heaven (2008) explain, “Despite the development and revision of research ideas over this time, a crucial factor in predicting academic achievement remains an individual’s level of general cognitive ability, or psychometric g” (p. 631).

One reason to study the relationship between cognitive ability and school success is “Measures of Gf, general reasoning ability, are highly predictive of success in school” (Lohman, 2003, p. 58). Another reason studying cognitive ability is important “is to flag these students for closer evaluation” (Lohman, 2003, p. 76). Cognitive ability scores can help identify students who need an accelerated curriculum to encourage higher level thinking skills as well as provide insight for which students might need more intervention and support when learning new academic content.

Lohman (2006) also shares insight on the overlap between achievement and cognitive ability. E. B. Hunt posited that general achievement was a better indicator of overall intelligence than fluid intelligence (Lohman, 2006). Furthermore, tests to determine cognitive ability are used to determine developed skills and abilities, which
come from a combination of education and experience (Lohman, 2006). Additionally, Lohman emphasizes the importance of reflecting on student aptitude by examining the difficulty of the task as well as the educational environment, instead of focusing solely on a cognitive ability score.

Several studies have been conducted to determine the relationship between cognitive ability and academic achievement. Rohde and Thompson (2007) hoped to determine whether general or specific cognitive abilities were better predictors of academic achievement. The participants included 71 undergraduate students, at least 18 years old, attending a Midwestern University. Rohde and Thompson (2007) remark, “Participants were assessed individually on a battery of cognitive tasks measuring working memory, processing speed, spatial ability, general cognitive ability, and academic achievement (p. 85). A two-step hierarchical multiple regression analysis was utilized throughout the study. “While there is empirical evidence for a strong association between general cognitive ability and academic achievement, there is still anywhere from 51% to 75% of the variance in academic achievement that is unaccounted for by measures of general cognitive ability alone” (Rohde & Thompson, 2007, p. 83). Additionally, the authors concluded even after controlling for working memory, processing speed, and spatial ability; cognitive ability was still a predictor of academic achievement (Rohde & Thompson, 2007).
Leeson, Ciarrochi, and Heaven (2008) conducted a three-year longitudinal study of students in five Australian high schools researching cognitive ability, personality, and academic achievement using a regression analysis. All students during the first year of high school were given a nation-wide standardized verbal and math test. Three years later academic student grades were examined. The results indicated that both psychometric g and positive thinking highly predict school achievement. “As expected, the relationships of verbal and numerical ability with school performance were substantially higher than the relationships between the personality variables and performance” (Leeson, Ciarrochi, & Heaven, 2008, p. 632).

Elementary school students have also been studied to identify factors that can best predict academic achievement. Spinath, Spinath, Harlaar, and Plomin (2006) studied nine-year old elementary school children to examine which factors (general mental ability, children’s self-perceptions of school-related abilities, and their intrinsic values for three school subjects) best predict school achievement. The study utilized 1,678 participants from the Twins Early Development Study (TEDS) a longitudinal study of twins born in 1994 and 1995. The study utilized adaptations from the Wechsler Intelligence Scale for Children and the Cognitive Abilities Test 3, and the authors realized “moderate correlations between g and school achievement (.44-.49)” (Spinath, Spinath, Harlaar, & Plomin, 2006, p. 368). In other words, mild correlations existed between general intelligence and school achievement. The authors also used stepwise
regression analyses and found g was the best predictor of achievement, and the only predictor in science (Spinath, Spinath, Harlaar, & Plomin, 2006).

A study examining the ability of personality assessments to predict academic achievement was conducted by Furnham and Monsen (2009). The participants were 334 high school students from England. The study utilized hierarchical regressions to analyze the results from personality assessments, an IQ test, and the GCSE (General Certificate of Secondary Education) public school examination. Scores on the ability tests were found to be “logically and positively” (Funham & Monsen, 2009, p. 32) related to high school exam scores (Furnham & Monsen, 2009). Furthermore, the authors concluded that personality did show validity in predicting academic achievement.

Moreover, Chamorro-Premuzic and Furnham (2005) indicated, “IQ scores predict school success in 6 to 12 year olds around r = .60, but drop to r = .50 for secondary school (13–18yrs)” (Furnham & Monsen, 2009, p. 28). In other words, as children move from elementary to secondary education, the predictive ability of general intelligence does not diminish; however, the test scores do lose predictive ability because of testing constraints (Furnham & Monsen, 2009).

Knowing that academic success can be predicted by various factors, Deary, Strand, Smith, and Fernandes (2007) asked the question, “What, then, is the association between cognitive ability and educational achievement? There is broad agreement that
there is a moderate to strong correlation between the two” (p. 13). To address this question, the authors hoped to better understand the relationship between cognitive ability and education by using various intelligence tests as forecasters and educational results with many participants (Deary, Strand, Smith, & Fernandes, 2007). This study utilized 70,000 participants in a five year longitudinal study of children in England. The study used an intelligence test called the Cognitive Abilities Test (CAT) and the National GCSE/GNVQ public examination. The authors found a .81 correlation between g and educational success (Deary, Strand, Smith, & Fernandes, 2007). “Thus, the main finding here is the large contribution of general mental ability to educational achievement overall” (Deary, Strand, Smith, & Fernandes, 2007, p. 19) and the correlation coefficient is above .80 even when the cognitive scores were attained five years before.

Rescorla and Rosenthal (2004) explored whether students with higher initial cognitive ability progress faster than other students, as well as if students with lower initial cognitive ability move closer ability-wise to students with higher intelligence. Three hundred twenty-eight public school students from Pennsylvania were included in the sample. The sample was sorted into three different cohorts, with Cohort A being 10th graders in 1995, Cohort B being 10th graders in 1992, and Cohort C were 10th graders in 1990. The Test of Cognitive Skills (TCS) was given to all 3rd, 5th, 8th, and 10th graders with the total score used for data analysis and the Comprehensive Test of Basic Skills
was used to measure academic achievement (Rescorla & Rosenthal, 2004). ANOVA tests were used to examine differences between each cohort’s mean scores longitudinally and at each specific grade level. The authors found cognitive and academic achievement was highly correlated for all groups. Additionally, Rescorla and Rosenthal (2004) concluded three findings: all students made similar progress with ability and achievement regardless of initial cognitive ability levels, higher level students did not advance faster, and lower level students did not fall farther behind brighter students in class. Furthermore, Lohman and Hagen (2001) share, “Research shows that students with slower rates of cognitive development often learn more effectively and have higher levels of achievement when they are in classes where students vary in levels of general cognitive ability” (p. 33).

Cognitive Ability to Predict Achievement in Math and Reading

One of the authors of the CogAT, David Lohman, has specified a relationship between cognitive scores and academic ability. More specifically, Lohman indicated the high correlation between the Cognitive Abilities Test and the Iowa Test of Basic Skills. Additionally, Lohman (2006) describes the versatility in using the CogAT scores to show “Competence in a broad range of verbal domains (e.g., reading comprehension and literary skills) is best predicted by the CogAT Verbal SAS score. On the other hand, success in mathematics and domains of study that demand quantitative thinking is best
predicted by a combination of the CogAT Quantitative and Nonverbal Reasoning Batteries” (p. 5).

Hart, Petrill, Thompson, and Plomin (2009) outline some of the issues when using cognitive skills to predict academic success as they remark “More importantly, researchers using multivariate genetic methods can also examine genetic and environmental influences upon the covariance among mathematical ability, general cognitive ability and reading” (p. 388). Moreover, a previous study indicated the relationship between cognitive ability and mathematics and between reading and mathematics ranged from r = .89 to r = .94 (Hart, Petrill, Thompson, & Plomin, 2009). The study conducted by Hart, Petrill, Thompson, and Plomin utilized a sample size of 314 twins. All participants were six years old during Wave 1, seven years old during Wave 2, and eight years old during Wave 3. Cognitive Abilities Tests, Reading measures and Math Measures were available for all three waves of data collection. The authors concluded, “General cognitive ability is significantly correlated between all waves of available data (r= .66-.76)” (pp. 391-92). Furthermore, the researchers used Pearson product–moment correlations to determine general cognitive ability was highly correlated with reading and math scores (Hart, Petrill, Thompson, & Plomin, 2009).

Mayes, Calhoun, Bixler, and Zimmerman (2009) in their study of 214 elementary students, who were subjects in a study of sleep disorders in children, found “IQ was the best single predictor of word reading and math computation achievement test scores
(explaining 35% and 22% of the variance)” (p. 239). The authors used Stepwise linear regression analysis to determine the most powerful predictors of reading and math standard scores using IQ, neuropsychological scores, and ADHD ratings. Mayes, Calhoun, Bixler, and Zimmerman (2009) described the significance of IQ in determining reading and math academic achievement scores. The authors also posited the useful practicality of cognitive tests, which uses subtests to predict reading and math achievement.

Studies have also been conducted to determine the relationship between cognitive ability and academic achievement for high and low performing students. Watkins and Glutting (2000) designed their study to examine the validity of the WISC-III profile and its ability to predict reading and math performance of normal and exceptional students. This study utilized the Wechsler Intelligence Scale for Children—Third Edition (WISC-III) to analyze cognitive abilities of both exceptional and non-exceptional students, while the Wechsler Individual Achievement Test (WIAT) was used to measure achievement for the non-exceptional students and the Woodcock-Johnson Tests of Achievement-Revised was used to measure achievement with students with exceptionalities. Four hierarchical multiple regression analyses were conducted to study and determine the validity of the elevation (scores over different subtests), scatter (difference of scores from the mean), and shape (rising and falling) of the scores. Watkins and Glutting (2000) concluded, “In contrast, a measure of cognitive elevation
was the most parsimonious predictor of reading and math achievement among both exceptional and non-exceptional students in this study” (p. 407). In other words, cognitive elevation was a frugal predictor of academic achievement with both populations of students. The authors also found a higher relationship correlation between cognitive ability and achievement for non-exceptional students than for students with exceptionalities.

Lewis and Hoover (1987) indicated school districts are often presented with standardized testing results that can then predict future achievement, however, “The purpose of this study was to examine differences in predicting achievement by sex on the Iowa Tests of Basic Skills (ITBS) from the Verbal, Quantitative, and Nonverbal scores on the Cognitive Abilities Test (CogAT)” (p. 108). Students in grades 2, 5, and 8 completed the CogAT and the ITBS in 1984 and the authors used regression equations to conduct the data analysis. Means and standard deviations for the Quantitative, Verbal, and Nonverbal scores were comparable for both genders in grades 2, 5, and 8. The authors posit that both Verbal and Quantitative scores should be utilized to predict future achievement and also indicate that girls achievement is under-predicted in the areas of reading and language while, future achievement is over-predicted for boys.

Sherman (1979) asks the question, “Can cognitive and affective variables measured in the ninth grade predict mathematics performance in the tenth, eleventh, and twelfth grades?” (p. 243). The sample was comprised of students from four high
schools in a Midwestern metropolitan area. Sherman (1979) used the Quick Word Test, the Space Relations Test of the Differential Aptitude, and the Test of Academic Progress to determine cognitive abilities and achievement during ninth grade. Additionally, the researcher studied eight affective variables to determine if any can predict future math achievement. Over the years, the data was collected from each grade level and analyzed by multiple regression tests. Sherman indicated the best indicator of potential math success in the future was previous math accomplishment. The author also concluded that geometry accomplishment can be predicted by spatial visualization.

Augustyniak, Cook-Cottone, and Calabrese (2004) conducted a study using the Phelps Kindergarten Readiness Scale (PKRS) with 148 students in New York. These students subsequently took the New York State fourth-grade language arts and math exams. Augustyniak, Cook-Cottone, and Calabrese (2004) concluded, the subtest scores and the overall score from the PKRS was correlated especially in math $r=.51$ and language arts $r = .47$. The authors posit that the results of the study provide evidence for using domain-specific kindergarten readiness screenings to predict future math and language arts achievement.

Clemmer, Klifman, and Bradley-Johnson (1992) conducted a study to determine the predictive validity of the Cognitive Ability Scales (CAS) over time. The study utilized 20 children from the Central Michigan area. This study used the CAS and the Stanford-Binet Intelligence Test. The CAS was given to the students when they were
either two or three years old, while the Binet-IV was given years later. Pearson product-moment correlations were used to determine the usefulness of the CAS to predict future cognitive ability and achievement. “A moderate to moderately high relationship was found between the CAS and the Binet IV composite and accounted for 25% of the shared variance” (Clemmer, Klifman, & Bradley-Johnson, 1992, p. 269) and it was determined the CAS could predict reading and math achievement at about the same level. The same authors also examined the relationship between the Weschler Intelligence Scale for Children – Revised (WISC-R) and the CAS. Pearson product-moment correlations found the two tests to be in the moderate range. “Results of both studies show that the CAS, given at age two or three, was able to predict quite well intellectual performance over approximately a five-year period” (Clemmer, Klifman, & Bradley-Johnson, 1992, p. 273). The authors also shared that the CAS seems to explain future academic achievement as well as other cognitive screening tests.

**Cognitive Ability Scores Used to Differentiate Instruction**

School districts have many useful forms of data to guide instruction. One form of data that is not always used, other than to determine giftedness, is the use of cognitive ability scores. These scores can empower teachers to understand the diversity of student ability levels in the classroom and can be used to provide instructional opportunities to best meet the needs of students, especially students with higher level thinking and reasoning abilities.
Giftedness has been described as having many facets including students having varying levels of ability (Feldhusen, 1982). Feldhusen identifies three fundamental concepts for effectively differentiating instruction for gifted learners. The first tenant involves providing gifted students with greater amounts of information that would be received in a typical classroom. Secondly, gifted learners should be exposed to higher level topics that utilize thinking and reasoning skills. Finally, gifted instruction should have an advanced pace to keep students interested in the content. By taking into account the diverse needs of each student, teachers can provide a differentiated curriculum in order to help all students meet grade level expectations.

Tomlinson, Brighton, Hertberg, Callahan, Moon, Brimijoin, Conover, and Reynolds (2003) explain, “As a transformation in society and schools evolves, effective teachers in contemporary classrooms will have to learn to develop classroom routines that attend to, rather than ignore, learner variance in readiness, interest, and learning profile” (p. 121). The authors contend it is crucial for teachers to adapt curricular practices to meet the needs of students’ readiness, interest, and learning profile (Tomlinson, Brighton, Hertberg, Callahan, Moon, Brimijoin, Conover & Reynolds, 2003). By adjusting teaching practices to implement a differentiated instruction, students are able to engage in beneficial learning opportunities as well as showcase knowledge which is aligned to individual learning styles. Furthermore, Tomlinson (2005) shares, “research indicates that students learn best when they work with
materials and tasks at a moderate level of challenge for them as individuals, that the
motivation to learn is enhanced when student interests are linked to desired outcomes,
and that students learn more efficiently when learning preferences are addressed in
classrooms” (p. 10).

Wehrmann (2000) shares, “Teachers differentiate through content, process, and
product” (p. 20). Content differentiation allows teachers to expose students to many
different types of materials in addition to the materials normally used in the classroom.
Process differentiation empowers students to work through the material at an
individualized pace and proceed on to the next task when students have demonstrated
mastery over a previous task. Finally, product differentiation encourages students to
highlight learning in a myriad of ways, instead of using a traditional paper-pencil
assessment. “The best way to meet the needs of the gifted in a mixed-ability classroom
is to raise the bar for everyone” (Wehrmann, 2000, p. 21) so all members of the class are
able to demonstrate learning in a unique manner consistent with individual ability
levels.

Toomela, Kikas, and Mõttus (2006) share results from previous research on
ability grouping, which indicate that “studies are in agreement that ability grouping is
beneficial for high-ability students” (p. 34). The authors examine the use of ability
grouping and the resultant effect on school performance within elite, private, and
alternative schools. The study utilized 147 seven year-old children from five different
schools in Estonia. In Estonia, students can attend public elite schools with rigorous admittance regulations, private schools, or alternative schools. All participants were studied at the beginning of first grade for non school subjects and in third grade the students were studied for academic achievement. Toomela, Kikas, and Mottus (2006) completed a Multiple Regression analysis and concluded, “It can thus be suggested that Academic Achievement was higher in the Elite school than in other schools only because of ability grouping” (p. 41). The authors also share, “Our result that attending Elite school had negative impact on Achievement when average cognitive ability of a school a child is attending was entered into the Multiple Regression analysis suggests that high academic performance of pupils in the Elite school should be attributed to ability grouping” (p. 41).

Encouraging students to learn at an individual pace is another form of differentiation. Olszewski-Kubilius, Shaw, Kulieke, Willis, and Krasney (1990) conducted a research study to address the following questions, “To what extent is success predictable given the wide range of predictor measures used? What is the relative role of the three categories of factors (ability, previous experience and exposure to the content area, and student characteristics) in predicting learning for gifted male and female students enrolled in fast-paced mathematics classes?” (p. 66). The research study used 108 students, from 11-15 years old, who participated in a Northwestern University advanced mathematics class during the summer. The course utilizes an
individualized approach to learning where students can move at their own pace throughout the course. Initial course placement is determined by taking a pre-test for placement into Algebra 1 or Algebra 2. Before the summer course began, students were asked to fill out questionnaires in the areas of math, science, and computer science. Additionally, “The California Psychological Inventory (2 subscales), the Survey of Study Habits and Attitudes, Form H, and the Harter Self-Perception Profile were administered by the teachers in the classrooms. On the first and final days of the program students took the College Board Achievement Test” (Olszewski-Kubilius, Shaw, Kulieke, Willis, & Krasney, 1990, p. 67). The researchers used regression tests to conclude that “ability was found to be a predictor of learning rate for males but not for females” (Olszewski-Kubilius, Shaw, Kulieke, Willis, & Krasney, 1990, p. 69). Furthermore, students with confidence were able to move faster through the course because they were able to be successful in initiating and sustaining learning on their own. Additionally, past experience with mathematics was a predictor for academic achievement in an advanced class.

The CogAT test score itself provides information that is useful for a teacher to understand when planning classroom instruction. Lohman and Hagen (2002) posit appropriate uses of CogAT scores that include, “helping teachers adapt instructional methods, learning materials, and the pace of instruction to the individual needs of students” (p. 16). In addition to the CogAT composite score, each student receives a
score profile highlighting strengths and weaknesses in cognitive ability that can be used by the teacher to modify instructional levels to meet the individual needs of students. The profile score includes a number score of 1-9, with a stanine score of 1 being low (indicating lower reasoning skills) with a score of 9 being high (indicating higher reasoning skills). The number is determined by finding the middle stanine from the scores on the verbal, quantitative, and nonverbal portions of the CogAT. For example, if the student received a 4 on the verbal, a 7 on the quantitative, and an 8 on the nonverbal, the middle stanine would be 7. Lohman and Hagen (2003) state, “If there are no significant differences among the student’s scores for all three batteries, the student has an even pattern of cognitive abilities; therefore, only the level of cognitive development is important” (p. 50). In addition to the number, the score profile also includes a letter. The letters are A, B, C, and E. The letter A indicates that the student has achieved basically the same scores. The letter B indicates one score is either above or below the other two scores, while the letter C indicates scores contrast with a strength, an area of improvement, and a score in the middle. The letter E indicates an extreme difference in scores. Within the A, B, and C profile, there are four different levels which are matched according to the number stanine (1-9). A stanine of 9 would indicate a very high profile score, while a score of 1 would indicate a low profile score. Numbers in the middle would represent an average score. Lohman and Hagen (2003) remark, “In general, the need for instructional support decreases while the need for
challenge increases as one moves from low to high” (p. 88). Finally, letters in parentheses highlight scores that are special, either indicating strengths or weaknesses on the verbal or quantitative sections.

Once a parent, teacher, or administrator has the profile score, appropriate instructional adaptations can be implemented to help the child be successful. Each profile score range has suggestions for instructional methods, which are aligned with the cognitive abilities of individual students. For example, a student with a profile score of 7B (Q-) would indicate “generally high scores, but a relative weakness on the quantitative battery” (Lohman & Hagen, 2003, p. 49). Using the example, 7b (V-) would indicate somewhat high scores, but with limitations on the verbal subtest. Using the Interpretive Guide for Teachers and Counselors (Lohman & Hagen, 2003) is beneficial for finding specific instructional strategies aligned with this score profile; however, overall, regardless of the score profile, the CogAT has focused teaching suggestions on the following key areas: building on strengths, focusing on working memory, encouraging strategic thinking, scaffolding wisely, and diversity in groups (Lohman & Hagen, 2003). Moreover, students in the upper elementary school grades can also understand the test results as well as gain a deeper understanding of individual strengths and weaknesses. “For students in these grades, the interpretation is likely to be most useful if it (1) emphasizes verbal rather than numerical descriptions of their performance, (2) points out the relationships between their scores and the successes and
difficulties they are having in the classroom, and (3) identifies particular strengths” (Lohman & Hagen, 2003, p. 155).

**Using Scores to Guide Intervention**

With the accountability measures of No Child Left Behind and Value Added, it is imperative that schools offer intervention to empower each child to meet with success academically within the classroom. Murawski and Hughes (2009) describe the three-tiered Response to Intervention (RtI) process in great detail. “In Tier I, the underlying assumption is that all students in the general education classroom are getting quality instruction (i.e., research based) that will be effective for approximately 80% of the students” (p. 268). In other words, the research-based curriculum adopted by a school district and provided to all students in the general education classroom is the first step in the RtI continuum. Another key component in this first tier is the use of progress monitoring throughout the year to determine if students are academically successful. Once student scores fall drastically, the student can be moved into the next level of the RtI model, Tier II. In Tier II, the interventions become much more focused and determined based on the individual needs of the learner. “Such intensive instruction is considered short-term and is provided through the collaboration between the general education teacher and a specialist” (Murawski & Hughes, 2009, p. 268). Finally, Tier III, allows students to receive the most intensive interventions for the students who need significant interventions in order to be successful learners. “The length of the Tier III
intervention is determined by the significance of the child’s needs and his response to the Tier III intervention—in essence, is he or she improving?” (Murawski & Hughes, 2009, p. 269). The entire model uses summative, formative, formal, and informal data sources to guide the instruction of the general education teacher as well as identify and implement interventions designed to help individual students.

The Cognitive Abilities Test provides several scores, which teachers can use to help determine appropriate interventions. The Standard Age Scores (SAS), Percentile Ranks (PR), and Stanines (S) are three scores teachers can analyze to determine whether students have high or low cognitive ability level and consequently which students would benefit from additional interventions. Students with an SAS of 50-72 are considered in the very low group, while students with an SAS of 73-88 are in the below average group (Lohman & Hagen, 2001). Lohman and Hagen (2001) share, “Percentile ranks below 25 indicate lower than average levels of cognitive skills” (p. 66), which could mean interventions are necessary to help students achieve academic success. Stanines 1-3 are usually associated with the very low and below average descriptions (Lohman & Hagen, 2001). Using these three scores collectively, a teacher can identify students in need of intensive, moderate, and occasional interventions in order to be successful learners.

Furthermore, another feature of the CogAT scoring report is the Class List that can be ranked by test. This score report indicates the SAS, the Age Percentile Rank
(APR), and the Grade Percentile Rank (GPR) in order from the highest score to the lowest score in the class on the verbal, quantitative, and non-verbal sections of the CogAT as well as for the composite score (Lohman & Hagen, 2003). Using this information, a teacher or intervention tutor can examine the data to determine how the scores for students with a lower cognitive ability level compare with scores of other students in the class as well as identify which students would need intensive intervention in the areas of reading and math. Lohman and Hagen (2002) share CogAT results can be used “to identify students whose levels and patterns of cognitive abilities indicate that the may be at risk of encountering difficulties in learning, so that appropriate early interventions can be implemented” (p. 16).

**Summary**

This chapter started by describing the history of intelligence testing (Gottfredson & Saklofske, 2009) as well as various methods for measuring intelligence (Boake, 2002; Turtle, 1999 & Lohman & Hagen, 2003). Additionally, the various uses of intelligence testing within education were discussed. The information presented in this chapter described the many uses of the CogAT (Lohman & Hagen, 2002), with a primary function of determining cognitive ability levels. Furthermore, previous research has established a strong, positive relationship between cognitive ability and predicting future achievement (Deary, Strand, Smith, & Fernandes, 2007; and Rohde & Thompson, 2007). Furthermore, several researchers have also identified a positive relationship
between cognitive ability and predicting academic success in the areas of math and reading (Hart, Petrill, Thompson, & Plomin, 2009; and Lohman & Hagen, 2002). Using this relationship between cognitive ability and predicting future academic achievement, teachers can use differentiated instructional methods to help each child, regardless of cognitive ability level, be successful in the classroom (Feldhusen, 1982; and Tomlinson, Brighton, Hertberg, Callahan, Moon, Brimijoin, Conover & Reynolds, 2003).

Furthermore, using the scores from the CogAT as one of multiple data sources may be useful in determining appropriate interventions designed to address the specific needs of individual students (Lohman & Hagen, 2002; and Murawski & Hughes, 2009).
CHAPTER III. METHODOLOGY

This chapter explains the methodology utilized throughout the study. Included in this chapter are descriptions of the research design, participants, instrumentation, procedures, research questions, and data analysis.

Research Design

A correlational research design was utilized for this study. A correlational research design was appropriate because the study aims to examine the relationship between two quantitative variables in order to explain or predict the results (Fraenkel & Wallen, 2006). The independent variable included the students’ composite scores on the Cognitive Abilities Test (CogAT), while the dependent variable was comprised of students’ scores on the fourth and fifth grade reading and math Ohio Achievement Tests (now referred to as the Ohio Achievement Assessments). The researcher gathered data from a suburban school district by attaining scores from the CogAT taken in third grade as well as scores for the same students on the fourth and fifth grade reading and math achievement tests.

Participants

This study seeks to examine the relationship between students’ test scores from assessments taken throughout the elementary school years. The test scores were obtained from all students (approximately 300) in a suburban school district in Northwest Ohio who were third graders in 2006-2007 and the same students who were
fourth graders in 2007-2008 and fifth graders in 2008-2009. Given that the suburban district in Northwest Ohio has continued to grow at a steady rate from 2006-2009, subject mortality occurred with an increase in overall student population. In addition to the overall district population increasing, some students left the district during these years. These changes in student population result in a different number of participants at the end of the study than at the beginning. Student mobility is a limitation for the study and has implications when reviewing the results of the current study. One implication is that the smaller the sample size, the more difficult it is to determine a relationship, especially with the below average group which includes only 15 students.

In third grade the students took the CogAT test, while in fourth and fifth grade the students completed the Ohio Achievement Tests in math and reading. In order to gain a deeper understanding of the participants, it is important to examine the demographics of the studied school district. According to the Ohio Department of Education’s website, the percent poverty in Perrysburg ranged from 4.2 to 6.4% from 2005 to 2008. The median income ranged from $45,012 to $48,677 from 2005 to 2008, while the percent minority was 7.9% in 2005 and 7.4% in 2008 in Perrysburg.

Additionally, this suburban district has created, nurtured, and sustained a culture of learning. The Intervention Assistance Team (IAT) meets regularly to discuss learning observed and documented difficulties of students and brainstorms possible solutions. Students in need of extra intervention have been provided assistance by
working individually or in a small group with an intervention teacher, reading teacher, tutor, aide, or parent volunteer. Furthermore, Title 1 services have been used to provide intensive intervention for struggling learners. Even more, the district uses progress monitoring tools, such as DIBELS and Star Math and Reading, to monitor student growth over time and uses the data to guide instruction or select appropriate interventions based on the needs of the child. The district has started to implement a Response to Intervention (RtI) model to meet the needs of individual learners through the use of research-based interventions implemented over time.

**Instrumentation**

The Cognitive Abilities Test (CogAT) and the fourth and fifth grade Reading and Math Achievement Tests were the instruments utilized to collect data throughout the study.

*Cognitive Abilities Test (CogAT)*

Lohman and Hagen (2002) describe the CogAT as designed to measure cultivated abilities, not natural abilities. The Cognitive Abilities Test consisted of verbal, quantitative, and nonverbal parts, and measures general and specific reasoning abilities. Lohman and Hagen (2002) share, “The general reasoning abilities reflect the overall efficiency of cognitive processes and strategies that enable individuals to learn new tasks and solve problems, especially in the absence of direct instruction” (p. 1). The CogAT series has a primary test as well as many multilevel tests in order to account
for cognitive development differences between younger and older children in order for “the most reliable assessment of the student’s cognitive skills to be obtained in any school grade” (Lohman & Hagen, 2002, p. 6). Although the CogAT has several purposes, one of the primary uses of the CogAT is to identify students with higher cognitive abilities.

The CogAT has also established age and grade level norms. These norms enable school administrators and staff to compare individual student results with other students at the same age level and the same grade level. This test provides several scores including a Universal Scale Score (USS), a Standard Age Score (SAS), and a Percentile Rank (PR) (Lohman & Hagen, 2002). Additionally, a composite score can be calculated by adding the Universal Scale Score for each of the three subparts (the Verbal, Quantitative, and Non-verbal) and dividing by three (Lohman & Hagen, 2002).

The Verbal Battery, comprised of 65 items, is divided into three individual tests assessing students in the areas of verbal classification, sentence completion, and verbal analogies (Lohman & Hagen, 2002). Lohman and Hagen (2003) indicate the purpose of the Verbal Battery is to “appraise verbal inductive and deductive reasoning skills, as well as flexibility, fluency, and adaptability” (p. 9) while working with verbal problems.

The Quantitative Battery is made up of 60 items and requires students to demonstrate skills in the area of quantitative relations, number series, and equation building. The Quantitative Battery requires students to use skills which are “significantly related to
high-level problem solving” (Lohman & Hagen, 2003, p. 9). Finally, the Nonverbal Battery attempts to measure students’ abilities in figure classification, figure analogies, and figure analysis by asking the students to complete 65 items, which “require reasoning, not spatial visualization abilities” (Lohman & Hagen, 2003, p. 9).

The CogAT can be administered individually or in a group setting. The test utilizes a standardized testing protocol, established by Lohman and Hagen, to ensure consistency among testing administrations. The test is assumed to be free of bias with regard to culture and gender.

Internal Consistency Reliability for the CogAT was determined using the Kuder-Richardson Formula 20 which indicate “CogAT Composite scores are highly reliable” (Lohman & Hagen, 2002, p. 49). Lohman and Hagen (2002) specify reliabilities of .95 for the Verbal, .94 for the Quantitative, and .95 for the Nonverbal. Long-term stability of the CogAT composite score had a reliability correlation coefficient ranging from $r = .82$ to $r = .87$ (Lohman & Hagen, 2002).

Validity for the CogAT Version 6 has also been established. Lohman and Hagen (2002) state, “Although each revision of the CogAT differs in content and sometimes in structure from the previous edition of the test, all forms were designed to appraise the same general abstract reasoning abilities. Furthermore, each form was carefully linked to the previous edition” (p. 53). “Both specific studies on particular item types and the general theory of reasoning were used to guide the construction and selection of items

Validity has also been established by using scores on the CogAT to correlate scores with achievement tests such as the Iowa Test of Basic Skills (ITBS). Lohman and Hagen (2002) indicate correlations with the ITBS composite score are .83 for the Verbal, .71 for the Nonverbal, .78 for the Quantitative, and .86 for the CogAT composite.

**Fourth and Fifth Grade Ohio Reading and Math Achievement Tests**

The fourth and fifth grade Ohio Reading and Math Achievement Tests are designed to measure a student’s ability over content learned throughout the year. More specifically, the test is designed to measure students’ knowledge of Ohio Academic Content Standards in math and reading taught throughout the year.

According to the Ohio Department of Education (ODE, 2009) Grade 4 and 5 Reading Achievement Test Blueprints, both tests are comprised of five selections, with each selection asking students to answer 29 multiple choice questions worth one point each. Additionally, throughout the test four or six short answer questions and two or three extended response questions worth two or four points respectively are tested within each of the reading standard areas including reading processes and reading applications. Moreover, each test has a field-test selection with multiple choice questions and an open response question.
The Grade 4 and 5 Math Achievement Test Blueprints (ODE, 2009) indicate both achievement tests are comprised of questions covering standards in number, number sense and operations; measurement; geometry and spatial sense; patterns, functions, and algebra; and data analysis and probability. The tests have 32 multiple choice questions (worth one point each) with six short-answer questions (worth two points each) and two extended response questions (worth four points each) for a total of 52 total points. The Blueprints specify 25% to 35% of the total points are in the low complexity level, 40% to 50% are in the moderate level, and 15% to 25% are in the high level.

The administration of the achievement tests is standardized with protocol provided by the Ohio Department of Education (ODE, 2009). The Ohio Department of Education (ODE, 2009) provides school districts with a number of security measures to ensure testing integrity throughout the testing process. Each classroom teacher in grades four and five is held accountable for implementing the testing procedure in an ethical manner. Each morning of testing, the classroom teacher is responsible for test security by safe-guarding the tests until the administration begins. Once the test booklets have been passed out, the teacher reads the directions to the class and informs the class of the allotted testing time. After the students have begun taking the test, the teacher can only monitor the students to ensure a fair and ethical testing environment is provided for each student. Furthermore, established administration measures ensure a
fair process consistent from classroom to classroom and district to district. The test is assumed to be free of bias with regard to culture and gender.

The scores from the achievement tests are part of the School Report Card received each year by each school in the state of Ohio. As reported on the School Report Card, the students are not individually identified; however, the percentage of students scoring proficient or above is listed for math and reading at the fourth and fifth grade levels. Additionally, the scores from the achievement tests are also utilized in calculating the Adequate Yearly Progress (AYP) mandate to ensure that students with each school building are making progress. Furthermore, the scores are also used to determine whether individual students have achieved Value Added (VA), which highlights students’ performance from year to year in an effort to make sure all students achieve a year’s worth of growth academically in reading and math.

According to the Ohio Department of Education (ODE, 2009), reliability was .89 for the fourth grade reading test and .88 for the fourth grade math test during the 2006-2007 school year, while the reliability was .88 for reading and .90 for math in fifth grade during the 2008-2009 school year.

The validity of questions on the Achievement Test is established through a multi-step process which ensures fairness and appropriate content. According to the Ohio Department of Education’s (ODE) website (ODE, 2009), the process begins by selecting a contractor. The contractor then trains question writers on the academic content
standards at each grade level. After the question writers have been trained, the writers develop possible questions. The contractor then accepts, rejects, or modifies each question. If the question is accepted it is then filtered through the ODE Curriculum Department. Once receiving approval from the Curriculum Department, the question then moves on to two external committees for examination. The first committee is the Fairness/Sensitivity Committee which ensures fairness and no bias toward any students. The second committee is the Content Advisory Committee which examines the question to make sure it is properly aligned with the academic content standards. Finally, the test question is field tested to make sure students respond in the same way as the test developers. These steps are in place to ensure content validity as well as fairness for each student taking the test.

**Procedures**

Prior to obtaining Human Subjects Review Board (HSRB) approval, the researcher contacted the school district in Northwest Ohio to receive permission from the superintendent to conduct the study to examine a secondary data source. HSRB approval was requested during spring 2010 after consent from the school district was secured. HSRB indicated the study did not utilize any human subjects, so HSRB approval was not needed for the current study. Next, the researcher worked with administrators from the suburban Northwest Ohio school district to collect data. In an effort to maintain confidentiality and anonymity, the pre-existing data set was matched
at the district level and the names were removed so there was no personal identification information of students. The researcher stressed the importance of maintaining anonymity by only collecting and utilizing information on students’ composite test scores from the CogAT which was taken during the 2006-2007 school year as well as scores from the fourth and fifth grade Ohio Achievement Tests in Reading and Math during the 2007-2008 and 2008-2009 school years. No other personally identifiable data were used throughout this study. The data were received in an Excel spreadsheet and then transferred to the statistical program, Statistical Package for Social Sciences (SPSS), for analysis to determine if a significant relationship exists.

**Research Questions**

1. Do composite scores on the Cognitive Abilities Test (CogAT) significantly relate to scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio?

2. Do CogAT composite scores significantly relate to fourth and fifth grade Ohio Achievement Test scores for CogAT performance levels (below average, average, above average)?

3. What composite scores on the CogAT are necessary to predict a proficient score, an accelerated score, and an advanced score on the fourth and fifth grade Ohio Achievement Tests in Reading and Math?
Data Analysis

The variables in all research questions include the independent variable of students’ composite test scores on the CogAT, while the dependent variable includes test scores from the fourth and fifth grade Reading and Math Ohio Achievement Tests. Descriptive statistics were calculated for measures of central tendency including the mean, median, and mode. Furthermore, scatter plots were created to graph the relationships and regression lines. SPSS was utilized to generate the inferential statistics. Data analysis methods are presented in Table 1.

Table 1

Research Questions, Variables, and Data Analysis

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Independent Variables</th>
<th>Dependent Variables</th>
<th>Data Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Do composite scores on the Cognitive Abilities Test (CogAT) significantly relate to scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio?</td>
<td>Composite Score on the CogAT (quant)</td>
<td>Scores on the fourth and fifth grade Ohio Reading and Math Tests (quant)</td>
<td>Pearson Correlation</td>
</tr>
<tr>
<td>2) Do the correlation coefficients between CogAT and fourth and fifth grade Reading and Math Achievement Tests in Ohio?</td>
<td>Composite Score on the CogAT (quant)</td>
<td>Scores on the fourth and fifth grade Ohio Reading and Math Tests (quant)</td>
<td>Pearson Correlation for each performance group</td>
</tr>
<tr>
<td>Research Questions</td>
<td>Independent Variables</td>
<td>Dependent Variables</td>
<td>Data Analysis</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>------------------------</td>
<td>----------------------------------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>fifth grade Ohio Achievement Test scores differ by CogAT performance level (below average, average, above average)?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3) What composite scores on the CogAT are necessary to predict a proficient score, an accelerated score, and an advanced score on the fourth and fifth grade Ohio Achievement Tests in Reading and Math?</td>
<td>Composite Score on the CogAT (quant)</td>
<td>Scores on the fourth and fifth grade Ohio Reading and Math Tests (quant)</td>
<td>Linear Regression Test</td>
</tr>
</tbody>
</table>

For research question one, Pearson Correlation was utilized to examine the relationship between the test scores on the CogAT and the scores on the fourth and fifth grade Reading and Math Achievement Tests. Research question two also utilized Pearson Correlation to examine the relationships between the CogAT and the Ohio Reading and Math Achievement Tests; however correlation coefficients were calculated for each group to determine if the relationships differ by CogAT performance level.
(below average, average, above average). For research question three, a linear regression test was utilized to determine whether the composite scores from the CogAT can predict proficiency on the fourth and fifth grade Ohio Achievement Tests in Reading and Math.
CHAPTER IV. RESULTS

Introduction

Chapter Four discusses the results of the data analysis. Descriptive statistics were conducted on the participants’ demographic information including gender, ethnic background, and the number of students on an Individual Education Plan (IEP). Furthermore, inferential statistics were discussed by research question to examine the relationship between scores on the Cognitive abilities Test (CogAT) and the fourth and fifth grade Ohio Achievement Tests (OAT). The chapter concludes with a summary, detailing specific correlations between the assessments.

Results

Descriptive Results

The 324 participants utilized in this study attended a suburban public school district in Northwest Ohio. Subject mortality affected the number of participants as students moved into and out of the district during this study which utilized data over three school years, including the 2006-2007, 2007-2008, and 2008-2009 school years. Data collected from each participant included: the composite score from the Cognitive Abilities Test and scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio. Of the 324 participants, 155 (47.8%) were female, while 169 (52.2%) were male. Additionally, 25 (7.7%) of the 324 participants had an IEP. Finally, 9 (2.8%) of the participants were Asian/Pacific Islander, 1 (.3%) of the participants was African
American, 11 (3.4%) of the participants were Hispanic, 288 (88.9%) of the participants were Caucasian/White, and 15 (4.6%) of the participants were Multi-Racial.

Further, given student mobility from 2006-2009, the sample size varied from year to year. Three hundred six students took the CogAT in third grade during the 2006-2007 school year, while 324 students completed the fourth grade OATs in Math and Reading during the 2007-2008 school year, and 309 students were tested in fifth grade with the OATs in Math and Reading during the 2008-2009 school year. Furthermore, 306 students completed third grade and fourth grade, and 309 students completed fourth grade and fifth grade. The sample size was 292 for students completing third grade, fourth grade, and fifth grade in the studied suburban school district.

**Research Question 1**

Do composite scores on the Cognitive Abilities Test (CogAT) significantly relate to scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio?

The mean, standard deviation, minimum, and maximum scores were calculated for each of the studied assessments (see Table 2). The 306 students who took the CogAT in third grade during the 2006-2007 school year generated a mean of 103.89, which is slightly higher than the norm of 100 for the Standard Age Score (Lohman & Hagen, 2002). The scaled scores for the Ohio Achievement Tests were also examined. OAT scaled scores utilize a standard of 400 as a proficient score. All OAT means were
substantially above the proficiency standard of 400. Most OAT means approximated 430, with the exception of 4th grade Math OAT, which generated a sample mean of 437.

The scaled score means on the fourth grade Reading and Math Achievement Tests were 429.02 and 437.43 respectively compared to a scaled score mean of 421.59 and 419.62 statewide in Ohio on the fourth grade Reading and Math Achievement Tests in 2008. Furthermore, the scaled score standard deviation on the fourth grade Reading OAT was 22.16, while the fourth grade Math OAT was 36.34. Scaled score standard deviations of 27.23 and 35.15 were reported for the fourth grade Reading and Math tests statewide in Ohio in 2008. The scaled score means on the fourth grade Reading and Math were higher than the statewide means on the same tests. Fifth grade Reading had a scaled score mean of 430.70 and a scaled score standard deviation of 27.35, while fifth grade Math had a mean of 430.99 and a standard deviation of 34.54. Statewide in Ohio in 2009, the fifth grade Reading OAT had a scaled score mean of 415.71 and a scaled score standard deviation of 31.27, and the Math OAT had a mean of 410.61 and a standard deviation of 35.96.
Table 2

Descriptive Statistics for CogAT and Achievement Tests Scores

<table>
<thead>
<tr>
<th>Test</th>
<th>n</th>
<th>M</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 CogAT</td>
<td>306</td>
<td>103.89</td>
<td>12.98</td>
<td>71</td>
<td>142</td>
</tr>
<tr>
<td>4 OAT Rdg</td>
<td>324</td>
<td>429.02</td>
<td>22.16</td>
<td>358</td>
<td>494</td>
</tr>
<tr>
<td>4 OAT Math</td>
<td>324</td>
<td>437.43</td>
<td>36.34</td>
<td>311</td>
<td>552</td>
</tr>
<tr>
<td>5 OAT Rdg</td>
<td>309</td>
<td>430.70</td>
<td>27.35</td>
<td>346</td>
<td>509</td>
</tr>
<tr>
<td>5 OAT Math</td>
<td>309</td>
<td>430.99</td>
<td>34.54</td>
<td>337</td>
<td>548</td>
</tr>
</tbody>
</table>

The Pearson correlation coefficients were calculated to determine if a significant relationship exists between the CogAT and fourth and fifth grade Ohio Achievement Test scores for the entire sample. The correlation coefficient was higher than .600 on all four achievement tests, which would indicate strong positive significant relationships ($p < .001$) between scores on each achievement test and scores on the CogAT for the entire sample ($n = 292$) (see Table 3).

Table 3

Correlation Coefficients of the 3rd Grade CogAT with 4th and 5th Grade OAT Reading and Math Scores ($n = 292$)

<table>
<thead>
<tr>
<th>Test</th>
<th>$r$</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 OAT Rdg</td>
<td>.628*</td>
</tr>
<tr>
<td>4 OAT Math</td>
<td>.692*</td>
</tr>
<tr>
<td>5 OAT Rdg</td>
<td>.663*</td>
</tr>
<tr>
<td>5 OAT Math</td>
<td>.729*</td>
</tr>
</tbody>
</table>

* $p < .001$
**Research Question 2**

Do CogAT composite scores significantly relate to fourth and fifth grade Ohio Achievement Test scores for performance levels (below average, average, above average)?

Lohman and Hagen (2002) indicate a standardized Mean (100) and the standardized Standard Deviation (16) for the Standard Age Scores on the CogAT. Applying this information to the composite scores, performance level groups on the CogAT were determined by utilizing the mean of 100 and one standard deviation above and below the mean. Using this information, the below average group \((n = 15)\) consisted of students who scored from 0-83 on the CogAT. Furthermore, the fifteen students in the below average group had a very small range of scores of 71-83 on the CogAT in the third grade. Students scoring 84-116 were in the average group \((n = 230)\), and students scoring above 117 were in the above average group \((n = 48)\). Correlation coefficients were calculated for each assessment and the CogAT for each CogAT group (see Table 4). Three of four of the coefficient correlations were very weak for the below average group, with the 5th grade Reading OAT generating a fair correlation with the CogAT. None of these coefficients were statistically significant at \(p < .05\). The average group generated the strongest correlations of the CogAT with all the OATs examined. For this group, the fourth and fifth grade OATs in Reading signify moderate positive significant relationships, while the fourth and fifth grade OATs in Math highlight a
strong positive significant relationship. The above average group generated moderate correlations with the fourth grade Reading test and Math test, and the fifth grade Math test all indicate a moderate positive significant relationship, while the fifth grade Reading test has a weak positive relationship that was not significant.

Table 4

Correlation Coefficient with CogAT for Total Sample and CogAT Performance Level Group

<table>
<thead>
<tr>
<th>Test</th>
<th>CogAT Performance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total Sample</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=292</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Below Average</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=15</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=230</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Above Average</td>
<td></td>
</tr>
<tr>
<td></td>
<td>n=48</td>
<td></td>
</tr>
<tr>
<td>4 OAT Rdg</td>
<td>.628*</td>
<td>.178</td>
</tr>
<tr>
<td>4 OAT Math</td>
<td>.692*</td>
<td>-.040</td>
</tr>
<tr>
<td>5 OAT Rdg</td>
<td>.663*</td>
<td>.380</td>
</tr>
<tr>
<td>5 OAT Math</td>
<td>.729*</td>
<td>-.039</td>
</tr>
</tbody>
</table>

* p < .001

Research Question 3

What composite scores on the CogAT are necessary to predict a proficient score, an accelerated score, and an advanced score on the fourth and fifth grade Ohio Achievement Tests in Reading and Math?

Simple linear regression was conducted to examine the ability of the CogAT to predict each of the 4th and 5th grade OATs. Scatter plots and regression lines were also graphed to represent the relationship between the CogAT and each of the studied OATs. Regression results indicate that the CogAT significantly predicts OAT scaled scores for each of the examined assessments (see Table 5).
Regression equations were then utilized to determine the CogAT score necessary to predict OAT performance levels. Each year, ODE creates cut scores to categorize student achievement in various performance levels. Cut scores applied to the specific OATs for each performance level (see Table 6) were entered into the respective regression equation to determine the CogAT. For example, the cut score of 400 was used to identify proficiency for the 4th grade OAT Reading. When this was entered into the regression equation (CogAT = -53.62 + .37X), the predicted CogAT score is approximately 93, indicating that a child who generates a score of 93 on the CogAT in 3rd grade is predicted to achieve proficiency for the 4th grade OAT Reading.
Table 6.

*Cut Scores for OAT Performance Levels (ODE, 2008 & 2009)*

<table>
<thead>
<tr>
<th>Test</th>
<th>Proficient</th>
<th>Accelerated</th>
<th>Advanced</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 OAT Rdg (Spring 2008)</td>
<td>400</td>
<td>435</td>
<td>467</td>
</tr>
<tr>
<td>4 OAT Math (Spring 2008)</td>
<td>400</td>
<td>432</td>
<td>452</td>
</tr>
<tr>
<td>5 OAT Rdg (Spring 2009)</td>
<td>400</td>
<td>441</td>
<td>459</td>
</tr>
<tr>
<td>5 OAT Math (Spring 2009)</td>
<td>400</td>
<td>424</td>
<td>439</td>
</tr>
</tbody>
</table>

Table 7 presents the CogAT scores that predict each performance level. The regression line for the CogAT and the 4th grade OAT Reading test is graphically displayed in a scatter plot presented in Figure 1. One can see how the regression line (with the regression equation) is used to predict each of the three OAT performance levels. As previously indicated, the proficiency cut-off score of 400 on the OAT Reading test (X-Axis) corresponds with the CogAT score (Y-Axis) of 92.97. When applying the cut off score of 435 for the accelerated level, a CogAT score of 105.80 is generated; while an advanced score of 467 generates a CogAT score of 117.53.

Table 7

*CogAT Score Needed to Predict Achievement Test Scores*

<table>
<thead>
<tr>
<th>Test</th>
<th>CogAT Score Needed to Achieve:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Prof</td>
</tr>
<tr>
<td>4 OAT Rdg</td>
<td>92.97</td>
</tr>
<tr>
<td>4 OAT Math</td>
<td>94.35</td>
</tr>
<tr>
<td>5 OAT Rdg</td>
<td>94.05</td>
</tr>
<tr>
<td>5 OAT Math</td>
<td>95.21</td>
</tr>
</tbody>
</table>
Figure 1. Scatter Plot and Regression Line for the CogAT and 4th Grade OAT Reading

The regression line for the CogAT and the 4th grade OAT Math is presented in Figure 2 and depicts the CogAT scores necessary to predict each performance level. A student who scores 94.35 on the 3rd grade CogAT is predicted to achieve a proficiency level (400). Whereas, a CogAT score 102.24 predicts accelerated level (432) and a CogAT score of 107.17 predicts the advanced level (452).
Figure 2. Scatter Plot and Regression Line for the CogAT and 4th Grade OAT Math

Figure 3 presents the regression line for the CogAT and the 5th grade OAT Reading and depicts the CogAT scores necessary to predict each performance level. A student who scores approximately 94 on the 3rd grade CogAT is predicted to achieve a proficiency level (400). When predicting the accelerated level (441), a CogAT score 107.13 is necessary, while a CogAT score of 112.88 predicts the advanced level (459).
Finally, the scatter plot and regression line for the relationship between the CogAT and the 5th Grade OAT Math is presented in Figure 4. A CogAT score of 95.21 predicts the proficiency level (400), while 101.85 predicts the accelerated level (424) and 106 predicts the advanced level (439).
Summary

The scaled score means on the fourth grade Reading and Math were higher than the statewide means on the same tests. The means on the fifth grade Reading and Math tests were substantially higher than the statewide means, while the standard deviations on both math tests were approximately the same.

Third grade CogAT scores strongly relate to 4th and 5th grade OAT Reading and Math scores for the total sample as well as students scoring in the average and above average categories on the CogAT. The correlation coefficients range from .628 to .729 for the total sample indicating a strong relationship between the test scores. In the average
group, a significant relationship exists with all of the achievement tests with high moderate to strong correlations. Finally, the above average group indicates moderate correlations with both 4th grade achievement tests and the 5th grade Math OAT. However, the CogAT scores have a weak to fair relationship with the OATs for students scoring in the below average category on the 3rd grade CogAT. Additionally, the 4th grade Math and the 5th grade Math indicate a negative weak correlation with the CogAT for this lower achieving group.

Regression results indicate that the 3rd grade CogAT is a significant predictor of 4th and 5th grade OAT Reading and Math achievement. The regression equations and best fitted line figures were used to identify the necessary CogAT scores to predict OAT performance levels (proficient, accelerated, and advanced) performance levels. In general, students who score approximately 93 to 95 on the CogAT in 3rd grade are likely to achieve a proficient level on the 4th and 5th grade OAT for Reading and Math. The range of CogAT scores necessary to predict accelerated and advanced levels increases greatly. To be predicted to achieve the accelerated level for the 5th grade OAT Reading, a CogAT score of 107 is needed; in contrast a CogAT score of 102 is required for the prediction of accelerated for the 5th grade OAT Math. The advanced performance level requires CogAT scores that range between 106 and 117.53. In addition, higher CogAT scores were necessary to achieve accelerated or advanced for Reading (4th and 5th) in contrast to the Math (4th and 5th).
CHAPTER V. CONCLUSIONS AND RECOMMENDATIONS

Chapter Five discusses the research findings for each research question. After reviewing the findings, the researcher describes conclusions and offers recommendations for teachers and administrators. Lastly, the chapter details opportunities for future research based on the results of this study.

Review of Study

Schools are faced with increased accountability measures from No Child Left Behind, as well as achieving Adequate Yearly Progress (AYP) and a year’s worth of growth for each student with the Value Added initiative. Additionally, schools are collecting and examining an overwhelming amount of data from baseline assessments, formative and summative assessments, and progress monitoring assessments. Another test given to many elementary students is the Cognitive Abilities Test (CogAT) to determine gifted eligibility. The purpose of this study was to determine the relationship between scores on the CogAT and the fourth and fifth grade Reading and Math Ohio Achievement Tests as well as to use the scores on the CogAT to predict students’ scores on the Ohio Achievement Tests. The study was framed using Snow’s aptitude theory which describes a students’ degree of readiness. Applying this theory to the current study, a student with a higher degree of readiness would be able to score higher on the Ohio Achievement Tests. This study was significant because it empowers teachers to have a clear purpose when examining data and guides instruction to
differentiate learning for all students. The participants in this study include the 324 students in a suburban Northwest Ohio district. These students took the CogAT test in third grade in 2006-2007, the fourth grade Reading and Math OATs in 2007-2008, and the fifth grade Reading and Math OATs in 2008-2009.

Discussion of Research Findings

Research Question 1

Do composite scores on the Cognitive Abilities Test (CogAT) significantly relate to scores on the fourth and fifth grade Reading and Math Achievement Tests in Ohio?

Pearson Correlation coefficients were calculated to determine if a significant relationship exists between composite scores on the Cognitive Abilities Test and scores on the fourth and fifth grade Reading and Math Achievement Tests. The coefficients (all of them greater than .600) indicate a strong, positive relationship exists between the two assessments. As scores on the CogAT increase, one would hopefully expect the scores on the achievement tests to increase, which is indicative of the strong, positive relationship. These results align with previous research conducted by Lohman and Hagen. The researchers found a strong relationship between a cognitive abilities test and an achievement test with correlations between the CogAT and the ITBS (Iowa Test of Basic Skills) are .83 for the Verbal, .78 for the Quantitative, .71 for the Nonverbal, and .86 for the CogAT composite score (Lohman & Hagen, 2002). Additionally, Lohman and Hagen (2002) share, “SAS [Standard Age Scores] scores from previous editions of
CogAT have been correlated with scores from individually administered ability tests such as the Stanford-Binet Intelligence Scale (r ~ .8 for the Verbal Battery, r ~ .7 for the Quantitative Battery, and r ~ .6 for the Nonverbal Battery), with other group-administered ability tests such as the Differential Aptitude Tests” (p. 97). Previous forms of the CogAT have also been used to indicate correlations with school achievement (Thorndike & Hagen, 1987; Lohman & Hagen, 2002).

**Research Question 2**

Do the correlation coefficients between CogAT and fourth and fifth grade Ohio Achievement Test scores differ by CogAT performance level (below average, average, above average)?

The correlation coefficients had the strongest, positive relationships between the CogAT scores and the Math and Reading Achievement Tests for the entire sample (n = 292), with the fourth grade reading having the lowest correlation at .628. However, when the below average group’s correlation coefficients were examined, the results specified the weakest relationship between this group’s performance and the composite score on the CogAT. In fact, the below average group’s performance indicate the fourth and fifth grade Math test had a negative, weak relationship, while both Reading tests had a weak positive relationship. The below average group designate the lowest relationship with the CogAT with all of the coefficients being weak and two of the coefficients being negative.
Even with the small sample size of the below average group (n = 15), the below average group had a lower correlation coefficient than the average and above average groups. Although the researcher has not been able to find literature to describe why the correlation coefficient is lower for the below average group, one possible interpretation is, “that the student has not had appropriate opportunities to develop crystallized knowledge and skills” (Lohman & Hagen, 2003, p. 75). In other words, the student has demonstrated reasoning skills, however, has not developed the skills and knowledge to be successful with academic content that is tested on the achievement tests. An additional possible reason for this weak relationship could be “the student has not applied her- or himself with sufficient diligence to school learning” (Lohman & Hagen, 2003, p. 75). Again in this situation, the student demonstrates reasoning skills, but ultimately could result in lower academic achievement because of lack of effort in the classroom due to a lack confidence and/or motivation to perform well academically. Furthermore, achievement tests measure academic content learned throughout the school year and do not comprehensively measure abilities in other areas such as the arts, music, or sports. Going even further, students who might be successful in the classroom given multiple assessment options might not be as successful on the CogAT or the achievement tests which utilize multiple choice, short answer, and extended response answers to gauge academic achievement. Additionally, with the pressures of high stakes testing, teachers can often feel added stress to make sure all students make
Adequate Yearly Progress. Students often are aware of teacher stress and often internalize the stress of the teacher when encountered with testing situations leading to lower scores on standardized assessments. Students also sometimes have testing anxiety or lack of confidence which could be a possible reason for lower scores on achievement tests. Test bias for minority students, including African American and Hispanic students, could be another possible explanation. Williams (1983) shares, “Test constructors should bear responsibility for including minorities in all aspects of test development and not limit this to the standardization sample” (p. 205). Additionally, educators must be able to oversee testing protocols and examine test results with a deeper understanding of the various experiences students bring into the classroom (Williams, 1983). Skiba, Knesting, and Bush (2002) remark, “In short, underestimating the effects of unequal opportunity on a minority child’s test results is a serious error of interpretation that probably reduces the accuracy of predictions drawn from that data (p. 71).

Furthermore, even with the weak relationship between the CogAT and the achievement tests for students in the below average group, the CogAT can be used to identify struggling learners who are in danger of not passing the achievement tests. The extra intervention that struggling students receive in the classroom to be successful learners could explain why the CogAT has the weakest correlation with the achievement tests because effective academic interventions implemented in the
classroom would hopefully help students score higher on the achievement tests.

Additionally, the RtI process emphasizes the importance of being proactive (Pascopella, 2009). By being proactive and implementing the Fast Forward Reading Program, The Lamar County (Mississippi) School District saw “improved scores on high stakes tests” as well as reporting “about 40 percent fewer referrals to special education over the past two years” (Pascopella, 2009, p. 47). Further, schools must be able to recognize when interventions are working and when interventions need to be modified in order to intensify academic support (Pascopella, 2009).

The above average group’s performance exhibit moderate, positive relationships exist between the CogAT and the fourth grade Math and Reading and the fifth grade Math test. The average group ($n = 230$) had highest correlation coefficients among the three groups, indicating this group’s OAT performance had the best relationship with the CogAT. Lohman and Hagen (2003) share, “One interpretation is that such students have applied themselves well to school tasks and have acquired higher levels of knowledge and skills than one would predict, given the level of their reasoning abilities” (p. 75). So in effect, the students are able to use reasoning abilities along with student knowledge that was gained throughout the school year to obtain a higher, successful score on the achievement test. Additionally, Lohman and Hagen (2003) remark, “their problem-solving strategies are relatively context bound” (p. 75)
indicating the reasoning skills that are being utilized are for specific skills which are assessed on achievement tests resulting in higher achievement test scores.

Research Question 3

What composite scores on the CogAT are necessary to predict a proficient score, an accelerated score, and an advanced score on the fourth and fifth grade Ohio Achievement Tests in Reading and Math?

The final research question used a simple linear equation and scatterplot to determine which CogAT scores are necessary to attain a passing score on the fourth and fifth grade Reading and Math Achievement Tests. In order to achieve a proficient score on the achievement tests, students must score in the mid to low 90s on the 3rd grade CogAT. Likewise, a score near 100 is required to be in the accelerated range on the fourth and fifth grade Reading tests. A score above 105 is required to score in the accelerated range on the fourth and fifth grade Math test. A score above 110 is needed to be in the advanced range on the Reading tests in fourth and fifth grade, while the math tests require a CogAT score between 100-110 to be advanced. Given that the proficient score range on the achievement test is the lowest score range a student can be in and still pass, a lower score on the 3rd grade CogAT would be expected to predict a necessary passing score on the achievement tests. As students score higher on the CogAT, the predicted scores on the achievement tests in the accelerated and advanced ranges would be expected to rise as well. Higher reasoning skills as indicated on the
CogAT would hopefully predict higher academic success as measured on the achievement tests. The researcher could not find any previous research with similar results.

**Conclusions**

After analyzing the results of the study, three main conclusions are evident. The first conclusion indicates the CogAT is significantly related to the fourth and fifth grade Reading and Math Achievement Tests, which indicates cognitive ability, and can be used to predict future academic achievement. Given the significant relationship found in this study between the CogAT and the achievement tests, CogAT scores can be used not only to identify students for the gifted and talented program, but also to inform instruction in order to provide a differentiated curriculum and identify students in need of academic interventions. Differentiated instruction should be designed to match the cognitive abilities of all students with the curriculum as well as provide interventions for students in danger of not passing future achievement tests. Secondly, predictions for future academic achievement are stronger with the above average and average groups, while weaker for the below average group. Given this information, teachers should use the information carefully to guide differentiated instruction for higher performing students and to provide necessary interventions and remediation for lower performing students to ensure success on the Ohio Achievement Tests. The third
conclusion is the importance of making data-driven decisions. These conclusions are further discussed below.

The first conclusion focuses on the importance of using the CogAT scores to help all students achieve a year’s worth of growth by providing an individualized, differentiated curriculum as well as research-based, effective interventions. North Topsail Elementary School in North Carolina has embraced differentiation in an effort to improve student achievement (Lewis & Batts, 2005). Teachers and administrators at this school work cooperatively to examine data from beginning of year tests, state assessments, and classroom assessments in an effort to monitor student learning throughout the year. Lewis and Batts (2005) share, “Students are identified as at-risk if they are below grade level, and teachers develop intervention plans to improve achievement. In addition, the teachers plan more challenging activities for students assessed as above grade level or those who have mastered a concept” (p. 30). The authors conclude that all students benefit from the differentiated instruction, with students struggling academically showing the most growth during the school year (Lewis & Batts, 2005).

“The J. Erik Jonsson Community School in Dallas, Texas promotes a simple formula to achieve success: Powerful pedagogy + trusting relationships = student engagement for learning” (Minnett, Murphy, Nobles, & Taylor, 2008, p. 26). Within this school, differentiation is achieved by creating a culture focused on engaging students of
all ability levels in academic learning activities. The authors indicated that “participating teachers began to adjust their actions to gain more student engagement” (p. 30). After examining CogAT scores to better understand individual cognitive strengths and weaknesses of each child, positive teacher interactions can become an important component in creating a classroom atmosphere based on trust. By establishing this trusting relationship, teachers will be able to engage students at individual ability levels, while encouraging higher level thinking skills through a differentiated curriculum.

Additionally, Lohman and Hagen (2003) outline several instructional suggestions for differentiation, which include capitalizing on strong points, enhancing memory, scaffolding, recommending reasoning skills, and using various grouping methods. By taking the time to take all of these into consideration, a teacher is differentiating through high expectations and individualized learning outcomes.

After examining the results of the current study, a second conclusion indicates the CogAT is a better predictor of academic achievement for the above average and average groups. Lohman and Hagen (2003) state, “Achievement tests aim to measure knowledge and skills explicitly taught in the schools. These are what some psychologists call crystallized abilities. CogAT, on the other hand, aims to measure reasoning abilities that are developed indirectly through instruction that challenges students to think in new ways as well as through a wider range of learning experiences.
in the culture. These are what psychologists call fluid reasoning abilities” (pp. 74-75).

Given this information, a student scoring higher on the CogAT would hopefully possess higher reasoning skills (or higher fluid reasoning abilities) which could be helpful in utilizing learned skills (crystallized abilities) in new situations and experiences such as those experienced on the achievement tests. However, a student scoring lower on the CogAT would have possible lower reasoning skills (or lower fluid reasoning abilities) leading to possible difficulty in utilizing learned skills (crystallized abilities) in new situations with achievement test questions. Teachers should use the CogAT scores in order to determine necessary interventions to help the student achieve academic success. However, teachers should also be mindful of improved academic achievement (both in the classroom and on the achievement tests) given the interventions the student has received during the school year.

The third conclusion reinforces the need for data-driven decision making.

Schools have a plethora of data sources which can be overwhelming to educators and administrators that reinforces the need for data-driven decision making. Schools must utilize research-based data sources with strong correlations to future academic achievement to determine instructional practices as well as curricular differentiation.

“The single distinguishing characteristic of the best professionals in any field is that they consistently strive for better results” (Fullan & Hargreaves, 1996, p. 82) by using a process “where teachers work together to construct their understanding of student-
learning problems and embrace and test out solutions together through rigorous use of data and constructive dialogue” (Love, 2009, p. 22). Data-driven decisions must be contextually based on the information specific to each classroom, school building, or school district and teachers must work cohesively in order to gain a deeper understanding of the data to understand the results better.

Forsyth County Schools in Georgia illustrate the importance of making data-driven decisions. Pijanowski (2008) remarks “The professional learning not only transformed classroom practice, but also drove the district to make significant changes in how school leaders and teachers used assessment data” (p. 43). Pijanowski describes three levels of data-driven decision making, which include teacher reflection, grade-level reflection, and school wide reflection. “Using timely, standards-based data and focused, collegial conversations” (Pijanowski, 2008, p. 46) the school district was able to notice improvements in student learning.

Reeves (2008) shares, “The challenge is facing both an overabundance of data and a scarcity of information that educators can readily use to make better decisions” (p. 89). Although data abounds, educators are not often able to make sense of the data in order to change instructional practice. Reeves (2008) posits several suggestions to help educators make sense of the data. Examining data should be on-going and fluid. When examining data it is helpful to have a focus, so the results are more meaningful.
Lastly, examining data requires digging deeper than the surface values of the test results to better understand the root causes for the results.

**Recommendations**

Given the practical applicability of this study for teachers and administrators, the recommendations have been separated into practical recommendations and policy recommendations. The practical recommendations could be implemented immediately and should be aligned with most school structures and cultures. Furthermore, a large amount of overlap exists between the conclusions and recommendations, so many of the recommendations build off of previously described conclusions.

**Practical Recommendations**

The following practical recommendations can be implemented immediately and when used appropriately can help teachers meet the needs of all students. Since the CogAT is often taken in the fall of third grade to determine gifted eligibility (Lohman & Hagen, 2002), the third grade teachers should receive the score reports. The third grade teachers are able to use this information immediately to implement instructional decisions (Lohman & Hagen, 2002) based on the needs of all students. The scores are also placed in each student’s cumulative folder. Once the students move on to fourth grade or fifth grade, the information often remains as part of the cumulative file, but is often not otherwise shared. One practical application would be to have the third grade teacher share the CogAT scores with the fourth grade teacher during transition
meetings at the end of the third grade school year. Additionally, the fourth grade teacher could pass the CogAT scores onto the fifth grade teacher during the transition meetings at the end of the fourth grade school year. By doing this, the teacher at the next grade level has a better idea of the overall cognitive ability of each student and has a deeper insight into the class dynamics in terms of academic ability. Moreover, the fourth grade teacher could share additional information from the fourth grade OATs in Math and Reading and the relationship between the CogAT and the OAT scores. This information provides a road map for the fifth grade teacher to use when planning instruction and interventions. Additionally, staff members could work together during staff meetings throughout the year in order to examine data provided by the CogAT score reports. After initially examining this data, teachers could meet several times throughout the year to ensure students are making adequate academic progress. Follow-up meetings the next year could also ensure pertinent student information about cognitive ability is passed from grade level to grade level.

CogAT scores can be used to differentiate instruction by, “Helping to identify the strengths and weaknesses of an individual’s general cognitive skills, so that the strengths can be utilized to facilitate learning, and weaknesses can be addressed efficiently and effectively” (Lohman & Hagen, 2002, p. 16). Using the score report from the CogAT, the teacher knows the cognitive strengths and weaknesses of each student. Knowing a student has a verbal or quantitative strength or weakness can help the
teacher develop multi-modal curriculum units to solidify strengths and enrich areas of weaknesses. Furthermore, students could be grouped according to ability so that higher level students can move at a faster, more independent pace than other students that might require more instruction. Finally, student choice can be used to differentiate instruction. By giving students options, the students are able to take accountability and responsibility for learning at a higher level. Knowing a student’s cognitive ability level can enable the teacher to provide numerous learning activities for students to choose from that are matched with individual abilities of each student. Lohman and Hagen (2003) identify structure and group versus individual work as two classroom characteristics should be considered when differentiating. Structure provides classroom organization for higher level students to participate in discovery-oriented activities, which may not always be beneficial for struggling learners (Lohaman & Hagen, 2003). Opportunities to work alone should be used to help students enhance individual reasoning abilities and as a group to strengthen cooperative learning abilities.

Another way to differentiate is to keep the focus on individualizing the curriculum. Tomlinson (2010) remarks, “Personalizing instruction has, for me, been a laboratory for differentiation. If I can figure out how to make learning work for one student, I’m better prepared to understand and address the needs of all of the students who come my way” (p. 16). By enabling one student to be successful, a teacher becomes
better equipped to help all students achieve success. In order to make this dream a reality, a teacher must make learning individualized (Tomlinson, 2010). Moreover, Tomlinson and Jarvis (2006) state, “Good teaching is inevitably the fine art of connecting content and kids—of doing what it takes to adapt how we teach so that what we teach takes hold in the lives and minds of students” (pp. 16-17).

While differentiating, the teacher should give special attention and focus to students in the below average group. Using information provided from the CogAT results, teachers can identify students who are in need of academic interventions throughout the year. One method to ensure students are receiving research-based, effective instruction is the Response to Intervention (RtI) model that allows teachers to effectively respond to students needing additional academic support. The Response to Intervention Model is comprised of three tiers with tiers 2 and 3 designed to provide intense and directed interventions to help struggling learners achieve educational learning objectives. Jackson, Pretti-Frontczak, Harjusola-Webb, Grisham-Brown, and Romani (2009) share, “The foundational principles of RtI provide educators with guidance on how to match the needs of children with appropriate levels of support to ensure that instructional opportunities are effective and foster continued progress” (p. 424).

Furthermore, this must be a fluid process utilizing a team approach comprised of all involved stakeholders to ensure the child will be successful in school. Interventions
should be closely monitored and adjusted to ensure students are making adequate growth. Ysseldyke, Burns, Scholin, and Parker (2010) remark, “Generally, the most meaningful and effective data are likely direct and frequent samples of the behavior in question before, during, and after implementing interventions. Such data provide information about how the student is responding to specific interventions and about the extent to which instructional changes are necessary” (p. 56). At the end of an intervention, the student should have shown improvement. If at the end of an intervention a student is not able to demonstrate proficiency, another intervention should be implemented. Moreover, a student might need to move from tier 1 to tier 2 or from tier 2 to tier 3 in order to receive additional interventions, if previous attempts at remediation were unsuccessful. The Response to Intervention (RtI) model emphasizes that “instructionally relevant assessment needs to be precise, frequent, and sensitive to change” (Ysseldyke, Burns, Scholin, & Parker, 2010, p. 56).

Lastly, third grade CogAT scores should be one of multiple data sources used to identify interventions for struggling learners. CogAT scores can be used to predict scores on the fourth and fifth grade OATs, especially students who are in danger of not passing. The CogAT can be used to recognize at-risk students who have trouble learning, so learning supports can be implemented (Lohman & Hagen, 2002). Using the CogAT scores as one of multiple data sources, teachers can implement interventions within the classroom to help students be successful life-long learners. Moreover,
students in need of additional support can receive small group assistance to focus on specific skills identified as weaknesses on the CogAT that will be on the OATs.

Easton (2008) remarks, “many data-analysis experts advocate for gathering evidence that complements student achievement data” (p. 21) and “just as fruits and vegetables are considered necessities in the diet, data from real students and real student work accessed through professional learning strategies should become a staple in the data diet” (p. 24). Easton posits students can offer insight in a variety of ways such as focus groups and interviews. Focus groups allow students and teachers to interact in an honest and meaningful way to discuss instructional practices and learning outcomes. Moreover, interviews are personalized for individual students to encourage dialogue about the effectiveness of the school. Shadowing students for a day also provides data about student learning and instructional practices which can be a powerful form of data when shared with teachers. Lastly, classroom walkthroughs allow the administrator the opportunity to watch the classroom in action. The administrator can identify positives and areas of strengths as well as offer valuable feedback for improvement.

Policy Recommendations

In addition to the practical recommendations, the researcher asserts several policy recommendations. Given that the CogAT is an important piece of data for teachers to use when planning and delivering instruction, one policy recommendation
could be for all third graders to take this test so teachers can better match instructional methods and strategies with individual student ability levels. Professional development is another major policy application that is necessary to understand CogAT score reports. The score reports contain data that can be confusing if the teacher does not know what each score means and what each score can tell one about the student. Lohman and Hagen (2001) suggest, “that staff development activities for interpreting score reports include a sample page of each type of report ordered by the school” (p. 39). Furthermore, once a teacher is aware of the various academic abilities within the classroom, implementing differentiated instruction can be overwhelming without professional development. Professional development can provide teachers with applicable, practical, and meaningful methods for teaching to a diverse group of students. Lohman and Hagen (2001) also emphasize the importance of reading through and interpreting case studies to “illustrate how the score report can be used for planning and adapting instruction” (p. 39). Finally, interventions are also necessary to ensure struggling learners pass the achievement tests. Often teachers know that students need help, but do not have the knowledge or skills necessary to effectively utilize research-based interventions to help students learn. Love, Stiles, Mundry, and DiRanna (2008) state,

When teachers generate their own questions, engage in dialogue, and make sense of data, they develop a much deeper understanding of what is going on relative
to student learning. They develop ownership of the problems that surface, seek out research and information on best practices, and adopt or invent and implement the solutions they generate. When teachers engage in ongoing collaborative inquiry focused on teaching and learning and making effective use of data, they improve results for students. (p. 12)

Such innovative professional development was implemented by Boone County Schools in West Virginia. Before the school year started, the schools in Boone County organized a professional development day called DDay – a day for school personnel to meet and examine district data. This allowed teachers to have an opportunity to examine various forms of data, not just summative assessments (Beck, 2008). Furthermore, “teachers in this small rural school system strategically reviewed test results and developed plans of action for the new school term to address individual and school wide strengths and challenges (p. 35). By organizing this before school event, teachers were able to reflect on student achievement from the previous year as well as outline goals to work toward for the upcoming school year.

Velasquez Elementary School in Richmond, Texas also adopted policy changes to help teachers examine data and identify struggling students. Each Monday a team comprised of the administration, pertinent teachers and support staff meet to identify interventions designed to specifically address the learning difficulties of each child (Berkey & Dow, 2008). Representatives from different grade levels ensure that the
Interventions are implemented throughout the week. Additionally, this elementary school utilizes shared planning time in order to discuss instructional practices.

Teachers must engage in collegial discussions and have the opportunity to talk collectively about student data and the resultant impact on classroom learning (Harrison & Bryan, 2008). The authors describe several forms of communication that are necessary for changes to be sustained and instructional practice to be embedded in the school culture. To begin, the entire staff of the school must participate in conversations, which can then be continued on a grade-level or department basis with the focus on achieving a year’s worth of growth, teaching practice, and student interventions. Finally, students must also be active participators in the process, by setting goals and learning outcomes and discussing these expectations with teachers and peers.

Creating and utilizing a grade level reporting system, including cognitive ability scores and achievement scores, teachers can gain a deeper understanding of student background knowledge and abilities. By developing a simple recording sheet, the information can be contained in one simple database and can be passed from teacher to teacher each year. This information can be used within fifth grade to make sure students make the year’s worth of growth as required by the Value Added initiative. Additionally, interventions can also be described, so future teachers can be aware of what has worked previously and might give some ideas of interventions to try.
Future Research Opportunities

Several future research opportunities exist based on the results of this study.
This study highlighted correlations between the third grade CogAT and the fourth and fifth grade Reading and Math OATs. Future studies could address the correlation with the fifth grade Science OAT in order to see if a stronger or weaker correlation exists with the CogAT. Furthermore, although research has been conducted by Lohman and Hagen between the CogAT and the Iowa Test of Basic Skills (ITBS) for multiple grades, this study focused on the OATs at the elementary level. Future research could examine the relationship between the CogAT and the sixth through eighth grade Ohio Achievement Tests in Reading and Math. Further, future research could examine the relationship between the CogAT taken in Junior High and the Ohio Graduation Test and the ACT. Even though a lack of knowledge/data regarding teacher interventions and quality and quantity of teacher performance was a limitation for this study, it could indicate two more suggestions for future study opportunities to determine if a relationship exists between teacher interventions implemented in the classroom and future academic success on achievement tests. Moreover, another study could focus on the impact of teacher performance on student success on future achievement tests. Both of these studies are important to develop a clearer idea of what impacts future student success.
Additionally, this study examined one suburban school district in Northwest Ohio. Future studies could be conducted to see if the same results can be attained by using districts in rural and urban areas inside and outside of Northwest Ohio.

Furthermore, this study did not take into account the Socio-Economic Status (SES) or the ethnic background of the students. Future studies could examine the effects of ethnic background and Socio-Economic Status on test results. Lastly, this study focused only the Achievement Tests in Ohio. Additional studies could be conducted to determine the correlations between the CogAT and other state achievement tests to see if a significant relationship exists.

**Final Thoughts**

Given the predictive ability of the CogAT to determine future academic success, the CogAT should be one of many data sources utilized to inform instruction. The CogAT can be utilized to gain a deeper understanding of the cognitive ability levels of individual students in order to provide enrichment for higher achieving students as well as provide supplemental instruction for struggling learners. Lastly, information gleaned from the CogAT should be shared from year-to-year and used to ensure students are progressing with academic indicators throughout the school year.
REFERENCES


