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Estimating WASI IQ Scores to Assist in Identifying Elementary School Gifted Students

Debra Garrett Pregler
University of Missouri-St. Louis, dgp59e@umsl.edu

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Debra Garrett Pregler
B.S.B.A., Accounting, University of Arkansas, 1978
M.Ed., Counseling, University of Missouri – St. Louis, 1997

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Advisory Committee

Mark Pope, Ed.D.
Chairperson

Susan A. Kashubeck-West, Ph.D.

M. Lee Nelson, Ph.D.

Jan Munro, Ed.D.

Abstract

Identifying gifted students early is important so they may receive adaptations in their learning environment including admittance into gifted programs (Subotnik, Olszweski-Kubilius, & Worrell, 2012). An effective method to increase the likelihood of identifying gifted students is needed (Pfeiffer, 2003). Admission at the elementary level primarily uses the individually-administered intelligence test; yet, the test is only administered to students nominated to the gifted program. The purpose of this study was to determine if individually-administered IQ test scores were related to specific information available to the elementary school counselor to aid in the determination of unidentified gifted elementary school students who would benefit from participating in the school district's gifted program. This study examined whether an individually-administered IQ score on the Wechsler Abbreviated Scale of Intelligence (WASI) was accurately estimated by a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, or grade. The data were split into two equal samples of 107, one used for development of the regression model and one for validation of the regression model. A significant model emerged for the model sample (n=107) explaining 46.3% of the variance, when all 10 independent variables were entered as predictors into a simultaneous multiple regression. Total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were the significant predictors. The revised regression equation with only the five significant contributing independent variables explained 45.9% of the variance in the WASI score; yet, it only had a correlation of .27 between the actual WASI score and the estimated WASI score from the revised model using the validation sample and has a weak

correlation of 7.3% of the variance explained. Future research is needed to investigate these findings before the model is used in practice. Research on identifying gifted students; characteristics of giftedness; implications for counselors in the areas of counseling, school, and career development; and the role of the school counselor in advocacy and action research were discussed.

Keywords: gifted, IQ, identification, early identification, characteristics, regression, equation, cross-validation, advocacy, action research, school counselor, career development, counseling.

DEDICATION

I want to thank and dedicate this dissertation to:

- God who gave me the ideas, talents, and tenacity to perform this work.
- my husband for loving me the way I am and encouraging me to pursue my own path. Without your backing, your understanding, and your selflessness, I could not have completed it. I am eternally grateful that you embarked on this journey with me. It is as much your accomplishment as it is mine. Who knew when we got married that this would be part of our story.
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- the many students I have been blessed to know. I am appreciative for the many lessons you have taught me. I am a better person for having each of you in my life.

Will it be easy? Nope.

Will it be worth it? Absolutely!

– unknown

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Chapter 1

INTRODUCTION

Gifted students need to be identified early (Subotnik, Olszweski-Kubilius, & Worrell, 2012; Worrell, Olszewski-Kubilius, & Subotnik, 2012) so they may participate in gifted programs that match their academic (Dai & Chen, 2013; Peterson, 2015; Rinn & Bishop, 2015; Subotnik et.al, 2012), social (Colangelo & Wood, 2015b; Cross & Cross, 2015; Olszewski-Kubilius, Subotnik, & Worrell, 2015), and career needs (Greene, 2006; Levinson & Ohler, 2006; Muratori & Smith, 2005; Schultheiss, 2008; Watson & McMahon, 2005). Some students may be overlooked for the program and not administered the individual intelligence test that is the primary identification component for the gifted program (Acar, Sen, & Cayirdag, 2016; Peterson, 2006). Therefore, a question arises about the gifted students that are never nominated (Peterson, 2006). Is there an alternate way to more accurately estimate which students might qualify for the gifted program and should be given an IQ test (Pfeiffer, 2003)? This alternate process could be used in place of or in addition to the existing identification procedures.

The school counselor can help identify and advocate for gifted students (American School Counseling Association (ASCA), 2013; Gentry, 2006; Maxwell, 2007) using an alternate process by determining and then running a formula to estimate individually-administered IQ scores (Pfeiffer, 2003). The formula would then be applied to all students. Thus, all students would have an opportunity to be screened for potential nomination to the gifted program. In essence, the school counselor would embrace action research (Dahir & Stone, 2009). Action research focuses on concerns detected by the practitioner, which is the school counselor in this study, who wants to use the results to

impact those concerns by informing or changing them (Guiffrida, Douthit, Lynch, & Mackie, 2011).

The researcher in this study is an elementary school counselor who processes the gifted nominations at an elementary school in the district in this study, by gathering the information on a student and submitting it to the gifted program. The researcher has a passion for locating gifted students. Not all 18 colleagues at the other elementary schools in the school district, however, share this passion. This study was developed, as action research, to potentially help each student at all 19 elementary schools have an equal opportunity to be selected for the gifted program, not just the students at schools where the counselors actively search for them.

Overview

The interest in high intelligence in the U.S. was present throughout the 20th century with key studies from Terman (1925), Hollingworth (1942), and Stanley (1977). The race to the moon (Colangelo & Wood, 2015a), the Marland Report (Marland, 1972), and the Javits Act (Jacob K. Javits Gifted and Talented Students Education Act of 1988) were key government efforts that influenced the movement toward identifying gifted students. The development and usage of intelligence quotient (IQ) tests also contributed to the movement of identifying gifted students and to how IQ tests became the instrument used to measure giftedness (Lambie & Williamson, 2004). The interaction of research studies, government efforts, and the development and usage of intelligence tests determined the background for the interest in giftedness**.**

Although the interest in high intellect in the U.S. has been around for over a century, the terms “gifted” or “giftedness” have evolved over this timeframe yet

remained somewhat elusive in the field of giftedness and education (Colangelo & Wood, 2015b; Dai, Swanson, & Cheng, 2011; Kroesbergen, van Hooijdonk, Viersen, Middel-Lalleman, & Reijnders, 2016; Peterson, 2015). Several definitions of giftedness exist; but, there is lack of consensus for a single definition (Dai et al., 2011). Because funding for gifted services is determined by each state, the definition of giftedness, the exact procedures for identifying students, and the various types of gifted programming that is provided to the student varies by state (Peterson, 2015). What remains common between the states is the interest in identifying gifted students and that IQ is a key component in the criteria to identify a gifted student (Gallagher, 1992).

Two theories are especially related to giftedness and this study – Sternberg's (1981) Triarchic Theory of Human Intelligence and Renzulli's (1976) Three-ring Conception of Giftedness. In addition to other components, a key component in Renzulli's theory is intelligence, which is represented by the IQ score. The Schoolwide Enrichment Model (SEM) was used for this study as it most resembles the program criteria in the school district from which the data were collected (Renzulli, 1999; Renzulli & Reis, 2000).

In addition to the history, definitions, and theories related to giftedness, it is important to counselors and educators to understand characteristics unique to gifted persons. Gifted individuals possess some characteristics that are easily recognized (Colangelo & Wood, 2015b; Maxwell, 2007; Peterson, 2009, 2015; Peterson, Duncan, & Canady, 2009) and some that are unique (Colangelo & Wood, 2015a) such as: (a) learning (Bailey, 2011; Kettler, 2014; Walsh & Kemp, 2012), (b) learning rate (Bailey, 2011; Dai & Chen, 2013; Gagne, 2007; Kettler, 2014; Warne, 2016), (c) multipotentiality

(Greene, 2006; Maxwell, 2007; Peterson et al., 2009; Rinn & Bishop, 2015; Rysiew, Shore, & Leeb, 1999), (d) perfectionism (Greene, 2006; Peterson & Rischar, 2000; Walsh & Kemp, 2012), (e) asynchronous development (Bailey, 2011; Colangelo & Wood, 2015b; Greene, 2006; Peterson, 2006, 2009, 2015; Warne, 2016), and (f) sense of obligation (Muratori & Smith, 2015).

Gifted students are vivacious learners (Bailey, 2011), learn quickly (Bailey, 2011; Dai & Chen, 2013; Gagne, 2007; Kettler, 2014; Warne, 2016) without much repetition or practice, and need a quick pace (Rogers, 2007). They also have many interests and are talented in many of these areas (Greene, 2006; Maxwell, 2007; Peterson et al., 2009; Rinn & Bishop, 2015; Rysiew et al., 1999). They often are perfectionistic which can be positive if it drives them to mastery or negative if they avoid challenges for fear of making a mistake (Greene, 2006; Walsh & Kemp, 2012). In addition, a gifted student's cognitive development usually outpaces their social and emotional development (Peterson, 2006, 2009, 2015), which may strain their same-age peer relationships (Bailey, 2011; Cross & Cross, 2015). Last, gifted students often focus on fairness and justice (Bailey, 2011; Cooper, 2009; Gentry, 2006; Greene, 2006; Peterson, 2009) and have a value driven mission in life (Greene, 2006; Rysiew et al., 1999). If unknown to counselors and educators, these unique characteristics may be misconstrued or pathologized (Peterson, 2006, 2015).

The unique traits of the gifted have implications for counselors in three arenas: counseling, school, and career development. Because gifted persons experience the world differently than their nongifted peers (Bailey, 2011), counselors need to be aware of how the following issues may appear in counseling sessions: (a) anxiety (Cross &

Cross, 2015; Peterson, 2009), (b) underachievement (Peterson, 2009; Peterson & Colangelo, 1996), (c) high achievement (Cross & Cross, 2015; Gentry, 2006; Peterson, 2015), (d) depression (Cross & Cross, 2015; Peterson, 2009; Peterson et al., 2009), (e) friendship (Cross & Cross, 2015; Lee, Olszewski-Kubilius, & Thomson, 2012), (f) suicide (Delisle, 1986; Peterson, 2009), and (g) stress (Bailey, 2011; Greene, 2006; Moon, 2009; Peterson, 2009; Peterson et al., 2009). It is important for counselors to consider if their client is gifted when they present with these concerns, as they require specific interventions for both student and adult gifted persons (Colangelo & Wood, 2015b; Cross & Cross, 2015; Olszewski-Kubilius et al., 2015).

In addition to counseling needs, educational needs are a critical area for gifted students in the areas of: (a) programming (Dai & Chen, 2013; Greene, 2006; Olszewski-Kubilius et al., 2015; Reis & Colbert, 2004), (b) academic challenge (Gentry, 2006; Muratori & Smith, 2015; Office of Educational Research and Improvement, 1993; Peterson, 2015), (c) similar peers (Assouline, Nicpon, & Huber, 2006; 2006; Peterson, 2015; Rinn & Bishop, 2015), and (d) environment match (Olszewski-Kubilius et al., 2015; Subotnik et al., 2012; Warne 2016). It is crucial that the student's ability and instructional level match (Dai & Chen, 2013). Inadequate academic challenge may be a problem for a gifted student that then impacts their emotional development which can then impact their learning (Peterson, 2015). Gifted students need interaction with gifted peers during childhood and adolescence for gifted adults to reach their potential (Rinn & Bishop, 2015). For giftedness to develop fully, it needs to be nurtured such as through gifted programs (Olszewski-Kubilius et al., 2015). Matching the challenge level for gifted persons to their school or work environment increases the likelihood of positive

peer relationships and fulfilment (Cross & Cross, 2015).

In addition to the counseling and schooling aspects, intentional career development must be considered for a gifted person related to: (a) lifespan (Greene, 2006; Muratori & Smith, 2005; Schultheiss, 2008), (b) early career development (Porfeli, Hartung, & Vondracek, 2008; Rysiew et al., 1999; Schultheiss, 2008; Watson & McMahon, 2008), (c) girls (Greene, 2006; Kerr & Colangelo, 1988; Maxwell, 2007), and (d) career indecision (Emmett & Minor, 1993; Maxwell, 2007; Rinn & Bishop, 2015; Rysiew et al., 1999). Career development spans a lifetime (Greene, 2006; Muratori & Smith, 2005; Schultheiss, 2008); yet the career needs are often not programmed for gifted students (Levinson & Ohler, 2006). Career interventions are critical at elementary school (Watson & McMahon, 2008) where gifted students learn their strengths and interests and are exposed to a wide range of possible careers (Rysiew et al., 1999). Gifted girls are at-risk for underachievement in adolescence, which is the opposite of their performance in elementary school (Galbraith, 1999; Greene, 2006; Maxwell, 2007). Career indecision may occur because of seeking the perfect career (Rysiew, et al, 1999), fear of making the wrong decision (Emmett & Minor, 1993), or not being able to choose among their many talents (Greene, 2006; Maxwell, 2007; Rinn & Bishop, 2015; Rysiew et al., 1999). In summary, counselors need to be aware of and make others aware of a gifted person's unique traits and needs and how they may appear in counseling sessions, at school, and in their career.

Gifted students need to be identified early so that the appropriate level of supports can be put in place as early as possible and maintained or accelerated as needed (Subotnik et al., 2012). An educational fit between the school and the environment is

critical (Dai & Chen, 2013). The earlier this match is made, the more likely the student will thrive in their education (Gagne, 2007; Kroesbergen et al., 2016; Masten, Herbers, Cutuli, & Lafavor, 2008; Olszewski-Kubilius et al., 2015; Worrell et al., 2012) as well as learn self advocacy skills (Maxwell, 2007). In addition, elementary school career intervention is critical to the successful career development across an individual's lifespan (Watson & McMahon, 2008); so, this must be in place even earlier for gifted children because of their asynchronous development (Jung, 2012). Early identification is important so that skills may be taught and practiced (Worrell et al., 2012) as well as the student learning what it means to be gifted, what gifted characteristics they possess, and how to embrace and utilize them (Maxwell, 2007).

Each school district determines their exact identification process (Acar et al., 2016) and it often begins with a parent or teacher nominating students to see if they meet the qualifications for a gifted program (McBee, 2010). Gifted program admission typically is based on exceptionally high IQ scores, achievement test scores, parent rating scales, and classroom performance, usually grade point average (National Association for Gifted Children, 2015, 2017a). An IQ of 130 is a well recognized threshold for giftedness for IQ (Gagne, 2007; Peterson, 2015). The main instrument for identifying gifted students remains the individually administered intelligence test such as the Wechsler Abbreviated Scale of Intelligence (WASI), Wechsler Intelligence Scale for Children (WISC), and Stanford-Binet Intelligence Tests (Gallagher, 1992). In the school district for this study, IQ must be two standard deviations above the mean for a student to qualify for the gifted program. In other words, the minimum IQ for admission to the gifted program in this school district is 130 because the mean IQ is 100 with a standard

deviation of 15 (Keith, 2001). This score equates to the top 2.5% of the population (Peters, Matthews, McBee, & McCoach, 2014). Individually-administered intelligence tests are, however, costly (George Mason University, 2017). Therefore, individually-administered intelligence tests are usually given only to students nominated to the gifted program.

On the other hand, ability/aptitude tests developed to be administered in groups are used more often and administered to entire grade levels (George Mason University, 2017). The results are used as a basis for educational decisions by both the school and the parent (Gallagher, 1992). Group-administered ability/aptitude tests are less costly than individually-administered intelligence tests; however, group-administered intelligence ability/aptitude scores are also less accurate than individually-administered intelligence scores for the individual (George Mason University, 2017).

Students recognized as potentially being gifted are nominated and tested for admission to the gifted program. There is concern that some gifted students may not be identified (Acar et al., 2016). Potential gifted students may not be nominated because adults may think they do not need anything beyond a traditional classroom because they are smart (Moon, 2009) or that it is discriminatory to provide special programming to some but not all students (Callahan, 2009). A question arises about the gifted students that are never nominated (Peterson, 2006). Is there an alternate way to estimate which students might qualify for the gifted program and should be given an IQ test (Pfeiffer, 2003)? This alternate process could be used in place of or in addition to the existing identification procedures.

The school counselor can play a key role in identifying gifted students so they

may access appropriate programming early in their education (Gentry, 2006). Without identification, students may not have access to appropriate programming (Peterson, 2006). Students must be identified as gifted to access some services and learning opportunities. The ASCA model (ASCA, 2013) instructs school counselors to help gifted students in programming, advocacy, and collaboration with staff and families and increase awareness of gifted students' attributes and needs. The school counselor should advocate for special programming, intentional interventions for girls (Maxwell, 2007), and career development (Muratori & Smith, 2015) to help ensure their gifted needs are met. The school counselor should look for gifted students just as the counselor would look for students who might need special education services or other students in need (Milsom & Peterson, 2006; Peterson, 2006, 2015). In addition to advocacy, ASCA encourages action research where practicing counselors conduct research to improve policies and practices that address their needs (Dahir & Stone, 2009). Practitioners can use a quantitative study to influence school improvement, specifically their day-to day practice (Rowell, 2005). The school counselor may have a substantial impact on identifying gifted students through advocacy and action research, both of which are the foundation for this study.

Purpose of the Study

Certain gifted students may not exhibit gifted characteristics or their composite group ability/aptitude score may not accurately reflect their ability level. Therefore, their parent or teacher may not recognize them as potentially gifted and not nominate them to the gifted program (Acar et al., 2016; McBee, 2010; Peterson, 2015). These students need to be identified so that they may receive the services that they need in order to

develop their potential (Dai & Chen, 2013; Subotnik et al., 2012). Otherwise, they may be at risk as they enter adolescence (Greene, 2006; Maxwell, 2007). Therefore, a method to increase the likelihood of identifying potentially gifted students is needed. Because an individually-administered intelligence score is obtained only for students nominated to the gifted program, the specific research problem becomes whether there is a way to estimate individual IQ scores from information available to the elementary school counselor. Thus, the purpose of this study is to determine if individually-administered IQ test scores are related to specific information already available to the elementary school counselor to aid in the determination of unidentified gifted elementary school students who would benefit from participating in the school district's gifted program.

Research Question

The research question is: Is an individually-administered IQ score accurately estimated by a function of the national percentile achievement test scores in total reading; total mathematics; language; spelling; science/environment; and listening; verbal, and nonverbal cognitive abilities; gender; or grade (see Figure 1)?

Hypotheses

The hypotheses are that a statistically significant contributing relationship exists between some or all of the 10 independent variables and the individually-administered full scale IQ test score.

H1: The national percentile achievement test scores in (a) total reading, (b) total mathematics, and (c) language, and (d) the verbal cognitive ability score will significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test score.

H2: The national percentile achievement test scores in (a) spelling, (b) science/environment, and (c) listening, (d) the nonverbal cognitive ability score, (e) gender, and (f) grade will not significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test score.

Delimitations

The school district providing the context for this study is typical of many school districts. IQ is the predominant qualifying characteristic for acceptance into the gifted program and it is used by the school district in this study. Participants were elementary school students in a public K-12 school district located in a suburb of a Midwestern metropolitan area. Specifically, they were second through fifth grade elementary school students in general education classrooms. Participants consisted of students tested for admittance into the district's gifted program during the 2004-2005, 2005-2006, 2006-2007, or 2007-2008 school years. The district changed to the WASI, Otis-Lennon School Ability Test, Eighth Edition (OLSAT8), and the Stanford Achievement Test, Tenth Edition (SAT10) at the beginning of the 2004-2005 school year. The SAT10 contains more batteries than the previous achievement test used by the district. This is the preferred data set for this study. During these school years, the same instruments were administered to the students at the same grade levels. This provides four years of consistent data which strengthens the study rather than using one year of data. In addition, it provides a population size of more than 10 participants for each of the 10 independent variables. Subsequent years were considered; however, they were insufficient for a data set.

The participants must also have had all of the following data: (a) a full scale IQ score on the individually-administered WASI, (b) achievement tests scores on the group-administered SAT10, preceding the WASI, (c) ability scores on the group-administered OLSAT8, preceding the WASI, and (d) information available about gender and grade. Data were collected from existing sources including: (a) computer download of students with a WASI IQ score, (b) students' computer information system, (c) computer download of OLSAT8 scores, and (d) computer download of SAT10 scores. Student identifiers were removed after the data were reviewed for completeness in order to maintain confidentiality, prior to the data being given to the researcher. Data were analyzed using simultaneous regression analysis to determine the equation to estimate the dependent variable, the WASI IQ score.

Definition of Terms

Several of the terms important to this study have been mentioned earlier, but are specifically delineated here to assist the reader in understanding in detail the concepts at the foundation of this study.

Giftedness. Giftedness is defined as the predominant qualifying criteria used by the school district in this study in determining if a student qualifies for the gifted program. Operationally, this is an individually-administered full scale IQ score of 130 or above on the WASI.

Intelligence. Intelligence is the "ability to learn, reason, and problem solve" (NAGC, 2017a). Intelligence is measured both by the individually-administered intelligence test and by the group-administered intelligence test. The individually-administered intelligence test is considered more accurate than the group-administered

intelligence test. The individually-administered intelligence test also costs more and is given less frequently than the group-administered intelligence test (George Mason University, 2017).

Individual IQ measurement. An intelligence quotient (IQ) score is a "numerical representation of intelligence" (NAGC, 2017a). An average IQ is 100 (NAGC, 2017a). The Wechsler Intelligence Tests have a mean of 100 and a standard deviation of 15. The Stanford-Binet Intelligence Test had a mean of 100 and a standard deviation of 16, until the release of the Stanford-Binet 5. The Stanford-Binet 5 has a mean of 100 and a standard deviation of 15. Individual IQ in this study is measured via the full scale score on the Wechsler Abbreviated Scale of Intelligence (WASI) administered in a one-to-one setting, i.e., tester and one student (Plake & Impara, 2001). Individual tests cost more than group instruments because they are given in a one to one setting (George Mason University, 2017).

Ability/aptitude. Ability/aptitude is equivalent to a student's potential. It is the level at which a student is capable of performing in school. Ability/aptitude tests are in contrast to achievement tests (Linn, 1992a; NAGC, 2017a). Ability/aptitude relates to psychological characteristics, in other words, innate ability. It is what the student may achieve in the future. Ability/aptitude tests estimate future performance while achievement tests measure current learning (Linn, 1992a, 1992b; NAGC, 2017a). The ability/aptitude test in this study is the Otis-Lennon School Ability Test, Eighth Edition (OLSAT8). It contains the verbal and nonverbal batteries and is administered in a group setting, i.e., administrator and a classroom of students (Spies, Carlson, & Geisinger, 2010). Group-administered tests are more cost effective than individually-instruments

because they are given in a group setting (George Mason University, 2017).

Achievement. Achievement is the mastery of a subject content area. It is the level of a student's actual performance. Achievement tests are in contrast to ability/aptitude tests. Achievement relates to accomplishments, in other words, what has been learned from study or practice. It is what the student currently knows (Linn, 1992a; NAGC, 2017a). Achievement tests are more directly linked to specific learning experiences. Achievement tests measure current learning while ability/aptitude tests estimate future performance (Linn, 1992a, 1992b; NAGC, 2017a). The achievement test in this study is the Stanford Achievement Test, Tenth Edition (SAT10). It contains the total reading, total mathematics, language, spelling, science/environment, and listening batteries and is administered in a group setting, i.e., administrator and a classroom of students (Spies & Plake, 2005). Group-administered tests are more cost effective than individually-administered instruments because they are given in a group setting (George Mason University, 2017).

Grade. Grade is defined as the grade level the student attended at elementary school when the individual IQ test (WASI) was administered.

Gender. Gender is defined as only male or female because these are the only two categories collected in the school district's computer information system.

Significance of the Study

This study could be valuable to the students, the elementary school counselors, and the school district, plus the research community, counselors, and other school districts outside of the school district in this setting. First, it could help locate "missed" nominations to the gifted program under the current nomination method. These students

deserve to learn in the best environment that meets their needs. Next, it will validate or invalidate the reliance on information readily available to the elementary school counselor in interpreting data to help teachers and parents decide to pursue a nomination to the gifted program. Third, it could save the counselor time on processing gifted referral paperwork. It could also prevent time spent in intervening in discipline referrals that arise because of mismatched students with their environment. Next, this approach aligns with the proactive intentional, results based counseling activities recommended by the ASCA (ASCA, 2012) as it is seeking to identify students and helping obtain appropriate programming for them.

This study could also potentially save the school district money if it shows that the district could rely on a multiple regression formula instead of continuing to administer the OLSAT8 in the sixth and ninth grades. Next, the results will help advance theory by demonstrating that a relationship does or does not, and to what extent, exist between the independent variables selected for this study and IQ. It could also serve as an example of how another district might set up their own study and perform their own analysis, which could ultimately influence the assessments they purchase and administer. Parochial schools, private schools, charter schools, and other public schools without an established gifted program could be particularly interested in the results of this study to help them in identifying gifted students and influencing their school's programming.

In summary, there is a need to identify gifted children early so that they may begin receiving education and enrichment matched to their intellectual needs as early as possible (Subotnik et al., 2012). The elementary school counselor is in a key position to help identify these children (Gentry, 2006). This is consistent with the ASCA national

model (ASCA, 2012) to help all children. Elementary school counselors, however, juggle many activities (Green & Keys, 2001; Hughey, 2001) and need a way to help identify these children effectively and efficiently (Pfeiffer, 2003). With the availability of data and the ability to process these data easily via computer programs, it seems logical to determine if there is a way to better estimate which children should be considered for the gifted program rather than solely relying on teachers and parents to nominate the students. This study developed from an actual need to develop an efficient way to cast a wide enough net to catch as many gifted students as possible, that is, to decrease the number of false negatives.

Therefore, the purpose of this study is to determine if certain variables could accurately estimate an IQ score. If so, these variables for all students could be entered into the regression formula and used to estimate each student's IQ score. From this list, all students scoring above a set threshold would then be administered an actual IQ test. This would help ensure that all students are considered for gifted programming. It would also be easily possible to re-run the regression analysis with new data each year or even during the year as new data are available to see if other students should be given an IQ test. It could also identify high ability students that, even though they do not qualify for a gifted program, need interventions matching their high ability level. In addition, the results might also influence which tests a district would purchase and administer or might help obtain funding by obtaining a true picture of the number of gifted and high learners in the district.

An example of action research and a quantitative study by a counselor are secondary benefits of this study. Practitioners should actively contribute to research by

searching for ways to solve day-to-day problems that they encounter (Rowell, 2005). Not only may they contribute to the research base (Falco, Bauman, Sumnicht, & Engelstad, 2011) but could also help practitioners with their problems, which ultimately helps children and adolescents (Rowell, 2005). In addition, counselors often perform qualitative research or research the impact of interventions and look at group differences for small numbers of students (Dahir & Stone, 2009). This study is an example of a quantitative study to solve a problem using a large amount of data. Counselors should not shy away from using data even though this may feel out of their comfort zone (Dahir & Stone, 2009).

This study originated from a genuine need and interest of the researcher. A thorough review of the literature (counseling, career counseling, school counseling, giftedness, and school psychology) was conducted looking for previous studies or a gap in the literature as Guiffrida et al. (2011) suggested. No studies were found addressing the research question in this study.

Whiston (1996) noted that advantages of action research are the ability to collect information in real-world settings and ease of implementing any recommended changes because the researcher suggested the problem in the first place. Dai and Chen (2013) summarized gifted education as "mainly concerned with effecting desirable changes in our most able students through proper educational provisions and adaptations" (p. 152). This study is the combination of these two concepts — finding a way to locate gifted students early so they may prosper in school and throughout their life.

Chapter 2

REVIEW OF THE LITERATURE

As detailed in this review of the literature, gifted children need to be identified early (Subotnik et al., 2012; Worrell et al., 2012) so they may receive appropriate counseling interventions (Colangelo & Wood, 2015b; Cross & Cross, 2015; Olszewski-Kubilius et al., 2015), schooling (Dai & Chen, 2013; Peterson, 2015; Rinn & Bishop, 2015; Subotnik et.al, 2012), and career development (Greene, 2006; Levinson & Ohler, 2006; Muratori & Smith, 2005; Schultheiss, 2008; Watson & McMahon, 2005). To partake in gifted programs, however, the student must first be nominated to the gifted program. A question arises about the gifted students that are never nominated (Acar et al, 2016; Peterson, 2006). Is there an alternate way to accurately estimate which students might qualify for the gifted program and should be given an intelligence test (Pfeiffer, 2003)? This alternate process could be used in place of or in addition to the existing identification procedures. Therefore, the purpose of this study is to determine if individually-administered IQ test scores are related to specific information already available to the elementary school counselor to aid in the determination of unidentified gifted elementary school students who would benefit from participating in the school district's gifted program.

The following literature review is organized as follows: (a) history, (b) evolution in the definition of giftedness, (c) definitional problems, (d) theories of giftedness, (e) characteristics of giftedness, (f) implications for counselors, (g) early identification, (h) identification process, (i) role of the school counselor, (j) prior studies, (k) this study, and (l) summary and conclusion.

History

The interest in high intelligence in the U.S. was present at the turn of the 20th century when Terman (1925) conducted his longitudinal study on gifted individuals in 1925 (Foley-Nicpon & Assouline, 2015; Olszewski-Kubilius et al., 2015; Rinn & Bishop, 2015). He followed a group of individuals with an average age of 11 and an IQ of 140 or above into adulthood and demonstrated a relationship between high IQ and high achievement (Olszewski-Kubilius et al., 2015; Terman, 1925). An impetus in society at this time was the "betterment of the human race" (Dai & Chen, 2013, p. 154).

Hollingworth (1942) studied children with IQ scores of 180 or above concluding that the students needed different educational experiences such as acceleration and enrichment as well as needing help with problems coming from the difference in their intellectual development and their social and emotional development (Hollingworth, 1942; Olszewski-Kubilius et al., 2015).

Stanley (1977) conducted his famous study, Study of Mathematically Precocious Youth (SMPY), on exceptional math students resulting in the relationship between more educational opportunities in childhood and adult accomplishment (Olszewski-Kubilius et al., 2015; Stanley, 1977) and a relationship between higher SAT scores and high IQ (Rinn & Bishop, 2015) as well as positive results of acceleration (Van Tassel-Baska & Brown, 2007).

In addition to these studies, several government efforts also impacted the movement toward identifying gifted students. First, in response to the Russians successful launch of the Sputnik satellite in 1957 to become the first to enter space, the U.S. exerted an effort to be the first to land a person on the moon. So, the National

Defense Education Act of 1958 (National Defense Education Act of 1958) was passed which placed counselors in schools with the goal of guiding students with high math and science abilities into college (Colangelo & Wood, 2015b; Lambie & Williamson, 2004; Pope, 2000).

Next, in 1972, the government issued the first national report on gifted education, the *Education of the Gifted and the Talented*, commonly referred to as the Marland Report (Marland, 1972). It stated that giftedness included 3-5% of the school-age population and informed Congress that the gifted population's educational needs were not being met. It emphasized the need for programming and that unmet academic needs might hurt students' development. It did not, however, include any funding (Assouline et al., 2006).

Additionally, in 1988, limited federal funding was appropriated for research, but not for programming, via the Jacob K. Javits Gifted and Talented Students Education Act (Jacob K. Javits Gifted and Talented Students Education Act of 1988), referred to as the Javits Act. The Javits Grants from the Department of Education in the early 1990s led to research with a common theme that intelligence is multifaceted and that giftedness can be manifested in different ways (Brown et al., 2005).

The development and usage of IQ tests also contributed to the movement of identifying gifted students and to how IQ tests became the instrument used to measure giftedness. Overall, intelligence is a construct that Warne (2016) described, in simple terms as, "the general ability to reason and think abstractly" (p. 3). Terman (1925) developed the Stanford-Binet Intelligence Scale to measure the intelligence construct. World War I played a key role in the usage of individually-administered intelligence

tests. The government was interested in matching a person's ability with a job during the war and used the newly developed Stanford-Binet Intelligence Scale to do so (Lambie & Williamson, 2004; Pope, 2000).

Related to schools, IQ tests "are often the best predictors of school success available to psychologists" (Kush et al., 2001, p. 85). Gagne (2007) found that IQ scores accounted for individual differences in academic achievement three times better than variables such as motivation and stage of development. Vogl and Preckel (2014) found that cognitive ability was a solid estimator of academic success and positively related to socioemotional adjustment.

Related to giftedness, Terman (1925) believed that giftedness could be measured by intelligence tests (Dai & Chen, 2013; Warne, 2016) and that the gifted are those scoring in the top 1% on the Stanford-Binet Intelligence Test (Sarouphim, 2001; Terman, 1925); therefore, many equated gifted to be a score of 135 or above (Brown et al., 2005). Reis and Colbert (2004) noted that giftedness is equated with high IQ and Borland (2009) noted that the concept that IQ equals giftedness is still in practice. High intellectual ability (Foley-Nicpon & Assouline, 2015; Olszewski-Kubilius et al., 2015) represented by IQ scores was a component of the definition of giftedness (Olszewski-Kubilius et al., 2015).

In summary, the interaction of research studies, government efforts, and the development and usage of IQ tests determined the background for the increased interest in giftedness that has emerged.

Evolution in the Definition of Giftedness

While the interest in high intellect in the U.S. has been around for over a century,

the terms gifted or giftedness have evolved over this timeframe, yet remained somewhat elusive (Colangelo & Wood, 2015b; Dai et al., 2011; Kroesbergen et al., 2016; Peterson, 2015). Definitions are presented from: (a) Terman, (b) Marland Report, (c) Renzulli, (d) Javits Act, (e) National Excellence Report, (f) NAGC, and (g) others.

Terman. As stated earlier, Terman's (1925) initial belief that the top 1% on the Stanford-Binet Intelligence Scale were gifted started the definition of giftedness, which many equated to a score of 135 or above (Brown et al., 2005).

Marland Report. The Marland Report (1972) added performance domains to the already existing academic domains. Gifted had high potential in "(1) general intellectual ability, (2) specific academic aptitude, (3) creative or productive thinking, (4) leadership ability, (5) visual and performing arts, and (6) psychomotor ability" (p. 2). The report stated that giftedness included 3-5% of the school-age population demonstrating outstanding abilities, performance, and achievement (including general intellectual ability) in specific academic domains. Although not explicitly stated in the report, the top 3% full scale IQ score on the WASI is 128-129 and the top 5% is a score of 124-125. Scores of 130-132 are in the top 2% (The Psychological Corporation, 1999). Assouline et al. (2006) and Gallagher (1992) noted that the definition in the Marland Report served as a base for definitions of giftedness used by most states.

Renzulli. Renzulli (2005) defined giftedness via his three-ring theory as the interaction of above-average ability, high creativity, and high task commitment. Others like Maker (1993), added to the understanding of the emerging definitions of giftedness by seeing intelligence and creativity as related. Maker felt this interaction helped gifted persons comprehend problems and find solutions efficiently but also creatively and

effectively (1996).

Javits Act. The Javits Act (Jacob K. Javits Gifted and Talented Students Education Act of 1988) defined giftededness as:

> children and youth who give evidence of high performance capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who require services or activities not ordinarily provided by the school in order to fully develop such capabilities. (p. 109)

National excellence report. The Department of Education released *National Excellence: A Case for Developing American's Talent* (Office of Educational Research and Improvement, 1993) and built upon the definition from the Javits Act (Jacob K. Javits Gifted and Talented Students Education Act of 1988) to define giftedness as:

> Children and youth with outstanding talent perform or show the potential for performing at remarkably high levels of accomplishment when compared with others of their age, experience, or environment. These children and youth exhibit high performance capability in intellectual, creative, and/or artistic areas, possess an unusual leadership capacity, or excel in specific academic fields. They require services of activities not ordinarily provided by schools. (p. 26)

Its major contribution was explicitly stating that all students can be gifted – "from all cultural groups, across all economic strata, and in all areas of human endeavor" (p. 26).

NAGC. The National Association for Gifted Children (NAGC) is the professional organization promoting the education of gifted children as well as advocacy, research, and resources. Their flagship journal is the *Gifted Child Quarterly* (National

Association for Gifted Children, 2017b). In a position statement, the NAGC defined giftedness as "outstanding levels of aptitude (defined as an exceptional ability to reason and learn) or competence (documented performance or achievement in top 10% or rarer) in one or more domains" (National Association for Gifted Children, 2010, p. 1).

Others. Acar et al. (2016) listed current approaches for identification beyond IQ and achievement scores to include other components such as portfolios. Maxwell (2007) agreed that there are various definitions of giftedness, but most indicated "individuals with well-above average intellectual capabilities" (p. 207). Gagne (2007) coined the the term "IGAT" for the population at most gifted programs –intellectually gifted and academically talented (IGAT). Gagne felt this was congruent with identification based on IQ (measure of IG) and achievement tests or grades (AT).

Definitional Problems

Several definitions of giftedness were presented in the prior section. This section discusses the (a) lack of one standard definition, (b) state control, (c) past practice, and (d) current practice.

Lack of one standard definition. Pfeiffer (2003) found that the "lack of consensus on how to conceptualize or define the gifted and talented" (p. 163) was the number one concern for 94% of the 64 gifted experts who responded in that study. This included lack of a national definition, inconsistency between states, and uncertainty as to whether creativity is a component of giftedness. Dai et al. (2011) confirmed the continued lack of consensus for one definition of giftedness.

State control. Because the funding for gifted services was administered at a state level, each state was responsible for determining its own definition of giftedness (Brown

et al., 2005; Colangelo & Wood, 2015b) as well as the corresponding funding and programming, if any (Callahan, 2009; Colangelo & Wood, 2015b). Furthermore, each school district in the state may have leeway in how they interpreted the state's definition and how it designed its gifted program (Acar et al., 2016).

Past practice. Many school districts used only IQ scores to identify gifted students (deBarona & Barona, 2006) or as the predominant main criteria to be considered gifted (Dai & Chen, 2013). The resulting score was then used to determine who qualified as gifted and the cutoff scores used to determine who was selected were often arbitrary (Dai & Chen, 2013). An IQ score of 130 on an individually-administered assessment of intelligence is a well recognized threshold for giftedness (Gagne, 2007; Peterson, 2015). Sternberg and Grigorenko (2002) concluded that IQ tests should be only one component of gifted identification and that each school district would need to determine which and how to use other criteria. Brown et al. (2005) found that intelligence and academic achievement assessments were frequently mandated by the state.

Current practice. Most of the states have relied on the Marland Report definition of giftedness to create their own criteria for identifying giftedness (ASCA, 2017). Dai and Chen (2013) found that achievement tests, rating scales, and other data are being used for identification of giftedness and ASCA (2017) reported that criteria typically included multiple measures such as IQ scores, achievement test scores, grade point average, and teacher and parent input, and may include student work and interviews.

Although there is not a consensus for a universal definition of giftedness (Greene, 2006), intelligence, reported as an IQ score, was a component in most states' criteria for

meeting the definition of giftedness in order to receive gifted services from the school system (Gallagher, 1992; McBee, 2010) and IQ tests were the most frequent assessment used to identify the gifted (National Association for Gifted Children, 2015) such as the Wechsler Abbreviated Scale of Intelligence (WASI), Wechsler Intelligence Scale for Children (WISC), and Stanford-Binet Intelligence Tests (Gallagher, 1992). Despite most definitions of giftedness using multiple criteria rather than solely an IQ score, giftedness continued to be equated with high IQ scores by the gifted community and educators (Reis & Colbert, 2004).

In summary, several definitions of giftedness were presented along with a discussion of the difficulties with the lack of one standard definition, state control, past practice, and current practice. The definition of giftedness, the exact procedures for identifying students, and various types of gifted programming that is provided to the student varied by state (Peterson, 2015). What remained common between them is their interest in identifying gifted students and that IQ scores were a key component in the criteria to identify a gifted student.

Theories of Giftedness

Two theories of giftedness are particularly important to this study. These are Sternberg's (1981) Triarchic Theory of Human Intelligence and Renzulli's (1977) Three-ring Conception of Giftedness. Both Sternberg and Renzulli sought to understand the construct of intelligence and its contribution to success (Callahan, 2011). In addition, both theories are well defined, researched, and recognized as delineating the constructs of intelligence (broadly by Sternberg) and giftedness (specifically by Renzulli) (Olszewski-Kubilius, et al., 2015).

Intelligence. Sternberg's (1981,1985) Triarchic Theory of Human Intelligence saw intelligence as including three components of thinking. The executive part plans, makes decisions, and monitors performance. The performance part solves problems. The knowledge-acquisition part acquires, remembers, and transfers information (Van Tassel-Baska & Brown, 2007). Brown et al. (2005) referred to the three components of intelligence as analytical, synthetic/creative, and practical.

Sternberg and Grigorenko (2002) defined successful intelligence as:

> the ability to succeed in life according to one's own definition of success, within one's sociocultural context, by capitalizing on one's strengths and correcting or compensating for one's weaknesses; in order to adapt to, shape, and select environments; through a combination of analytical, creative, and practical abilities. (p. 265)

Sternberg (1981, 1986) referred to his Componential Theory of Intellectual Giftedness as a special case of the more general Triarchic Theory of Human Intelligence. Sternberg referred to it as an information-processing theory. The components are (a) metacomponents (executive planning and decision making), (b) performance components (execution of problem-solving strategy), and (c) an acquisition, retention, and transfer component (learning new information, retrieving information, and generalizing to another context). The components are very interactive with the metacomponents as the central element.

The Triarchic Theory of Human Intelligence included three kinds of giftedness: analytical, creative, and practical. Analytical is the ability to analyze, evaluate, and critique. Creative is the ability to discover, create, and invent. Practical is the ability to

use, utilize, and apply. When these abilities are present and instruction is matched to these student strengths, achievement increases (Sternberg, Ferrari, Clinkenbeard, & Grigorenko, 1996). This theory says that gifted persons are well able to achieve success by combining their practical, creative, and analytical abilities. It specifies the processes used in intelligence rather than the specific domains.

Giftedness. Renzulli (1977, 2011, 2012) developed the Three-ring Conception of Giftedness as a theory of human potential. Renzulli saw giftedness as a combination of three different interacting areas: high cognition, high task persistence, and creativity (Dai & Chen, 2013; Renzulli, 1977, 2011, 2012; Sternberg & Grigorenko, 2002). A student's above average ability refers to traditional intellectual traits. Task commitment refers to motivation, determination, and perseverance. Creativity refers to curiosity, ingenuity, and challenges tradition. Renzulli viewed giftedness as "a developmental set of behaviors that can be applied to problem-solving situations. Varying kinds and degrees of gifted behaviors can be developed and displayed in certain people, at certain times, and under certain circumstances" (Renzulli, 2012, p. 153).

Renzulli (1977, 1999) simultaneously developed the Enrichment Triad Model as a counterpart to the Three-ring Conception of Giftedness theory so they could be interactive. Renzulli (1999) explained that the Three-ring Conception of Giftedness theory provided the rationale for identification and the Enrichment Triad Model dealt with programming. The Enrichment Triad Model was a learning theory which "prescribes educational experiences that create conditions for stimulating interaction between and among the three rings" (Renzulli, 2011, p. 306).

Renzulli (1976, 1999; Renzulli & Reis, 2000) also developed the Schoolwide

Enrichment Model (SEM) which applied the Three-ring Conception of Giftedness theory directly to giftedness. Gifted identification in this model included above-average achievement, creativity, and motivation (Assouline et al., 2006; Reis & Colbert, 2004). Taking a group-administered ability test, such as the Cognitive Abilities Test (CoGAT), was a key step in the identification process as well as taking a nationally normed, grade-level achievement test (Assouline et al., 2006). A variation of SEM was the foundation for most of the gifted school programs in the U.S. (Assouline et al., 2006; Reis & Colbert, 2004). SEM is capable of identifying twice-exceptional – both gifted and learning disabled – students (Reis & Colbert, 2004) and provides a flexible pattern of sequence at different developmental stages (Van Tassel-Baska & Brown, 2007).

Renzulli (2012) later advocated that students be identified for a talent pool with multiple measures such as achievement tests, teacher and parent nominations, creativity, and task commitment. High achievement or IQ scores automatically place the student in the talent pool (Van Tassel-Baska & Brown, 2007). Then, the students receive varying levels of services. All students receive learning and interest assessments and their curriculum is compacted – previously mastered content is eliminated from the regular curriculum and alternative work is substituted. Then three types of "enrichment" are put in place depending on the student's level (Van Tassel-Baska & Brown, 2007). Type I is general exploratory experiences (Van Tassel-Baska & Brown, 2007) not in the traditional curriculum (Sternberg & Grigorenko, 2002). Type II is designed to develop "thinking, feeling, research, communication, and methodological processes" (Van Tassel-Baska & Brown, 2007, p. 346). Type III places the student in the role of a first-hand professional and takes the student as far as they can master (Van Tassel-Baska & Brown, 2007) such

as independent projects and creating new products (Sternberg & Grigorenko, 2002).

Sternberg and Grigorenko (2002) felt that the Triarchic Theory of Human Intelligence and SEM fit togther as SEM focuses on ability and the Triarchic Theory of Human Intelligence further describes what the ability looks like.

In summary, two theories related to giftedness were presented – Sternberg's Triarchic Theory of Human Intelligence and Renzulli's Three-ring Conception of Giftedness. In addition to other components, a key component in Renzulli's theory is intelligence, which is represented by the IQ score. Renzulli's SEM model is used for this study, as it most resembles the gifted programs in many school districts in the U.S.

Characteristics of Giftedness

Having presented a history of giftedness, evolution in the definitions of giftedness, definitional problems, and theories related to giftedness, the next section presents a discussion of the importance of understanding the specific characteristics unique to gifted persons.

Gifted individuals possess some characteristics that are easily recognizable from images presented in popular culture such as verbal precocity or extraordinary math skills (Colangelo & Wood, 2015b) as well as perfectionism (Maxwell, 2007; Peterson, 2009, 2015; Peterson et al., 2009). They may also have some attributes that are unique to the gifted population and could be misconstrued (Colangelo & Wood, 2015a). For instance, their precociousness allows them to comprehend complex situations along with their struggles and ramifications at a young age (Peterson, 2006). They are, however, not prepared to handle "world problems" such as social justice issues and war (Peterson, 2009).

Another quality is their asynchronous development, which refers to the uneven development between their mental, psychomotor, and affective skills (Bailey, 2011; Colangelo & Wood, 2015b; Greene 2006; Warne, 2016). If not recognized as a gifted attribute, educators and counselors may not recognize the depth to which a student understands a concept beyond their actual age. If they do, adults may erroneously expect the student to comprehend all concepts at that level. Other qualities that may be misinterpreted are intensity (Bailey, 2011; Colangelo & Wood, 2015b; Greene, 2006; Peterson 2006, 2009, 2015), drive (Peterson, 2006; Peterson et al., 2009), sensitivity (Bailey, 2011; Greene, 2006; Peterson, 2006; Peterson, et al., 2009), and overexcitability (Bailey, 2011; Peterson, 2015; Peterson, et al., 2009). Sensitivities may lead to intense responses to negative life events and situations (Peterson, 2009). Gifted students often possess a level of intensity uncomfortable for adults (Lovecky, 1986). This can be in many areas such as regulation of emotions, attention seeking (Colangelo & Wood, 2015b), motor activity (Colangelo & Wood, 2015b; Greene, 2006; Peterson, 2009, 2015), and intellectual stimulation (Peterson, 2009, 2015). Other characteristics cited by Maxwell (2007) are introspection, emotionality, and a fear of failure. Galbraith (1999) noted that gifted children: (a) learn easily and quickly, (b) are persistent, (c) ask a lot of questions, (d) are very curious, (e) have a good sense of humor, (f) dislike repetition, (g) are sensitive to others, (h) think logically and prefer things to make sense, and (i) are open to new, creative, radical ideas.

All of these characteristics can increase challenges related to personal, family, and school transitions and age appropriate developmental tasks (Peterson, 2015). Well-meaning adults may try to have the students decrease these behaviors rather than helping

them embrace and own them as qualities of whom they are. The message received by the student and corresponding response may be drastically different between the two approaches. Over time, students that often hear that they need to disown, in essence, a quality of whom they are may inaccurately conclude that something is wrong with them when, in fact, they are normal traits of a gifted person (Colangelo & Wood, 2015b; Peterson, 2009). Counselors and others may misinterpret the students' behaviors leading to the student feeling stressed, for example seeing the intensity of a gifted student's reaction as a lack of emotional regulation instead of seeing it as a quality of giftedness (Peterson, 2006).

Not only is there a need for understanding the characteristics of gifted children and adolescents, there is a need to understand them because these characteristics continue with them into adulthood. In a study of gifted adults, Lovecky (1986) found five traits causing conflict for gifted adults "divergency, excitability, sensitivity, perceptivity, and entelechy" (p. 572). Divergency speaks to the divergent thinking often associated with innovative achievers who can see different aspects and solutions to a problem. Divergent thinkers may encounter difficulties when group consensus is important. Excitability refers to a high energy level and ability to concentrate for long periods and do many things well along with the excitement of taking risks and rising to challenges. The negative side is the need for stimulation and novelty and corresponding lack of completion. Sensitivity refers to the depth of feeling the gifted person possesses. Deep attachments, thinking with their feelings, commitments to social causes, and rights of others are qualities associated with this trait. A difficulty of this trait may be the inability to comprehend that others do not feel as passionately as they do and may exhaust

themselves. Perceptivity is being able to see various aspects of a situation at the same time, see beyond the superficial layer of a person, and see quickly to the core of the situation. Perceptive adults are also skilled at seeing others' motivations and differences between a facade and genuine thoughts and feelings. Others, however, may find these deep insights unsettling and move away from a relationship with the adult. Entelechy means helping self-actualization in others almost magically through natural offerings of hope and motivation. They actualize deep feelings in a relationship. Unfortunately, many people want to be around them without reciprocating the relationship. The gifted adult needs to find ways to stay nurtured and maintain boundaries.

The following characteristics will be discussed: (a) learning, (b) learning rate, (c) multipotentiality, (d) perfectionism, (e) asynchronous development, and (f) sense of obligation.

Learning. Gifted students are thorough problem solvers, use a wide range of strategies, utilize metacognitive strategies, sustain attention to a problem more than their nongifted peers (Kettler, 2014), have an exceptional memory (Kettler, 2014; Walsh & Kemp, 2012), and efficient retrieval from their memory (Kettler, 2014). An appetite for learning, curiosity, and need for mental stimulation are other learning characteristics that can prove trying in a traditional classroom because of the level of instruction utilized to teach a wide range of cognitive levels in the classroom (Bailey, 2011).

Learning rate. Gifted persons learn quickly, especially abstract concepts, and do not need each step articulated for them (Bailey, 2011; Dai & Chen, 2013; Gagne, 2007; Kettler, 2014; Warne, 2016). They often make connections not obvious to others and may aggressively seek information about their areas of interest (Warne, 2016). They

need less homework practice before mastery of the material (Rogers, 2007; Van Tassel-Baska & Brown, 2007). They have an above average memory and change strategies rather than using trial and error when faced with a problem they are unable to solve. They need a quick pace, little practice and review, and learn from whole to part because that is how they store the concept in their memory. They need consistent challenge, depth, and complexity. Another key component of their learning is the teacher determining what they already know before beginning the instruction (Rogers, 2007).

Multipotentiality. Most gifted persons demonstrate this quality (Maxwell, 2007; Peterson et al., 2009). Multipotentiality refers to having several interests and being talented in many of them, thus having the opportunity for several career paths (Greene, 2006; Maxwell, 2007; Rinn & Bishop, 2015; Rysiew et al., 1999). The student's career interest assessments show little differentiation between interest patterns and occupations which may add to their inability to commit to a career direction (Kerr & Colangelo, 1988) or often leading to career indecision (Greene, 2006; Maxwell, 2007; Rysiew et al., 1999) such as changing majors, delaying decisions, or making them too early, referred to as foreclosing (Greene, 2006; Rysiew et al., 1999).

Perfectionism. Perfectionism may be positive or negative. Becoming a master in a field can be fulfilling. Fear of making a mistake and not trying new things, however, may result in avoiding decision-making or letting others make the decisions (Greene, 2006). Children may avoid challenging material if they have not been exposed to challenges (Walsh & Kemp, 2012). Perfectionism may also be an effort to feel in control of their situations or emotions (Peterson & Rischar, 2000). Friendships may suffer if the student is hypercritical of others (Cross & Cross, 2015).

Asynchronous development. The gifted student's cognitive development usually develops faster than their social and emotional development. This is termed asynchronous development (Peterson, 2006, 2009, 2015). Social relationships may suffer because of the high intellectual development or the interests of gifted persons compared to their same-age peers. Gifted children may miss opportunities to learn social skills because they may prefer focusing on intellectual or abstract activities instead of peer interactions or because same-age peers prefer playing with children who prefer concrete activities. Gifted students may need to be overtly taught social skills to use with their same-age peers as well as have experiences with other gifted students like themselves (Bailey, 2011; Cross & Cross, 2015).

Sense of obligation. Many gifted persons are often focused on fairness and justice (Bailey, 2011; Cooper, 2009; Gentry, 2006; Greene, 2006; Peterson, 2009). Many feel they have a mission (Greene, 2006) and a sense to fulfill their purpose (Green & Keys, 2001). Many gifted persons possess moral qualities of social fairness, compassion, and creativity that suggest careers that may be in conflict with more prestigious careers. They possess the intellect to pursue these prestigious careers, but the careers may not fulfill their personal calling (Greene, 2006). They may feel "the burden of feeling obligated to contribute their gifts to society" (Muratori & Smith, 2015, p. 177). They may seek a career for self-actualization and be quite value driven (Rysiew et al., 1999). Because they have so many options open to them, focusing on whom they want to be as a person and what causes they want to champion in their lives may be helpful (Greene, 2006).

Gifted persons possess unique characteristics that if unknown may be

misconstrued or pathologized. Six characteristics were discussed: (a) learning, (b) learning rate, (c) multipotentiality, (d) perfectionism, (e) asynchronous development, and (f) sense of obligation. These qualities have implications for counselors, which are discussed next.

Implications for Counselors

The unique traits of the gifted have implications for counselors in three specific areas: counseling, school, and career development and each will be discussed.

Counseling. Research showed mixed results for whether gifted individuals have fewer or more counseling needs than their nongifted peers (Bailey, 2011; Peterson, 2006). Peterson (2006) cited multiple studies showing that giftedness is an asset, studies showing no differences in gifted and nongifted persons, and studies showing giftedness as a burden. Regardless of which one is accurate, Peterson concluded that there are differences for gifted individuals of which counselors need to be aware as they work with them such as career indecision and that giftedness itself may be an underlying construct in interpersonal problems.

It is important for counselors to be aware (a) that gifted persons may experience life events differently than nongifted persons, (b) that gifted behaviors may be inappropriately labeled as pathology, and (c) of specific counseling issues for gifted persons. These are discussed next.

The gifted experience. Martin, Burns, and Schonlau (2010) found little research showing whether the gifted have more or less mental health concerns than the nongifted. When they do have a problem, their giftedness, however, had a substantial impact that must be taken into account. Gifted students go through the same development stages as

their peers; however, the experience may differ between the two groups because of the gifted characteristics mentioned earlier (Peterson, 2009). Foley-Nicpon and Assouline (2015) supported that gifted individuals do not necessarily have problems different from nongifted individuals; however, they may experience them differently due to their high intellect and intense emotions. Olszewski-Kubilius, Lee, and Thomson (2014) noted that gifted students are diverse and reflect a combination of factors such as "age, gender, domain of talent, degree of giftedness, and educational environments" (p. 200).

Specifically, Moon (2009) noted that gifted persons are similar to nongifted persons in their likelihood of experiencing anxiety, illness, substance abuse, and other life circumstances. Other examples are a move, change in school, divorce, parent unemployment, and siblings going to college (Peterson, 2015). It is not that gifted persons encounter different life events, but that they may experience them quite differently because of their giftedness (Peterson, 2009). For example, gifted persons, even though they may appear quite capable on the outside, may have difficulty expressing their emotions because of their asynchronous development (Peterson, 2015). An assumption is that gifted students do not need anything special (Assouline et al., 2006). Another myth is that gifted people do not have unique social or emotional needs (Bailey, 2011; Peterson, 2009). In fact, being gifted can be both positive and negative, depending on the individual (Peterson, 2009). Research is conflicting about whether being gifted is an asset or a burden. Explanations offered are the degree of their asynchronous development, differences in interests and abilities from their peers, and lack of fit with educational opportunities and programming (Lee et al., 2012).

Rinn and Bishop (2015) noted that gifted adults seek counseling for many of the

same concerns that are present during school age years such as "high sensitivity, emotional intensity, existential depression, perfectionism, multi-potentiality, relationship difficulties, suicidal ideation, and career counseling" (p. 228). Colangelo and Wood (2015b) also called attention to challenges gifted adults face that may appear in counseling practices outside of school. These include:

> (a) their identity as gifted people, including belonging to a culturally or sexually diverse group; (b) questioning how to apply their talents to a career path when they have been told they are "good at everything" or believing that they had early promise but now find that they lack direction; (c) working through issues tied to asynchronous development or responses stemming from their unique traits and characteristics; (d) wrestling with the impact of negative experiences with the K-12 and even higher education systems; or (e) grappling with mental health concerns, such as depression, anxiety, suicidality, and substance abuse. (p. 132)

Mislabeling behaviors as pathology. Understanding the psychology of gifted students helps correctly understand behaviors and design corresponding interventions (Olszewski-Kubilius et al., 2015) rather than inappropriately labeling the behaviors of the gifted person as pathology (Peterson, 2006, 2015). Counselors need to be aware of the unique characteristics of the gifted and consider this when working with them otherwise inappropriate interventions and diagnoses may actually hurt them (Cross & Cross, 2015). There is little in counseling textbooks about the characteristics and needs of gifted persons (Peterson, 2009). Therefore, counselors may not normalize a gifted client's feelings, thoughts, or behaviors or may even pathlogize them. Without an understanding

of giftedness, counselors may compare the person to the normal population and misdiagnosis their behaviors (Rinn & Bishop, 2015).

Peterson (2013) found that counselors presenting counseling lessons in a gifted classroom had not previously perceived that the gifted students would be as different from the traditional classes as they were. The counselors found that gifted characteristics could have been misdiagnosed. Cross and Cross (2015) agreed that counselors may do more harm than good if they are unaware of the social and emotional differences and characteristics of gifted students. They suggested looking at giftedness instead of automatically looking for pathology, for example whether depression could be the result of an inappropriate academic placement such as not being in a challenging curriculum.

It is important for all counselors to consider whether their client is gifted when they present with these concerns as it may add a new dimension to consider in their work with the client (Colangelo & Wood, 2015b). Without knowing the person is gifted, the interventions may be ineffective and the therapeutic relationship may suffer (Peterson, 2015).

Specific counseling issues. Gifted persons experience the world differently than their nongifted peers (Bailey, 2011) and counselors need to be aware of how the following issues may appear in counseling sessions: (a) anxiety, (b) underachievement, (c) high achievement, (d) depression, (e) friendship, (f) suicide, and (g) stress.

Anxiety. Gifted persons may have anxiety (Cross & Cross, 2015; Peterson 2009). Pleasing others by performing at a high level may contribute to anxiety even if the student has always been successful in other circumstances. They may also over schedule themselves. They are highly aware of their environment and may not be able to ignore

perceived threats to their success (Cross & Cross, 2015). Maxwell (2007) commented that "gifted students are at risk to underachieve, overextend, and succumb to personal and societal pressures. Gifted girls seem to be especially vulnerable" (p. 206). Gifted students have higher anxiety about career decisions, achievement, and social status than nongifted students do.

In addition, gifted students may become anxious when they recognize a problem because of their asynchronous development but cannot solve it. Their precociousness allows them to comprehend complex situations along with their struggles and ramifications, which may lead them to theoretical and existential questions that may leave them feeling overwhelmed (Peterson, 2006). Gifted students understand complex emotions at young ages but lack the resources to cope with them (Bailey, 2011). Social justice, natural disasters, and war may trouble them a lot (Peterson, 2006).

Underachievement. Somewhat ironically, gifted students may also suffer from underachievement where their actual academic performance is less than their ability (Peterson, 2009). If they have not been already identified as gifted, this may inhibit their likelihood to be identified, as teachers are unlikely to nominate them to the gifted program (McBee, 2010; Peterson, 2015). To overcome this, teachers need training on indicators of giftedness that we now know and ones that will be uncovered with future research (Subotnik et al., 2012).

Kaplan and Geoffroy (1993) stated that underachievement may be out of fear of failure or success, boredom, or social ramifications. Peterson and Colangelo (1996) found that underachievers had this pattern established by middle school and it did not improve in high school. They found that monitoring attendance and achievement

patterns in seventh grade to be critical. Peterson (2006) noted that classes where the material is new may cause the gifted student to question their abilities instead of realizing that the symbols and sounds are new and must be learned, such as in math, science, and foreign language classes. A low achievement level often becomes established by middle school (Peterson & Colangelo, 1996). Unfortunately, chronic underachievement may hurt the students' grades, college opportunities, success, and eventual career choices (Muratori & Smith, 2015).

It is important to look at various sources of low achievement. Assouline et al. (2006) stated that a student might be bored because the school environment is not challenging or perhaps the student is both gifted and disabled. Underachievement may be due to a learning disability (Foley-Nicpon & Assouline, 2015; McCoach & Siegel, 2003), ADHD, hearing impairment, or mental, physical, or emotional issue (McCoach & Siegle, 2003). Many believe that gifted students cannot have a learning disability. There is also a myth of global giftedness – all areas of a student are gifted. All talent areas of a gifted individual are likely not equally developed (Assouline et al., 2006; Bailey, 2011).

Many underachievers see no extrinsic much less intrinsic benefits to school. When students value academic goals, they become motivated to succeed which in turn develops their self-regulation skills (McCoach & Siegle, 2003). Linking the thinking world of school to the doing world of work may help underachievers see a connection between the two (Porfeli et al., 2008). Underachievers need appropriate career counseling just like their performing counterparts, but it may be overlooked because of their lower performance (Greene, 2006).

High achievement. Gifted students who are successful in their accelerated

academic work often appear to the adults in their lives as not having problems. They, however, encounter life problems and developmental stages as other students do. The difference is that they may not approach others, including teachers, when they have a problem. Peterson (2006) found that gifted persons are often hesitant to ask for help, perhaps from a desire to protect their image, not disappoint others, or a belief that they should know the answer. They somehow believe that, because they are academically gifted, they should be able to figure out their problems on their own (Cross & Cross, 2015; Gentry, 2006; Peterson, 2015). The student may also not seek help in order to avoid disappointing others (Peterson, 2015; Peterson et al., 2009). Even counselors may assume that these students do not have serious problems (Peterson, 2015). Confusion arises for adults when gifted students use drugs, do risky behaviors, or drop out of college (Peterson, 2009, 2015). Bailey (2011) suggested that proactive counseling interventions should be in place for gifted students for "understanding, acceptance, and validation that may enable students to address troublesome issues they may otherwise feel a need to conceal" (p. 219) even before they are needed. Kerr and Colangelo (1988) found that students were more likely to access counseling for help with career goals than personal issues. High achievers may also decide on their career early because they are uncomfortable with uncertainty.

A high achiever may pursue excellence; but, an unhealthy perfectionist is motivated by anxiety from fears of failure or not being good enough. Students may avoid challenges for fear of making a mistake (Cross & Cross, 2015). Gifted persons often have a fear of failure (Peterson, 2015; Walsh & Kemp, 2012) which may impact their career development by not developing the skills for a particular career or not partaking in

career activities (Muratori & Smith, 2015). They may also fear not living up to their potential. Some may stay in the role of a student where it is safe (Rysiew et al., 1999). High achievers need normalization of their humanness, intellect, and talents (Peterson, 2009).

Depression. Gifted students may be depressed (Peterson, 2009). Gifted students are not more likely than their nongifted peers to develop anxiety, depression, and suicidality; however, because of their other experiences related to giftedness, they may experience these disorders differently than the general population. For instance, they may feel high performance expectations from teachers and family, past success that demands future success, and rejection from their nongifted peers (Cross & Cross, 2015).

Some adolescents hide their depression wishing to protect others or avoid shame (Peterson et al., 2009). Cross and Cross (2015) noted that "being misunderstood, receiving mixed messages, and recognizing potential threats in the environment (to oneself or to others) while being helpless to address the problem—all these can lead to hopelessness and depression" (p. 167). In addition, they found that verbal giftedness may make a student's giftedness more overt and students may compensate by dumbing down their language. In contrast, thy found that the "math geeks" are not as vulnerable for isolation and that verbal students may need more support than originally thought. The lack of an intellectual environment that matched their gifted ability can be the source of depression. They noted acceleration for students or job/career change as options to find a better fit.

Friendship. Masten et al. (2008) noted that elementary school students' developmental tasks in addition to learning academic skills, are making relationships and

functioning in a group setting. A gifted student's cognitive development usually develops faster than their social and emotional development (aka asynchronous development) (Peterson, 2006, 2009, 2015). Peers may not understand this difference, especially if it is in emotional regulation, and may exclude the student from their group (Cross & Cross, 2015).

In addition, gifted students' communication skills may be difficult for their nongifted peers to understand. Gifted students usually develop language skills early with an advanced vocabulary and high articulateness (Lee et al., 2012). Gifted students' early verbal development leads to abstract thinking and questioning of values that their same-age peers do not ponder. Because of their critical thinking, they may also be perceived as more judgmental which is difficult for peers to understand or want to be around.

The difference in interests and abilities may be another source of friendship difficulties. Gifted students, especially adolescents, may perceive giftedness as an internal conflict of whether to own their intellect or compromise to fit into a social group. On the other hand, they may avoid social opportunities, work or play alone, or seek older children (Lee et al., 2012).

Lee et al. (2012) also noted that students grouped by age hinders gifted students' ability to meet peers with similar language skills, interests, and maturity. Programs that correct this mismatch have shown to have positive impact on social and academic development. They also found that students who were accelerated a grade in a subject demonstrated higher interpersonal skills than those who were not accelerated.

Suicide. Characteristics such as perfectionism and sensitivity (Delisle, 1986), stress (Peterson et al., 2009), and isolation (Kaiser & Berndt, 1985) may be factors in a

gifted student attempting suicide but do not necessarily imply an increased risk of suicide for gifted students (Cross & Cross, 2015). Although giftedness itself does not put a person more at-risk for suicide, there may be some factors that influence their decision (Delisle, 1986; Peterson, 2009). For instance, failure to a gifted student may be a "B" when their standard is perfection. Another factor may be the external pressure they feel to not let society or their parents, teachers, etc. down. Another factor may be the uneven development between academic and emotional and social areas of their life resulting in their not feeling like they fit in. Lastly, their understanding of adult and world problems but not being able to influence them can create hopelessness (Delisle, 1986).

Stress. In an 11-year longitudinal study of gifted students, Peterson et al. (2009) found the top five most stressful events cited by these gifted students upon completion of high school in order were (a) academics, (b) transitions, (c) college applications and decisions, (d) peer relationships, and (e) overcommitment and overinvolvement. They also found that parents viewed events differently from their children suggesting that parents may not notice that their gifted children are experiencing stress.

The developmental stage of the student may impact their reaction or interpretation of an event such as their sensitivity to a family move and stress from high expectations as well as level of involvement in extracurricular activities, academic loads, and a forthcoming college decision (Peterson, 2006). Some of the psychological intensities felt by a gifted student may exacerbate their academic load with advanced classwork and their transition to college (Greene, 2006).

Gifted students may overcommit or overextend themselves which may add extra stress to their lives (Bailey, 2011; Moon, 2009; Peterson, 2009; Peterson et al., 2009) and

may keep them from achieving their potential (Moon, 2009). They may feel related stress from high expectations from themselves and others (Peterson, 2009) like parental expectations (Peterson et al., 2009). They also can become frustrated when they encounter a problem that they cannot solve (Bailey, 2011; Moon, 2009). Gifted students may engage in interests more like adults and may feel pressure to conform to their peers but also feel the need to succeed academically (Greene, 2006).

Issues that may appear as topics in counseling were discussed above: (a) anxiety, (b) underachievement, (c) high achievement, (d) depression, (e) friendship, (f) suicide, and (g) stress. It is important for counselors to understand that these may present themselves differently in counseling and require specific interventions for gifted persons.

Schooling. In addition to understanding the unique characteristics and needs of gifted students in counseling, educational needs are a critical area for them as well. Students spend 12 or more years in the educational system. Colangelo and Wood (2015b) pointed out that, "gifted students face unique challenges tied directly to their giftedness that can manifest themselves within academic, personal/social, and career domains" (p. 132) that likely fall within the school day in the presence of teachers and school counselors.

The following needs at school were repeated in the literature and will be discussed: (a) programming needs, (b) academic challenge, (c) similar peers, and (d) environment match.

Programming needs. It is crucial that a gifted student's ability and instructional level match (Dai & Chen, 2013). A gifted program may be appropriate. Renzulli (2012) felt that gifted students require educational experiences beyond the traditional classroom,

as do Reis and Colbert (2004). The Marland Report (1972) stated similiarly, "these are children who require differentiated educational programs and services beyond those normally provided by the regular school program in order to realize their contributions to self and society" (p. 2). Other authors echoed this gifted need for "differentiated educational programs or services beyond the regular school offerings because they possess outstanding abilities" (Greene, 2006, p. 34), "require a differentiated education" (Colangelo & Wood, 2015b, p. 135), and need a specialized learning environment (Olszewski-Kubilius et al., 2015).

Assouline et al. (2006) noted that both of the two extremes, special education and gifted education, require educational adaptations for them to be successful. Makel and Putallaz (2012) suggested that the goal of traditional and gifted education should be the same for both groups, that is, "to ensure that all students receive the education appropriate for them at any given time by maximizing the match between individual students' educational experiences with their individual educational needs" (p. 200). Worrell et al. (2012) added to this by pointing out that this is the foundation for special education, that is, a free and appropriate public education.

Academic challenge. Peterson (2015) reported that inadequate academic challenge may be a problem for a gifted student that then impacts their emotional development which can then impact their learning. Peterson referred to the lack of academic challenge as the "invisible struggles of gifted youth" (p. 160). Unchallenging schoolwork makes students vulnerable (Peterson et al., 2009). Muratori and Smith (2015) advocated that the gifted must be academically challenged so that learning can be optimized. There is a risk that they believe that learning should come easy to them if

they do not face challenges early in their school years. When it does become difficult, they may interpret their performance as disappointing to others or even decide to no longer pursue that particular learning. Gifted students need to be challenged and to learn how to deal with mistakes and failure. Many of them are used to getting top grades with little effort. When they experience the uncharted waters of challenging courses, competition, or setbacks, this may influence their desire to try more difficult activities and courses as well as a decline in their self-esteem. They need guidance in viewing these times as opportunities for growth (Olszweski-Kubilius et al., 2015).

Moon (2009) noted that students may not develop tenacity when they have unchallenging learning environments. Students may learn to slide through school without much effort and then encounter stress and lack of confidence when they eventually have to work. Gentry (2006) noted that without challenges, gifted students do not learn critical skills such as how to struggle, persevere, and work hard. In elementary school, they are likely to become bored, frustrated, and unmotivated and not learn that effort is needed to learn (Moon, 2009).

For students that already know the material or master it quickly, school could become unchallenging. The National Excellence Report from the U.S. Department of Education (Office of Educational Research and Improvement, 1993) noted that gifted students need services outside of the regular school curriculum because many gifted students already know half to all of the material before it is taught to them. Gentry (2006) felt that focusing on weaknesses rather than developing talents is pervasive.

Cross and Cross (2015) noted that gifted students in an unchallenging environment not meeting their needs may disengage from their learning or even drop out

of school. Boredom is a concern for these students and acceleration may be part of the solution. Reis and Renzulli (2009) believed that gifted students need "appropriate levels of support, time, effort, and personal investments and choices" (p. 235). In essence, school needs to "differentiate their educational experience to accommodate his or her giftedness" (Warne, 2016, p. 7). Watters (2010) suggested implementing a tailored program for the student.

Similar peers. Students seek other students who are similar to them. This may be difficult for a gifted student. They may be different on a cognitive level and an emotional level than their same-age peers (Cross & Cross, 2015). Rinn and Bishop (2015) noted that gifted students need interaction with gifted peers during childhood and adolescence in order for gifted adults to reach their potential. Being in a gifted program gives gifted students an opportunity to be around other high intellect students (Assouline et al., 2006; Gallagher, 1992). One benefit of a gifted program or services is that gifted students are able to "interact with intellectual peers at a crucial time in their social, emotional, and career development, with cognitive strengths validated in the process" (Peterson, 2015, p. 157) as well as peers that prefer abstract versus concrete thinking (Cross & Cross, 2015).

Gifted adolescents in regular classes rated their classroom environment and self-concept higher when there were three to seven intellectually comparable classmates (Vogl & Preckel, 2014), but students in homogeneous gifted classes showed higher intrinsic desire to participate in and enjoy thinking (Vogl & Preckel, 2014).

Environment match. Educators have recognized that gifted children need more than the traditional curriculum and have differentiated their curriculum (Warne, 2016). For giftedness to develop fully it needs to be nurtured such as through gifted programs

(Subotnik et al., 2012). They pointed out that athletes receive coaching in their domain as well as psychological training such as "goal setting, along with behavioral, cognitive, and emotional control" (p. 180) in addition to "handling setbacks, adjusting anxiety levels for optimal performance, and imagining success" (p. 181). Gifted academic individuals may not, however, experience this in a traditional classroom. Learning opportunities outside of school and "the importance of teachers and mentors in providing the right kind of instruction and emotional support at different stages of talent development" (Olszewski-Kubilius et al., 2015, p. 145) are needed. Gifted students need to learn at their individual speed, pre-test out of work they already understand, study things that interest them beyond basic schoolwork, and work with ideas that challenge their high intellect. Gifted students benefit, both academically and socially, from learning in an environment with children like themselves. They can be challenged to learn new things rather than having to wait for their classmates to catch up (Galbraith, 1999).

In a study of resiliency in gifted children, Neihart (2002) found no evidence that gifted children have social or emotional vulnerabilities unique to them. When social and emotional problems do occur, they usually, however, reflect the mismatch of environment and gifted characteristics. Peterson (2009) supported this mismatch between ability and educational environment with corresponding social and emotional discomfort. One way to help meet these social and emotional needs is by meeting the academic needs of the gifted students by differentiated instruction, acceleration, and compacting (Colangelo & Wood, 2015b). The NAGC (2017a) provides the following definitions for these terms. Differentiated instruction is defined as "modifying curriculum and instruction according to content, pacing, and/or product to meet unique

student needs in the classroom." Acceleration is defined as "progressing through education at rates faster or ages younger than the norm. This can occur through grade skipping or subject acceleration." Compacting is defined as adjusting the "curriculum for students by determining which students already have mastered most or all of the learning outcomes and providing replacement instruction." Warne (2016) listed other methods including ability grouping, whole-grade acceleration, single subject acceleration, curriculum compacting, and honors courses (Warne, 2016). The NAGC (2017a) defined these terms as well. Ability grouping is defined as "when students of a similar ability or achievement level are placed in a class or group based on observed behavior or performance." Whole-grade acceleration is defined as skipping an entire grade whereas single subject acceleration is skipping a grade level in one subject.

Vogl and Preckel (2014) noted the instruction in a gifted program included presenting the traditional curriculum at a fast pace (acceleration) and in more depth (enrichment), compacted curriculum (omit content already known), interdisciplinary projects, and grade skipping or early entrance to school. Gagne (2007) insisted that curriculum should be dense, difficult, deep, and diverse. In their article on resilience, Masten et al. (2008) stated, "effective schools and teachers provide children on a daily basis with mastery experiences, opportunities to experience success and enjoy achievement that also serve to foster intrinsic motivation, self-efficacy, and persistence in the face of failure" (p. 78).

Just like gifted students, gifted adults often have problems at work when the environment does not meet the needs of their giftedness (Rinn & Bishop, 2015). Matching the challenge level for gifted persons to their school or work environment

increases the likelihood of positive peer relationships and fulfilment (Cross & Cross, 2015).

The results of Kim's (2016) meta-analysis on the impact of programs for gifted students showed a positive impact on both the academic and social emotional aspects of a gifted student. Middle school students' social emotional development was influenced the most. Kim found that the gifted programs provide challenging learning and social experience with gifted peers. Shepard (1992) found that gifted programs raised students' achievement.

Hertzog (2003) found that students felt benefits of participating in gifted programming were better preparation for college, learning how to study, and becoming lifelong learners as well as teaching them a work ethic to accomplish their goals, time management, how to complete difficult tasks, plus feeling successful. They specifically commented on working hard and overcoming challenges, such as difficult material, plus encouraging an interest in career possibilities.

In summary, proper programming, challenging academics, being around similar peers, and an environment matched to their abilities were discussed and were reported as critical for the appropriate schooling of gifted students.

Career development. In addition to the counseling and schooling aspects, career development is a key aspect for a gifted person and will be discussed.

There is a myth that gifted persons do not need help with career planning (Greene, 2006; Maxwell, 2007). In essence, they will know what to do just because they are very smart (Muratori & Smith, 2015); instead, they need intentional career interventions (Emmett & Minor, 1993; Greene, 2006). Maxwell (2007) felt that "for gifted individuals,

career and mental health development seem particularly entwined" (p. 209). Porfeli et al. (2008) concluded that "vocational learning and aspirations may be involved in a complex, dynamic relationship with an emerging sense of self that includes elements of sex, race, and social class" (p. 28). They listed supporting details for this statement: (a) 4-year-olds can tell the occupation by the gender of who normally has that job, (b) career choices are influenced by gender stereotypes starting in elementary school, (c) girls tend to move away from math and science and boys move away from jobs that have a female majority, and (d) the poor, African American, and Hispanic children seek less prestigious jobs (Hartung, Porfeli, & Vondracek, 2005; Watson & McMahon, 2005).

Next, a discussion of the need for intentional career development education and activities in elementary school as well as two specific career needs will be discussed. These areas of career development were repeated in the literature and are organized as follows: (a) lifespan, (b) early career development, (c) girls, and (d) career indecision.

Lifespan. Career development spans a lifetime (Greene, 2006; Muratori & Smith, 2005; Schultheiss, 2008) and gifted persons could benefit from counselors who are aware of the specific challenges a gifted person may encounter (Muratori & Smith, 2015). Watson and McMahon (2008) noted the need to include children's career development as part of the concept of career development over a lifespan. Schools need to be proactive in career interventions at key points in children's development. Stimulating curiosity about career in childhood leads to productive career exploration of multiple job opportunities and a realistic look toward their future. Otherwise, adolescents may make decisions about career too early, referred to as foreclosure (Hartung et al., 2008), especially minority adolescents (Porfeli et al., 2008).

Adaptability and serial occupations can be anticipated in a career lifespan (Hartung et al., 2008). Childhood is the foundation for developing skills that will be utilized as career decisions are made throughout a person's lifespan. Savickas (2002) believed that these skills include autonomy, self-esteem, curiosity, a future time orientation, and that these skills need to be in place by adolescence. Specifically, how students assimilate the information and experiences and move through these stages will determine their attitudes, beliefs, and competencies toward career. Gottfredson (1981, 1996) felt that children by ages 6-8 (1^{st}-3^{rd} grades) notice roles in society and transfer those to possible careers by selecting ones that match their gender. Children ages 9-13 (4^{th} – 8^{th} grades) have become aware of social status and are apt to choose prestigious jobs. Helwig's (2008) longitudinal study of second through twelfth grade students corroborated Feller's (2003) position that high schools should focus more on career assessment and career plans than on college admission.

Levinson and Ohler (2006) pointed out that programming is often not provided for the career needs of gifted students and students with special needs. Schultheiss (2008) noted that specific interventions should be used with students who have not meet career goals such as students with diablilities. Schultheiss suggested that the gifted are also a population that may need specific interventions or at least tailored group instruction at a level above the majority of the students and at an earlier age. A gifted program could be a likely place for this to happen as they could readily infuse career into their already accelerated curriculum.

Porfeli et al. (2008) eloquently summarized a successful career lifespan as:

a playful, fantasy-oriented child becomes a goal-directed adolescent who

> endeavors to remain in school, explore the world of work, define an occupational calling, develop a sense of vocational self, and secure a career that satisfies and is congruent with contextual opportunities and pressures such as parental desires and community expectations. (p. 32)

Early career development. Career education needs to occur in elementary school where students learn their strengths and interests and are exposed to a wide range of possible careers (Rysiew et al., 1999). Schultheiss (2008) agreed that programs to help elementary students see the connection between school learning and their eventual world of work are important to learning, now and in the future, and important in transitions during school and to the world of work. Career interventions are critical in elementary school (Watson & McMahon, 2008) so that children may develop a positive view of the world of work (Porfeli et al., 2008) and that this early intervention would reinforce the relationship between school and work (Watson & McMahon, 2008).

Gifted children may make some career decisions very early because of their advanced reasoning abilities. These decisions include which career choices to exclude because they do not match with the child's self-concept, gender, or social status as well as which career choices are perceived as inaccessible because of lack of money or family expections (Muratori & Smith, 2015). Matthews and Foster (2005) agreed that gifted students think about their career early and it may be demonstrated in obsessively focusing on one topic. Watters (2010) emphasized the need for specific career curriculum for young gifted students to help keep their perspective broad and develop their views of career. Muratori and Smith (2015) noted that the expectation of high profile careers develop early and students may feel pressure from parents and others to decide before

they learn about different options. The implicit or explicit message is that because they have certain abilities, they should pursue a corresponding career because it is financially lucrative or expected to be in high demand. Maxwell (2007) agreed that gifted students need to be exposed to career activities younger than they typically are. Maxwell also suggested that discussions surrounding giftedness and what it means to them as well as discussions about expectations of others would be helpful in the career development process.

Greene (2006) concluded that counselors should adjust "the timing, pace, complexity, and intensity of career activities" (p. 38) to match the advanced cognitive abilities and characteristics of gifted students. An aptitude test is helpful to match the pace and curriculm level of a gifted student (Assouline et al., 2006). Peterson (2009) supported career impasse (when no progress seems possible) and that children need much earlier career development attention. Schultheiss (2008) noted that career development can be included in all content areas including social studies, math, science, language arts, health, and technology.

This concludes the discussion of the need for intentional career development education and activities in elementary school and two specific career needs will be discussed: girls and career indecision.

Girls. Girls' relationships with career are different that boys' relationships with career. Gifted girls are at-risk for underachievement in adolescence which is the opposite of their performance in elementary school (Greene, 2006; Maxwell, 2007). Girls may begin making choices about acceptable career goals based on gender as early as age 6. Gifted girls may attribute their academic success to luck rather than ability. Girls often

stop taking math and science classes in grade 7 when they become optional (Greene, 2006). In addition, gifted female students seemed more uncertain about their career plans and goals then gifted male students (Kerr & Colangelo, 1988). Gifted women often lowered their career goals in an effort to balance having a family and a career and needed help sorting out their decisions (Olszewski-Kubilius et al., 2015).

During middle school, when students are defining their identity, girls may hide their giftedness in a trade for social acceptance by peers (Galbraith, 1999; Peterson, 2009). They may no longer demonstrate their abilities in order to fit into the social structure of middle school (Greene, 2006; Maxwell, 2007). Girls may decide to give into the pressure of stereotypes by lowering their standardized test scores, not pursuing certain careers, and not taking challenging classes (Moon, 2009). Adolescent girls lost academic status which continued through high school (Lee et al., 2012).

Having interactions with peers who are accepting of the student is essential in developing a positive self-concept and a sense of connection, which are both important in developing a career identity (Maxwell, 2007). Kaufmann, Harrel, Milam, Woolverton, and Miller (1986) noted that, when women had mentors, women demonstrated career achievement similar to males. Maxwell (2007) also suggested interventions such as cinematherapy and bibliotherapy where students see characters who do not succeed and how it can have an important role in the character's development. Kerr and Colangelo (1988) found that, as female academic abilities rose from the 80th percentile to the 95th percentile to the 99th percentile on the ACT, the more their choices were similar to male choices in majors, extracuricular activites, and services.

Career indecision. Emmett and Minor (1993) found five clusters for gifted

adolescents that influenced making career decisions: "(a) sensitivity to others' expectations, (b), perfectionism, (c) developmental issues, (d) superior intelligence, and (e) multipotentiality" (p. 350). Sensitivity to the expectations of others often breeds fear of failure or choosing a career that others endorse instead of the one the student wants. Perfectionism may cause a student to delay making a decision for fear of it not being perfect (Emmett & Minor, 1993). Perfectionism may impact a gifted person's career development. A positive impact would be its influence on achieving at a high level whereas a negative impact would be never being satisfied with one's performance (Greene, 2006). A gifted student may feel there is a "perfect" career for them and seek to find only that (Rysiew et al., 1999).

Gifted individuals may have several interests and be talented in all of them, thus having the opportunity for several career paths—referred to as multipotentiality. This may also, however, lead to indecision because of the plethora of choices (Greene, 2006; Maxwell, 2007; Rinn & Bishop, 2015; Rysiew et al., 1999). Multipotentiality is at the root of many career indecisions and may foster keeping options open (Emmett & Minor, 1993). Some gifted individuals may inadvertently put off decisions long enough that only one choice remains (Muratori & Smith, 2015). ASCA (2013) noted that gifted individuals have unique needs related to academics, college, and career preparation. For instance, college or career indecision may grow from a sense of loss that goes with giving up past interests to pursue others (Greene, 2006; Maxwell, 2007; Peterson, 2015).

In contrast, gifted children may make career decisions prematurely (Kerr & Colangelo, 1988; Peterson, 2009) and many foreclose on career decisions early (Greene, 2006). They may concentrate on one area too early and not explore others. This could

also lead to avoiding other topics for fear of failure.

Gifted persons would benefit from working with a counselor to create and consider various career choices (Muratori & Smith, 2015) so that their indecsion does not delay meeting their potential (Jung, 2012). Emmett and Minor (1993) suggested reinforcing students for whom they are, instead of what they may accomplish. In addition, they suggest viewing career decision making as an ongoing process over a lifetime instead of a one-time choice, exposing them to a wide range of careers, and training in decision making to help them sort out their many interests. Role models and mentors (Greene, 2006; Watters, 2010), job shadowing, and talking to adults about their career (Muratori & Smith, 2015) were suggestions to expand a student's career interest.

Muratori and Smith (2015) pointed out that gifted individuals will have career needs beyond merely deciding which college to attend. College itself is filled with developmental potholes such as homesickness, changing boundaries, academic expectations, and a new social setting. It can also be a time of discovering new topics and interests which may reopen career decisions for which a counselor can help.

In summary, a lifespan focus, early career development, girls, and career indecision must be considered in a gifted person's career development.

This concludes the section on how the unique traits of the gifted have implications for counselors in three arenas: counseling, school, and career development. The importance of counselors being aware of how gifted persons experience life events, the potential to label gifted behaviors as pathology, and issues that may appear as topics in counseling and require specific interventions if the person is gifted were discussed: (a) anxiety, (b) underachievement, (c) high achievement, (d) depression, (e) friendship, (f)

suicide, and (g) stress. Next, the critical educational needs of (a) proper programming, (b) challenging academics, (c) being around similar peers, and (d) an environment matched to their abilities were discussed. Last, four areas of career development that must be considered were discussed: (a) lifespan, (b) early career development, (c) girls, and (d) career indecision. In summary, counselors need to be aware of and make others aware of a gifted person's needs and how they may appear in counseling sessions, at school, and in their career.

Early Identification

Having discussed the characteristics of giftedness and the implications for counselors in counseling, school, and career development, this section discusses the need for identifying the gifted early.

Gifted students are usually identified in elementary school (Colangelo & Wood, 2015b). Subotnik et al. (2012) advocated for early identification so that the appropriate level of supports can be put in place as early as possible and maintained or accelerated as needed. They proposed that the identification process should be "continuous, systematic, and ongoing" (p. 185). Renzulli (2012) felt that experiences for gifted students should begin at early ages and focus on hands-on activities. Reis and Renzulli (2009) noted that "continuous academic progress depends on strong academic preparation, especially at early ages when brain development progresses at a rapid pace" (p. 234). Gallagher (1992) suggested that gifted students could participate in gifted programs prior to elementary school. Reis and Colbert (2004) recommended that students be identified before middle or high school.

It is important to identify gifted students as early as possible. As discussed

previously, because elementary school career intervention is critical to successful career development across an individual's lifespan, this must be in place even earlier for gifted children because of their asynchronous development. Jung (2012) noted that career education and gifted education needs to start young.

In addition to the above reasons, two key reasons to identify gifted persons early are so that they can assure a proper educational fit and learn to self-advocate.

Educational fit. As discussed in the previous section, an educational fit matching the student's ability and the school environment is critical. The earlier this match is made, the more likely the student will thrive in their education. In their study of first and second grade gifted students, Kroesbergen et al. (2016) found that gifted students did not differ from their comparison group of nongifted students, except for those scoring high in creativity. They suggested that the educational environment might need to be adjusted to these students for a better fit and they advocated for early identification. Masten et al. (2008) also advocated for intervening before problems spread and utilizing interventions to focus on the student's strengths.

Moon (2009) succinctly stated that, "first, and most important, high-ability students need an appropriately challenging and supportive educational environment where the instruction is within their zone of proximal development – neither too easy, nor too hard" (p. 276). Gagne (2007) stated that, the longer that the educational environment and student's abilities are mismatched, increased boredom may set in resulting in a decreased motivation to learn, development of lazy habits, avoiding challenges and failures, and lack of the development of solid study habits. Betts (1986) noted that gifted students, "must have an opportunity to be together, not just for activities and classes that

help them meet their cognitive needs but for time to develop emotionally and socially" (p. 588).

Certainly, the match needs to be made before middle school, especially for girls (Olszewski-Kubilius et al., 2015). Otherwise, students may choose to abandon or downplay their ability to fit in with their peers and feel that they belong (Cross & Cross, 2015). Girls, especially, often abandon their math abilities in middle school so that they may maintain their popularity status. They no longer value and show their math ability. In fact, they may do the opposite. When a girl recognizes her math abilities earlier, like elementary school, and has appropriate role models and peers surrounding her, she is more likely to openly demonstrate her math ability past middle school.

Early identification is important so that skills may be taught and practiced. Worrell et al. (2012) noted that psychological strength training is as important as academic content; yet, it is often left to chance. Skills such as targeted risk taking, coping with challenges, handling criticism, being competitive or managing it, motivation level, and tenacity need to be overtly taught and practiced. Greene (2006) noted that gifted students experience conflicts from their incongruities in abilities, interests, and relationships earlier than their peers and this may have a substantial impact on their lifespan development.

Interventions and supports can be put in place early to help children flourish (VanDerHeyden & Snyder, 2006). Although they were talking about preschool (birth through age 5), the concepts can be continued on into elementary school. Specifically, they focused on prevention and universal screening to identify children who might need special education. They described the response to intervention (RTI) model that is based

on an individual child's needs. Children who are not making adequate academic progress with extra interventions in place are considered for extra services through special education. In essence, this child would need more intensive supports than even a child without a disability would. "Child-environment fit is evaluated, and where there is a lack of fit, interventions are implemented to alter the environment or the child's capacity to interact with environmental demands" (p. 525). Just as these early childhood educators used early intervention to concentrate on identifying children with disabilities as early as possible, so could elementary educators search for children with giftedness by asking the question, "Is the right child getting the right intervention at the right level of intensity?" (p. 530).

Because schools have experience with a large number of children, they are in a position to identify and take action to promote children's development such as identifying early risk factors for success. Although Masten et al. (2008) were discussing screening for school readiness and then intervening with preschool enrichment or treatment programs, a similar screening and intervening could be used with gifted students as well.

Keeping students engaged in their learning is an example of an early intervention (Masten et al., 2008). Young children need to feel there are many opportunities to learn and to be exposed to a wide variety of experiences. Here they build confidence to engage in their learning and embrace taking risks (Olszweski-Kubilius et al., 2015).

Self-advocate. Another reason to identify gifted students early is so that they may learn to self-advocate. Once they are aware they are gifted, they are able to learn what it means to them to be gifted. They can learn what gifted characteristics they possess and begin to normalize them rather than viewing them as a problem. They can

embrace their unique qualities and seek to find places to use them instead of trying to down play them. Another reason for early identification is to empower students so they have more time to learn what it means to be gifted and hence learn to self-advocate for what they need to be successful (Galbraith, 1999). Betts (1986) noted that gifted students in the 14-day residential program for gifted students, sought out learning about themselves, their problems, and relationships with others – gifted and nongifted.

In summary, gifted persons should be identified early especially to have a proper educational fit and learn self-advocacy skills.

Identification Process

In order to identify gifted students and to further the understanding of this study, it is important to understand the identification process.

Students are nominated by their teacher or parents to see if they meet the qualifications for a gifted program (McBee, 2010). Finch, Neumeister, Burney, and Cook (2014) found that aptitude tests were better locators of young gifted children than academic benchmarking assessments such as the Dynamic Indicators of Basic Literacy Skills (DIBELS). Teachers who solely use the data from common benchmark measures may omit students who are not yet scoring high on these measures. Looking for patterns may be more helpful than classroom benchmark scores. In addition, training for teachers to identify gifted students other than from assessment data is needed (Finch et al., 2014).

Teachers may receive training in characteristics of gifted students from their school district; however, teachers often receive this training once and may need a refresher or an update on current gifted research especially as more is learned about identifying economically disadvantaged and underrepresented groups. Teachers may not

be trained to identify gifted students (Acar et al., 2016). Peterson (2015) suggested being observant in day-to-day interactions for "evidence of a nimble mind, a sophisticated sense of humor, precise language, nuanced understanding, or impressive insights" (p. 156). Although referring to ethnic minorities, De Barona and Barona (2006) noted that educators need "to become familiar with the unique characteristics and experiences of their students in order for them to have an impact on the students' education success" (p. 4), otherwise they may use their views "to incorrectly interpret children's behaviors and approaches to learning" (p. 4).

Parents usually hear about the gifted program from the school, friends, or neighbors as well as having one of their children who seems different from their siblings in how they learn, problem solve, or their level of creativity. Some counselors make an extra effort to identify students that should be nominated to the gifted program. Unfortunately, school counselors have large caseloads (Green & Keys, 2001; Whiston, 2002), juggle many responsibilities (Green & Keys, 2001; Hughey, 2001), and may rely solely on teachers to nominate students. If a parent, teacher, or counselor does not nominate a student, the student may never be identified as gifted.

Next, two areas will be discussed: (a) current methods of identifying gifted students and (b) barriers to such identification.

Current methods of identifying gifted students. The National Association for Gifted Children (2015) found that multiple criteria is the majority method used to identify gifted students (19 states) comprised of IQ tests, achievement data, nominations, state-approved assessments, and portfolios (Acar et al., 2016). Peterson and Colangelo (1996) described the participants in their study. They had been identified as gifted in their

school district by qualifying on two of four measures. These included: (a) WISC-R IQ score of 130+, (b) Otis-Lennon School Abilitiy Test of 132+, (c) Stanford Achievement Test at 95th+ percentile, and (d) one subtest score on the Stanford Achievement Test at 98th+ percentile.

The nomination process, however, is more qualitative than quantitative. If gifted qualities are observed, a teacher or parent usually seeks consultation from the counselor to factor in the data the school may have on the student. Gentry (2006) felt that interpreting student records along with cognitive, aptitude, and achievement tests fall within the scope of a school counselor especially for individual student-learning growth. An older student will have more data than a younger student will have. Even though the data are quantitative in nature, the review of it is still somewhat subjective. The counselor will look for very high scores and also for any trends (Peterson, 2015). Experience gives the counselor better skills at interpreting the data and concluding whether the student should be nominated for the gifted program. If a formula that would estimate IQ scores existed such as one from data already collected by the school, the counselor would have better information to share with the parent or teacher for one student. If the equation were consistently applied to all students, the teacher and parent would know that the student had already been considered for nomination to the gifted program and would continue to be considered in the future as new data became available. Acar et al. (2016) noted the importance of basing the critical decision of who qualifies for a gifted program on empirical evidence.

Barriers to identifying gifted students. There is concern that all truly gifted students may not be identified so that they may benefit from inclusion in the school's

gifted program (Acar et al., 2016). Some students are not identified for gifted programs because schools may only look at academic data and may overlook underachieving students (Greene, 2006). In addition, 41% of the 64 gifted experts responding in Pfeiffer's (2003) study had concerns about the identification process including students who are gifted, but do not meet the cut-off scores. Peterson (2015) noted that students with disruptive behaviors or lack of classroom participation are not perceived as being gifted and thus generally not nominated to the gifted program.

There are myths about the gifted that contribute to them not being nominated. Such myths include: (a) no needs and (b) unequal opportunity.

No needs. One myth is that the very nature of being gifted means they do not have problems (Bailey, 2011; Moon, 2009). Also, some teachers may not nominate from a philosophical view that students do not need to participate in a gifted program. They may presume that gifted children will be successful academically in any school environment. In fact, all children need to be challenged at school, including the gifted. (Subotnik et al., 2012). Potential gifted students may not be nominated because adults may think they do not need anything beyond a traditional class because they are smart. Gifted students in traditional educational settings may not appear to have any problems because they are at grade level when they actually may be developing poor motivational habits and beliefs that will impact their future resilience (Moon, 2009).

Unequal opportunity. Another myth is that it is discriminatory to provide special programming to some but not all students. Callahan (2009) noted that there could be a "winner and loser" perception – the belief that an individual's need is less important than equal opportunity for all students. This is, however, a confusion between equity and

sameness (Muratori & Smith, 2015). Cooper (2009) eloquently explained the fallacy that fair means equal. Even though there is a classroom of students, each student is an individual learner and deserves to have instruction at his or her learning level and pace. Some people believe that using approaches and curriculum appropriate for high ability students is elitist. In essence, they believe that all children should be taught the same way. An alternative would be to "elevate *each* student to the level of his or her maximum ability" (p. 284) otherwise gifted learners will fall short of reaching their potential.

In summary, understanding the current methods of identifying gifted students and barriers to identifying gifted students contribute to an understanding of the identification process.

Role of the School Counselor

Having discussed the need for early identification and the identification process, this section will discuss the role of the school counselor in the identification of gifted students.

In their review of ASCA's National Model, Stevens and Wilkerson (2010) noted that a school counseling program should be "sensitive to the unique needs of the populations it serves" (p. 230). School counselors are in a position to help identify potential gifted students (Reis & Colbert, 2004). The ASCA model instructs school counselors to meet the needs of all students, including the gifted, using advocacy, leadership, collaboration, and systemic change (American School Counselor Association, 2012; Greene 2006). Gentry (2006) stated that gifted services are in the continuum of school counselor service. Galassi and Akos (2004) noted that school counselors are responsible for promoting the "optimal development of all students" (p. 155). Counselors

are now more preventative than reactive (Green & Keys, 2001). Clark and Breman (2009) pointed out that the ASCA National Model (2012) stresses that all students should be successful in school.

Gentry (2006) recommended that school counselors help "meet the needs of students already identified as gifted, and equally important, students, who with appropriate educational opportunities, might emerge as gifted" (p. 73). Peterson (2006) felt that large numbers of students may not be identified who would benefit from appropriate programming. In essence, the school counselor could use a similar process to look for gifted students just as the counselor would look for students who might need special education services or other students in need. One could think of it as it relates to a normal distribution curve. The students needing special education services are at one end of the curve and students needing gifted services at the other end (Milsom & Peterson, 2006; Peterson, 2006, 2015) two standard deviations above the mean IQ score (Borland, 2009; Gagne, 2007). Students at both ends of the curve have difficulty learning without nondifferentiated curricula and the "tempo, content, vocabulary level, level of abstraction, encouragement of critical thinking" (p. 43) may frustrate the student.

Two specific roles for the school counselor are (a) advocacy and (b) action research.

Advocacy. ASCA (2013) stated that school counselors should help address the needs of gifted students in their programming, advocacy, and collaboration with staff and families. ASCA (2013) specifically urged school counselors to increase awareness of gifted students' attributes and needs. Colangelo and Wood (2015b) even urged counselor training programs to require a class in gifted education or at least include gifted topics in

other classes like theories in order to expose counselors to the needs of gifted persons.

Olszewski-Kubilius et al. (2015) encouraged counselors to advocate for special programming to help gifted student support their abilities. Maxwell (2007) noted that counselors need to advocate for extra support to meet gifted students' needs, as well as programs to connect gifted students and for intentional interventions for girls. Muratori and Smith (2015) encouraged counselors not only to counsel their gifted clients but to also advocate with all others to educate them about the needs of the gifted, how their career is impacted, and remove any barriers standing in the way of their career development.

McMahon, Mason, Daluga-Guenther, and Ruiz (2014) described at length the expanded role of school counselors "toward collaboration, advocacy, leadership, and systemic change to promote academic success for all students" (p. 459) and to "use data to identify and address the inequities within the school system" (p. 460). DeBarona and Barona (2006) also advocated for systemic change and Dahir (2009) and Brigman (2006) supported data-driven action research. ASCA's National Model (2012) pushed counselors to use data to make decisions, especially which interventions to use (Brigman, 2006).

Action research. Guiffrida et al. (2011) noted that practitioners often feel research does not apply to them because they are "not conducted in real-world settings" (p. 282) and often avoid conducting their own research (Bauman, 2002). Crockett, Byrd and Erford (2014) called for more practitioner articles and action research on career development. Falco et al. (2011) suggested that practitioners conduct research to add to the professional literature. Rowell (2005) also noted that a benefit of action research is

that it bridges the gap between research and counseling practice, allows the practitioner to fill the void of practitioner research, and strengthens the link between theory and practice. Action research uses a scientific approach to improve educational methods.

ASCA has encouraged action research so that practicing counselors conduct research to improve policies and practices that address their specific needs (Dahir & Stone, 2009). Practitioners can use a quantitative study to influence school improvement, specifically their day-to-day practice. They described action research as "an organized way for school counselors to explore a school-based problem, develop a possible course of action, and monitor progress and results" (p. 14) and as "a commitment on the part of the school counselors to fully participate in school improvement, take initiative as leaders and social advocates to use data to inform programs and strategies, and seek to continuously improve practice" (p. 16). They continued by stating, "where increased academic performance for all students is the mandate goal, school counselors must take this next powerful step and become routine users of data to inform and sharpen their focus" (p. 18). In their 10-year review of the *Journal of Counseling & Development,* Ray et al. (2011) found research using data-driven methods to determine which counseling interventions were effective and emphasized that counselors should look at research to determine which interventions were more appropriate to use.

Rowell (2005) reported that the goal of action research is to improve practice and suggested that action research for a school counselor must be a part of the school counseling program and within the counselor's scope of influence. Rowell (2005) concluded that counselors "must take responsibility for generating new knowledge within their field, put their knowledge to the test of critical review and reflection, and base their

actions to strengthen their practice on carefully thought-through inquiry" (p. 33).

Guiffrida et al. (2011) noted that action research focuses on concerns detected by the practitioner, rather than an academic researcher, and wanted to use the results to impact the concerns by informing or changing them. They noted that it is, "the practitioners themselves who formulate these questions to improve their own practice and/or to earn their doctorates" (p. 283). One of the three categories that Whiston (1996) listed as practitioners' questions is, "How can we enhance what we are already doing?" (p. 284). Guiffrida et al. (2011) suggested that the focus of an action research study be narrow enough to enable it to be completed within the timeframe and with the resources that are available. In essence, the study "needs to be based on a combination of what is needed to more effectively serve clients, is of interest to the researchers, and is reasonable to investigate given the available context and resources" (Guiffrida et al., 2011, p. 284).

Researchers need to be aware of some limitations of action research. Whiston (1996) pointed out that action researchers need to be careful of dual roles and confidentiality. In addition, researchers need to be careful to not shape their interpretations of the results because of their own biases. Brigman (2006) not only advocated for action research but also that it may be generalizable to other school settings.

In summary, the school counselor may have a substantial impact on identifying gifted students through advocacy and action research.

Prior Studies

Prior studies and variables found during the literature review that are relevant to this study are discussed next.

Prior studies of the gifted student selection process. Gifted experts in Pfeiffer's (2003) study stated that there is a need to develop instruments to recognize early who might be gifted and that "algebraic equations that combine various diagnostic indicators might improve identification accuracy" (p. 165). Some studies used regression analysis to estimate a dependent variable but none were using the WASI, which was used in this study. Ware and Galassi (2006) explained how to set up regression analysis to estimate achievement scores using Excel. Their study is the closest one found to this study. Regression analysis and Excel were used to estimate achievement scores, not IQ scores which is the focus of this current study.

For the development of their study on underachieving gifted students, Peterson and Colangelo (1996) reviewed students cumulative files for the "wealth of pertinent information" (p. 399) and stated that "counselors have ready access to these data, which, even in early school years, might show events or patterns that would be important clues to difficulties that are not yet obvious in classroom behavior" (p. 399), advocating this information should be used to identify students early for prevention instead of remediation.

Variables. Variables identified in the literature include: (a) assessment data variables, (b) demographic variables, and (c) other variables.

Assessment data variables. In their study estimating achievement scores, Ware and Galassi (2006) used achievement scores, gender, ethnicity, and number of Parent Teacher Association (PTA) meetings attended as variables. Luck and Webb (2009) conducted action research to determine if a specific intervention would improve the statewide standardized test scores for grades 4 and 5. Variables included were student

number, grade, race, gender, number of sessions attended, and achievement level pre and post the interventions. Although their study was not trying to estimate test scores, some of the variables were consistent with this study.

Stanley's (1977) study of high mathematics students found that specific abilities, such as the SAT math or verbal subtests, and specific patterns, such as higher scores in one area, along with students' interests, could help identify which middle school students were likely to choose what field of study and related educational and occupational outcomes.

Assouline et al. (2006) discussed a gifted program where the Iowa Tests of Basic Skills (ITBS) results were used to determine whether to administer a CoGAT. The CoGAT results were then used to determine eligibility for gifted education classes. Assouline et al. (2006) noted that gifted students may be under identified if only group-administered tests such as the CoGAT are used because the composite score may be deflated. Reviewing subtest scores looking for students with extremely high scores in one area and average scores in other areas was suggested.

Peterson and Colangelo (1996) described the participants in their study who had been identified as gifted in their school district by qualifying on two of four measures. These included: (a) WISC-R IQ score of 130+, (b) Otis-Lennon School Ability Test composite score of 132+, (c) Stanford Achievement Test composite score at 95th+ percentile, and (d) one subtest score on the Stanford Achievement Test at 98th+ percentile in the areas of vocabulary, reading, number concepts, science, social studies, or language. This is quite similar to the identification method used in the school district for the participants in this study.

Demographic variables. School level of the student may be relevant as high school teachers listed different characteristics that led to a gifted nomination than the characteristics listed by elementary teachers (Hernandez-Torrano, Prieto, Ferrandiz, Bermejo, & Sainz, 2013).

Huang (2015) specifically studied birthdate effects on kindergarten students. Huang found that the older children in that specific grade had slightly higher achievement test scores which was associated with being selected for the gifted program, not just being older. Age, however, was not statistically significant in Acar et al.'s (2016) meta-analysis of 35 quantitative studies using both performance instruments and nonperformance instruments and variables to identify gifted students.

Greene (2006) noted that life roles are intertwined with career and that variables "such as race, gender, socioeconomic status, disability, sexual orientation, values, and interests influence careers" (p. 39). Acar et al. (2016) also found that nonperformance methods increased the pool of gifted students by 39% which supported using multiple criteria for identification. They laid out a tiered identification method depending on the district's program being offered. Whiston, Tai, Rahardja, and Eder (2011) noted variables of level in school (elementary, middle school, high school, mixed ages, home schooled), mean age, gender, ethnicity, GPA, achievement test scores, knowledge assessments, attendance, physical altercations, disciplinary referrals, peer counseling skills, problem solving, social skills, self-esteem, anxiety, and depression. Rinn and Bishop (2015) cited research showing that gifted students come from families consisting of: no or one sibling, educated parents, at least one gifted parent, abundance of books and magazines at home, and high socioeconomic status.

Other variables. Acar et al. (2016) found that teacher rating scales were more consistent with performance measures than teacher or parent nominations. Their study concluded that performance and nonperformance indicators should both be used in the identification process. Teacher nominations were statistically significant in the Acar et al. (2016) meta-analysis. Teacher nominations were not, however, always reliable (Walsh & Kemp, 2012) and may be biased against females (Hernandez-Torrano et al., 2013).

Acar et al. (2016) included three moderators: (a) grade level of student, (b) nomination source, and (c) assessments (IQ, aptitude, achievement, and creativity). They excluded gender, ethnicity, socioeconomic status, and verbal vs. nonverbal test.

In summary, no studies like this study were found in the literature review; however, one study stated a need for instruments to identify the gifted early as well as an equation to help identify gifted students. Prior studies and variables found during the literature review that are relevant to this study were discussed. The independent variables were categorized into: (a) assessment data variables, (b) demographic variables, and (c) other variables.

This Study

In this section, the variables are discussed for their impact and inclusion as the variables selected for this study. In addition, reviews of the three instruments utilized in this study are presented.

Variables. For this study, the dependent, or estimated, variable is the individually-administered full scale IQ score on the WASI. The selection of the independent variables is based on the theory and research discussed earlier in this

literature review as well as the information available to an elementary school counselor in the district in this study.

As discussed earlier, Stanley (1977) found a relationship between the Scholastic Aptitude Test (SAT) subtests with high school students' choice of occupations. The students in this study are elementary students and thus not old enough to have SAT scores. Instead, the SAT10 subtest scores were used. Assouline et al. (2006) discussed using the Iowa Tests of Basic Skills (ITBS) to determine whether to administer the Cognitive Abilities Test (CoGAT) to determine eligibility for gifted education classes. The SAT10 (which is similar to the ITBS) and the OLSAT8 (which is similar to the CoGAT) were used in this study.

Next, grade level of the student may be relevant as high school teachers listed different characteristics that led to a gifted nomination than the characteristics listed by elementary teachers (Hernandez-Torrano et al., 2013). Although this study only included elementary students, the student's grade was included to see if it has an impact in the elementary school years. In addition, Huang (2015) studied birthdate effects on kindergarten students and found that the older children in the grade have slightly higher achievement test scores. Age, however, was not statistically significant in Acar et al.'s (2016) meta-analysis. Because the assessments used in this study are given based on grade, grade was used rather than age.

Last, Hernandez-Torrano et al. (2013) found that teacher nominations to the gifted program may be biased against females. Therefore, gender was included in this study. Acar et al. (2016) included three moderators: (a) grade level of student, (b) nomination source, and (c) assessments (IQ, aptitude, achievement, and creativity). They excluded

gender, ethnicity, socioeconomic status, and verbal vs. nonverbal test. The variables in their study are, however, most consistent with this current study, which included gender, grade level of student, aptitude assessments, and achievement assessments.

For this study, the independent variables were categorized into: (a) ability variables (aptitude test scores), (b) performance variables (achievement test scores), and (c) demographic variables (gender and grade). The independent variables selected to be used in estimating individually-administered IQ scores were: (a) the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening based on national norms, (b) verbal and nonverbal cognitive abilities, (c) gender, and (d) grade.

The OLSAT8 is a group-administered measurement of ability/aptitude and the composite score was expected to be highly correlated positively to the individually-administered IQ scores. Therefore, the subscales of the OLSAT8 were used as independent variables as the subscales were expected to vary, and to identify which one(s) best estimates the individually-administered IQ score. Likewise, the national percentile achievement test scores on the SAT10 were expected to be highly correlated positively to the individually-administered IQ score and may overlap the OLSAT8 score. The grade and gender of the student were not expected to contribute to estimating the individually-administered IQ score.

This section provided the rationale for the selection of the variables for this study. Next, the specific instruments are discussed.

Instruments. The school district in this study administered three instruments (WASI, OLSAT8, and SAT10) as part of their annual assessment program. Reviews of

the three instruments are discussed next.

Wechsler Abbreviated Scale of Intelligence (WASI). The WASI, published by the Psychological Corporation, is "designed as a short and reliable measure of intelligence" (Plake & Impara, 2001, p. 1329). It is an intelligence test for ages 6-89. The WASI, published in 1999, is individually administered and produces full scale, verbal and performance scores similar to other Wechsler intelligence instruments. Keith (2001) advocated that the WASI may be viewed as a short version of two respected individually-administered intelligence tests by Wechsler – the Wechsler Intelligence Scale for Children (WISC-III) and the Wechsler Adult Intelligence Scale (WAIS-III). The WASI was designed as a "consistent, well-normed and technically adequate brief measure of intelligence" (Keith, 2001, p. 1329). Keith noted that all test items were new and designed for the WASI. The WASI is administered in less than an hour. As with all Wechsler IQ measures, the mean is 100 with a standard deviation of 15. It was standardized with children (1100) and adults (1145) ages 6-89. The sample was representative of the 1997 U.S. population based on "sex, racial and ethnic group, socioeconomic status (education level), and geographic region" (p. 1330).

Corrected split-half reliabilities ranged from .92 to .98 for the full IQ score and from .81 to .98 for the subtest scores. Test-retest reliability coefficients (N=222; administration intervals of 2-12 weeks) ranged from .85 to .93 for the children for the full IQ score and from .73 to .86 for the subtest scores. Construct validity was supported by its strong correlations between the WASI and the WAIS-III and ranged from .76 to .92 for the IQ score and from .66 to .88 for the subtest scores. Correlations between the WASI and the WISC-III ranged from .76 to .87 for the IQ score and from .69 to .74 for

the subtest scores. Keith (2001) concluded that the strength of the WASI being connected to the other Wechsler instruments was also its weakness. Validity would have been strengthened if it were correlated to other measures of intelligence outside of the Wechsler family of instruments. Lindskog and Smith (2001) felt that the factor analyses and intercorrelations of subtest and IQ scores supported the construct validity of the WASI. They believed that the WASI is an "excellent instrument" (p. 1332) and "far exceeds" (p. 1332) other brief measures of intelligence. They also noted that the WASI manual is accurate for identified clinical groups including gifted students.

Otis-Lennon School Ability Test, Eighth Edition (OLSAT8). The OLSAT is published by Pearson. It is "designed to measure those verbal, quantitative, and figural reasoning skills that are most closely related to scholastic achievement" (Spies, Carlson, & Gessinger, 2010, p. 875). It is an ability and general aptitude test battery that has various levels that are used to test students in grades K-12. The OLSAT is administered in a group setting and takes about an hour to complete. The OLSAT has had editions from 1977 – 2003 (even though its foundations began in 1918 with the Otis Group Intelligence Scale). It was initially called the Otis-Lennon Mental Ability Test. The term "mental ability" was changed to "school ability" to more accurately reflect the intent of the instrument rather than inferring a stronger relationship with the concept of intelligence than was meant by the test designers. All items on the OLSAT are multiple choice. The OLSAT8 contains items from both the prior OLSAT6 and OLSAT7 plus new items. A stratified random sampling technique was used to select the spring (275,000) and fall (135,000) standardization samples in 2002 that reflected the population of the 2000 U.S. Census. The OLSAT provides a total score as well as a verbal and

nonverbal score. The mean is 100 and the standard deviation is 16. The OLSAT8 provides percentile rank, normal curve equivalent, stanine scores, and a school ability index (Maddux, 2010).

Kuder-Richardson Formula 20 (KR-20) reliabilities for total, verbal, and nonverbal scores were calculated for the spring group and were all in the .80s or .90s; however, reliability was only presented for the spring (Morse, 2010). No information was found for test-retest reliability. Face and construct validity were said to have been addressed but were not explained. Construct validity was shown by correlations with the OLSAT7 and the OLSAT8 ranging from .74-.85 for the total score, .64-.80 for the verbal score, and .71-.80 for the nonverbal scores (Maddux, 2010). Morse (2010) felt that, because a purpose of the OLSAT is to assess school learning ability, it should have validity data showing the relationship between OLSAT scores and grades in school.

Stanford Achievement Test, Tenth Edition (SAT10). The SAT10, published by Harcourt Assessment, Inc., "measures student achievement in reading, language, spelling, study skills, listening, mathematics, science and social science" (Spies & Plake, 2005, p. 968). It is a general achievement test battery that has various levels to test students in grades K-12. Both Morse (2005) and Carney (2005) considered the SAT10 to be a reliable, well-respected achievement test. The SAT has had editions since 1923. The SAT10 is administered in a group setting and is untimed. Carney pointed out that the test materials attempt to replicate the materials that students see daily such as full-color illustrations to try to improve motivation. In addition, children's authors wrote the reading sections. The easy and difficult items within a subtest are mixed rather than starting with the easy questions and building up to the difficult ones. Next, a 20-member

"Bias Review Advisory Panel" reviewed the test items to minimize bias from "gender, ethnic, cultural, disability, SES, or stereotyping" (p. 970). Both spring (250,000 students) and fall (110,000 students) norms were established in 2002. School districts were chosen to parallel the variables in the 2000 Census of Population and Housing and the 2000-2001 National Center for Education Statistics. The SAT10 provides percentile rank, normal curve equivalent, and stanine scores, as well as other scores, for each student (Carney, 2005).

Reliability was measured with the KR-20. The majority were in the mid-.80s to .90s. Alternate-form reliability for Forms A and B were usually in the .80s and the composite scores were usually close to .90. Content validity was considered to be the responsibility of the school district using the test. The SAT10 provides extensive information about the skills and content tested to assist the school district in their effort to determine the match between the SAT10 and the district's curricula and goals. Correlations between the subtests and totals of the SAT10 and the previous SAT9 were in the .70s-.80s (Carney, 2005).

In summary, the variables and instruments selected for this study were discussed in this section. The dependent variable is the individually-administered full scale IQ score on the WASI. The independent variables selected to be used in estimating the dependent variable were: (a) the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening based on national norms, (b) verbal and nonverbal cognitive abilities, (c) gender, and (d) grade. Reviews of the three instruments used in this study were also presented: (a) WASI, (b) OLSAT8, and (c) SAT10.

Summary and Conclusion

This literature review discussed the areas of: (a) history, (b) evolution in the definition of giftedness, (c) definitional problems, (d) theories of giftedness, (e) characteristics of giftedness, (f) implications for counselors, (g) early identification, (h) identification process, (i) role of the school counselor, (j) prior studies, (k) this study, and (l) summary and conclusion.

In summary, identifying gifted students is important for several reasons. First, it is important to help these children as early as possible (Reis & Renzulli, 2009). Next, these children require differentiated educational programs beyond those provided by the traditional school program. (Dai & Chen, 2013; Greene, 2006; Olszewski-Kubilius et al., 2015; Reis & Colbert, 2004). One place that has a substantial opportunity to urge students to reach for their potential is school. Unfortunately, for some gifted students, school does the opposite (Cross & Cross, 2015). Gifted children need an environment that takes advantage of their characteristics instead of stifling them. Gifted children: (a) learn easily and quickly, (b) are persistent, (c) ask a lot of questions, (d) are very curious, (e) have a good sense of humor, (f) dislike repetition, (g) are sensitive to others, (h) think logically and prefer things to make sense, and (i) are open to new, creative, radical ideas (Galbraith, 1999). When social and emotional problems do occur, they usually reflect the mismatch of environment and gifted characteristics (Peterson, 2009).

Next, gifted children need to be challenged. They need stimulation above what traditional schoolwork provides (Colangelo & Wood, 2015b; Greene, 2006; Olszewski-Kubilius et al., 2015). They need to learn at their individual speed, pre-test out of work they already understand, study things that interest them beyond basic schoolwork, and

work with ideas that challenge their high intellect. Gifted students benefit, both academically and socially, from learning in an environment with children like themselves. They can be challenged to learn new things rather than having to wait for their classmates to catch up (Galbraith, 1999). Otherwise, they may not learn to cope with issues of effort and perseverance that other children learn through schoolwork (Muratori & Smith, 2015).

In addition, gifted students need interaction with gifted peers during childhood and adolescence in order for gifted adults to reach their potential (Rinn & Bishop, 2015) and being in a gifted program gives gifted students an opportunity to be around other high intellect students (Assouline et al., 2006) and to be taught by trained staff that challenge the students academically and intellectually and provide emotional support at different stages of talent development (Olszewski-Kubilius et al., 2015)

Gifted programs provide a challenging learning environment and social experience with gifted peers (Kim, 2016) and raise students' achievement (Shepard, 1992). Programs for gifted children focus on the specific needs of gifted children and provide appropriate academic challenges, role models, and social supports for them as well as place them around students who are similar to them (Olszewski-Kubilius et al., 2015). Schools can match the learning environment with the characteristics of gifted students (Subotnik et al., 2012). Thus, it is important to identify these gifted children so that they may participate in these programs as early as possible (Reis & Renzulli, 2009).

Chapter 3

METHODOLOGY

As discussed in Chapters One and Two, gifted children need to be identified early so they may receive appropriate counseling interventions, schooling, and career development. Problems frequently arise when the educational environment does not nurture and simultaneously stimulate the gifted student (Dai & Chen, 2013; Peterson, 2015). Gifted programs provide these challenges, thus matching the environment with the needs of the gifted student (Subotnik et al., 2012). Gifted programs use the individual intelligence test score (IQ) as its primary identification component (Greene, 2006; National Association for Gifted Children, 2015; Reis & Colbert, 2004;). To be included in gifted programs the student must first, however, be nominated to the gifted program. Certain students may not exhibit gifted characteristics and may risk not being considered for the program (Acar et al., 2016). A question arises about the gifted students that are never nominated. Is there an alternate way to accurately estimate which students might qualify for the gifted program and should be given an intelligence test to officially determine that they do not meet the criterion? This alternate process could be used in place of or in addition to the existing identification procedures.

The school counselor can help identify and advocate for gifted students (ASCA, 2013; Gentry, 2006; Maxwell, 2007) by determining and then running a formula to estimate individually-administered IQ scores (Pfeiffer, 2003). The formula would be applied to all students. Thus, all students would have an opportunity to be screened for potential nomination to the gifted program not limited to the nomination process. When new data become available, the formula could be reapplied to the students' data to

determine if anyone new should be considered for the gifted program. McMahon, et al. (2014) described at length the expanded role of school counselors "toward collaboration, advocacy, leadership, and systemic change to promote academic success for all students" (p. 459) and to "use data to identify and address the inequities within the school system" (p. 460). This study is congruent with this definition. It is advocating to locate potential gifted children by finding both a systemic and systematic method using existing data. All children would have the opportunity to be identified for the gifted program by utilizing the validated regression formula.

Therefore, the purpose of this study is to determine if individually-administered IQ test scores are related to specific information already available to the elementary school counselor to aid in the determination of unidentified gifted elementary school students who would benefit from participating in the school district's gifted program. The research question is: Is an individually-administered IQ score accurately estimated by a function of the national percentile achievement test scores in total reading; total mathematics; language; spelling; science/environment; and listening; verbal, and nonverbal cognitive abilities; gender; or grade (see Figure 1)?

This chapter describes the design of this study and methods that were utilized for executing this study. The following specific areas are presented: (a) hypotheses, (b) participants, (c) procedures, (d) statistical analysis, (e) limitations, and (f) summary.

Hypotheses

The hypotheses are that a statistically significant contributing relationship exists between some or all of the 10 independent variables and the individually-administered full scale IQ test score. The working hypotheses are:

H1: The national percentile achievement test scores in (a) total reading, (b) total mathematics, and (c) language, and (d) the verbal cognitive ability score will significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test score.

H2: The national percentile achievement test scores in (a) spelling, (b) science/environment, and (c) listening, (d) the nonverbal cognitive ability score, (e) gender, and (f) grade will not significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test score.

Participants

The participants (students) in the study attended a public elementary school in a suburb of a Midwestern metropolitan area during the 2004-2005, 2005-2006, 2006-2007, or 2007-2008 school years. The school district contained 19 elementary schools, 6 middle schools, and 4 high schools. The student population of the school district was approximately 22,000 and was almost equally divided between boys and girls, with 51% boys and 49% girls. The student race/ethnicity was 84% Caucasian, 11% African American, 4% Asian, and 1% Hispanic students (Missouri Department of Elementary and Secondary Education, 2017).

This is the preferred data set for this study. During these school years, the same instruments were administered to the students at the same grade levels. This provides four years of consistent data which strengthens the study rather than using only one year of data. In addition, it provides a population size of more than 10 participants for each of the 10 independent variables. Subsequent years were considered; however, they were

insufficient for a data set. For example, after the 2007-2008 school year, the SAT10 was not administered to all grades 2-5. In 2014-2015, the CoGAT was adopted in place of the OLSAT8 for grades one, three, and five. The following year, however, it was administered to grades two and four. In 2016-2017, the WASI was replaced with the WISC providing one year of data. The 2004-2008 data set provides consistent administration of the same instruments to the same grade levels over four continuous years thus providing a stable data set for analysis.

The participants consisted of all second through fifth grade elementary students in general education classrooms for whom all of the following are available: Individually-administered WASI IQ scores, SAT10 scores, OLSAT8 scores, gender, and grade. Individually-administered IQ scores were available for students who had been nominated to the gifted program, regardless of whether the student did or did not ultimately qualify for the gifted program, not only the ones who qualified for the gifted program. All participants who had WASI IQ scores, SAT10 scores, OLSAT8 scores, gender, and grade were included in the study instead of selecting a sample in order to strengthen the results of the study. The initial population size was 224 and decreased to 214 after the data cleaning was completed. Data cleaning detected, then corrected or removed inaccurate records from the data set before they were analyzed. The data were then randomly split into two equal samples of 107 by SPSS, one used for development of the model and one used for validation of the model.

Descriptive statistics for the WASI IQ scores and independent variables for the total data set (N=214), model sample (n=107), and validation sample (n=107) are in Tables 2, 3, and 4, respectively. The mean, standard error of the mean, median, mode,

variance, standard deviation, skewness, and kurtosis for each variable are the statistics reported in each table.

In the total sample (N=214) shown in Table 2, the WASI mean was 123.35, median was 123.00, and mode was 126.00 along with a standard deviation of 11.21. Gender was almost equally distributed between two categories with 108 (50.5%) females and 106 (49.5%) males. Grade was distributed with 39 (18.2%) in second grade, 116 (54.2%) in third grade, 44 (20.6%) in fourth grade, and 15 (7.0%) in fifth grade.

In the model sample (n=107) shown in Table 3, the WASI mean was 123.02, median was 123.00, and mode was 117.00 along with a standard deviation of 11.55. Gender was almost equally distributed between two categories with 54 (50.5%) females and 53 (49.5%) males. Grade was distributed with 15 (14.0%) in second grade, 64 (59.8%) in third grade, 23 (21.5%) in fourth grade, and 5 (4.7%) in fifth grade.

In the validation sample (n=107) shown in Table 4, the WASI mean was 123.67, median was 123.00, and mode was 132.00 along with a standard deviation of 10.89. Gender was almost equally distributed between two categories with 54 (50.5%) females and 53 (49.5%) males. Grade was distributed with 24 (22.4%) in second grade, 52 (48.6%) in third grade, 21 (19.7%) in fourth grade, and 10 (9.3%) in fifth grade.

A correlations table was created for all of the variables for the model sample (Table 5) and for the validation sample (Table 6). Looking at Table 5 for the model sample, total reading, total mathematics, listening, verbal, and nonverbal are significant positive correlations with the WASI and grade has a significant negative correlation with the WASI. Looking at Table 6 for the validation sample, total reading, total mathematics, language, science/environment, verbal, and nonverbal are significant positive correlations with the WASI and there are no significant negative correlations with the WASI.

Procedures

The IQ scores and other information needed for this study existed as part of the normal assessment program of the school district assessment program, i.e., regardless of this study. The data for the study were obtained from downloads of test data results from the school district's student computer information system. Permission from the University of Missouri-St. Louis Internal Review Board (IRB) was obtained to accumulate and analyze the data (see Figure 2).

The school district previously administered the three instruments (WASI, OLSAT8, and SAT10) in this study as part of their annual assessment program, i.e., none of the instruments were administered solely for this study. The district's testing results as archival data were used for this study. The OLSAT8 was administered near the beginning of the school year to all students in grades one and three. It provided verbal, nonverbal, and total scores as well as a standard age indicator (SAI) score. The SAT10 was administered early in the school year to all students in grades two through five. It provided a national percentile achievement test score in total reading, total mathematics, language, spelling, science/environment, and listening based on national norms. The WASI was administered only to students nominated to the gifted program. It provided an individual full scale IQ score. The OLSAT8 and SAT10 scores that were used for this study came from the test administration immediately preceding the WASI, as these are the scores that the elementary school counselor would review when considering whether to nominate a student to the gifted program.

Initially, the district's gifted center provided a download of students for whom an individually-administered IQ score on the WASI existed within the four-year timeframe

of this study. The student ID and the remaining information necessary for the study were then obtained from the download of test data results from the school district's student computer information system and matched to the student ID in the data file from the gifted center. After the data were reviewed for completeness, student identifiers were removed in order to maintain confidentiality, prior to the data being given to the researcher. The data that were collected for this study were found in the students' cumulative files and student computer information system and were accessible by the school counselor, but only for students at the researcher's school. Because the data for this study were for the whole school district and were confidential, the data were collected and provided to the researcher in a digital file, instead of separate manila folders on each child.

The merged data file given to the researcher was in an Excel spreadsheet. Gender (0, 1) and grade (2, 3, 4, 5) were coded in order to convert them to numeric variables. Responses for female were coded 0. Responses for male were coded 1. Grade was coded as 2 if in grade 2, 3 if in grade 3, 4 if in grade 4, and 5 if in grade 5. Next, the data were reviewed for missing information. The number of cases with missing information and their resolution are discussed in the results section.

Statistical Analysis

The determination of the adequacy of the sample size, the selection of which multiple regression method to use, and the regression models are discussed in this section.

Sample size. Various criteria for determining sample size for this study were reviewed. Brace, Kemp, and Snelgar (2016) stated a general rule of thumb that the

sample size should be 10 times the number of independent variables which equated to 100 (10 x 10). To test the multiple correlation, Tabachnick and Fidell (2013) recommended a sample size of eight times the number of independent variables added to 50 which equated to 130 ((10 x 8) + 50). To test the individual independent variables, they recommended a sample size of 104 plus the number of independent variables which equated to 114 (104 + 10). Last, a calculation of power with a medium effect size of 0.30, α=.05, and a sample size of 200 yielded power of 0.99 for both a one- and two-tailed test. Changing the sample size to 100 yielded power of 0.92 for a one-tailed test and 0.86 for a two-tailed test.

The recommended sample sizes above were 100, 114, 130, and 200. The number of participants after the data were cleaned was N=214 which clearly exceeded all of the recommended sample sizes. The question became whether to split the sample into two separate and equal samples of n=107 (214 ÷ 2), one for calculating the regression model and one for validating the results. The model using a split sample (n=107) met two of the recommended sample sizes of 100. The researcher decided that the .92 power for the one-tailed test (n=100) was adequate and the benefit of validating the results outweighed calculating the model on the whole (N=214) data set. Therefore, the two data sets of n=107 were randomly created by SPSS. To distinguish between these two samples, they are, hereafter, referred to as the model sample and the validation sample.

Multiple regression method. The data were analyzed, using the Statistical Package for Social Science (SPSS), via multiple regression analysis. Multiple regression analysis was selected because the research question is about the relationship of the quantitative data and multiple predictors, all of which are or were converted to numeric

variables.

The three types of multiple regression were considered: (a) simultaneous or standard method, (b) sequential or hierarchical method, and (c) statistical or stepwise method. A brief description of each method follows along with the rationale for the use of the simultaneous method.

Simultaneous method. In the simultaneous method, all of the independent variables are entered into the model at the same time. Each independent variable is then assessed on its additional contribution to the variance explained by the other independent variables combined. The disadvantage of this method is that the regression coefficients represent only the unique variance attributed to the independent variable. In essence, shared variance between two variables is not attributed to the coefficient of any other specific variable. All of the variance of the dependent variable, however, is included in the calculation of *R* and other statistics summarizing the whole model. In this method, the total model may be strong even if some of the independent variables appear weak (Tabachnick & Fidell, 2013).

Sequential method. In the sequential method, independent variables are entered into the model in a sequence determined by the researcher based on a theoretical, empirical, or logical basis. In essence, a hierarchy is assigned to the independent variables. The first independent variable entered into the model is assigned all of the variance that it explains in the dependent variable, including any shared variance with other independent variables. The next independent variable entered into the model is assigned its unique variance, including any shared variance with the other independent variables not already entered into the model. Each subsequent independent variable

enters the model in the same way as the first two independent variables (Tabachnick & Fidell, 2013).

Statistical method. In the statistical method, the order that the independent variables are entered into the model is based on the strength of their correlation with the dependent variable. As the independent variable enters the model, its effect is assessed along with the other independent variables already entered into the model being reassessed. Any independent variable already in the model that no longer significantly contributes to the model is removed. This method is considered controversial and used most often for exploratory research. It requires a large number of cases and should be validated with a second data set (Tabachnick & Fidell, 2013).

Selection of regression method. The simultaneous method was selected for the data analysis process because it best fit the goal of determining the value of each independent variable in estimating the dependent variable. The disadvantage of this model was that the regression coefficients only represent their unique variance and did not include shared variance.

The sequential method was considered and not selected to use for data analysis. There was not a solid theoretical basis to utilize to determine which independent variables should enter the model before other independent variables. Without this basis, independent variables that should be kept in the model could have been removed solely because they were not entered before another independent variable. Therefore, this method was not used.

The statistical method was also considered and not selected to use for data analysis. Tabachnick and Fidell (2013) recommended a cases-to-independent-variable

ratio of 40 to 1 for the sample size for the statistical method. This equates to N=400 (40 x 10) cases and the maximum sample size in this study was N=214. In addition to the sample size being below the recommended number of participants, there would not have been enough participants from which to create a second data set to use to validate the results. Therefore, the statistical method was not chosen for the data analysis process because of the small sample size and the controversial nature of the statistical method.

Regression models. Specifically, simultaneous regression analyses were used to identify those variables that made the most independent significant contribution to predicting the IQ score and to determine the degree to which the prediction of IQ scores could be improved by using multiple factors. First, the full model was calculated followed by each independent variable being removed one at a time to determine its impact on the full model. Each of the models will be explained.

Full model (model 1). The research or alternate hypothesis for the full model is: an individually-administered IQ score is a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade (see Figure 1). This is represented as:

Model 1

H_A: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_1$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$; where:

Y_{WASI} = estimated individual intelligence full scale score on WASI

b_0 = constant intelligence score independent of other independent variables

b_1 through b_{10} = partial regression coefficients

X_{READ} = SAT10 achievement score in total reading, immediately preceding the WASI IQ test

X_{MATH} = SAT10 achievement score in total mathematics, immediately preceding the WASI IQ test

X_{LANG} = SAT10 achievement score in language, immediately preceding the WASI IQ test

X_{SPELL} = SAT10 achievement score in spelling, immediately preceding the WASI IQ test

$X_{SCI/ENV}$ = SAT10 achievement score in science/environment, immediately preceding the WASI IQ test

X_{LISTEN} = SAT10 achievement score in listening, immediately preceding the WASI IQ test

X_{VERB} = verbal battery score on OLSAT8

$X_{NONVERB}$ = nonverbal battery score on OLSAT8

X_{GEN} = "1" if being male; "0" if being female

X_{GRADE} = "2" if grade 2; "3" if grade 3; "4" if grade 4; "5" if grade 5

E_1 = error of prediction

Null model (model 2). The null model (Model 2) or statistical hypothesis for the full model is: an individually-administered IQ score is not a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling,

science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade (see Figure 1). This is represented as:

Model 2:

H_O: $Y_{WASI} = b_0 + E_2$

and $\rho_1 = 0$; $\rho_2 = 0$; $\rho_3 = 0$; $\rho_4 = 0$; $\rho_5 = 0$; $\rho_6 = 0$; $\rho_7 = 0$; $\rho_8 = 0$; $\rho_9 = 0$; and $\rho_{10} = 0$.

E_2 = error of prediction

As stated earlier, this study was specifically interested in the predictive value of the model. As such, it was interested in determining the individual contribution of each variable to the predictive value of the full model equation. Therefore, each variable was examined in a regression analysis with only one variable removed in relation to the full model. The individual variable restriction hypotheses and resulting models are as follows:

First restricted model (model 3). The first restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in total reading. The alternate research hypothesis for this model is the same as the Full Model.

The Model 3 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in total reading. This is represented as:

Model 3

H_O: $Y_{WASI} = b_0 + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} +$

$b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_3$

and $\rho_1 = 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_3 = error of prediction

Second through tenth restricted models (models 4 through 12). The remainder of the restricted models (second through tenth restricted models) are similar to the first restricted model in that each independent variable is removed one at a time in order to determine its impact on the full model. The second through tenth restricted models (models 4 through 12) are presented in detail in Appendix C.

This section discussed the determination of the adequacy of the sample size, the selection of the simultaneous multiple regression for data analyses, and the regression models.

Limitations

The external validity of this study is limited to a population characterized by middle to upper SES, primarily Caucasian, not migratory, educated parents, and high test scores within a high scoring school district. This is not a limitation for the purpose of this study as this study was designed to be used with the population from which the study was performed. In other words, this study may only be generalized to second through fifth grade students in this district or a district similar to this one. Also, study participants may not represent all school students as students in the sample have been nominated for the gifted program.

A threat to internal validity could exist as the individually-administered IQ scores were obtained over four years and there was no control over history. This would be a

normal occurrence in the general population, however, and is not considered a substantial risk to this study.

The same person did not administer all of the individually-administered IQ tests. There is, however, a strict administration and scoring protocol that the two district psychometrists were required to follow when giving an individually-administered IQ test.

Summary

This chapter described the design of the study and methods that were utilized for executing the study to answer the research question: Is an individually-administered IQ score accurately estimated by a function of the national percentile achievement test scores in total reading; total mathematics; language; spelling; science/environment; and listening; verbal, and nonverbal cognitive abilities; gender; or grade (see Figure 1)? The following specific areas were discussed: (a) hypotheses, (b) participants, (c) procedures, (d) statistical analysis, and (e) limitations. The research question was answered in Chapter 4 using this methodology.

In the next section, Chapter 4 contains descriptions and an analysis of the data utilized in the study. Chapter 5 discusses the findings and limitations of the study as well as recommendations for future research and a conclusion followed by Figures in Appendix A, Tables in Appendix B, and the Regression Models in Appendix C.

Chapter 4

RESULTS

This chapter is divided into four sections: (a) data preparation, (b) statistical analyses, (c) hypotheses testing, and (d) summary. Data preparation discusses the steps for data cleaning, that is, detect, then correct or remove inaccurate records from the data set before they were analyzed. The statistical analyses section presents the results of the multiple regression analysis. The hypotheses testing section explains how the actual results compared to the hypotheses. Last, a summary concludes this chapter.

Data Preparation

Prior to statistical analyses, the dependent (IQ score) and independent variables (total reading, total mathematics, language, spelling, science/environment, listening, verbal, nonverbal, gender, and grade) were examined through various IBM SPSS 24.0 programs for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis. The specific steps are described in the remainder of this section: (a) initial review and import of data, (b) missing data, (c) recoding data, (d) univariate outliers, (e) multivariate outliers, (f) multiple regression assumptions, (g) pattern of missing data, (h) correlations, (i) gender as covariate, and (j) grade as covariate.

Initial review and import of data. The initial data set received from the school district in this study was in an Excel spreadsheet and included 224 participants (N=224). The researcher made some minor changes to the file such as right justifying all of the cells containing data and moving the column with Wechsler Abbreviated Scale of Intelligence (WASI) scores to the far left of the other columns. The data were reviewed for reasonableness such as open cells on the spreadsheet. The only unusual items noted

were five cases with missing data which were also found later in the process of data cleaning. They are discussed later (two cases were removed from the data set and the single missing scores for three cases were replaced by the mean). Both the original data set and formatted data set were saved.

The Excel data sheet was then imported into SPSS. The variable information was completed in the variable view of SPSS. In addition, to facilitate the location of missing data, the missing value was set as 250 as this is not a possible score on any of the variables. The data set was saved in SPSS (N=224). Descriptive statistics were reviewed for reasonableness looking for implausible or impossible values. Even though the data were not directly entered into SPSS (it was imported), the mean statistic for each variable in SPSS was checked to the mean for each variable calculated on the formatted Excel spreadsheet before it was imported into SPSS to cross-check for data entry errors. No errors were found.

Missing data. Next, the data were reviewed for missing cells as well as a review of the Missing Value Analysis (MVA) report was performed. Two cases were missing data for an entire test, case 15 for the Otis-Lennon School Ability Test, Eighth Edition (OLSAT8) and case 32 for the Stanford Achievement Test, Tenth Edition (SAT10). Both cases were deleted. The MVA report was rerun and noted only the three cases missing single scores mentioned earlier. As discussed later, they were replaced with the mean. After the two cases were deleted, 222 participants remained (N=222). The descriptive statistics were rerun and the minimum, maximum, mean, range, and standard deviations were reviewed for reasonableness looking for implausible or impossible values.

Recoding data. Next, because this study did not use survey data, there was no need to recode any of the variables that need to be reverse-scored nor to create scale/subscale

scores.

Univariate outliers. To look for univariate outliers, *z*-scores were created and manually reviewed for scores greater than +3 or less than –3. Zero cases were found that were greater than +3. Seven cases were found that contained 11 cells that were less than –3. The missing scores were verbal (4), reading (2), listening (2), spelling (1), math (1), and science/environment (1). These cases (62, 70 (missing four cells), 116, 137, 139, 180 (missing two cells), 207) were removed from the data set. In addition to reviewing the *z*-scores, the five highest and five lowest scores from the Extreme Values Report (EVR) created by Explore were reviewed. All of the scores found in the EVR greater than +3 or less than –3 had been found in the manual review. After the seven univariate outliers were removed from the data set, the remaining participants were 215 (N=215).

Multivariate outliers. To look for multivariate outliers, Mahalanobis Distance data were created and manually reviewed for chi-square scores greater than 31.264 (11 variables, $p < .001$) critical value. One case (case 224) was found greater than the critical value and removed from the data set. In addition to reviewing the chi-square-scores, the five highest and five lowest scores from the EVR created by Explore were reviewed. All of the scores found in the EVR greater than the crucial value had been found in the manual review. After the one univariate outlier was removed from the data set, the remaining participants were 214 (N=214).

Multiple regression assumptions. Next, the data were reviewed for meeting the assumptions for multiple regression, namely normality, linearity, and homoscedasticity. Skewness values were reviewed for less than an absolute value of 2 and all were less than this amount. Kurtosis values were also reviewed for less than an absolute value of 10 and all were less than this amount. The results of the skewness and kurtosis review indicate

normality and no need to transform the variables. The bivariate scatterplots were reviewed to assess linearity and homoscedasticity and all were oval indicating these assumptions were met.

The Normal P-Plot of Regression Standardized Residual graph (see Figure 3) was also reviewed. The residual values lay close to the 45° upward sloping diagonal line indicating that the residuals were normally distributed. The scatterplot graph (see Figure 4) showed the standardized residuals versus the estimated values. Because the residuals were in a fairly even horizontal band around zero and randomly scattered, x and y have a linear relationship and have homogeneity of variance. As a result of this analysis of the data, the multiple linear regression assumptions were met and the data analysis that followed was considered valid.

Pattern of missing data. Next, a MVA report was created and determined that there was no pattern in the missing data. The three cases missing a single score mentioned earlier were found. The missing scores were replaced by the mean for the variable. Two cases (120 and 221) were missing reading scores and one case (124) was missing a math score. Descriptive statistics were reviewed and the N statistic now showed 214 for all of the variables indicating that there were no missing scores (N=214). In summary, a total of 10 (4.5%) cases were removed from the original data set (N=224).

Correlations. A correlations table was created for all of the variables (see Table 1). A review of the table showed that all of the correlations were less than 0.7 indicating the lack of multicollinearity. Looking at Table 1, total reading, total mathematics, language, listening, verbal, and nonverbal are significant positive correlations with the WASI and there are no significant negative correlations with the WASI.

Gender as covariate. To determine if a covariate relationship existed between

gender and the WASI score, an independent samples *t*-test was completed using $p < .001$. Gender was almost equally divided in the sample between female (108) and male (106). The WASI mean and standard deviation for female were $M=122.35$ and $SD=10.96$ and for male were $M=124.36$ and $SD=11.41$. The independent *t*-test showed that the difference between female and male and the effect size were both non-significant ($t=1.31$, df=212, $p=.096$, one-tailed, $d=.18$).

Grade as covariate. To determine if a covariate relationship existed between grade and the WASI score, a one-way between-subjects ANOVA was completed using $p < .001$. Grade was unequally divided in the sample between second grade (39), third grade (116), fourth grade (44), and fifth grade (15). The WASI mean and standard deviation for each grade were: second grade $M=122.90$, $SD=9.54$; third grade $M=124.92$, $SD=11.01$; fourth grade $M=121.14$, $SD=12.62$; and fifth grade $M=118.80$, $SD=10.94$. A one-way between-subjects ANOVA was conducted to examine the effect of grade on the WASI IQ score. This revealed a non-significant effect of grade ($F(3, 210) = 2.22$, $p=.087$).

This section discussed: (a) initial review and import of data, (b) missing data, (c) recoding data, (d) univariate outliers, (e) multivariate outliers, (f) multiple regression assumptions, (g) pattern of missing data, (h) correlations, (i) gender as covariate, and (j) grade as covariate. The next section discusses the statistical analyses that were conducted.

Statistical Analyses

This section describes the statistical analyses of this study and presents the results of the: (a) calculation of regression model, (b) calculation of revised regression model,

and (c) cross-validation of revised regression model.

Calculation of regression model. Simultaneous regression analysis was used to identify those variables that made the most independent significant contribution to predicting individually-administered IQ scores and to determine the degree to which the prediction of these IQ scores could be improved by using multiple factors. For the model sample (n=107), all 10 independent variables were entered as predictors into a multiple regression using the simultaneous method to estimate WASI IQ scores. A statistically significant model emerged: $F(10, 96) = 10.130$, $p<.001$. The model explained 46.3% of the variance in the WASI IQ score (adjusted $R^2=.463$). The results in Table 7 show that total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were significant predictors as they had a probability for change in F of less than .05. The remaining variables of total reading, language, spelling, verbal cognitive ability, and gender did not significantly contribute to predicting the individually-administered IQ score.

To calculate the individual R^2 change for each independent variable, the full model was calculated first followed by each independent variable being removed one at a time in order to determine its impact on the full model. The model with one independent variable removed was calculated. The removed independent variable was then added back to the model before removing the next variable. This process continued until each of the independent variables had been removed and added back to the full model.

The results in Table 7 show that Model 3, with total reading removed, explained 0.4% of the variance and was not statistically significant ($F(1,96) = .707$, $p=.402$). Model 4, in which total mathematics was removed, explained 3.0% of the variance

($F(1,96) = 5.933$, $p=.017$) and was statistically significant. Model 5, with language removed, accounted for zero variance ($F(1,96) = .637$, $p=.427$) and was not significant. Model 6 removed spelling which explained 1.0% of the variance and was not significant ($F(1,96) = 2.027$, $p=.158$). Model 7 removed science/environment and explained 3.3% of the variance and was significant ($F(1,96) = 6.499$, $p=.012$). Model 8 in which listening was removed explained 10.7% of the variance and was also significant ($F(1,96) = 21.082$, $p<.001$). Model 9 explained zero of the variance with verbal removed and was not significant ($F(1,96) =.147$, $p=.702$). In model 10, the removal of nonverbal accounted for 6.2% of the variance and was significant ($F(1,96) = 12.195$, $p=.001$). Model 11 removed gender and was not significant and accounted for 1.4% of the variance ($F(1,96), = 2.834$, $p=.096$). Last, Model 12 removed grade and accounted for 5.0% of the variance and was significant ($F(1,96) = 9.892$, $p=.002$).

Next, Table 8 provides information about regression coefficients for the independent variables entered into the model. Total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were significant predictors of the WASI score. Total reading, language, spelling, verbal cognitive ability, and gender were not significant predictors of the WASI score. The following equation could be used to estimate the individually-administered WASI Full Scale IQ score using the coefficients presented in Table 8:

$$Y_{WASI} = 106.103 + .053X_{READ} + .134X_{MATH} - .042X_{LANG} - .061X_{SPELL} - .115X_{SCI/ENV} + .210X_{LISTEN} + .023X_{VERB} + .185X_{NONVERB} + 2.980X_{GEN} - 3.810X_{GRADE}$$

Calculation of revised regression model. The purpose of multiple linear

regression is to find the combination of independent variables that best predicts the dependent variable with the minimum amount of data collection. With this concept in mind, the data analysis was repeated with only the statistically significant contributing independent variables of total mathematics, science/environment, listening, nonverbal cognitive ability, and grade as identified earlier. The resulting data are shown in Table 9.

In summary, the adjusted R^2 of the revised multiple linear regression equation with five independent variables was .459 versus the .463 when all 10 variables were included. The revised model was significant ($F(5, 101) = 18.98$, $p<.001$). The following revised equation may be used to estimate the individually-administered WASI Full Scale IQ score using the coefficients presented in Table 10:

$$Y_{WASI} = 106.119 + .137X_{MATH} - .115X_{SCI/ENV} + .205X_{LISTEN} + .192X_{NONVERB} - 3.941_{GRADE}$$

There was a significant correlation between the estimated WASI score from the model and from the revised model ($r=.96$, n=107, $p<.01$, one-tailed). It is a high correlation with 92.1% of the variance explained ($R^2=.92$).

Cross-validation of revised regression model. In order to perform cross-validation, the revised equation using the coefficients presented in Table 10 was used to calculate the estimated WASI score with the data from the validation sample (n=107). The correlation between the actual WASI scores and the estimated WASI scores from both the model and from the revised equations were significant but were not strong. Using the validation sample, the correlation between the actual WASI score and the estimated WASI score from the full model was .29 ($r=.29$, n=107, $p<.01$, one-tailed) and had a weak correlation with 9.0% of the variance explained ($R^2=.09$). The correlation

between the actual WASI score and the estimated WASI score from the revised model was .27 (r=.27, n=107, p<.01, one-tailed) and had a weak correlation with 7.3% of the variance explained (R^2=.07).

This section described the statistical analyses of this study and presented the results of the: (a) calculation of regression model, (b) calculation of revised regression model, and (c) cross-validation of revised regression model.

Hypotheses Testing

This section discusses the hypotheses compared to the results from the statistical analyses. The hypotheses were developed around the idea that a statistically significant contributing relationship existed between some or all of the 10 independent variables and the individually-administered full scale IQ test score.

H1: The national percentile achievement test scores in (a) total reading, (b) total mathematics, and (c) language, and (d) the verbal cognitive ability score will significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test score.

The results presented earlier and in Table 8 show that, of these four independent variables hypothesized to predict the WASI score, only total mathematics was a significant predictor. Total reading, language, and verbal cognitive ability were not statistically significant predictors.

H2: The national percentile achievement test scores in (a) spelling, (b) science/environment, and (c) listening, (d) the nonverbal cognitive ability score, (e) gender, and (f) grade will not significantly contribute to the accurate estimation of the individually-administered WASI full scale IQ test

score.

The results presented earlier and in Table 8 show that, of these six independent variables hypothesized to not predict the WASI score, only spelling and gender were not statistically significant predictors. Science/environment, listening, nonverbal cognitive ability, and grade were statistically significant predictors of the WASI score.

Summary

This chapter reported on the results and discussed four areas of this study: (a) data preparation, (b) statistical analyses, (c) hypotheses testing, and (d) this summary.

For the model sample (n=107), all 10 independent variables were entered as predictors into a multiple regression using the simultaneous method to estimate WASI IQ scores. A statistically significant model emerged: $F(10, 96) = 10.130$, $p<.001$ which explained 46.3% of the variance in the WASI IQ score (adjusted $R^2=.463$). Total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were significant predictors. The remaining variables of total reading, language, spelling, verbal cognitive ability, and gender did not significantly contribute to predicting the individually-administered IQ score.

Because the purpose of multiple linear regression is to find the combination of independent variables that best predicts the dependent variable with the fewest variables (minimum amount of data collection), the data analysis was repeated with only the statistically significant contributing independent variables of total mathematics, science/environment, listening, nonverbal cognitive ability, and grade as identified earlier. The adjusted R^2 of the revised multiple linear regression equation with five independent variables was .459 versus the .463 when all 10 variables were included. The revised model was significant ($F(5, 101) = 18.98$, $p<.001$). The following revised

equation may be used to estimate the individually-administered WASI Full Scale IQ score:

$$Y_{WASI} = 106.119 + .137X_{MATH} - .115X_{SCI/ENV} + .205X_{LISTEN} + .192X_{NONVERB} - 3.941_{GRADE}$$

The correlation between the estimated WASI score from the model and from the revised model was significant and high (r=.96, n=107, p<.01, one-tailed) and explained 92.1% of the variance (R^2=.92).

Cross-validation of the revised equation with a second data set was performed to assess for overfitting of the equation to the sample which would result in reduced generalizability. The revised equation was used to estimate the WASI score with the data from the validation sample (n=107). The correlation between the actual WASI scores and the estimated WASI scores from both the full model equation and the revised equations were significant but not strong. Only 9.0% of the variance was explained using the model equation (r=.29, n=107, p<.01, one-tailed). Similarly, only 7.3% of the variance was explained using the revised model equation (r=.27, n=107, p<.01, one-tailed).

Chapter 5 provides a summary of the study, discusses these findings, provides recommendations including recommendations for future research, identifies limitations of the study, and presents conclusions followed by Appendices of Figures, Tables, and the Regression Models.

Chapter 5

DISCUSSION

Gifted students need to be identified early (Subotnik et al., 2012; Worrell et al., 2012) so they may participate in gifted programs that match their academic (Dai & Chen, 2013; Peterson, 2015; Rinn & Bishop, 2015; Subotnik et al., 2012), social (Colangelo & Wood, 2015b; Cross & Cross, 2015; Olszewski-Kubilius et al., 2015), and career needs (Greene, 2006; Levinson & Ohler, 2006; Muratori & Smith, 2005; Schultheiss, 2008; Watson & McMahon, 2005). Some students may be overlooked for the program and not administered the individual intelligence test that is the primary identification component for the gifted program (Acar et al., 2016; Peterson, 2006). Therefore, a question arises about the gifted students that are never nominated (Peterson, 2006). Is there an alternate way to more accurately estimate which students might qualify for the gifted program and should be given an intelligence quotient (IQ) test (Pfeiffer, 2003)? This alternate process could be used in place of or in addition to the existing identification procedures.

The school counselor can help identify and advocate for gifted students (ASCA, 2013; Gentry, 2006; Maxwell, 2007) using an alternate process by determining and then running a formula to estimate individually-administered IQ scores (Pfeiffer, 2003). The formula would then be applied to all students. Thus, all students would have an opportunity to be screened for potential nomination to the gifted program. The school counselor would embrace action research (Dahir & Stone, 2009) which focuses on concerns detected by the practitioner (the researcher in this study) who wants to use the results to impact those concerns by informing or changing them (Guiffrida, Douthit, Lynch, & Mackie, 2011). The researcher sought to locate potential gifted children by

finding both a systemic and systematic method using existing data. All children would have the opportunity to be identified for the gifted program by utilizing the validated regression formula.

This chapter is organized into the following sections: (a) summary, (b) findings, (c) recommendations, (d) significance of this study and future studies, and (e) conclusion. The summary reviews the purpose of the study, the research question, and data collection. The findings section includes a discussion of the significance of the regression model, the revised regression model, the cross-validation of the revised model, and the comparison of the three data sources and correlations. The recommendations section includes a discussion of the implications to prior studies, implications for practitioners, recommended actions to be taken, and recommendations for future research followed by the limitations and delimitations of the study. The significance of this and future studies and the value of this research are then discussed followed by the conclusion.

Summary

This section reviews the (a) purpose of the study, (b) the research question, and (c) data collection.

Purpose of the study. The purpose of this study was to determine if individually-administered IQ test scores were related to specific information already available to an elementary school counselor to aid in the determination of unidentified gifted elementary school students who would benefit from participating in the school district's gifted program.

Research question. The research question was: Is an individually-administered IQ score accurately estimated by a function of the national percentile achievement test

scores in total reading; total mathematics; language; spelling; science/environment; and listening; verbal, and nonverbal cognitive abilities; gender; or grade (see Figure 1)?

Data collection. The school district previously administered the three instruments in this study as part of their annual assessment program, i.e., none of the instruments were administered solely for this study. The instruments are the Wechsler Abbreviated Scale of Intelligence (WASI), the Otis-Lennon School Ability Test, Eighth Edition (OLSAT8), and the Stanford Achievement Test, Tenth Edition (SAT10). The district's testing results as archival data were used for this study.

Individually-administered IQ scores were available for students who had been nominated to the gifted program, regardless of whether the student did or did not ultimately qualify for the gifted program, not only the ones who qualified for the gifted program. All participants who had WASI IQ scores, SAT10 scores, OLSAT8 scores, gender, and grade were included in the study instead of selecting a sample. The initial population size was 224 and decreased to 214 after the data cleaning was completed. The data were then randomly split into two equal samples of 107 by SPSS, one used for development of the regression model and one for validation of the regression model.

This section reviewed the (a) purpose of the study, (b) the research question, and (c) data collection. The next section discusses the findings of the study.

Findings

The data were analyzed using IBM SPSS 24.0 via simultaneous multiple regression analysis to identify those variables that made the most independent significant contribution to predicting the IQ score and to determine the degree to which the prediction of IQ scores could be improved by using multiple factors. This section

includes a discussion of the significance of (a) the regression model, (b) the revised regression model, (c) cross-validation of the revised regression model, and (d) comparison of the three data sources and correlations.

Regression model. A statistically significant model emerged for the model sample (n=107), when all 10 independent variables were entered as predictors into a simultaneous multiple regression to estimate WASI IQ scores. The model explained 46.3% of the variance in the WASI IQ score. Total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were the significant predictors. The remaining variables of total reading, language, spelling, verbal cognitive ability, and gender did not significantly contribute to predicting the individually-administered IQ score.

The focus of the study was whether a statistically significant contributing relationship existed between some or all of the 10 independent variables and the individually-administered full scale IQ test score. This was found to be true. The two individual hypotheses, however, were not proven correct; however, five of the 10 individual variables were found to be statistically significant. For instance, hypothesis one predicted scores in total reading, total mathematics, language, and verbal cognitive ability to significantly contribute to the WASI score. Yet, only total mathematics was a significant predictor and total reading, language, and verbal cognitive ability were *not* significant predictors. Hypothesis two predicted scores in spelling, science/environment, listening, and nonverbal cognitive ability plus gender, and grade to *not* significantly contribute to the WASI score. Only spelling and gender, however, were *not* significant predictors and science/environment, listening, nonverbal cognitive ability, and grade

were significant predictors of the WASI score.

These results are important because, from the researcher's interactions with fellow counselors and teachers in the school district in this study, they often looked intuitively at a student's reading, language, and verbal cognitive ability to determine whether to nominate a student for the gifted program. Instead, the results from this study suggested that a student who shows strong nonverbal, math, and listening skills should indeed be considered for the gifted program. These are offset with the negative coefficients of science/environment and grade. The findings of which variables are and are not statistically significant need to be shared with the staff and parents. Elementary students especially who read and communicate well stand out to adults and are often nominated to the gifted program. The reasoning type math, nonverbal cognitive ability, and science/environment students may not be nominated to the gifted program. Specific training of what to look for in a gifted student would be helpful in identifying students who should be nominated to the gifted program who, otherwise, might be overlooked.

As explained later, grade needs to be evaluated cautiously because of the large number of third grade students in all of the samples in this study. If further research determines that the grade coefficient is valid, it appears that the earlier a student is tested, the higher their WASI score (because the coefficient is negative). That would translate into looking for as many nominations as possible in second grade.

Revised regression model. The purpose of multiple linear regression was to find the combination of independent variables that best predicts the dependent variable with the minimum amount of data collection. In other words, the addition of independent variables to the equation and the corresponding effort to accumulate and analyze the data

needs to be weighed against the extra R^2 or predictability of the dependent variable gained. The revised equation with only the five statistically significant contributing independent variables (total mathematics, science/environment, listening, nonverbal cognitive ability, and grade) met this purpose. The revision resulted in an adjusted R^2 of .459 versus the .463 when all 10 variables were included. The small decrease of .004 with the removal of five variables was advantageous over the full model. Very little predictability was lost yet the needed data were reduced by half. There was also a significant correlation between the estimated WASI score from the model and from the revised model. It is a high correlation with 92.1% of the variance explained indicating that the revised model is efficient.

The revised model was practical, too. If the information was needed quickly for a single student, it would be easy for a counselor to use a calculator or set up a formula in Excel to calculate the estimated score with five variables from information in the student's cumulative file. In addition, the school district could perform an analysis of the data for all students in the school district as new data become available. The results would then be shared with the counselor at each school. The importance was that students that might not be identified until months or years later, if ever, could be identified at this time with minimum effort. These students could then begin receiving the services that they need. If this proactive effort identified only one child a year that would have otherwise been overlooked, it would be worth the time to try to locate that student. The earlier interventions are put in place, the more successful students can be.

Cross-validation of revised regression model. In order to test the predictably of the revised equation, cross-validation was performed using the validation sample. The

correlation between the actual WASI scores and the estimated WASI scores from both the model and from the revised equations were statistically significant but were low to moderate. The correlation between the actual WASI score and the estimated WASI score from the full model was .29 with only 9.0% of the variance explained. The correlation between the actual WASI score and the estimated WASI score from the revised model was .27 with only 7.3% of the variance explained.

These results provided additional issues. The revised equation is not predictive of WASI scores even though the results presented and explained earlier were positive. Perhaps the split of the original data set into the model and validation samples was not actually representative of the original data set. Perhaps the sample size was too small. Future research is needed to answer these questions. One recommendation is to obtain a larger sample from a similar district or from a national data set. This should be performed before the regression equation is utilized in practice. Because the results of the cross-validation were low to moderate, the researcher is concerned that others may blindly apply the revised regression equation without verifying it with their population.

Comparison of the three data sources and correlations. In order to seek further insights to these questions, a review of the three data sources was performed.

Three data sources. A comparison of the three data sources (total data set, model sample, and validation sample) in Tables 2, 3, and 4, respectively, showed that the means and standard deviations were fairly consistent (M=123.35, 123.02, and 123.67; SD=11.21, 11.55, 10.89). The median of 123.00 was the same for the three data sources. Mode varied from 126.00 to 117.00 to 132.00. Therefore, the two samples vary from each other and the total data set in the most frequent IQ score found in that sample. The

distribution of male and female was almost equal and the percentage of male and female in each data source was equivalent. The distribution of grades from each data source were: second (18.2%, 14.0%, 22.4%), third (54.2%, 59.8%, 48.6%), fourth (20.6%, 21.5%, 19.7%), and fifth (7.0%, 4.7%, 9.3%).

A majority of the distribution of grades in each data source contained approximately 50% from third grade and less than 10% from fifth grade. Third grade is overrepresented in the samples and fifth grade is underrepresented in the samples. Therefore, the user of the results from this study will need to consider this with their population. The large number in third grade may be typical because of the timing of the administration of the OLSAT8 assessment. The OLSAT8 was given every two years in first and third grades. It is reasonable to expect many students to be tested for the gifted program in third grade after the results of the OLSAT8 are received. Similarly, the smaller number in fifth grade may be typical because this is the end of elementary school and many referrals to the gifted program would have occurred during the earlier grades. Both of these findings will need to be investigated in future research.

Correlations. A comparison of the three data sources (total data set, model sample, and validation sample) summarized in Table 11, all showed nonverbal cognitive ability as the largest positive correlation with the dependent variable (+.464, +.510, +.414) and verbal cognitive ability as the second largest positive correlation (+.376, +.449, +.270). The two largest negative correlations with the dependent variable were grade and spelling. For the total data set and the model sample, grade was the largest negative correlation (–.113, –.239) and spelling was the largest negative correlation for the validation sample (–.082). For the total data set and the model sample, spelling was the second largest negative correlation (–.033, +.018) and grade was the second largest negative correlation for the

validation sample (–.005). This supported the finding that nonverbal cognitive ability was one of the significant predictors for the revised regression model. It was surprising to the researcher that verbal cognitive ability, as the second largest positive correlation with the dependent variable, was not a significant predictor for the revised model. Likewise, the correlations with the dependent variable supported grade as a significant predictor for the revised regression model. It was surprising to the researcher that spelling, as the second largest correlation with the dependent variable, was not a significant predictor in the revised model.

A comparison of the three data sources (total data set, model sample, and validation sample) summarized in Table 12, all showed the largest positive correlations among the independent variables between nonverbal cognitive ability and verbal cognitive ability for the total data set and for the model sample (+.544, +.668), and with total mathematics for the validation sample (+.451). The large correlation between nonverbal and verbal cognitive abilities may explain why verbal cognitive ability is not a statistically significant predictor variable. The contribution it made to the regression equation may already be accounted for in the nonverbal cognitive ability variables presence in the revised regression equation. This logic would also apply to total mathematics, yet, total mathematics is a significant predictor in the revised regression equation. A comparison of the three data sources (total data set, model sample, and validation sample) all showed the largest negative correlations among the independent variables between gender and total reading for the total data set and the model sample (–.197, –.251), and with spelling for the validation sample (–.176). Gender, total reading, and spelling are not significant predictors in the revised regression equation.

This section included a discussion of the significance of (a) the regression model,

(b) the revised regression model, (c) cross-validation of the revised regression model, and (d) comparison of the three data sources and correlations.

Recommendations

This section includes a discussion of the (a) implications to prior studies, (b) implications for practitioners, (c) recommended actions to be taken, (d) recommendations for future research, (e) limitations, and (f) delimitations of the study.

Implications to prior studies. Next, the findings of the current study are compared to the prior studies used to select the variables for the current study.

As discussed in Chapter Two, Stanley (1977) found a relationship between the Scholastic Aptitude Test (SAT) subtests with high school students' choice of occupations. The students in the current study were elementary students and thus not old enough to have SAT scores. Instead, the SAT10 subtest scores were used. In addition, Assouline et al. (2006) discussed using the Iowa Tests of Basic Skills (ITBS) to determine whether to administer the Cognitive Abilities Test (CoGAT) to determine eligibility for gifted education classes. The SAT10 (which is similar to the ITBS) and the OLSAT8 (which is similar to the CoGAT) were used in this study.

Both the Stanley (1977) and Assouline et al. (2006) studies discussed using standardized test scores. They did not specify which scores they expected to be significant. The results of the current study found total mathematics, science/environment, and listening from the SAT10 and nonverbal cognitive ability from the OLSAT8 as significant independent variables.

Next, grade level of the student was considered potentially relevant as high school teachers listed different characteristics that led to a gifted nomination than the

characteristics listed by elementary teachers (Hernandez-Torrano et al., 2013). Although the current study only included elementary students, the student's grade was included to see if it had an impact in the elementary school years. In addition, Huang (2015) studied birthdate effects on kindergarten students and found that the older children in the grade had slightly higher achievement test scores. Age, however, was not statistically significant in Acar et al.'s (2016) meta-analysis. Because the assessments used in the current study were given based on grade, grade was used rather than age.

The Hernandez-Torrano et al. (2013) study expected a difference in the two levels of school – elementary versus secondary. The current study focused on second through fifth grades in elementary school. Grade was found to be a significant independent variable.

Next, Hernandez-Torrano et al. (2013) found that teacher nominations to the gifted program may be biased against females. Therefore, gender was included in the current study. The findings did not support this bias. Gender was almost equally divided in the population of students with 108 females and 106 males.

Last, Acar et al. (2016) included three moderators: (a) grade level of student, (b) nomination source, and (c) assessments (IQ, aptitude, achievement, and creativity). They excluded gender, ethnicity, socioeconomic status, and verbal vs. nonverbal test. The variables in their study are, however, most consistent with this current study which included gender, grade level of student, aptitude assessments, and achievement assessments. The current study found total mathematics, science/environment, listening, nonverbal cognitive ability, and grade were significant predictors of the WASI. Total reading, language, spelling, verbal cognitive ability, and gender were not significant

predictors of the WASI.

Implications for practitioners. The purpose of the study was to identify variables that would help the school counselor estimate individually-administered IQ scores from available data. The results of the study found five significant variables that should be considered in selecting students to nominate to the gifted program. It did not find an equation that successfully estimated WASI IQ scores. The revised regression equation with only the five significant contributing independent variables (total mathematics, science/environment, listening, nonverbal cognitive ability, and grade) explained 45.9% of the variance in the WASI score; yet, it only explained 7.3% of the variance between the actual WASI score and the estimated WASI score from the revised model. Future research is needed to investigate these findings before the regression equation is used in practice and before the regression equation is shared with the school district that supplied the data for the study. At this time, it is unknown whether there are other variables that would predict the WASI IQ score, whether the split of the total data set into the model and validation samples was not representative of the total data set, whether the sample size was too small, or some other explanation. In addition, a majority of the distribution of grades in each data source contained approximately 50% from third grade and less than 10% from fifth grade. Therefore, third grade may be overrepresented in the samples and fifth grade may be underrepresented in the samples. Therefore, the user of the results from this study will need to consider this with their population. In summary, the five significant variables should be considered when determining which students to nominate to the gifted program. The regression equation should be regarded as exploratory research.

Recommended actions to be taken. The first action that is recommended is to obtain a larger sample from a similar district or from a national data set, run the regression again, and then validate those results. This would validate or dispute the formula found in this study and potentially indicate other areas of refinement. Adding the variables of culture/ethnicity and free and reduced lunch status is also encouraged.

Even though the regression equation needs further work, the results from the literature review are complete. There is no reason to wait until the new research on the regression formula is concluded to potentially increase the nominations from teachers. After all, the purpose of the study was finding "missed" nominations to the gifted program. Therefore, while the additional research is being designed and completed, the findings in the literature should be shared with teachers in the district to help them understand the reasons why it is important to identify gifted students. This should be followed by the characteristics of gifted students and encouragement to nominate students for the gifted program. Even though the formula calculated from the revised regression model was not cross-validated and should not be utilized until it or another model is validated, teachers could be encouraged to look not only for the students with high reading, language, and verbal cognitive ability but also look for students with strong nonverbal, math, and listening skills for nomination to the gifted program.

Likewise, counselors need to be made aware of and make others aware of a gifted person's unique traits and needs and how they may appear in counseling sessions, at school, and in their career. Therefore, the results of the literature need to be shared with the other counselors in the school district.

Last, a similar study should be conducted when three to four years of data for the

current assessments that the school district is using are available.

Recommendations for future research. One research recommendation is to perform a similar study on the general student population, not just students nominated to the gifted program. The results may provide information or an equation that would discriminate between scores for gifted and nongifted students. In essence, the participants in the current study were chosen from a subset of the general student population and may not have been representative of the general student population. This could be important because states have differing eligibility criteria as well as the ability to include different variables.

Another idea is to look at the screening process the district uses for all kindergarten students to see if there are other variables that could be included in a future study. Even if the revised regression equation is validated with a new sample, there is room to find other variables that could add to the explanation of the variance. Other variables could be included such as culture/ethnicity and socioeconomic status (likely defined as free and reduced lunch status). Last, if other variables were desired, such as birth order, whether a sibling was identified as gifted, etc., these data could be added to the gifted program's paperwork and after a few years, would be available to include in a similar study.

Additional studies could include finding formulas for students with various disabilities, especially learning disabilities. Two populations that are well researched in the gifted literature are underachieving gifted students and twice-exceptional (both gifted and learning disabled) students. Variables would need to be identified from this literature as they were not included in the literature review for this study.

Next, another study could calculate multiple regression analyses for students nominated for the gifted program who have a different intelligence test score such as the WISC or Stanford-Binet.

Last, instead of predicting IQ scores, other studies could predict who are successful in gifted programs or high school and then determine how those qualities translate to elementary school. Those variables, which might include career or personality variables, could then be used to predict who should be considered for the gifted program.

Limitations. The external validity of this study is limited to a population characterized by middle to upper SES, primarily Caucasian, not migratory, educated parents, and high test scores within a high scoring school district. This is not a limitation for the purpose of this study as this study was designed to be used with the population from which the study was conducted. In other words, this study may only be generalized to second through fifth grade students in this district or a district similar to this one. Also, study participants may not represent all school students as students in the sample have been nominated for the gifted program.

A threat to internal validity could exist as the individually-administered IQ scores were obtained over four years and there was no control over history. This would be a normal occurrence in the general population, however, and is not considered a substantial risk to this study.

The same person did not administer all of the individually-administered IQ tests. There is, however, a strict administration and scoring protocol that the two district psychometrists were required to follow when giving an individually-administered IQ test.

Delimitations. The school district providing the context for this study is typical of many school districts. IQ scores are the predominant qualifying characteristic for acceptance into the gifted program and are used by the school district in this study. Participants were elementary school students in a public K-12 school district located in a suburb of a Midwestern metropolitan area. Specifically, they were second through fifth grade elementary school students in general education classrooms. Participants consisted of students tested for admittance into the district's gifted program during the 2004-2005, 2005-2006, 2006-2007, or 2007-2008 school years. The participants must also have had all of the following data: (a) a full scale IQ score on the individually-administered WASI, (b) achievement tests scores on the group-administered SAT10, preceding the WASI, (c) ability scores on the group-administered OLSAT8, preceding the WASI, and (d) information available about gender and grade.

This section included a discussion of the (a) implications to prior studies, (b) implications for practitioners, (c) recommended actions to be taken, (d) recommendations for future research, (e) limitations, and (f) delimitations of the study.

Significance of this Study and Future Studies

This study yielded important results. Even though this study did not provide results supporting the use of the revised regression equation, there remains a need to further the research in this important area. It is important to not lose sight of the value of this work and misguidedly discontinue research in this area. This study and future studies could be valuable to the students, the elementary school counselors, and the school district, plus the research community, counselors, and other school districts outside of the school district in this setting.

First, they could help locate “missed” nominations to the gifted program under the current nomination method. They could also identify high ability students that, even though they do not qualify for a gifted program, need interventions matching their high ability level. Next, the studies will validate or invalidate the reliance on information readily available to the elementary school counselor in interpreting data to help teachers and parents decide to pursue a nomination to the gifted program. The findings in this study plant the seed that the students that are strong in areas such as nonverbal ability, mathematics, and listening skills should be proactively nominated for the gifted program. They may not stand out as much as the students who have strong reading or verbal skills. Third, the results of the studies could save the counselor time on processing gifted referral paperwork. They could also prevent time spent in intervening in discipline referrals that arise because of mismatched students with their learning environment. Next, this approach aligns with the proactive intentional results based counseling activities recommended by the ASCA (ASCA, 2012) as it is seeking to identify students and helping obtain appropriate programming for them.

This and future studies could also potentially save the school district money if they show that the district could rely on a multiple regression formula instead of continuing to administer cognitive assessments in the sixth and ninth grades. The results might also influence which tests a district would purchase and administer or might help obtain funding by obtaining a truer picture of the number of gifted and high learners in the district. Next, the results will help advance theory by demonstrating that a relationship does or does not, and to what extent, exist between the independent variables selected for the study and IQ. This and future studies could also serve as an example of

how another district might set up their own study and perform their own analysis, which could ultimately influence the assessments they purchase and administer. Parochial schools, private schools, charter schools, and other public schools without an established gifted program could be particularly interested in the results of this study to help them in identifying gifted students and influencing their school's programming.

Conclusion

This chapter was organized into the following sections: (a) summary, (b) findings, (c) recommendations, (d) significance of this study and future studies, and (e) this conclusion.

There is a need to identify gifted children early so that they may begin receiving education and enrichment matched to their intellectual needs as early as possible (Subotnik et al., 2012). With the availability of data and the ability to process these data easily via computer programs, this study sought to determine if there was a way to better estimate which children should be considered for the gifted program rather than solely relying on teachers and parents to nominate the students. This study developed from an actual need to develop an efficient way to locate as many gifted students as possible. This study was developed, as action research, to potentially help each student have an equal opportunity to be selected for the gifted program, not just the students at schools where the counselors actively search for them.

Although the results of this study raised questions that need to be answered with future studies, it did have some other accomplishments. First, five variables were found to be significant and should be considered when nominating students for the gifted program. These students may not stand out as much as verbal students. Second, as

explained earlier, the results of the literature review may be shared with teachers in an effort to increase nominations to the gifted program and thus find potential "missed" nominations. Next, the results of the literature review also need to be shared with counselors as they may be unaware of the specific counseling, academic, and career development needs of gifted students and adults. Next, this study is a first step in potentially determining a method or process that does significantly estimate IQ scores. It will be easier to conduct future studies with this study as a springboard. Next, it serves as an example of action research demonstrating that practitioners should actively contribute to research by searching for ways to solve day-to-day problems that they encounter (Rowell, 2005). Counselors should not shy away from using data even though this may feel out of their comfort zone (Dahir & Stone, 2009).

In conclusion, this study provided material for current staff development with teachers and counselors as well as ideas for future studies to uncover a potential method for identifying gifted children in elementary school so that they may obtain the programming changes necessary to challenge them and help them reach their potential as well as become successful adults. As this researcher once read, "It is easier to build a child than to repair an adult".

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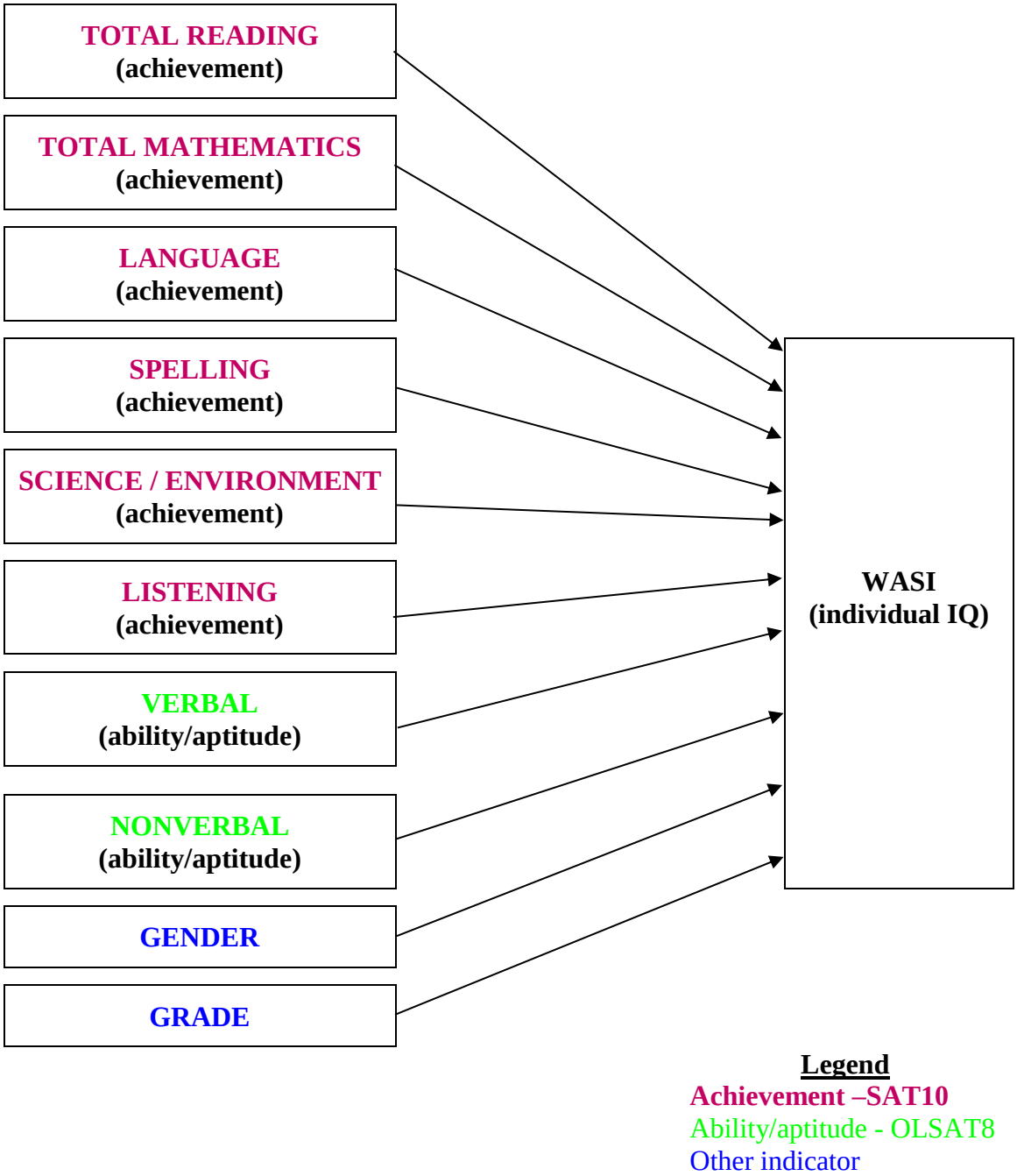
Appendix A

LIST OF FIGURES

Figure 1

Full Research Model Presentation



H_A: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_1$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$ where:

Y_{WASI} = estimated individual intelligence full scale score on WASI

b_0 = constant intelligence score independent of other independent variables

b_1 through b_{10} = partial regression coefficients

X_{READ} = SAT10 achievement score in total reading, immediately preceding the IQ test

X_{MATH} = SAT10 achievement score in total mathematics, immediately preceding the IQ test

X_{LANG} = SAT10 achievement score in language, immediately preceding the IQ test

X_{SPELL} = SAT10 achievement score in spelling, immediately preceding the IQ test

$X_{SCI/ENV}$ = SAT10 achievement score in science, immediately preceding the IQ test

X_{LISTEN} = SAT10 achievement score in listening, immediately preceding the IQ test

X_{VERB} = verbal battery score on OLSAT8

$X_{NONVERB}$ = nonverbal battery score on OLSAT8

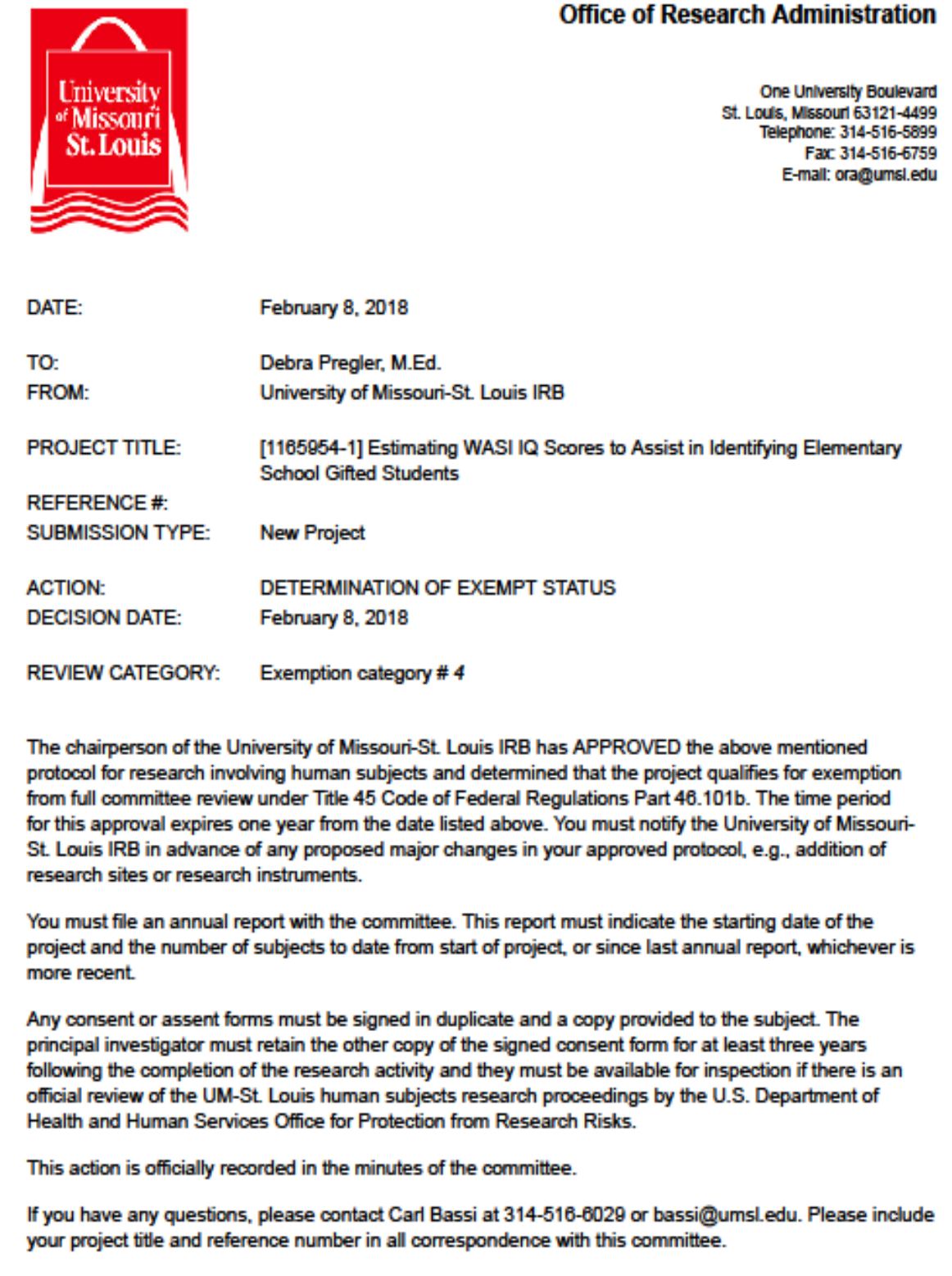
X_{GEN} = “1” if being male; “0” if being female

X_{GRADE} = “2” if grade 2; “3” if grade 3; “4” if grade 4; “5” if grade 5

E_1 = error of prediction

Figure 2

Institutional Review Board Approval



Office of Research Administration

One University Boulevard
St. Louis, Missouri 63121-4499
Telephone: 314-516-5899
Fax: 314-516-6759
E-mail: ora@umsl.edu

DATE: February 8, 2018

TO: Debra Pregler, M.Ed.
FROM: University of Missouri-St. Louis IRB

PROJECT TITLE: [1165954-1] Estimating WASI IQ Scores to Assist in Identifying Elementary School Gifted Students
REFERENCE #:
SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: February 8, 2018

REVIEW CATEGORY: Exemption category # *4*

The chairperson of the University of Missouri-St. Louis IRB has APPROVED the above mentioned protocol for research involving human subjects and determined that the project qualifies for exemption from full committee review under Title 45 Code of Federal Regulations Part 46.101b. The time period for this approval expires one year from the date listed above. You must notify the University of Missouri-St. Louis IRB in advance of any proposed major changes in your approved protocol, e.g., addition of research sites or research instruments.

You must file an annual report with the committee. This report must indicate the starting date of the project and the number of subjects to date from start of project, or since last annual report, whichever is more recent.

Any consent or assent forms must be signed in duplicate and a copy provided to the subject. The principal investigator must retain the other copy of the signed consent form for at least three years following the completion of the research activity and they must be available for inspection if there is an official review of the UM-St. Louis human subjects research proceedings by the U.S. Department of Health and Human Services Office for Protection from Research Risks.

This action is officially recorded in the minutes of the committee.

If you have any questions, please contact Carl Bassi at 314-516-6029 or bassi@umsl.edu. Please include your project title and reference number in all correspondence with this committee.

Figure 3

Normal P-Plot of Regression Standardized Residual: Model Sample (n=107

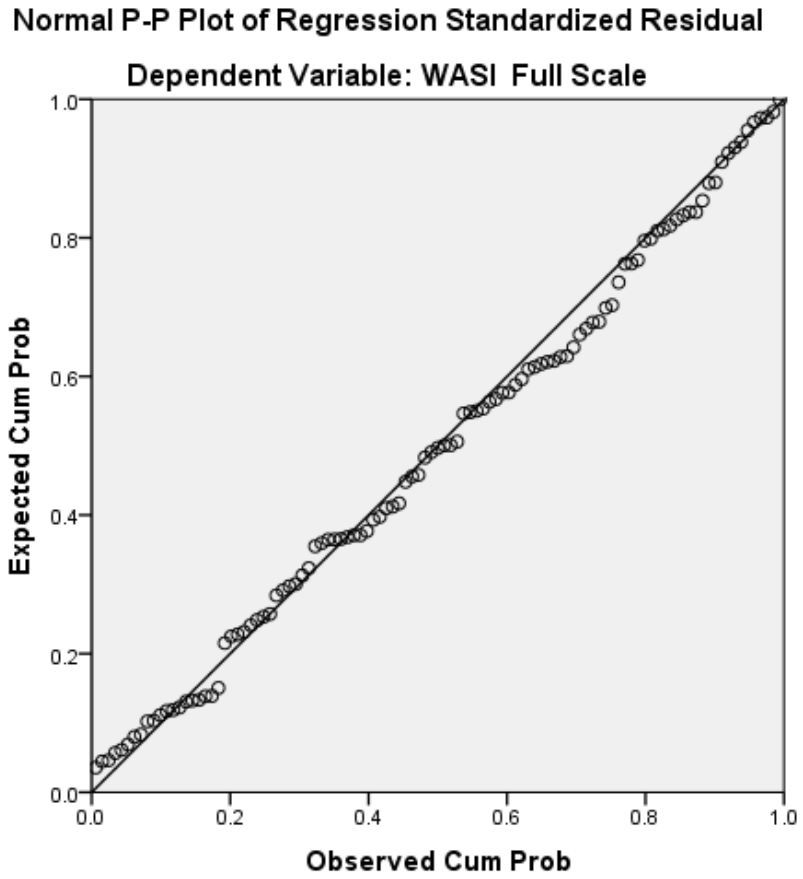
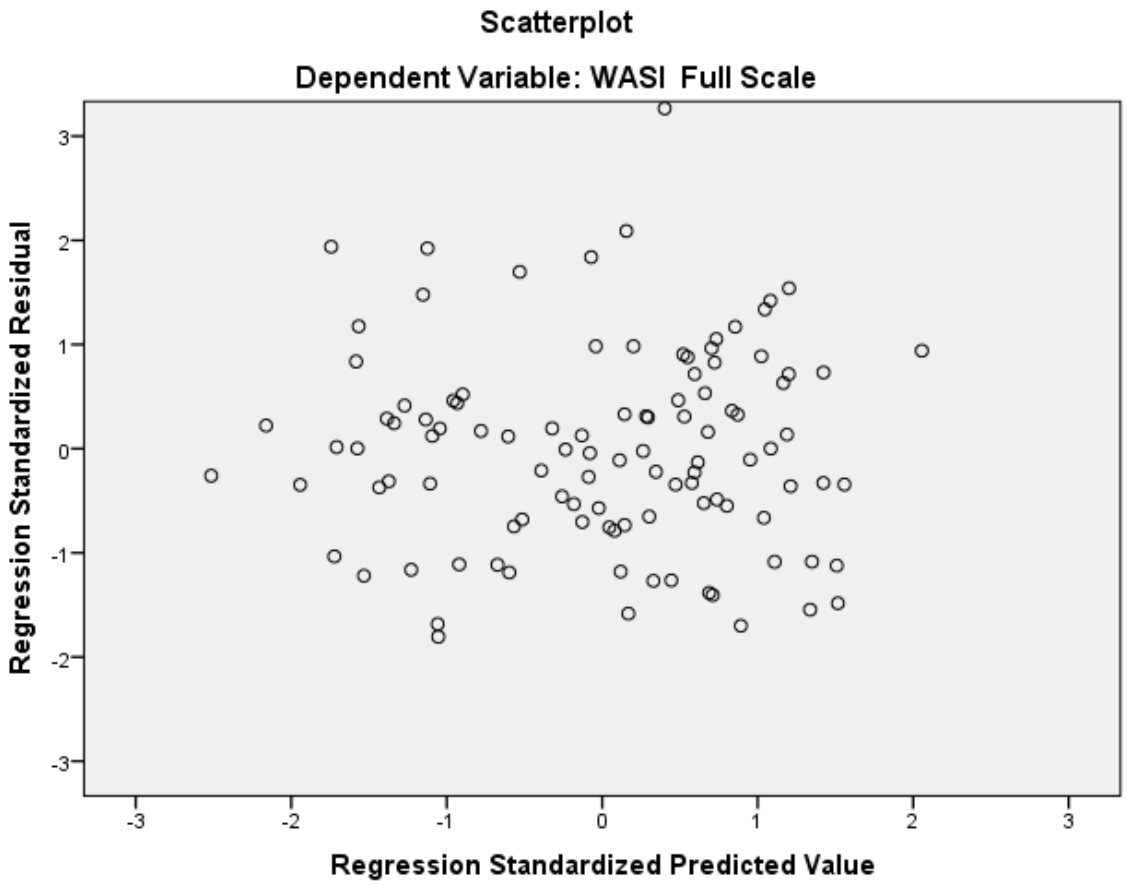


Figure 4

Scatterplot of Dependent Variable – WASI: Model Sample (n=107)



Appendix B

LIST OF TABLES

Table 1

Correlation Matrix: Total Data Set (N=214)

	WASI	Total Reading	Total Mathematics	Language	Spelling	Science/ Environment	Listening	Verbal	Nonverbal	Gender
Total Reading	.266**									
Total Mathematics	.338**	.453**								
Language	.232**	.462**	.402**							
Spelling	–.033	.377**	.307**	.203**						
Science / Environment	.158*	.250**	.256**	.342**	.028					
Listening	.258**	.266**	.197**	.388**	.050	.366**				
Verbal	.376**	.333**	.316**	.327**	.108	.208**	.244**			
Nonverbal	.464**	.367**	.478**	.257**	.140*	.221**	.148*	.544**		
Gender	.090	–.197**	.098	–.141*	–.093	.025	–.063	–.060	.034	
Grade	–.113*	.107	.064	.125*	.000	.312**	.103	.003	-.003	–.062

** Correlation is significant at the 0.01 level (1-tailed)

* Correlation is significant at the 0.05 level (1-tailed)

Table 2

Descriptive Statistics of Elementary Students with IQ Scores: Total Data Set (N=214)

Statistic	WASI	Total Reading	Total Mathematics	Language	Spelling	Science / Environ-ment
Mean	123.35	72.11	71.36	67.06	72.09	73.42
Std. Error of Mean	.77	1.19	1.27	1.38	1.46	1.39
Median	123.00	73.50	75.00	71.00	79.50	78.00
Mode	126.00	70.00	77.00	71.00	86.00	92.00
Variance	125.55	301.46	346.67	405.85	457.27	410.73
Std. Deviation	11.21	17.36	18.62	20.15	21.38	20.27
Skewness	.11	–.69	–.82	–.62	–.92	–.99
Kurtosis	–.36	–.15	.11	.05	.10	.28

Table 2 Continued

Descriptive Statistics of Elementary Students with IQ Scores: Total Data Set (N=214)

Statistic	Listening	Verbal	Nonverbal
Mean	72.63	77.75	71.00
Std. Error of Mean	1.35	1.16	1.54
Median	75.00	83.00	77.00
Mode	57.00	81.00	87.00
Variance	387.06	285.37	504.97
Std. Deviation	19.67	16.89	22.47
Skewness	–.77	–1.10	–1.07
Kurtosis	–.08	.58	.37

Gender

	Frequency	Percent
Female	108	50.5
Male	106	49.5
Total	214	100.0

Grade

	Frequency	Percent
2	39	18.2
3	116	54.2
4	44	20.6
5	15	7.0
Total	214	100.0

Table 3

Descriptive Statistics of Elementary Students with IQ Scores: Model Sample (n=107)

Statistic	WASI	Total Reading	Total Mathematics	Language	Spelling	Science / Environ-ment
Mean	123.02	71.69	70.07	63.78	72.99	71.30
Std. Error of Mean	1.12	1.73	1.91	1.92	2.03	2.11
Median	123.00	72.11	74.00	64.00	80.00	77.00
Mode	117.00	70.00	86.00	71.00	94.00	92.00
Variance	133.45	320.97	389.72	394.52	441.54	477.59
Std. Deviation	11.55	17.92	19.74	19.86	21.01	21.85
Skewness	.09	–.61	–.81	–.43	–.79	–.81
Kurtosis	–.26	–.20	–.02	–.29	–.06	–.32

Table 3 Continued

Descriptive Statistics of Elementary Students with IQ Scores: Model Sample (n=107)

Statistic	Listening	Verbal	Nonverbal
Mean	70.71	75.94	70.21
Std. Error of Mean	2.06	1.93	2.20
Median	75.00	84.00	77.00
Mode	57.00	86.00	87.00
Variance	452.45	399.85	518.67
Std. Deviation	21.27	20.00	22.77
Skewness	–.64	–.96	–.98
Kurtosis	–.35	–.15	.14

Gender

	Frequency	Percent
Female	54	50.5
Male	53	49.5
Total	107	100.0

Grade

	Frequency	Percent
2	15	14.0
3	64	59.8
4	23	21.5
5	5	4.7
Total	107	100.0

Table 4

Descriptive Statistics of Elementary Students with IQ Scores: Validation Sample (n=107)

Statistic	WASI	Total Reading	Total Mathematics	Language	Spelling	Science / Environ-ment
Mean	123.67	72.52	72.65	70.34	71.20	75.54
Std. Error of Mean	1.05	1.63	1.68	1.93	2.11	1.78
Median	123.00	77.00	77.00	71.00	79.00	78.00
Mode	132.00	86.00	77.00	78.00	86.00	78.00
Variance	118.62	284.44	303.52	399.28	475.69	338.67
Std. Deviation	10.89	16.87	17.42	19.98	21.81	18.40
Skewness	.15	–.79	–.79	–.86	–1.04	–1.19
Kurtosis	–.48	–.04	.15	.74	.23	1.22

Table 4 Continued

Descriptive Statistics of Elementary Students with IQ Scores: Validation Sample (n=107)

Statistic	Listening	Verbal	Nonverbal
Mean	74.54	79.56	71.80
Std. Error of Mean	1.72	1.25	2.15
Median	81.00	81.00	79.00
Mode	82.00	81.00	89.00
Variance	317.91	166.98	494.74
Std. Deviation	17.83	12.92	22.24
Skewness	–.87	–.85	–1.19
Kurtosis	.18	–.05	.73

Gender

	Frequency	Percent
Female	54	50.5
Male	53	49.5
Total	107	100.0

Grade

	Frequency	Percent
2	24	22.4
3	52	48.6
4	21	19.7
5	10	9.3
Total	107	100.0

Table 5

Correlation Matrix: Model Sample (n=107)

	WASI	Total Reading	Total Mathematics	Language	Spelling	Science/ Environment	Listening	Verbal	Nonverbal	Gender
Total Reading	.300**									
Total Mathematics	.419**	.506**								
Language	.200*	.507**	.411**							
Spelling	.018	.370**	.239**	.245**						
Science / Environment	.082	.270**	.348**	.300**	.101					
Listening	.404**	.312**	.224*	.366**	.117	.417**				
Verbal	.449**	.405**	.388**	.414**	.141	.193*	.327**			
Nonverbal	.510**	.389**	.501**	.359**	.109	.318**	.237**	.668**		
Gender	.076	–.251**	.060	–.178*	–.008	.024	–.035	–.152	.061	
Grade	–.239**	.035	.056	.155	.029	.243**	.099	–.100	.024	.054

** Correlation is significant at the 0.01 level (1-tailed)

* Correlation is significant at the 0.05 level (1-tailed)

Table 6

Correlation Matrix: Validation Sample (n=107)

	WASI	Total Reading	Total Mathematics	Language	Spelling	Science/ Environment	Listening	Verbal	Nonverbal	Gender
Total Reading	.226**									
Total Mathematics	.239**	.388**								
Language	.262**	.421**	.383**							
Spelling	–.082	.388**	.391**	.181*						
Science / Environment	.249**	.224*	.120	.370**	–.045					
Listening	.069	.207*	.149	.397**	–.017	.277**				
Verbal	.270**	.227**	.186*	.184*	.080	.216*	.074			
Nonverbal	.414**	.343**	.451**	.149	.174*	.100	.036	.375**		
Gender	.104	–.139	.141	–.109	–.176*	.027	–.097	.077	.131	
Grade	–.005	.171*	.075	.107	–.024	.395**	.112	.135	–.025	–.158

** Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

Table 7

Model Summary Statistics for the Variables in the Full Model and the Restricted Models: Model Sample (n=107)

Model No.	Explanation	R^2	Adjusted R^2	R^2 Change	F-Ratio for Change	df1	df2	Sig. F Change
1	Full model	.513	.463	n/a	10.130	10	96	.000
2	Null model	.000	.000	n/a				
3	Total reading removed	.510	.464	–.004	.707	1	96	.402
4	Total mathematics removed	.483	.435	–.030	5.933	1	96	.017
5	Language removed	.510	.465	–.003	.637	1	96	.427
6	Spelling removed	.503	.457	–.010	2.027	1	96	.158
7	Science / Environment removed	.480	.432	–.033	6.499	1	96	.012
8	Listening removed	.407	.352	–.107	21.082	1	96	.000
9	Verbal removed	.513	.467	–.001	.147	1	96	.702
10	Nonverbal removed	.452	.401	–.062	12.195	1	96	.001
11	Gender removed	.499	.453	–.014	2.834	1	96	.096
12	Grade removed	.463	.414	–.050	9.892	1	96	.002

Table 8

Unstandardized and Standardized Regression Coefficients for the Variables in the Full Model: Model Sample (n=107)

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	t	Sig.
(Constant)	106.103	5.98		17.73	.000
Total reading	.053	.06	.08	.84	.402
Total mathematics	.134	.06	.23	2.44	.017
Language	–.042	.05	–.07	–.80	.427
Spelling	–.061	.04	–.11	–1.42	.158
Science/environment	–.115	.05	–.22	–2.55	.012
Listening	.210	.05	.39	4.59	.000
Verbal	.023	.06	.04	.38	.702
Nonverbal	.185	.05	.37	3.49	.001
Gender	2.980	1.77	.13	1.68	.096
Grade	–3.810	1.21	–.24	–3.15	.002

Table 9

Revised Model Summary: Model Sample (n=107)

Model No.	Explanation	R^2	Adjusted R^2	R^2 Change	F-Ratio for Change	df1	df2	Sig. F Change
1	Full model	.484	.459	.484	18.975	5	101	.000

Table 10

Unstandardized and Standardized Regression Coefficients for the Variables in the Revised Model: Model Sample (n=107)

	Unstandardized Coefficients		Standardized Coefficients		
Variable	B	Std. Error	Beta	t	Sig.
(Constant)	106.119	5.07		20.92	.000
Total mathematics	.137	.05	.24	2.76	.007
Science/environment	–.115	.05	–.22	–2.56	.012
Listening	.205	.04	.38	4.76	.000
Nonverbal	.192	.04	.38	4.48	.000
Grade	–3.941	1.18	–.25	–3.33	.001

Table 11

Two Largest Positive and Negative Correlations Between the Independent Variables and the WASI

	Total Data Set	Model Sample	Validation Sample
Positive:			
Nonverbal	+.464**	+.510**	+.414**
Verbal	+.376**	+.449**	+.270**
Negative:			
Grade	–.113*	–.239**	–.005
Spelling	–.033	+.018	–.082

** Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

Table 12

Two Largest Positive and Negative Correlations Between the Independent Variables

Independent Variables		Total Data Set	Model Sample	Validation Sample
Positive:				
Nonverbal	Verbal	+.544**	+.668**	
Nonverbal	Total Mathematics	+.478**		+.451**
Language	Total Reading		+.507**	+.421**
Negative:				
Gender	Total Reading	–.197**	–.251**	
Gender	Spelling			–.176*
Gender	Language	–.141*	–.178*	
Gender	Grade			–.158

** Correlation is significant at the 0.01 level (1-tailed)
* Correlation is significant at the 0.05 level (1-tailed)

Appendix C

REGRESSION MODELS

Simultaneous regression analyses were used to identify those variables that made the most independent significant contribution to predicting individually-administered IQ scores and to determine the degree to which the prediction of these IQ scores could be improved by using multiple factors. First, the full model was calculated followed by each independent variable being removed one at a time to determine its impact on the full model. Each of the models will be explained.

Full model (model 1). The research or alternate hypothesis for the full model is: an individually-administered IQ score is a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade (see Figure 1). This is represented as:

Model 1

H_A: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_1$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$; where:

Y_{WASI} = estimated individual intelligence full scale score on WASI

b_0 = constant intelligence score independent of other independent variables

b_1 through b_{10} = partial regression coefficients

X_{READ} = SAT10 achievement score in total reading, immediately

preceding the WASI IQ test

X_{MATH} = SAT10 achievement score in total mathematics, immediately preceding the WASI IQ test

X_{LANG} = SAT10 achievement score in language, immediately preceding the WASI IQ test

X_{SPELL} = SAT10 achievement score in spelling, immediately preceding the WASI IQ test

$X_{SCI/ENV}$ = SAT10 achievement score in science/environment, immediately preceding the WASI IQ test

X_{LISTEN} = SAT10 achievement score in listening, immediately preceding the WASI IQ test

X_{VERB} = verbal battery score on OLSAT8

$X_{NONVERB}$ = nonverbal battery score on OLSAT8

X_{GEN} = "1" if being male; "0" if being female

X_{GRADE} = "2" if grade 2; "3" if grade 3; "4" if grade 4; "5" if grade 5

E_1 = error of prediction

Null model (model 2). The null model (Model 2) or statistical hypothesis for the full model is: an individually-administered IQ score is not a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade (see Figure 1). This is represented as:

Model 2:

H_O: $Y_{WASI} = b_0 + E_2$

and $\rho_1 = 0$; $\rho_2 = 0$; $\rho_3 = 0$; $\rho_4 = 0$; $\rho_5 = 0$; $\rho_6 = 0$; $\rho_7 = 0$; $\rho_8 = 0$; $\rho_9 = 0$; and $\rho_{10} = 0$.

E_2 = error of prediction

As stated earlier, this study was specifically interested in the predictive value of the model. As such, it was interested in determining the individual contribution of each variable to the predictive value of the full model equation. Therefore, each variable was examined in a regression analysis with only one variable removed in relation to the full model. The individual variable restriction hypotheses and resulting models are as follows:

First restricted model (model 3). The first restricted model or alternate statistical hypothesis tested the effect of the national percentile achievement test score in total reading. The alternate research hypothesis for this model is the same as the Full Model.

The Model 3 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in total reading. This is represented as:

Model 3

H_O: $Y_{WASI} = b_0 + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_3$

and $\rho_1 = 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_3 = error of prediction

Second restricted model (model 4). The second restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in total mathematics. The alternate research hypothesis for this model is the same as the Full Model.

The Model 4 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in total mathematics. This is represented as:

Model 4

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_4$

and $\rho_1 \neq 0$; $\rho_2 = 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$

E_4 = error of prediction

Third restricted model (model 5). The third restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in language. The alternate research hypothesis for this model is the same as the Full Model.

The Model 5 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile

achievement test score in language. This is represented as:

Model 5

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_5$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 = 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_5 = error of prediction

Fourth restricted model (model 6). The fourth restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in spelling. The alternate research hypothesis for this model is the same as the Full Model.

The Model 6 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, science/environment, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in spelling. This is represented as:

Model 6

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_6$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 = 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_6 = error of prediction

Fifth restricted model (model 7). The fifth restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in

science/environment. The alternate research hypothesis for this model is the same as the Full Model.

The Model 7 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, and listening, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in science/environment. This is represented as:

Model 7

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_7$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 = 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_7 = error of prediction

Sixth restricted model (model 8). The sixth restricted model or alternate statistical hypothesis tests the effect of the national percentile achievement test score in listening. The alternate research hypothesis for this model is the same as the Full Model.

The Model 8 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, and science/environment, verbal and nonverbal cognitive abilities, gender, and grade and is not affected by the national percentile achievement test score in listening. This is represented as:

Model 8

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} +$

$b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_8$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 = 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_8 = error of prediction

Seventh restricted model (model 9). The seventh restricted model or alternate statistical hypothesis tests the effect of the verbal OLSAT8 battery score. The alternate research hypothesis for this model is the same as the Full Model.

The Model 9 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, nonverbal cognitive abilities, gender, and grade and is not affected by verbal cognitive abilities. This is represented as:

Model 9

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_8X_{NONVERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_9$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 = 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_9 = error of prediction

Eighth restricted model (model 10). The eighth restricted model or alternate statistical hypothesis tests the effect of the nonverbal OLSAT8 battery score. The alternate research hypothesis for this model is the same as the Full Model.

The Model 10 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total

mathematics, language, spelling, science/environment, and listening, verbal cognitive abilities, gender, and grade and is not affected by nonverbal cognitive abilities. This is represented as:

Model 10

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_9X_{GEN} + b_{10}X_{GRADE} + E_{10}$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 = 0$; $\rho_9 \neq 0$; and $\rho_{10} \neq 0$.

E_{10} = error of prediction

Ninth restricted model (model 11). The ninth restricted model or alternate statistical hypothesis tests the effect of gender. The alternate research hypothesis for this model is the same as the Full Model.

The Model 11 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, and grade and is not affected by gender. This is represented as:

Model 11

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_{10}X_{GRADE} + E_{11}$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 = 0$; and $\rho_{10} \neq 0$.

E_{11} = error of prediction

Tenth restricted model (model 12). The tenth restricted model or alternate statistical hypothesis tests the effect of grade. The alternate research hypothesis for this model is the same as the Full Model.

The Model 12 null hypothesis is: an individually-administered IQ score is only a function of the national percentile achievement test scores in total reading, total mathematics, language, spelling, science/environment, and listening, verbal and nonverbal cognitive abilities, and gender and is not affected by grade. This is represented as:

Model 12

H_O: $Y_{WASI} = b_0 + b_1X_{READ} + b_2X_{MATH} + b_3X_{LANG} + b_4X_{SPELL} + b_5X_{SCI/ENV} + b_6X_{LISTEN} + b_7X_{VERB} + b_8X_{NONVERB} + b_9X_{GEN} + E_{12}$

and $\rho_1 \neq 0$; $\rho_2 \neq 0$; $\rho_3 \neq 0$; $\rho_4 \neq 0$; $\rho_5 \neq 0$; $\rho_6 \neq 0$; $\rho_7 \neq 0$; $\rho_8 \neq 0$; $\rho_9 \neq 0$; and $\rho_{10} = 0$.

E_{12} = error of prediction