1-1-2012

Tell me more about it: a query into intelligence scores and their relations with achievement and problem behavior

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TELL ME MORE ABOUT IT: A QUERY INTO INTELLIGENCE SCORES AND THEIR RELATIONS WITH ACHIEVEMENT AND PROBLEM BEHAVIOR

by

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DISSERTATION

Submitted to the Graduate School

of Wayne State University,

Detroit, Michigan

in partial fulfillment of the requirements

for the degree of

DOCTOR OF PHILOSOPHY

2012

MAJOR: PSYCHOLOGY (Clinical)

Approved by:

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Advisor Date

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ACKNOWLEDGEMENTS

First and foremost I would like to acknowledge and thank the members of this dissertation committee for their support and guidance. Thank you to Drs. Marla Bartoi, Jeffrey Kuentzel, and Cheryl Somers for your willingness to be on my committee, for your patience, and helpful suggestions. I would specifically like to thank my dissertation chair and advisor, Dr. Douglas Barnett for his mentorship on this project and throughout graduate school. His guidance was crucial in providing the skills, encouragement, and motivation that was necessary to complete this project. I am highly indebted to my committee as a whole for their invaluable insight and flexibility in helping me complete this project.

Furthermore, I would like to extend my deepest gratitude to my family, spouse, and friends for their support and inspiration. Graduate school would not have been possible without your presence and encouraging words.

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CHAPTER 1

INTRODUCTION

> *"Some recent philosophers seem to have given their moral approval to these deplorable verdicts that affirm that the intelligence of an individual is a fixed quantity, a quantity that cannot be augmented. We must protest and react against this brutal pessimism; we will try to demonstrate that it is founded on nothing"* (Binet, 1909, p. 141).

As is evident in the above quote, the creator of the first standardized instrument to assess individual intellectual capacity, Alfred Binet, was quick to question the idea that intelligence was innate and immutable. Binet hypothesized that intelligence was malleable, could be influenced by environmental factors, and was of questionable validity if utilized with children outside of the backgrounds of the children in the standardization samples. It is interesting to examine Binet's beliefs about intellectual assessment in the current context of intelligence testing, namely as Detterman (1994) argued,

> "…*there is no doubt that there is measurable variability in human intellectual ability. Research demonstrates that intelligence tests are highly reliable…. Intelligence tests predict important things like number of years of schooling completed, school performance, and the scores on other tests of intelligence and achievement. The reasons for these correlations may be debatable, but the empirical fact of the correlations is indisputable"* (as cited in Sattler, 2001, p. 161).

It is indeed the case that psychologists have long been interested in assessing intelligence and identifying its many correlates. Unlike Detterman's dismissive statement, however, understanding the reasons for these associations may be just as important, if not more, than the simple fact that the correlations exist. For instance, researchers can learn a lot by further examining why decades of research has found that people with lower intelligence are more likely to have higher rates of emotion and behavior problems than people who score higher on intelligence tests (Jaggers, 1934; Rutter, 1971). The association between IQ and adjustment problems has been documented for a wide range of difficulties, including both internalizing and externalizing problems (Blumberg & Izard, 1985; Cook, Greenberg, & Kusché, 1994; Hodges & Plow, 1990; Kaslow, Rehm, & Siegel, 1984; Lynam, Moffitt, & Stouthamer Loeber, 1993).

Investigators have repeatedly attempted to explain why low IQ might be connected to increased behavior, emotional, and delinquency problems. Some have argued that lower IQ leads to behavior problems, either directly or indirectly (Schonfeld, Shaffer, O'Connor, & Portnoy, 1988). However, it could just as likely be that children with behavioral and emotional problems do not have the behavioral control to perform well on IQ tests (Glutting, Oakland, & Konold, 1994), suggesting that the association is an artifact of the test rather than an underlying causal mechanism. One way to further untangle the association between IQ and adjustment is to look at whether and how this association varies as a function of employing a variety of research methods.

The current study explores these relations and the theories behind them by comparing associations between behavior problems, achievement, and cognitive functioning comparing the newest (i.e., fourth edition) version of the Wechsler

Intelligence Scale for Children (WISC -IV: Wechsler, 2003) with its predecessor. By contrasting the relations of behavior and emotional problems on updated versions of the test, we can further examine the strength of these associations. If the association between intelligence and behavior remains on the amended and re-standardized exam we can have greater confidence in the findings. If, as testing methods are revised and hopefully improve, the association between behavior problems and intelligence diminishes we have evidence that other mechanisms might be underlying the correlation between intelligence and behavior problems rather than some type of "determining pathway" connecting the two constructs. To be clear, a cross-sectional study like the current one cannot provide definitive evidence of causality. However, comparing two relatively similar, large samples on the WISC III & IV can provide additional clarity on the nature and strength of relation between IQ and behavior problems, identify and control for potential confounding variables, support hypothesized mechanisms and offer hypotheses for further research and experimentation.

Externalizing Problems. In clinical and developmental psychology, externalizing behavior problems and disorders tend to refer to problems that are seen in children's explicit behavior and reflect a child acting out in an observable, negative way (Campbell, Shaw, & Gilliom, 2000). Clinically, disruptive and aggressive behaviors are usually classified as signs of externalizing disorders. In the literature, the link between externalizing behaviors and intelligence has been documented in both discrete categories and on a continuum of problematic behavior. In the case of categorical manifestations of externalizing pathology, Oppositional Defiant Disorder (Speltz, DeKlyen, Calderon, Greenberg, & Fisher, 1999) and Conduct Disorder (Lynam et al.,

1993; Richman, Stevenson, & Graham, 1982) have been associated with lower intelligence scores. Research has also shown that when considered on a continuum, acting out behavior problems are inversely related to intelligence in children (Cook et al., 1994) and aggressive behavior in nonclinical samples of adults (Giancola, & Zeichner, 1994).

Internalizing Problems. Although not as broadly researched as externalizing problems, it is also important to consider the role that internalizing problems might play in cognitive processing abilities. Internalizing problems generally refer to the internal psychological state as opposed to rule violation and other disruptive behavior. Problems such as anxiety, withdrawal, inhibition, and depression are usually classified as internalizing disorders (Campbell et al., 2000). Internalizing symptoms, including both anxiety and depression, in children have also been linked with cognitive functioning.

Children with depression have shown impaired performance on tasks that assess working memory and perceptual organization, but not vocabulary (Blumberg & Izard, 1985; Kaslow et al., 1984). This pattern has also been replicated in adult populations, indicating some consistency in test demands (Kluger & Goldberg, 1990). Anxiety disorders have also been linked with lower overall intelligence scores (Hodges & Plow, 1990). It is not necessary for children to meet the full criteria for an anxiety disorder for related characteristics, such as shyness and withdrawal, to have an influence on their performance in a testing situation. Children identified as shy typically achieve lower language assessments scores, particularly in the areas of expressive vocabulary and verbal fluency (Evans, 1993).

It seems clear from the previous research documenting associations between children's behavioral and emotional problems and cognition that there appears to be some mechanism at work linking these constructs. There are several pathways that have been proposed and evaluated to explain the link between intelligence and behavior. Understanding these various pathways helps shed light on the current state of the field and the necessity of the current project.

Potential Pathway 1: Cognitive Deficits Lead to Emotional and Behavior Problems

One proposed pathway explaining these associations suggests that cognitive deficits lead to behavior problems, either directly or indirectly through mediating variables (Schonfeld et al., 1988). Although it is possible that early cognitive deficits and associated learning problems may lead directly to frustration and misconduct (Schonfeld et al., 1988), it is also possible that there are factors that perform an intermediary function. This would be supported in the current study if other variables predicted behavior problems above and beyond measures of intelligence. In fact, researchers have posited several such potential mediators to account for the relations between intelligence and behavior problems, several of which were examined in the current study.

Verbal mediators. One well-documented research line of thought proposes that the association between intelligence and behavior problems is mediated by verbal deficits (Moffitt & Silva, 1988). In an extensive review of conduct problems and delinquency, most studies provided evidence that delinquent and conduct disordered youth had lower verbal IQs relative to performance (Moffitt, 1993a). In addition to cross sectional research, prospective longitudinal studies have shown that early deficits in

verbal learning and reasoning predict antisocial outcomes two decades later (Farrington & Hawkins, 1991; Moffitt, 1990). In one of the most ambitious studies of development and its corollaries, the Dunedin Multidisciplinary Health and Development Study has followed a large cohort of New Zealand children (>1,000) from birth (1972-1973) through adulthood. In this study, researchers assessed cognitive performance with a slightly modified version of the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974). Data from this project demonstrated that one of the most robust findings of mental deficits among children with high rates of delinquent behaviors is a deficit in verbal abilities (Moffitt, 1990; Moffitt, 1993a). This provides convincing evidence that language deficits are important to consider in understanding the relations of intelligence and problem behaviors.

The theory behind this verbal mediation model has been explained in several different ways. One possible explanation holds that difficulties with verbal skills may lead to mislabeling others' emotions, which then leads to inappropriate reactions (Savitsky & Czyzewski, 1978). It is also possible that a deficit in verbal abilities actively interferes with problem solving by inhibiting a person's ability to anticipate the consequences of their actions (Wilsan & Hernstein, 1985). This is further explained by Lynam and Henry (2001) who suggest that the cognitive deficits might prevent children from understanding rules or from being able to use words to negotiate in a conflict, and thus increase the likelihood that they will engage in antisocial behavior. Others have also proposed that the lack of verbal skills interferes with the individual's ability to engage in internal or private speech, which is an important component of behavior regulation (Loney, Frick, Ellis, & McCoy 1998). Specifically, it suggests that when

children's language skills are not developed they do not possess the language that is necessary to be able to communicate and express their feelings and so they might show their feelings rather than talking about them. As they are able to cognitively mature they are able to regulate their emotions by vocalizing the expression of language. When children's language improves, their problem solving skill and their ability to resolve conflicts in more prosocial ways also improve (Coie & Dodge, 1998). The theory of verbal skills as a mediator of intelligence and behavior problems would be supported in the present study if the verbal index of intelligence predicted behavior problems beyond other indexes of intelligence on both the current and previous editions of the WISC and explained the relations between IQ and behavior. Given the cross-sectional design of the current study, however, it was not possible to test directionality or causation. Additionally, these pathways may not be mutually exclusive. It is possible that for some children cognitive abilities are a predisposing variable for developing emotional and behavior problems, and for some children the directionality might be reversed.

Attention mediator. In addition to intelligence and potential language related deficits, attention, a measure of executive functioning, is another important variable to consider when examining the relations of behavior and emotion problems to cognitive abilities (Moffitt, 1993). For example, approximately three-quarters of all children with clinically significant acting out behaviors also have ADHD and struggle with problems of impulsivity and lack the sustained attention necessary for the problem solving required by both cognitive task demands and resolving interpersonal disputes (Isen, 2010). These difficulties with attention could initiate a cycle of mutually reinforcing externalizing

behavior, poor achievement, and weak cognitive performance (Quay, 1987). Although one might make the argument that it is the impulsivity component rather than attention issues influencing academic achievement and cognitive abilities, analyses suggest that performance is primarily impaired by the inattention component rather than the hyperactivity or impulsivity (Barriga, et al., 2001).

When it comes to anxiety and depression, it is possible that the disorder can adversely affect attention capacity. In the criteria for Depression, “diminished ability to think or concentrate” is specified as a symptom. Additionally, with anxiety the symptoms often result in self-focus and apprehension that can diminish attention capacity (Mellings & Alden, 2000). Inverse relations have been documented between anxiety and cognitive ability, such that high levels of anxiety are associated with decreased memory and cognitive functioning (Von Ameringen, Mancini, & Favolden, 2003). Indeed, attention problems often co-occur with behavior problems, such as Conduct Disorder, and emotional difficulties, such as anxiety and depression (Angold, Costello, & Erkanli, 1999). Based on the research looking at attention problems associated with both internalizing and externalizing disorders, it seems reasonable that attention might play an important role as a mediator or moderator of performance on cognitive ability tests.

The current study examined how indices of attention related to cognitive abilities and achievement. If, as was predicted, attention was a predictor of performance on standardized ability tests it should be significantly related to scores on tests of intelligence and achievement. Additionally, if attention, as an executive function, was a mediator of overall cognitive ability and its relation to behavioral and emotional difficulties, indices of attention should have been related to children’s scores of

internalizing and externalizing functioning above and beyond other cognitive abilities, such as verbal and perceptual ability scores.

Potential Pathway 2: Emotional and Behavior Problems Lead to Cognitive Deficits

One potential pathway suggests that emotional and behavior problems create difficulties for children that prevent them from learning the skills necessary to perform well on cognitive performance tests (Schonfeld et al., 1988). Although it is possible that students exhibiting unruly or antisocial behavior may obstruct their learning process and thus impair cognitive development, the research mostly suggests that disruptive behavior is unlikely to be the cause of cognitive deficits (Schonfeld et., al 1988). However, research exploring the role of internalizing disorders, such as anxiety and depression, in the development of cognitive deficits provides some evidence that emotional difficulties might precede cognitive problems.

Anxiety/depression and task familiarity. Research with a non-clinical sample of normally developing children shows that those with higher rates of self-reported depression perform poorly on tasks that involve new concepts, like those assessed on the block design subtest (from WISC-R), or tests that require concentration skills, like coding and digit span. However, when they are able to rely on previously learned material, such as the case with vocabulary (from PPVT), their performance is not impaired (Blumberg & Izard, 1985). The discrepancy between performance and verbal tasks for depressed children may be explained by a learned helplessness conceptualization. The theory of learned helplessness holds that children with depression perceive that they lack control over their environment and find that their behavior cannot produce their desired results. This attribution style leads to the belief

that they cannot influence their performance on unfamiliar tasks, but does not impair performance on tasks that do not require learning completely new concepts (Hodges & Plow, 1990).

With regard to anxiety, it is thought that the task demands create mental preoccupation and high anxiety that might underestimate children's true cognitive potential (Hodges & Plow, 1990). Temperamentally, "very shy" children also perform significantly worse on other cognitive tasks than children who are not shy (Schneider & Sodian, 1991). In an unfamiliar testing environment, the first time that "very shy" children were asked to recall text that was read to them they performed less well than their same aged peers. When given the opportunity to perform the task a second time, the performance of the group of "very shy" children was equivalent to that of their peers Thus, it seems that shy and anxious characteristics can affect children's retention in an unfamiliar interview and testing situation and as a result affect their performance.

Additional research has documented a similar association between environmental familiarity and task performance (Zigler, Abelson, & Seitz, 1973). Zigler et al. (1973) argued that wariness and fearfulness of unfamiliar testing situations leads children to respond in maladaptive ways, which can lower performance and reduce tests scores. In their study, the researchers also showed that young children from economically disadvantaged backgrounds were particularly sensitive to the familiarity of the environment. When given the opportunity to be retested in a more comfortable and familiar environment, either with the same examiner or following a play session, children from disadvantaged backgrounds showed a substantial gain in performance on the Peabody Picture Vocabulary Test (PPVT). Furthermore, these gains were greater than

those gains shown by children from advantaged backgrounds. The researchers proposed that the substantial improvement in performance was due primarily to a decrease in situational test anxiety (Zigler et al., 1973). This suggests that when situational wariness is addressed directly, by making the environment more friendly or predictable, IQ scores are higher than when no effort is made.

Although the limitations of the current project prevent a determination of directionality, it is possible to explore the relations of anxiety and depression symptoms to cognitive test scores. If, as the previous research suggests, anxiety and depression symptoms are related to intelligence scores, the current study should show that internalizing scores are related to measures of intelligence on both the WISC-III and WISC-IV.

Re-examining verbal abilities. Most of the theories exploring the verbal mediation model posit that directionality begins with the cognitive verbal deficit increasing risk for behavioral problems. This pathway was discussed extensively above in the section that reviewed research suggesting that cognitive deficits as a predecessor to the development of behavior problems. However, it is important to note that some theories propose the opposite. One such argument suggests that children's history of disobedience and coercive style prevents them from socializing in an appropriate manner, which consequently makes it difficult to obtain the cultural skills that would improve their verbal IQ and behavior regulation (Patterson, 1990).

Potential Pathway 3: Other Factors Explains Both Emotional and Behavior Problems and Cognitive Deficits

It is also possible that the associations between cognitive functioning and

behavior problems are actually a result of some “third,” unmeasured variable that directly or indirectly affects both (Schonfeld et al., 1988). This pathway has gained some support from research documenting the stability and early onset of both IQ and conduct problems (Schonfeld et al., 1988). Additional support has also come from research exploring the role of potential antecedent factors, such as temperamental factors, stressful life factors, and parenting variables.

Environmental factors. Numerous studies have documented the connection between IQ and behavioral problems, but some have argued that the underlying internal processes that may lead to antisocial and aggressive behavior are best understood in context with other important variables such as the organization and structure of the home environment, parenting style, and neighborhood effects. Indeed, cognitive deficits and child-parent relationship quality, along with other systems, tend to covary in samples of children with severe behavior problems (Cicchetti & Richters, 1993).

Researchers have argued that an adverse environment could actually be the explanatory mechanism underlying both cognitive processes and behavioral outcomes (Richters & Cicchetti, 1993). An interaction between family adversity and verbal abilities on levels of aggression has been documented (Moffitt, 1990). In this study, children raised in harmful home environments and who demonstrated verbal deficits were much more aggressive than children with low verbal skills alone or being raised in a dysfunctional home. Theoretically, children who are exposed to a chaotic home environment or dysfunctional parent relationships could also be at risk for both delays in cognitive growth and contexts that indirectly reinforce behavior problems. This is an important consideration, and there is evidence that supports this argument as prior

research has highlighted the association between the development of both behavior problems and cognitive ability with neighborhood quality and measures of poverty (Brooks-Gunn, & Duncan,1997).

Even after accounting for negative household environment and prenatal risk factors, children who are consistently poor show greater deficits in cognitive development than children who are not exposed to persistent poverty (Duncan, Brooks-Gunn, & Klebanoy, 1994; Korenman, Miller, Sjaastad, 1995). In a diverse sample of children, the effect of persistent poverty on IQ was nearly twice as large for children who experience transient poverty (Duncan et al., 1994). Poverty can also influence other systems in which a child lives, including their neighborhood and access to education and health services. Although the effects are not as large as those documented for individual income level, living in an affluent neighborhood positively affects performance on the Wechsler Preschool and Primary Scale of Intelligence (Duncan et al., 1994).

The development of emotional and behavioral problems has also been linked to neighborhood factors. Residing in urban environments that have higher rates of unemployment, single-parent homes, and recipients of social welfare services is positively associated with behavior problems, including increased severity and frequency of delinquency (Loeber & Wikstrom, 1993; Peeples & Loeber, 1994). There also seems to be a cumulative effect of living in impoverished environments on children's socioemotional development. Specifically, with greater duration of time spent living in poverty, children's feelings of unhappiness, anxiety, and dependency are amplified (McLeod & Shanahan, 1993). Living in persistent poverty rather than transient poverty also has a disproportionately large effect on the development of children's

behavioral problems (Duncan et al., 1994).

An important factor to consider when evaluating the effects of poverty on child development is the high rate of exposure to community violence that is present in impoverished environments. Exposure to community violence is highly associated with children's adjustment, and has been connected to the development of externalizing behavior problems and emotional problems, such as depression and anxiety (Schwab-Stone et al., 1999). Greater exposure to violence has also been linked to lower cognitive and achievement scores (Ratner et al., 2006). The mechanisms behind this association were explored in a large, urban, diverse sample of young children (Ratner et al., 2006). In that study, children's cognitive abilities were assessed with the Wechsler Primary and Preschool Scale of Intelligence-Revised (WPPSI-R). Despite the significant relation between cognitive ability and community violence in this sample, children who reported having a greater sense of safety, regardless of their exposure to violence, had higher intelligence and achievement scores. The results of this study suggest that the stress associated with feeling unsafe, and potentially being in a constant state of hypervigilance, diverts children's attention on learning and performance (Ratner et al., 2006).

Despite the accumulation of evidence documenting poverty and environment as potential antecedents for the development of both behavior problems and cognitive deficits, other studies have shown that the relations between cognitive ability and conduct problems holds even when accounting for environmental factors, such as socioeconomic status (Lynam et al., 1993). Therefore, it seems likely that although environmental factors might exacerbate and strengthen the IQ-behavior association,

this explanation is not able to account for the connection completely and thus it is necessary to explore other explanations.

Considering the Role of Academic Achievement

Academic achievement may also provide an important clue in understanding the link between intelligence and problem behaviors. One possibility is that low intelligence leads to school failure, which then prevents children from identifying and socializing with prosocial peers – leading to increased behavior problems or even increased symptoms of withdrawal, depression, and anxiety (Moffitt, 1993a). In this scenario, it is school achievement that mediates the relation of cognitive abilities and either internalizing or externalizing problems. Studies have been done to attempt to better understand the relations of these factors to one another.

In perhaps one of the most comprehensive assessments of attention, child adjustment, and school-entry achievement, a multi-site research team examined the relations among these variables in a nationally representative sample of U.S. children, Canadian children, and British Children by combing longitudinal data sets. (Duncan et al. 2007). They regressed measures of reading and mathematic achievement on school-entry achievement, attention, anti-social behavior and internalizing behavior problems. Their findings suggest that the best predictor of later achievement was basic math and reading skills assed at school entry. Despite considering the role of externalizing and internalizing problems, these were not related to later achievement, but attention related skills were. There were not many differences in how the factors of interest related to math vs. reading achievement, and children's attention skills was just as important for both math and reading, whereas internalizing and externalizing

problems were equally unimportant for both. Importantly, controls for child IQ, behavior and temperament, and parent education and income, all of which were measured prior to the point of kindergarten entry, were included in the regressions. One small difference in predicting math vs. reading achievement was apparent in their results. Surprisingly, early math skills and early reading skills uniformly predicted later reading achievement, but early reading skills were not as strongly related to math achievement, although it still predicted a significant portion of the variance (Duncan et al.,2007). This study provides convincing evidence that attention is a particularly important variable to consider in understanding achievement, and that there seem to be few differences for how socioemotional variables and attention relate to math vs. reading achievement.

In a community-based population of children, the cognitive, achievement, and psychopathological functioning of children was investigated (Kusché, Cook, & Greenberg, 1993). Children in this study were administered the Vocabulary and Block Design subtest of the WISC-R (Wechsler, 1974) and classified into subgroups of emotional and behavioral functioning based on their self-report and teacher's responses to the Achenbach checklist (Achenbach, 1991). Achievement functioning was also assessed, and was based on scores from the California Achievement Test (CTB/McGraw-Hill, 1986) and the Wide Range Achievement Test- Revised (Jastak & Wilkinson, 1984). When compared with controls, children with internalizing symptoms only, children with externalizing symptoms only, and children with both externalizing and internalizing symptoms – all demonstrated significant deficits in intellectual functioning and academic achievement (Kusché et al., 1993). That study suggested that

achievement, intelligence, and emotional well-being are likely inter-related constructs, but highlights the difficulty in delineating causality.

Teasing apart directionality between achievement and IQ is not an easy task and has been a matter of debate for decades (Watkins, Lei, & Canivez, 2007). The correlations between achievement performance and performance on intelligence tests are quite high (Naglieri & Bornstein, 2003). This has led many to question the distinctiveness of the two constructs (Flanagan, Andrews, & Genshaft, 1997) and others to suggest that the relation between intelligence and achievement is best understood as reciprocal and mutually influential rather than causal (Brody, 1997). However, research using more complicated statistical methods, including structural equation modeling, can estimate the directional effects of intellectual ability and achievement. The result of this research suggests that psychometrically, IQ as measured by the WISC-III significantly predicts future achievement measures whereas achievement scores do not substantially influence future intellectual ability scores (Watkins et. al, 2007). The results of this study suggest that although IQ is statistically predictive of academic achievement, the opposite appeared not to be the case.

A recent meta-analysis was completed in order to more systematically document and quantify the discrepancy between performance and verbal IQ and also to explore the role of school achievement in the development of verbal deficits and behavior problems (Isen, 2010). The results from this meta-analysis showed that the verbal-performance discrepancy, with stronger performance abilities relative to verbal skills, was not significant in children, greatest in adolescents (mean effect size = .45), and considerably smaller in adults (mean effect size = .22). The author observed that this

divergence in adolescent versus adult performance was not because of an increase in performance subtests, but rather a result of substantially worse performance on tests of verbal abilities among the adolescent samples. Additionally, the author speculates that young children with behavior problems do not show this prototypical verbal-performance split because it is the antisocial behavior problems that over the course of time prevent children from acquiring verbal skills. As they age and enter early adolescence, behavior problems increasingly interfere with their learning and so they fail to gain from academic experiences. Perceptual abilities, however, are thought to be less susceptible to academic experiences and therefore are less likely to be impaired by behavior problems in the learning environment. The author concludes that the connection between Verbal IQ and delinquency is not mediated by academic failure, but is likely either a parallel process or a product of the behavior problems (Isen, 2010). It is also the case that evidence from longitudinal studies indicates that poor academic performance precedes problem behaviors, including delinquency and substance use, rather than vice versa (Bachman et al., 2008).

Findings from both the Isen (2010) meta-analysis and longitudinal studies suggest that verbal abilities and school achievement are likely key components in understanding any potential associations between cognitive functioning and the development of behavior problems. Notably, this meta-analysis did not include any studies that utilized the most recent version of the Wechsler Intelligence Scale for Children. Because academic achievement is likely playing some role in the association between behavior problems and intelligence, it is important to continue exploring the nature of this association with the most updated version of the Wechsler Intelligence

Scale for Children. The current study adds to the research by exploring these relations with the WISC-IV, WISC-III, and WIAT-II. Previous research suggests that achievement mediates the relation of behavior problems and cognitive abilities (Moffitt, 1993a), thus it was expected that measures of achievement would predict total behavior problems above and beyond measures of intelligence as assessed with both the WISC-III and WISC-IV.

Child Characteristics as Potential Moderators

Gender. In evaluating prevalence rates for problem behaviors, boys are typically rated as engaging in higher rates of externalizing behaviors from early childhood through adolescence (Giordano & Cernkovich, 1997). Some researchers have proposed that boys and girls actually engage in similar rates of disruptive behaviors, but that these problem behaviors manifest differently in girls (Keenan & Shaw, 1997). Taken together, these studies suggest that gender is an important factor to consider when attempting to understand the relations of problem behaviors to cognitive functioning. Indeed, girls who demonstrate disruptive behaviors tend to have lower intellectual functioning relative to boys (Gaub & Carlson, 1997). This also seems to be true for children who are not already demonstrating problem behaviors. In a nonclinical sample of preschool children, IQ scores were predictive of externalizing behavior scores only for girls (Andersson & Sommerfelt, 2001).

There are several explanations that attempt to clarify the stronger association between IQ and behavior problems in girls. One theory suggests that there is a socialization component underlying these relations. Namely, that adults are more willing to tolerate acting out behavior from boys (Serbin, O'Leary, Kent & Tonick, 1973) and

have greater difficulty interacting constructively with girls who demonstrate behavior problems. Consequently, these disrupted interaction patterns make it more difficult for behavior disordered girls to fully engage and develop their cognitive functioning (Andersson & Sommerfelt, 2001). It has also been suggested that because girls on the whole tend to mature and develop adaptive skills more rapidly than boys, girls whose development is relatively slower are placed at a disadvantage (Keenan & Shaw, 1997). Taken together, this research suggests that gender is an important moderator of intellectual functioning and externalizing behavior problems, and it is necessary to evaluate in the current investigation.

Ethnicity. Some epidemiological research has shown that the base rate of disruptive and delinquent behavior is higher among African-American students than Caucasian students (Council on Crime in America, 1996; United States Department of Health and Human Services, 1999). Although the research attempting to explain the factors underlying the different base rates in behavior problems is limited, there are several theories that exist that are important to consider (Yung & Hammond, 1997). One such theory proposes that African-American students experience a greater number of risk factors and are more likely to experience higher levels of punitive interactions with adults and less likely to experience positive interactions and reinforcement for successful performance (Polite, 1994; Yung & Hammond, 1997).

Although it has been suggested that this combination of factors may lead to an increased number of behavior problems and disorders for African American children, it is important to note that not all of the research exploring potential ethnic differences in the distribution of behavior disorders is consistent. In fact, the best research suggests

that there are no ethnic differences in the rates of behavior problems. According to normative data collected with one of the most widely used measures of diagnosing disruptive child behavior problems there are consistently few differences in the distribution of emotional and behavior problems by ethnicity (Achenbach, Howell, Quay, & Conners, 1991). Moreover, family income and gender are consistently better predictors of behavior problems than ethnicity (Patterson, Kupersmidt, & Vaden, 1990).

Different intelligence tests have yielded a range of scores for various ethnicities; on average, however, the mean for African-American children in early studies was typically about one standard deviation (or 15 points) below Caucasians (Jensen, 1980). There is some evidence that this disparity is diminishing with more recent standardizations. The Black/White differential was on average about 11 points when the Standford-Binet was restandardized and 11.5 points on the newest version of the WISC (Dickens & Flynn, 2006). Despite the largely held belief that cognitive markers are static (Cattell, 1941; Jensen, 1998), there is some evidence that psychological factors have a substantial influence on cognitive performance (Aronson, Fried, & Good, 2002; Salekin, Lester, & Sellers, 2011). Stereotype threat is one such factor that is important to consider when exploring ethnic differences on standardized tests of intelligence. Inducing stereotype threat prior to a test by emphasizing a test as a measure of ability, or emphasizing race, significantly impairs the performance of African Americans on intellectual tests such as the Graduate Record Exam (Aronson et al., 2002). However, significant gains in performance are made when stereotype threat is minimized. Presenting a standardized test as non-diagnostic of ability is sufficient to minimize the threat and essentially eliminate the gap in performance for African Americans and

Caucasians (Aronson et al., 2002). The research studies on minimizing stereotype threat provide important evidence that cognitive performance is not definitive and that modifying the message about intelligence can alter cognitive performance for youth.

Stereotype threat is not the only possible explanation for the gap in intelligence test performance between ethnic groups. Various explanations have been proposed; however, no consensus exists about the reason for the gap in performance (Neisser et al., 1996). Whatever their origin, these findings indicate that ethnicity remains an important variable to consider when exploring cognitive test performance and understanding behavior problems. The influence of race was explored and controlled for in the current study.

Developmental Considerations

At some point in their development almost all children sporadically struggle to regulate their behavior or emotions; it is not uncommon for children to occasionally cry, hit, or otherwise be disobedient in response to requests from parents or teachers. There are some developmental stages across the lifespan in which a certain degree of acting out is common enough that it is considered a normative feature of that stage of life (Moffitt, 1993b). Early adolescence, in particular, is a time period that is marked by a steady increase in the base rate of problem behaviors that continues into high school (Donovan & Jessor, 1985). However, there tends to be a difference in frequency, stability, and severity that differentiates normative childhood acting out from children with emotional and behavioral disorders. This differentiation has important implications for children's expected trajectory. Ample research has shown that children who demonstrate patterns of aggressive, coercive, antisocial, or delinquent behavior

continue to demonstrate similar patterns of externalizing problems across time (Campbell, Ewing, Breaux, Szumowski, 1986; Heller, Baker, Henker, & Hinshaw, 1996; Nagin & Tremblay, 1999; Verlhulst, Koot, & Berden, 1990)

Aggressive behavior (stability coefficient: .63) actually proves to be just as stable over a decade as the stability of performance on cognitive tests (Kazdin, 1987; Olweus, 1979). Intelligence test scores are fairly stable during development; when children were tested on the WISC-R throughout childhood and adolescence their test scores remained highly correlated (stability coefficients range from .74 to .85) from one developmental stage to the next (Moffitt, Caspi, Harkness, & Silva, 1993). To be clear, in the development of intelligence, children make steady gains in general knowledge, vocabulary, and reasoning ability over time and thus their absolute value of cognitive skills grows. What remains relatively stable is the child's score relative to his or her peers (Neisser et al., 1996).

Given the high stability of both behavior problems and intelligence, it is important to examine the role that age might play in the relations of behavior problems to intelligence. In a 20-year longitudinal study comparing adopted and biological children, researchers were able to examine the strength of environmental influences on cognitive development over time (Plomin, Fulker, Corley, & DeFries, 1997). The longitudinal nature of the study allowed researchers to see that the influence of common environmental factors on cognitive ability decreases over time (Plomin et al., 1997). This suggests that the factors that influence children's cognition may vary based on their development and age. As such, it is particularly important to examine how behavior problems and intelligence might relate at different developmental periods. The current

study examined the relation of age to achievement, intelligence, and behavior problems. If such a relation existed, it would suggest important implications for the field regarding the timing of academic and behavioral interventions.

Influence of Test Design

In attempting to better understand the relation between cognitive functioning and emotional and behavioral adjustment, one underemphasized but important variable to consider is the influence of the test itself. The standard intelligence tests, including the widely used Wechsler tests, were designed to measure overall intelligence; however, scores can be influenced by other factors, including test-session behavior as well as how children form judgments in response to test questions (Campbell & McCord, 1999; Sattler, 2002). This suggests that, contrary to popular belief, scores on measurements of intelligence are not able to perfectly capture the global construct of intelligence and that other variables can influence scores. Thus, it is important to consider how characteristics of certain disorders may influence children's performance on the test independent of intelligence, as may be the case for children with behavioral and emotional difficulties.

There are several ways that emotional or behavioral difficulties could influence children's performance on intelligence tests. One potential way is that off task behaviors that arise during the testing process might affect the measurement of intelligence. For example, children who demonstrate behavioral problems at home and in the classroom are likely to also display off task behavior during testing (Gordon, DiNiro, Mettelman, & Tallmadge, 1989). When children display avoidant, inattentive, or uncooperative behavior during testing their overall scores on the intelligence test are adversely

affected (Glutting, Oakland, & Konold, 1994). One study used structural equation modeling, which can assess the full complexity of relations among constructs, to identify the degree to which behavior problems might influence the assessment of intelligence (Konold, Maller, & Glutting, 1998). The results from their analyses showed that test-session behaviors have a greater influence on the assessment process itself than on the actual construct of intelligence. This suggests that intelligence scores reflect both the underlying cognitive abilities they intend to capture as well as the behavioral problems that impede children's actual performance. Additional evidence for a relation between test taking behaviors and IQ scores comes from a meta-analysis that showed an overall mean correlation of –.34 between problematic test-taking behaviors and the IQ scores obtained during the same test session (Glutting, Oakland, & Watkins, 1996). This means that there is a modest inverse relation between negative test behaviors scores and scores on tests of general intelligence. Consequently, children with acting out problems may achieve scores on intelligence tests that do not accurately reflect their true abilities.

Another way in which emotional and behavioral adjustment might unduly influence test scores is if the subtest itself taps constructs above and beyond general intellectual ability. Indeed, the Comprehension subtest and the Picture Arrangement subtests, which were administered on previous iterations of both the adult and child version of Wechsler's intelligence scales, are purported to contain items that rely on social judgment and thus believed to measure social intelligence and competency (Campbell & McCord 1999; Lipsitz, Dworkin, & Erlenmeyer-Kimling, 1993; Sipps, Berry, & Lynch, 1987). However, the data appears to be mixed about the actual strength of this

relation. Some findings support Comprehension and Picture Arrangement as independent assessments of social intelligence apart from general intelligence (Sipps et al., 1987). In one such study, the California Personality Inventory and the Picture Arrangement, Comprehension, and Vocabulary subtests from the Wechsler Adult Intelligence Scale—Revised **(**WAIS—R; Wechsler, 1981**)** were administered to university students and members of the general community. Performance on the Comprehension and Picture Arrangement was highly related to personality measures of social intelligence, above and beyond verbal abilities (Sipps et al., 1987).

Other research, however, has failed to find a positive relation between Picture Arrangement and Comprehension subtests and measures of social ability (Beebe, Pfiffner, & McBurnett, 2000; Campbell & McCord, 1999; Lipsitz et al., 1993). In a study that evaluated both children and adults who were clinically referred, performance on measures of the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) and the WAIS-R were compared to measures of personality and social skills. The results of this study showed that social deficiencies were unrelated to Picture Arrangement and Comprehension subtest scores for either the WISC-R or WAIS-R (Campbell &McCord, 1999). In an earlier study, investigators used the original WISC and WAIS (Wechsler, 1949; Wechsler, 1955) to further test the assumption that Comprehension and Picture Arrangement were sensitive to social judgment. This study involved both non-referred participants and participants identified as “high risk.” The overall results from this study suggested that Comprehension and Picture arrangement were not sensitive to measures of social functioning (Lipsitz et al., 1993). It is important to note, however, that the studies (Beebe et al., 2000; Campbell & McCord, 1999;

Lipsitz et al., 1993) disputing the association between social judgment and performance on specific subtests utilized primarily Caucasian participant samples.

Despite the conflict in the research findings, the Picture Arrangement subtest was dropped in the most recent addition of the WISC because of its dependency on social judgment (Williams, Weiss, & Rolfhus, 2003). As children with behavioral difficulties are likely to have difficulty with social perceptions, this revision would likely work to their benefit. Indeed, it is possible that as test construction matures we are better able to remove the ways in which other factors, like behavioral and emotional issues, have an effect on measurement of cognitive skills. The current study can add to the literature by exploring whether the association between behavior problems and cognitive functioning are a result of performance on the Picture Arrangement and Comprehension subtests in a diverse sample. If performance on Picture Arrangement or Comprehension subtest is controlled, and the association between cognitive abilities on the WISC-III and behavior problems diminishes or disappears, there is evidence that these subtests could be measuring more than just cognitive ability. Additionally, it would be expected that with the elimination of the Picture Arrangement subtest on the WISC-IV, previously documented correlations between behavior and cognitive abilities would be either reduced or no such correlation would exist.

Revisions to the WISC-IV. Although some minor changes have already been noted above, there are additional revisions to the Wechsler Scale of Intelligence for Children- Fourth Edition (WISC-IV; Wechsler, 2003), that are worthy of elaboration. As a whole, the revisions to this version of WISC are of greater substance than on any of the Wechsler predecessors, and involve extensive revisions to both content and structure

(Prifitera Weiss, Saklofske, & Rolfhus, 2005). The WISC-III and WISC-IV remain similar in that they both produce an overall ability score, Full Scale IQ (FSIQ), the best broad indicator of general intelligence “g”. The test as a whole, however, has been conceptually revised. Namely, the common core structure shared by previous additions of the WISC, that produced two main factor scores (Verbal IQ and Performance IQ), was abandoned and replaced by a four-factor structure. Now, in addition to FSIQ, four major factors or indexes of mental ability are obtained and include the Verbal Comprehension Index (VCI), Perceptual Reasoning Index (PRI), Working Memory Index (WMI) and Processing Speed Index (PSI).

Although the authors of the WISC-IV suggest that for evaluation purposes, the Verbal Comprehension Index and Perceptual Reasoning Index can be substituted for the Verbal IQ and Performance IQ, respectively, these index scores have undergone substantial modifications designed to put less emphasis on time and acquired knowledge (Prifitera et al., 2005). For example, compared to Verbal IQ, the Verbal Comprehension Index is composed of subtests intended to place more emphasis on reasoning and comprehension rather than prior knowledge (Wechsler, 2003). Additionally, compared to other ability measures on the WISC-IV, the Perceptual Reasoning Index (PRI) has perhaps been the most significantly revised. The PRI, designed to measure perceptual reasoning and organization, has been modified to better assess nonverbal reasoning with less dependence on dexterity and psychomotor integration than the Performance IQ (Weiss, Prifitera, & Saklofske, 2005). These alterations include the addition of two new subtests (Matrix Reasoning and Picture Concepts) to replace three previous subtests (Picture Completion, Picture Arrangement,

and Object Assembly). Only one core subtest of the PRI, the Block Design subtest, remained the same from the WISC-III to the WISC-IV. However, even the Block Design subtest was modified so that time bonuses had less of an influence on the score. These changes were made with the hope that the PRI score would provide a more accurate measure of fluid reasoning and the child's capacity to think logically and solve problems in novel situations with less emphasis on speed and dexterity.

The Processing Speed Index and the Working Memory Index faced less substantial changes, and other major revisions to the test include changes to item content, administration rules, and scoring procedures (Wechsler, 2003). In total, five new subtests were added to the WISC-IV and three core subtests were revised and included as supplemental subtests. The extensive changes to the WISC-IV raise questions about the generalizability of prior research documenting associations between cognitive ability and adjustment.

To date much of the research examining the relations of intelligence and behavior problems have focused on data obtained with WISC-R and WISC-III profiles. However, some recent research has compared the pattern of performance of children with ADHD on both the WISC-III and WISC-IV (Mayes & Calhoun, 2004). The research completed by Mayes and Calhoun (2004) compared children diagnosed with ADHD and normal controls. The results from their study showed that children with ADHD had similar performance patterns on the WISC-IV and the WISC-III, but that the index discrepancies typically associated with ADHD were even greater on the WISC-IV. Based on these results, the authors concluded that the WISC-IV might actually be more helpful in understanding the pattern of cognitive performance for children with ADHD

(Mayes & Calhoun, 2004). This study highlights potential contributions that the WISC-IV can offer beyond the WISC-III to diagnosing and understanding neurological functioning in children with ADHD, and also suggests that there may be subtle differences between how each of the tests relates to childhood disorders. However, it did not explore the pattern of strengths and weaknesses for children with emotional or behavioral difficulties such as depression, anxiety, or oppositional defiant disorder. Therefore, one of the primary purposes of this study was to explore how the WISC-IV related to children's emotional and behavioral well-being.

The Current Study

Although many investigators have attempted to explain why low IQ might be connected to increased behavior and emotion problems, several questions still remain. There are many theories attempting to explain the well-documented associations, and taken together, they suggest multiple pathways linking intelligence and emotion/behavior adjustment problems, but teasing apart the true connection between intelligence and behavior is complicated. The cross-sectional design of the current study was limited in that it was not able to address any questions that remained in the literature about causality. It is important to note, however, that much of the previous work exploring the relations of adjustment and intelligence has been based on the widely used Wechsler series of tests. An association between behavior problems and intellectual deficits has been consistently documented in precursors of the Wechsler Intelligence Scale for Children IV, but this is not the case with the WISC-IV, which has been substantially revised (Kaufman & Lichtenberger, 2006). If there really are associations between cognitive abilities and emotional and behavior disturbance, then

this should continue to be observable with updated versions of the test. The current study can provide important and unique information by examining how the relations between cognitive abilities and behavior and emotional problems hold up using the newest Wechsler Intelligence Scale for Children.

Previous research also highlights the importance of academic achievement in understanding the relations of intelligence and adjustment (Kusché et al., 1993; Moffitt, 1993a). However, prior studies exploring the influence of achievement on behavior problems did not control for intelligence, or the overlap between attention/concentration and other behavior problems such as internalizing symptoms and conduct problems. Moreover, some studies have used grades, which can confound achievement with child behavior and teachers' perceptions of as well as relationships with the children they are evaluating. The current study can further explore these relations by using standardized measures of achievement, consider various components of intelligence and behavior, and potentially replicate these associations in both the WISC-III and WISC-IV.

Thus, the current study re-examined the association of behavioral and emotional problems, cognitive abilities, and achievement by comparing these relations on the two most recent versions of the Wechsler Intelligence Scale for Children – the WISC-III and WISC-IV in a diverse, clinically referred population. Several questions related to the more discrete cognitive domains and specific behavior problems also were addressed. Based on previous research, the specific aims and corresponding hypotheses of this study were to:

1. Examine whether the previously documented association between behavior problems and intelligence held up when using the WISC IV.

Hypothesis 1: Consistent with the literature that shows an inverse relation between IQ and behavior and emotion problems (Blumberg & Izard, 1985; Cook et al., 1994; Hodges & Plow, 1990; Kaslow et al., 1984; Lynam et al.,1993), it was expected that as with previous versions of the WISC, there would be a significant association between externalizing and internalizing behavior problems and children's IQ as measured by the WISC-IV.

Exploratory Hypothesis: Are there groups of children that this relation does/does not hold up for? If so, what are those characteristics? Previous research has already shown that the strength of the association between intelligence and behavior problems is affected by other factors including gender (Andersson & Sommerfelt, 2001) and potentially age (Heller, et al., 1996). This was explored in greater depth in the current study.

2. Examine possible mediators of the relation between IQ and behavior problems, including how the four intellectual factors (Verbal, Perceptual, Processing Speed, and Working Memory) assessed by the WISC-III and IV related to internalizing problems, externalizing problems, and total problems.

   Hypothesis 2 - Verbal mediator: Given the previously documented research suggesting that the relation between behavior problems and IQ is mediated by verbal deficits (Moffitt & Silva, 1988; Wechsler, 1944), it was expected that Verbal Comprehension would mediate the relation between IQ and behavior problems.

Hypothesis 3: Previous research has highlighted that anxiety and depression can impair performance on tasks that assess perceptual organization and working memory (Blumberg & Izard, 1985; Kaslow et al., 1984), given this deficiency, it was expected that children with internalizing problems would have impaired performance on working memory and perceptual tasks relative to other areas.

3. Explore how the various achievement indices related to the Wechsler Intelligence Scale for Children-IV.

Hypothesis 4: Given the well-documented associations between achievement and intelligence (Watkins et al., 2006) and longitudinal research showing that IQ at age 7 and 8 is predictive of academic achievement 10-18 years later, even after controlling for behavior problems (Fergusson, Horwood, & Ridder, 2005), it was expected that intelligence would predict achievement independent of childhood behavior problems.

Hypothesis 5: It has been suggested that low intelligence leads to difficulty learning school related materials, and that poor academic performance precedes increases in behavior problems (Moffitt, 1993a). Thus, it was expected that academic achievement would mediate the relation between overall intelligence and total problem behaviors.

Hypothesis 6: Symptoms of inattention have been shown to adversely affect both academic achievement and cognitive abilities; prior analyses suggest that performance is primarily impaired by the inattention

component (Barriga, et al., 2001). It was predicted that that parent report of attention on the CBCL and related cognitive processes, such as the index scores on the WISC sensitive to attention (Working Memory Index and Processing Speed Index) would predict achievement, over and above various intelligence indices.

CHAPTER 2

METHOD

Participants

Approximately 321 children ages 6 to 16 years (*M*=9.67,*S*=2.86) who were clinically referred by their parents for academic and/or behavioral concerns participated in this project. To be included in the study, children must have been administered the Wechsler Intelligence Scale for Children (WISC -III or WISC-IV) and one other assessment measure of interest in the current study (WISC-III, n=98; WISC-IV n=210). Participants in this study were from the metropolitan area of Detroit, Michigan and seen at a university training clinic. There were more boys (65.4%) included in the study than girls (34.6%). This was a relatively diverse sample of children that included Caucasians (43.0%), African Americans (48.6%), Asians (1.9%), and Hispanic/Latinos (1.6%). Approximately half (45.8%) of the study participants lived at home with their biological married parents and the average income reported was 43,388 annually.

Measures

Demographics. A demographics questionnaire was administered to the caregiver to get background information. This measure included questions about child ethnicity, age, gender, parents' education, and income.

Child Behavior problems. Child behavioral functioning was measured using the Child Behavior Checklist (Achenbach, 1991). This instrument is a 113-item checklist that includes a comprehensive list of problem behaviors that children can demonstrate. Caregivers rate individual children's problems, on a 0-2 scale (not true to often true), and these ratings produce a score that measures internalizing complaints such as

anxiety, depression, and various somatic complaints. They also produce a score that is a measure of externalizing behaviors, such as rule breaking and aggression. Examples of items on the internalizing scale include. “Cries a lot” and “Clings to adults or too dependent.” Typical items on the externalizing scale are “Gets in many fights” and “Disobedient at home.” The Achenbach Child Behavior Checklist Form is one of the most frequently used standardized instruments to assess behavior problems in children from the perspective of their parents, and has well established reliability and validity (Achenbach, 1991).

Intelligence. To assess cognitive functioning, all children completed either the Wechsler Intelligence Scale for Child-third edition (WISC–III) or Wechsler Intelligence Scale for Child-fourth edition (WISC–IV). As previously noted, the Wechsler Intelligence scales are one of the most widely used measures to assess intellectual functioning or mental ability and have sound psychometric properties (Wechsler, 2003). Despite the modifications to the WISC-IV, correlations between the WISC-III and WISC-IV remain high. Specifically, the correlation between the FSIQ on the WISC-III and WISC-IV is 0.89 and the correlations for the index scores range from 0.72 to 0.88 (Wechsler, 2003).

Achievement. To assess achievement, the Wechsler Individual Achievement Test – Second Edition (WIAT-II) was administered. The WIAT-II is an individually administered and standardized test utilized to assess performance in academic subjects. The battery consists of nine subtests that cluster into four composite scores that include reading, mathematics, written language, and oral language. The WIAT has moderate to strong psychometric properties (Wechsler, 2002).

Procedure

The present study included children referred to a University training clinic in a large urban area. Children in the study were referred for a variety of reasons, most often involving behavioral and academic concerns. Children were evaluated by completing a standard battery of tests, including the WISC-III or WISC-IV and the WIAT-II. Trained graduate students individually administered all of the tests to children. Scores on both intelligence and achievement measures were double-checked for accuracy. Parents of referred children completed the CBCL and provided demographic information.

CHAPTER 3

RESULTS

Preliminary Data Analysis

Before formal analyses, preliminary data screening was completed. No outlying data points were found and age, WISC-III scores, WISC-IV scores, achievement scores, and scores on the CBCL were all normally distributed while income was highly kurtotic (positive kurtosis). There were a total of 343 participants (WISV-IV, n=224; WISC-III, n=119). However, of the 343 children in the database who had completed either the WISC-IV or WISC-III, only 321 participants (WISV-IV, n=223; WISC-III, n=98) also had complete data from the WIAT II and/or the CBCL and were included in the present study. Demographic information for the current study is reported in Table 1 for the children who were assessed via the WISC-III or WISC-IV and also had either adjustment or achievement data available. Initial analyses were conducted to examine any potential demographic group differences between children administered the WISC-III or WISC-IV. Independent sample t-tests revealed that the WISC-III participants did not differ from WISC-IV participants in terms of age (t (318)=-1.49, p = 0.13) or household income (t (197)=-.16, p = 0.99). Chi-square analyses showed there were no significant differences between the WISC-III and WISC-IV groups in terms of ethnicity (χ^2 (2) = .03, p = .90), gender (χ^2 (1) = 2.43, p = .13), maternal education (χ^2 (2) = 1.61, p = .45), or percent of children living with their married parents (χ^2 (1) = 3.71, p = .06). These results suggest that children in the WISC-III group were equivalent to the children in the WISC-IV group on demographic variables. Additional analyses of participant scores on the main variables of interest in this study, including scores on the WIAT-II

and CBCL, were also compared to ensure that there were no significant differences on these scores among children tested with the WISC-III versus the WISC-IV. One-way ANOVAs were completed between the WISC-III and WISC-IV groups on WIAT-II scores (Mathematics Composite, Reading Composite, Total Composite) and CBCL scores (attention, internalizing problems, externalizing problems, total problems), revealed no significant differences, and can be seen in Table 2.

Exploratory analyses were conducted to examine for the potential confounding effects of various demographic characteristics on the study's focal variables of behavior problems, IQ, and achievement scores. Gender was unassociated with total achievement, overall IQ scores, and parent report of total problems. Age was unrelated to overall IQ scores, but was negatively related to overall achievement (r=-.29, p < .01) and positively related to total problem behaviors (r= .18, p < .01). Ethnicity was significantly related to total achievement (F(4,234) = 4.34, p <.01), WISC-III overall intelligence (F(4,92) = 3.31, p =.01), and WISC-IV overall intelligence (F(4,218) = 14.67, p <.01). On measures of intelligence and achievement children who identify as Asian had the highest scores, followed by Caucasians, African Americans, and Hispanic/ Latinos. Ethnicity was also significantly related to parent report of total behavior problems (F(4,287) = 2.93, p =.02) such that Caucasian children had the highest rate of problem behaviors, followed by African Americans, Hispanic/Latinos, and Asians. Means and standard deviations for ethnicity on the key study variables can be seen in Table 3. Given the significant relation of ethnicity and age to many of the key variables, it was controlled for in a majority of the subsequent analyses, however, it was not

controlled for in initial analyses, specifically it was not controlled for in the moderator analyses as both age and ethnicity were examined as potential moderator variables.

Hypothesis Testing

Hypothesis 1. It was hypothesized that as with previous versions of the WISC, there would be a significant association between externalizing behavior problems, like aggression, and children's IQ. Therefore, Pearson product-moment correlation coefficients were conducted to assess the strength of association between behavior problems and intelligence on both the WISC-III and the WISC-IV. As expected, WISC-III index scores were significantly associated with parent report of child behavior problems. Specifically, WISC III Full Scale IQ scores were negatively correlated with externalizing problems (r= -.203, p = .03), and total problems (r= -.261, p < .01), but were unrelated to internalizing problems (r=-.069)

Surprisingly, WISC IV Full Scale IQ scores were not significantly correlated with parent rated internalizing (r= .029), externalizing (r= .009), and total problems (r=-.05). Using Fisher's (1921) procedures, the correlations between full scale IQ and total behavior problems for the two samples were significantly different (z= 1.69; p <.05), indicating less shared variance between intelligence and self-control for the WISC IV compared to the WISC-III. Differences were also significant for externalizing problems (z=1.67; p<.05), but not internalizing problems (z= .07; p >.05). See Figures 1 and 2 to see the relation of WISC FSIQ scores to parent reported total problems and Table 4 for the correlation statistics of WISC-III and WISC-IV IQ scores to parent report of internalizing, externalizing, and total problems.

To further explore how intelligence related to children's problem behavior, the means and standard deviations for WISC-III and WISC-IV factor/index scores were compared at different levels of problem behaviors. Specifically, parent report of child behavior problems was broken into 2 categories including children who had clinically significant total problems (T-score of 60 or greater) or children with no significant problems (T-score of < 60). This cutoff was based on research suggesting that a T-score of 70 on the broadband scales for the CBCL may be too stringent, and that a T-score cutoff of 60 will correctly identify about one quarter to one third of children who later develop a DSM-IV diagnosis (Petty et al., 2009). Results from comparisons on total problems can be seen in Table 5. Notably, the WISC-III Index scores were higher in the group of children who did not have total problem scores in the clinically significant range, and this was not the case for the WISC-IV index scores. However, there was no main effect for the WISC-III (Wilks' Lambda = .97 $F(4, 78) = .52$, $p = .72$, $\eta_{p2} = .03$) and WISC-IV (Wilks' Lambda = .98 $F(4, 195) = 1.09$, $p = .36$, $\eta_{p2} = .02$) index scores in relation to problem groups after controlling for age and ethnicity. When similar calculations and cutoffs were repeated for externalizing and internalizing problems, there was again no main effect observed for WISC-III (Wilks' Lambda = .94 $F(4, 78) = 1.27$, $p = .29$, $\eta_{p2} = .06$) and WISC-IV (Wilks' Lambda = .98 $F(4, 195) = 1.20$, $p = .31$, $\eta_{p2} = .02$) index scores in relation to internalizing problem groups or WISC-III (Wilks' Lambda = .95 $F(4, 78) = 1.13$, $p = .35$, $\eta_{p2} = .06$) and WISC-IV (Wilks' Lambda = .98 $F(4, 195) = 1.03$, $p = .39$, $\eta_{p2} = .02$) index scores in relation to externalizing problem group.

Exploratory Hypothesis: This study explored whether there might be certain groups of children where the association between IQ and behavior problems is stronger.

In order to explore the potential moderating effect of age on the relations between intelligence and behavior problems, the independent variables of interest (age, WISC-III IQ, and WISC-IV IQ) were all centered by subtracting the mean score from each data point. Interaction terms were created with the centered age variable and the centered IQ variables. Linear regressions were computed separately for the WISC-III and WISC-IV samples, but a similar process was utilized. In predicting parent report of total problems, the centered WISC IQ variables and centered age variable were entered as the independent variables in the first block, then both centered variables and their interaction term were entered as the independent variables (block 2). This procedure was repeated with both parent report of externalizing and internalizing problems each entered as the dependent variable. The results from these analyses can be seen in Table 6 and Table 7 for the WISC-III sample and Table 8 and Table 9 for the WISC-IV sample. As can be seen from the resulting p-values, the moderation term was not significant for total problems (β =.07, p =.55), internalizing problems (β =-.06, p=.56), or externalizing problems (β =.21 , p = 06) in the WISC-III. Similar results were observed with the WISC-IV, and the moderation term was also not significant for total problems (β =.04, p =.54), internalizing problems (β =.02, p =.80), or externalizing problems (β =.00, p =.99) An examination of the main effects, including the main effect for age and the main effect for IQ partially replicate what was shown in the previous analyses, namely that WISC-III IQ is negatively related to total problem behaviors (β =-.23, p=.03), while WISC-IV IQ is not (β =0.04., p >.05). There was also a main effect for age in predicting total problems and internalizing problems in the WISC-III (β =0.22, p =.04; β =0.33, p <.01, respectively) and WISC-IV (β =0.15, p =.04; β =0.15, p =.03, respectively)

samples, suggesting that age was positively related to parent report of internalizing and total behavior problems. Notably, however, neither the WISC-III nor WISC-IV had a significant main effect on internalizing or externalizing problems.

To explore the possibility that gender moderated the relation of IQ and total problems, a similar procedure was utilized. However, given that gender is a categorical variable, it was first dummy coded, and then a similar procedure described above was used to test its effect as a moderator. The centered WISC IQ variables and dummy coded gender variables were entered as the independent variables (block 1), then both centered IQ variables, coded gender, and their interaction term were entered as the independent variables (block 2). The results of this analysis showed a significant main effect for WISC-III IQ and total problems (β =-.26, *p*=.01) and externalizing problems(β =-.21, *p*=.05), but no main effect for internalizing problems (β =.05, *p*=.64). As with previous analyses, no main effect was observed for WISC-IV on total problems (β =-.05, *p*=85), internalizing problems (β =.03, *p*=.68), or externalizing problems (β = .01, *p* =.90). No main effect was observed for gender. Additionally, gender did not prove to be a significant moderator of the relations of either WISC-III IQ or WISC-IV IQ to behavior problems. The results of the analysis can be seen in Table 10 and Table 11 for WISC III and Table 11 and Table 12 for WISC-IV.

The last moderator of interest to explore was the potential moderating effect of ethnicity. Given the small number of individuals in the study that did not identify as either Caucasian or African American, other identified ethnicities were excluded given the difficulty of identifying specific effects with such small numbers. Therefore, in the moderator analysis of ethnicity, only African-American and Caucasian participants were

included. Similar to the process with gender, ethnicity was first dummy coded, and then a series of regressions was used to test its effect as a moderator of IQ and behavior problems. The centered WISC IQ variables and dummy coded ethnicity variables were entered as the independent variables (block 1), then both centered IQ variables, coded ethnicity, as well as their interaction term were entered as the independent variables (block 2). The results of this analysis showed a significant main effect for WISC-III IQ and total problems (β =-.29, *p*=.01) and externalizing problems (β =-.22, *p*=.05), but not internalizing problems (β =-.13, *p*=.29). As with previous analyses, no main effect was observed for ethnicity in the WISC-III sample. However, for the children who took the WISC-IV there was a significant main effect for ethnicity on total problems (β =-.20, *p*=.01), and internalizing problems (β =-.22, *p*=.01), but not for externalizing problems (β = -.10, *p* =.22). Upon closer inspection of the main effect for total problems, it appears that children who identified as Caucasian had significantly higher reported total problems and internalizing problems (*M*= 59.11, *SD*=10.45; *M*= 57.97, *SD*=9.746, respectively) than children who identified as African American (*M*= 55.72, *SD*=11.85; *M*= 53.69, *SD*=11.32, respectively). The results of these analyses, however, did not offer any support that ethnicity is a significant moderator of the relations of either WISC-III IQ or WISC-IV IQ to behavior problems. The results of the analysis can be seen in Table 14 and Table 15 for the WISC-III and Table 16 and Table 17 for the WISC-IV.

Hypothesis 2. This hypothesis states that Verbal Comprehension, above and beyond other cognitive indexes, would be related to behavior problems. Hierarchical multiple regressions were used to test the relative influence of verbal abilities as measured by the WISC-III on parent's report of children's total problem behaviors,

internalizing problems, and externalizing behavior problems. Participant demographics, a control variable consisting of age and ethnicity that were previously shown to be associated with total problems, were entered in the first block. Index scores from the WISC-III, specifically Perceptual Reasoning, Freedom from Distractibility, and Processing Speed were entered in the second block. In the third block the Verbal Comprehension index from the WISC-III was entered. The full regression equation, including control variables, Perceptual Reasoning, Freedom from Distractibility, and Processing Speed, and Verbal Comprehension, was significant for predicting total problem behaviors, $F(6,78) = 2.77$, $p = .02$, and internalizing problems, $F(6,78) = 2.42$, $p = .03$, but was not a significant predictor of externalizing problems, $F(6,78) = 1.78$, $p = .11$. The full model was responsible for 17.6% and 15.4% of the total variance in children's total problem behaviors and internalizing behaviors, respectively. An examination of how each of the independent variables contributes to the equation suggests that none of the WISC-III index scores makes a unique contribution to total problems, internalizing problems, or externalizing problems. Contrary to what was predicted, Verbal Comprehension did not significantly add to the prediction of problems above and beyond what was accounted for by control variables and other WISC-III index scores, however, it did contribute an additional 3.9% in variance accounted for in internalizing problems, which was approaching significance ($p = .06$). The results of these regressions are presented in Table 18 and 19.

In a similar fashion, hierarchical multiple regressions were used to test the relative influence of verbal abilities as measured by the WISC-IV on parent's report of children's total problem behaviors, internalizing problems, and externalizing behavior

problems. Control variables were entered into the first block, and index scores from the WISC-IV, specifically Perceptual Organization, Working Memory, and Processing Speed were entered in the second block. In the third block the Verbal Comprehension index from the WISC-IV was entered. The full regression equation, including control variables, Perceptual Organization, Working Memory, Processing Speed, and Verbal Comprehension, was not significant for predicting total problem behaviors, $F(6,195) = 1.59$, $p=.15$, and only accounted for approximately 4.7% of the total variance in children's total problem behaviors. The full regression equation was also not significant for predicting internalizing problems, $F(6,195) = 1.31$, $p=.25$, or externalizing problems, $F(6,195) = 1.65$, $p=.14$, and only accounted for approximately 3.9% and 4.8% of the total variance, respectively. Inspection of each step within the model showed that the addition of Verbal Comprehension only accounted for an additional .1% of variance in total problem behaviors ($p = .77$), and did not account for any additional variance in internalizing ($p=.91$) externalizing problems ($p = .53$) above and beyond the other intelligence indices. The results of these regressions are presented in Table 20 and Table 21.

Despite the hypothesis suggesting that verbal abilities would make a significant contribution to the development of problems above and beyond other intelligence measures this did not appear to be the case for internalizing, externalizing or total problems. However, it is noteworthy that the overlapping contributions of the WISC-III factor scores taken together does account for a significant amount of the variance in parent report of total problems.

Hypothesis 3. Given the research suggesting that children with depression and anxiety symptoms have impaired performance on Working Memory and perceptual tasks, it was expected that internalizing symptoms would be related to measures of Freedom from Distractibility/Working Memory and Perceptual Organization/Reasoning on both the WISC-III and WISC-IV. To test this hypothesis, the hierarchical multiple regressions previously run to examine the influence of all of the index scores on problem behaviors were revisited to see specifically how Perceptual Reasoning/Perceptual Organization and Working Memory/Freedom from Distractibility contribute to internalizing symptoms after accounting for the variance contributed by the other indices. Contrary to what was initially hypothesized, the results of these analyses indicated that neither WISC-III Perceptual Organization (β =-.14, p=.36) nor WISC-III Freedom from Distractibility (β = -.28, p =.09) individually accounted for a significant portion of the variance in internalizing problems. Even if not significant, follow-up analyses suggest that when added to the model, Freedom from Distractibility individually accounts for an additional 3.2% of the variance whereas Perceptual Organization only accounts for an additional .9% of the variance. Similarly, WISC-IV Perceptual Reasoning (β =-.06, p =.61) and WISC-IV Working Memory (β =.13, p=.24) did not uniquely contribute to the prediction of internalizing symptoms, but only accounted for .1% and .7% of the variance in internalizing problems, respectively.

Hypothesis 4: This hypothesis states that intelligence would predict achievement independent of childhood behavior problems. A hierarchical multiple regression was used to test the relative influence of overall intelligence, independent of problem behaviors on children's achievement scores. As in previous regressions,

participant demographics, a control variable consisting of age and ethnicity, were entered in the first block. Parent's report of total problem behaviors was entered into the second block. In the third block the WISC-III factors of intelligence were entered, including Verbal Comprehension, Perceptual Organization Freedom from Distractibility, and Processing Speed. The full regression equation, including control variables, total problem behaviors, and intelligence (Verbal Comprehension, Perceptual Organization, Freedom from Distractibility, and Processing Speed) was significant for predicting the dependent variable of achievement, as measured by WIAT-II total comprehension scores, $F(7,34) = 18.67$, $p < .01$. The full model accounted for 79.4% of the total variance in children's achievement. Notably, inspection of each step within the model showed that the addition of total problems at step two was able to account for a significant increase in variance above control variables ($\Delta R^2 = .135$, $p < .05$). After controlling for total problems, WISC-III measures of intelligence significantly predicted more variance in WIAT-II total achievement ($\Delta R^2 = .58$, $p < .01$), supporting the initial hypothesis. The results of these regressions are presented in Table 22.

Given previous results demonstrating statistical differences in how the WISC-III and WISC-IV are related to problem behaviors, a hierarchical multiple regression was repeated to test the relative influence of WISC-IV intelligence factors and total problems, on children's total achievement score on the WIAT-II. The control variables, consisting of age and ethnicity, were entered in the first block and parent's report of total problem behaviors was entered into the second block. In the third block the intelligence indices from the WISC-IV were entered, including Verbal Comprehension, Perceptual Reasoning, Working Memory, and Processing Speed. The full regression equation,

including control variables, total problem behaviors, and intelligence (Perceptual Reasoning, Working Memory, Processing Speed, and Verbal Comprehension) was significant for predicting the dependent variable of achievement, as measured by WIAT-II total comprehension scores, $F(7,162) = 36.75$, $p < .01$,. The full model accounted for 61.4% of the total variance in children's achievement. Inspection of each step within the model showed that the addition of total problems at step two did not account for a significant increase in variance above control variables ($\Delta R^2 = .01$, $p > .05$). The addition of the four WISC-IV index scores to the model, however, was significant ($\Delta R^2 = .53$, $p < .01$). This is in contrast to results from the WISC-III regression, where the addition of total problems was not a significant predictor of achievement. The results of this regression analysis are presented in Table 23.

Hypothesis 5. This hypothesis states that academic achievement mediates the relation between overall intelligence and total problem behaviors. Therefore, Baron and Kenny's (1986) four-step approach was used to explore the strength of achievement as a potential mediator. The four-step approach was repeated to explore the strength of achievement as a potential mediator in the relation of WISC III Full Scale IQ to parent report of total problems. In the first step, WISC-III full scale IQ was entered into the regression as the predictor, controlling for ethnicity and age, with total problems as the dependent variable. This step was significant, $F(3,39) = 3.31$, $p = .03$, and establishes that there is a statistically significant relation between WISC-III IQ and total problems that may be mediated by another factor. Given the significance of step 1, step 2 was performed and, WISC full scale IQ was entered into the regression as the predictor, controlling for ethnicity and age, with WIAT-II total achievement (the potential mediator)

as the dependent variable. This step was also significant, $F(3,39) = 32.31$, $p < .01$ and suggests that WISC-III full scale IQ is significantly related to WIAT-II total achievement. The third step requires that the mediator be significantly related to the outcome variable. To assess this, WIAT-II total achievement was entered as the predictor variable, controlling for ethnicity and age, with total problems entered as the dependent variable. This step was also significant, $F(3,39) = 5.02$, $p < .01$. Given that there are significant relationships from Steps 1 through 3, Step 4 of the approach was completed to explore whether achievement might mediate the relations of WISC-III IQ and total problems. The dependent variable of interest, total problems was entered into the model, controlling for age and ethnicity, and both achievement and WISC-III overall IQ scores were entered as predictors. After controlling for the effect of intelligence on total problems, the effect of achievement on total problems remained significant, suggesting that achievement plays a significant role in mediating the relation of IQ, as measured by the WISC-III, to total problems $F(3,38) = 4.05$, $p < .01$.

Not surprisingly, given previous analyses, WISC-IV IQ scores were unrelated to total problem behaviors. When WISC-IV full score IQ scores were entered into the regression as the predictor, controlling for ethnicity and age, with total problems as the dependent variable, WISC-IV full scale IQ was not a significant predictor of total problems $F(3,198) = 2.83$, $p > .05$. This step establishes that there is no effect for WISC-IV IQ on total problems that may be mediated by another factor, and so no further steps were performed.

Hypothesis 6. It is predicted that that parent report of attention on the CBCL and related cognitive processes, such as the index scores on the WISC sensitive to

attention (WISC-III Freedom from Distractibility, WISC-IV Working Memory Index, WISC-III and WISC-IV Processing Speed) would predict achievement, over and above various intelligence indices. Hierarchical linear regressions were used for predicting reading and math achievement, with the various intelligence indices and attention as the independent variables. These regressions were completed for both the WISC-III and WISC-IV samples. The first series of hierarchical multiple regressions were run to test the relative influence of attention (as measured by parent report and WISC-III intelligence indices sensitive to attention) on children's math and reading achievement scores on the WIAT-II. The control variables, consisting of age and ethnicity, were entered in the first block, Verbal Comprehension and Perceptual Organization were entered into the second block. In the last two blocks parent's report of attention (block three) and the WISC-III Freedom from Distractibility and Processing Speed indices were entered (block four). The full regression equation was significant for predicting the dependent variable of reading achievement ($F(7,38) = 10.17$, $p < .01$) and math achievement ($F(7,36) = 8.98$, $p < .01$). The full model was responsible for accounting for 63.6% and 65.2% in reading and math achievement, respectively. When attention measures (both parent report and WISC-III Freedom from Distractibility) were included in the model they were able to account for a significant increase in proportion of the variance in reading ($\Delta R^2 = .08$, $p = .03$) and math ($\Delta R^2 = .17$, $p < .01$) achievement scores. When parent report of attention problems and other attention indices were added to the model, parent report of attention and the Freedom from Distractibility accounted for the significant increase in the variance accounted for in math achievement, whereas they did not significantly predict reading achievement. In fact,

when all variables of interest were included in the model to predict reading achievement, only Verbal Comprehension remained significant. However, the unique contributions of Freedom from Distractibility to Reading Achievement was in the expected direction and approaching significance (p=.058). Basic descriptive statistics and regression coefficients can be seen in Table 24.

Following a similar data entry strategy, hierarchical linear regressions were repeated with WISC-IV index scores entered as predictor variables. As in the previous analyses, the full regression equation, including control variables, and WISC-IV Verbal Comprehension, Perceptual Reasoning, parent report of attention, and WISC-IV factors sensitive to attention (Working Memory and Processing Speed) were significant for predicting the dependent variable of reading achievement ($F(7,173) = 30.01$, $p < .01$) and math achievement ($F(7,181) = 38.74$, $p < .01$), and were responsible for accounting for 54.8% and 60% in reading and math achievement, respectively. When verbal and perceptual indices of intelligence were included in the model they were able to account for a significant proportion of the variance in reading and math achievement, accounting for 49.1% and 55% of the variance respectively. When parent report of attention problems and other attention indices were added to the model, Working Memory accounted for a significant increase in the variance accounted for in reading achievement ($\Delta R^2 = .05$, $p < .01$) while parent report of attention and Working Memory accounted for a significant increase in the variance accounted for in math achievement ($\Delta R^2 = .04$, $p < .01$). Notably, the significance of the independent variables contributions to reading and math achievement was different than what was observed based on

WISC-III data. Basic descriptive statistics and regression coefficients can be seen in Table 25.

Follow-up Analyses

Following the completion of original hypotheses testing, subsequent analyses were performed in order to shed additional light on the results. Specifically, several analyses were conducted to explore how test revisions to subtests and factor scores might influence the relation of intelligence and behavior problems. The Perceptual Reasoning Index, in particular, was significantly revised in the most updated version of the WISC. If the original unmodified measure of perceptual abilities in the WISC-III accounts for much of the relation between IQ and children's problems, it would be expected that the Perceptual Organization factor score would account for the greatest proportion of variance in total problems. To assess this possibility, hierarchical regressions were conducted including control variables (block 1), WISC-III Verbal Comprehension, WISC-III Freedom from Distractibility, WISC-IIII Processing Speed (block 2), and WISC-III Perceptual Organization (block 3). The results of this analysis suggest that, after controlling for the influence of other measures of intelligence, the Perceptual Organization does not uniquely contribute to the variance in total problem behaviors (ΔR^2 = .001, p =.81). Additional follow-up analyses were conducted to explore how revisions to the Verbal Comprehension and Perceptual Organization subtests might contribute to the prediction of total problem behaviors. To evaluate this possibility, hierarchical analyses were completed evaluating how well performance on the WISC-III Verbal Comprehension subtests and Perceptual Organization subtests added to the prediction of total problem behaviors after controlling for demographic

variables and other measures of intelligence. According to the analysis aimed at exploring the influence of Verbal Comprehension, Verbal subtests do not significantly add to the prediction of total problem behaviors (ΔR^2 = .006, p =.97). Regression coefficients for Verbal Comprehension subtests can be seen in Table 26. Despite the results suggesting that Verbal Comprehension subtests do not offer any unique contributions to the prediction of total problems, it appears that Perceptual Organization subtests might offer valuable information in understanding WISC-III relations to problem behaviors. Specifically, the results from this analysis show that Picture Arrangement alone remained a unique predictor of variance accounted for in total problem behaviors (β =-.33, p=.03), even after accounting for the contribution of other intellectual factors. After controlling for the other factors, performance on the Picture Arrangement subtest accounts for 4.7% of the variance in parent report of total problems.

CHAPTER 4

DISCUSSION

The aims of the present study were to understand associations of behavioral and emotional problems, cognitive abilities, and achievement by comparing these relations on the two most recent versions of the Wechsler Intelligence Scale for Children – the WISC-III and WISC-IV in a diverse, clinically referred population. Numerous studies have demonstrated inverse relations between IQ and behavior and emotion problems (Blumberg & Izard, 1985; Cook et al., 1994; Hodges & Plow, 1990; Kaslow et al., 1984; Lynam et al.,1993). However, these associations had not yet been replicated with the updated WISC-IV, which has undergone substantial revisions from its predecessor in terms of both the content and structure. Given that the WISC-IV is currently one of the most widely utilized measures on which educational decisions for children are made, it is particularly important to understand how this updated and revised scale functions for children with various emotional and behavioral difficulties. Overall, the results suggest that IQ and parent reported total problems and externalizing problems were significantly related when measured by the WISC-III, but not the WISC-IV. Possible explanations for this discrepancy are discussed next.

It was hypothesized that as with previous versions of the WISC, there would be a significant association between behavior problems and children's IQ. Indeed, WISC-III factor scores and WISC-III Full Scale IQ were significantly related to parent report of total problems, while WISC-III Full Scale IQ and most of the WISC-III factor scores (Verbal Comprehension, Freedom from Distractibility, and Processing Speed) were significantly related to parent report of externalizing problems. However, contrary to

what was expected, WISC IV Full Scale IQ and WISC-IV index scores were not statistically significantly related to parent rated externalizing and total problems.

There are several potential contributing factors to these differences. One possibility is that the newest version of the WISC is better at assessing intelligence independently of behavior problems. Along those lines, some specific modifications to the WISC-IV may account for these apparent differences in relations. As previously described, the Perceptual Reasoning Index was revised significantly in the latest edition of the WISC. For instance, two timed visual-motor subtests, Picture Arrangement and Object Assembly, were replaced by tests of visual reasoning that were motor-free. Additionally, some opportunities for time-bonuses were eliminated. These revisions reflect an increased emphasis on assessing fluid reasoning that are independent of the effects of motor speed (Mayes & Calhoun, 2006).

As deficits in motor control and goal-directed persistence are known to underlie several types of behavior problems, including inattention, hyperactivity, and impulsivity (Barkley, 1997), less emphasis on these core areas of executive functioning and increased emphasis on reasoning ability could work to the advantage of children with behavior problems. The changes made to Perceptual Reasoning may also work to the benefit of children who have a nonverbal learning disability and who are typically are identified on tests of intelligence by a Verbal IQ score that is 10 points or more higher than the individual's Performance IQ score (Rourke, 1989; Rourke, 1995). This pattern of cognitive performance predicts nonverbal deficits that are associated with difficulty in interpersonal relations and problems interpreting the nonverbal social cues of others. These impairments in social perception and judgment are thought to result in confusion

and create behavioral deficits that look similar to a child with hyperactivity, impulsivity, or conduct problems (Rourke & Tsatsanis, 2000). Notably, nonverbal learning disabilities are associated with a primary neuropsychological deficit in the right hemisphere, which in turn results in difficulty with tactile perception, complex psychomotor skills, and problems with visual perception (Rourke, 1989; Rourke, 1995). Consequently, children with nonverbal learning disabilities may not have the typical deficit in Perceptual Reasoning performance, given the added weight placed on fluid reasoning rather than visuospatial skills and speed. Indeed, a recent dissertation provides evidence that only some elements of the previously documented pattern of performance for children with a nonverbal learning disability has been validated on the WISC-IV (Landwher, 2010). Of particular interest to the current study, and in light of the findings that the WISC-IV was unrelated to problem behaviors, the well-known ten-point difference between Verbal Comprehension and Perceptual Reasoning was not replicated with the WISC-IV. Similarly, the Perceptual Reasoning Index was not significantly lower than Working Memory or Processing Speed for children with the behavior and emotional difficulties consistent with a nonverbal learning disorder.

If it is truly the case that the measure of perceptual abilities accounts for much of the relation between IQ and children's problems, it would be expected that the Perceptual Organization factor score would account for the greatest proportion of variance in total problems and externalizing problems. However, follow-up analyses did not suggest that this was the case, so perhaps the answer to how revisions to the Perceptual factor score influences the prediction of problem behaviors lies in the revisions to the individual subtests.

Specifically, although the Picture Arrangement subtest loaded fairly well on g, it was dropped not only to reduce administration time but also because of its dependency on social judgment (Williams, Weiss, & Rolfhus, 2003). As children with behavioral difficulties or externalizing problems are likely to have difficulty with social perceptions (Kouros, Cummings, & Davies, 2010), this revision would likely work to their benefit. In order to evaluate this possibility, additional analyses were completed evaluating how well performance on the Picture Arrangement subtest, as well as other WISC-III Perceptual Organization subtests, predicted parent report of total problems. The results of these subsequent analyses provide convincing evidence that children's performance on Picture Arrangement is a significant factor in understanding the relation of IQ and problem behaviors, as Picture Arrangement alone remained a unique predictor of variance accounted for in total problem behaviors.

The instructions to several of the WISC subtests also were revised. Specifically, instructions on the Coding, Symbol Search, and Block Design subtests were all shortened. It is possible that the reduced verbiage and simpler instructions are less susceptible to some lapses of attention or behavior dysregulation. At the very least this change reduces administration time, which is likely to work to the benefit of children with behavior problems. Unfortunately, the specific influence of instructional changes cannot be examined in the current study, but does offer a compelling explanation for why WISC-III scores might be related to higher rates of problems, but WISC-IV scores are not.

In order to better understand and explore how problem behaviors might be related to intelligence, I was particularly interested in exploring potential child

characteristics, such as age, ethnicity, and gender that influenced the direction and/or strength of the relation between behavior problems and intelligence. Unfortunately, moderator analyses were not able to offer any additional insight into intelligence-behavior problem relations. Ethnicity, gender, and age were all insignificant as moderators for both WISC-III IQ and WISC-IV IQ relations to behavior problems. However, analysis of the main effects from these analyses provided additional support for WISC-III as a significant predictor of total problems.

It was hypothesized that verbal abilities would be related to behavior problems above and beyond other cognitive indices. However, in the current study, verbal comprehension as measured by the WISC-III and WISC-IV did not account for any additional variance in externalizing problems or total problems above and beyond the other intelligence index scores. Given that previous research suggests that verbal deficits are one of the most robust cognitive predictors of problem behavior, this was a surprising finding (Moffitt, 1990; Moffitt, 1993a). This is not to say that verbal comprehension was unrelated to problem behavior, it was certainly the case that WISC-III verbal abilities were significantly related to both externalizing and total problems Additionally, the WISC-III Verbal Comprehension scores appear to be higher in the group of children with problem behavior scores below the clinical cutoff (*M*=104.85*, SD*= 17.73) than children above the clinical cut off (*M*=99.31*, SD*= 18.51). However, even if in the expected direction, this difference was not statistically significant, and after taking into account the contributions of the other intellectual factors Verbal Comprehension does not offer anything unique in the prediction of total problems.

One possible reason for this finding is that previous research linking verbal abilities

and problem behaviors did not take into account the contributions of other, highly confounded, intellectual abilities when considering how verbal skills relate to children's behavior. Although there are studies demonstrating a link between verbal abilities and behavior in nonclinical samples (Nigg, Quamma, Greenberg, & Kusche, 1999), many of the studies linking verbal intelligence and children's deviant behavior has found this association in samples of children and adolescents with more extreme acting out behavior than the current one (Farrington & Hawkins, 1991; Isen, 2010; Moffitt, 1990). Although this was a clinically referred participant sample, only a third of the children (about 37%) met the clinical cutoff for total problem behaviors. Regardless, this proportion of children above the clinical cutoff for problem behaviors should have provided a sample large enough to detect a difference if there was one. Given that problem behavior was captured solely by parent report in this study, we do not have specific information about the types of problem behaviors in the sample. Even for the children above the clinical cutoff, it is unclear if the range of behaviors demonstrated would meet the criteria for antisocial behavior or for a formal disruptive behavior diagnosis. So it is possible the WISC-III Verbal Comprehension and the individual verbal subtests failed to uniquely account for a significant portion of the variance in problem behaviors because of the limited manner in which problem behavior was measured. Thus it may be an artifact of the current sample rather than a lack of relation between verbal skills and more extreme behavioral acting out.

It was hypothesized that internalizing symptoms would be related to measures of Working Memory and Perceptual Organization on both the WISC-III and WISC-IV. Contrary to what was initially hypothesized, the current study did not find any significant

relations between internalizing symptoms and Perceptual Organization and Working Memory on the WISC-III or WISC-IV. One possible reason for the inconsistency with previous research suggesting that such a relation exists could lie in the nature of the clinical sample in the current study. Specifically, a vast majority of the participants in this study were referred for academic or behavioral concerns, rather than emotional difficulties. This could potentially result in lower internalizing score relative to externalizing scores, which would be more likely to pick up the behaviors that were linked to the majority of referral questions. To evaluate if this was the reason for the lack of significance, analyses were done to ensure that the internalizing and externalizing scores observed in the current sample were not significantly different from each other. Inspection of the mean scores and standard deviations revealed quite the opposite, that internalizing scores (*M*= 55.01, *SD*=10.65) were similar to externalizing scores (*M*= 55.15, *SD*=11.83). However, it is still possible that the characteristics of the current sample prevented the detection of significant relations between emotional problems and cognitive difficulties.

Additionally, the lack of findings might be related to how internalizing symptoms were measured in the current sample. Specifically, parent report of symptoms was utilized. Although parent and teacher report may be an accurate way to capture observable behavior and acting out problems, it might not be quite as adept at accurately detecting the presence of symptoms like anxiety and depression that are largely internal, unobservable, and may be more ambiguous (Cole et al., 2002).

It is worth considering that the lack of findings is actually reflective of a nonsignificant relation between the WISC and internalizing symptoms. Specifically,

performance on the WISC may not be negatively impacted by increased symptoms of depression or anxiety. It is worth noting that the literature linking cognitive profiles and disorders reflective of internalizing difficulties is not entirely consistent. Although some research has suggested that there may not be a relation at all (Brumback, Jackoway, & Weinberg, 1980), other research offers evidence that internalizing disorders, such as major depression, may not result in substantial impairments in cognitive functioning if the individual is healthy enough to be functioning in school and other outpatient contexts (Grant, Thase, & Sweeny, 2001). If this is indeed the case, it helps alleviate concerns that performance on the WISC-IV will be underestimated as a result of symptoms of depression and anxiety.

However, it is also important to recognize that there may be important moderating variables that were not measured in the current study that might also explain the relation. For example, it is possible that more severe and chronic internalizing psychopathology would put children at greater risk for deficits in cognitive functioning compared to children with transient or state based internalizing symptoms. Research has shown that trait measures of emotional instability are more likely to be related to intelligence test scores, and that specifically, the severity of anxiety (high vs. low) is related to intelligence test scores, and that highly anxious individuals have lower scores (Moutafi, Furnham, & Tsaousis, 2006). Although, chronicity was not captured in the current study, internalizing symptoms could be dichotomized into low and high symptom groups. However, high/low internalizing symptom groups did not appear to be significantly different on any of the WISC-III or WISC-IV index scores. Despite previous research suggesting that severity of emotional problems is an important component of

the relation of symptoms to cognitive deficits (Nussbaum & Bigler, 1986), that was not the case in the current study. However, it is possible that still other internal characteristics not measured might have better explained the relation of internalizing and intelligence problems. For example, self-esteem, self-efficacy, and locus of control have all been linked with internalizing problems and performance on intelligence tests (Bauer, 1975; Riding & Craig, 1998).

It was hypothesized that intelligence would predict achievement independent of childhood behavior problems. This hypothesis was supported, and intelligence index scores on both the WISC-III and WISC-IV were highly predictive of total achievement scores, with the full model of WISC-III and WISC-IV intelligence factors and total problems accounting for 79.45% and 61.4% of the total variance in children's achievement, respectively. As was expected, the Intelligence factor scores were most predictive of achievement, and when children's total problems were controlled, the WISC IV index scores and WISC-III factor scores added an additional 52.7% and 58% the variance accounted for in achievement, respectively. This finding is consistent with previous research showing that IQ is strongly related to achievement (Neisser et al., 1996).

Additionally, an examination of how each of the index score contributed to the prediction of variance suggests that Freedom from Distractibility/Working Memory and Verbal Comprehension were the most important in determining total achievement scores for both the WISC-III and WISC-IV. This is consistent with recent research comparing the relations of WISC-III and WISC-IV to achievement in an ADHD population (Mayes & Calhoun, 2007). This finding makes sense, given that academic

achievement scores show greater associations with verbal intelligence than nonverbal intelligence (Konold, 1999). Interestingly, the explained variance for the WISC-III/WISC-IV index scores and WIAT-II total achievement score in the current study was slightly lower than what was found in previous studies. For example, in the normative sample, WISC-IV FSIQ accounted for 76% of the variance in WIAT-II composite scores (Wechsler, 2003). In a nonclinical sample of children, when all four index scores were used to predict achievement, the WISC-III factor scores alone accounted for 70% of the variance in total achievement (Konold,1999). The findings from the current study, however, appear to be consistent with another study that used a clinically referred sample of children with ADHD, and adds merit to the argument that other variables, apart from intelligence, might be important in influencing achievement in a clinical sample (Mayes & Calhoun, 2007).

In addition to exploring how intelligence might predict achievement, it was hypothesized that academic achievement may be a mediator of the relation between overall intelligence and total problem behaviors. Since there was not a significant relation between WISC-IV intelligence scores and problem behaviors, achievement as a potential mediator was not tested with WISC-IV data. However, WISC-III index scores were related to total problem behaviors, and subsequent mediator analyses suggested that achievement fully mediated the existing relation between WISC-III overall IQ and problem behaviors. This finding provides support for the idea that the pathway between measurements of cognitive ability and problem behaviors in children is highly influenced by achievement.

As was discussed above, intelligence is a well-established predictor of academic achievement (Konold, 1999; Neisser et al., 1996; Wechsler, 2002), and so it is not surprising that WISC-III intelligence predicts a large proportion of the variance in achievement. It is also the case that achievement deficits are highly correlated with children's behavior problems; as many as 10-50% of children with elevated levels of externalizing behavior also demonstrate low academic achievement (Hinshaw, 1992). Based on previous research, and the current results, children's difficulties in one domain of functioning, such as academic achievement, seems to be highly associated with problems in the behavioral and adjustment domain of functioning. Although the current study does not provide results that can entirely tease out directional effects between the domains of functioning, the results of the mediation analysis could reflect the influence of cognitive abilities on children's ability to acquire the necessary academic skills at school to perform well on achievement tests. Low school achievement could, in turn, exacerbate children's frustration and sense of discouragement and result in decreased attachment to school and teachers and increased misbehavior in the school environment (Hinshaw, 1992). Adding some strength to the argument that achievement influences problem behaviors, when interventions are aimed at enhancing school competence and achievement, proportional gains are also made in lowering children's risk for developing problem behaviors (Hawkins, Catalano, Kosterman, Abbot, & Hill, 1999).

It is most likely that the current results reflect a bidirectional and/or reciprocal relation between achievement and problem behaviors, such that low cognitive skill initiates a cycle of underachievement and behavior problems, with low achievement

leading to opposition and defiance, and disruptive behaviors interfering with a student's ability to gain from instruction or academic intervention (Sameroff & Fiese, 2000). It is also possible that cognitive ability, achievement, and problem behavior are not linked directly, but rather are connected by some other variable that remained unmeasured in the current study. Some likely candidates for unmeasured processes that might underlie or cause difficulties in all of these areas include parenting quality, trauma exposure, genetics, children's self-regulatory skills, and school environmental factors.

Self-regulation is an important executive control process that underlies emotional reactions and involves the act of initiating, inhibiting, or modulating that internal state. Self-regulation is the learned method of responding to emotion, and determines whether regulation of the feeling state is required and the act of regulation, including attention, cognitive, or behavioral responses (Vohs & Baumeister, 2011). Although beyond the scope of the current study, it is worth differentiating between the "hot" and "cool" components of executive functioning (Zelazo & Müller, 2002). Cool executive functions are related to cognitive skills, attention, impulse control, and planning under relatively calm conditions and using affectively neutral stimuli; these functions tend to be captured well on measures of intelligence, especially Working Memory and Processing Speed (Brock et al., 2009; Zelazo & Müller, 2002). Hot executive functions, on the other hand, are not as easily measured and are those skills related to responding to strong emotional arousal, navigating social situations, and utilizing effective communication. While parent report of children's internalizing, externalizing, and total problem behaviors theoretically assesses the behavioral and observable consequences of children's poor hot self-regulatory skills, direct assessments of children's inhibition and emotion

regulation were not obtained in the current study. This is important because hot and cool executive functioning skills are likely related to children's time engaged in school learning and their ability to problem-solve, which in turn has important consequences for their test performance (Fantuzzo, Bulotsky, McDermott, Mosca, & Lutz, 2003; Olson, Sameroff, Kerr, Lopez, & Wellman, 1999). This suggests that self-regulation strategies are important to consider when examining the relations of behavior problems and intelligence, as ineffective self-regulation might explain both difficulty with the demands of the test taking environment, ability to learn in the school environment, as well as being a predisposing variable for behavioral and emotional problems (Ayduk, Rodriguez, Mischel, Shoda, & Wright, 2007).

In addition to self-regulation, it is also possible that unmeasured parenting factors could amplify, attenuate, or underlie the behavior problem-achievement pathway. It seems likely that highly responsive and involved parents would be more "in tune" with their children's abilities and emotional dispositions and better able to adequately respond to both achievement difficulties and behavior and emotional acting out. The available research provides support for the importance of parenting quality in relation to behavior problems and academic success. Parenting factors, such as warmth, harshness, support, and involvement have shown that these elements of the parent-children relationship, not captured in the current study, are linked to academic achievement and the development of early problem behaviors (Campbell et al.,2000; Deater-Deckard, Ivy, & Petrill, 2006; Jeynes, 2005).

Self-regulation and parenting factors, in addition to other factors mentioned, are probably not independent of one another. Increasingly, research is showing the

potential influence of parenting on children's self-regulation development and development of executive functioning (Karreman, van Tuijl, van Aken, & Dekovic, 2006). Whether considered individually or jointly, self-regulation and parenting seem particularly important in fully understanding how the domains of behavior, intelligence, and achievement relate to one another, the current study cannot shed any additional light on the influence of these unmeasured variables or specify pathways of influence. This is not atypical in the literature, and the difficulty in teasing out causality is highlighted by literature showing that disruptive behavior and early academic skills are linked even before formalized schooling begins (Hinshaw & Anderson, 1996). Despite some of these limitations, the results from this study suggest that the relation between WISC-III IQ scores and behavior problems is mediated by achievement, with the association between WISC-III IQ scores and total problems fully accounted for by the association with achievement.

An exploration of how cognitive functioning relates to achievement would not be complete without considering the role of children's ability to control and sustain attention. It was hypothesized that parent report of attention on the CBCL and related cognitive processes, such as the index scores on the WISC sensitive to attention (WISC-III Freedom from Distractibility, WISC-IV Working Memory Index, WISC-III and WISC-IV Processing Speed) would predict achievement, over and above various intelligence indices. As was expected, child verbal and nonverbal intellectual functioning as measured by both the WISC-III and WISC-IV were significantly associated with both reading and math achievement. Child attention, including parent reported attention and

intelligence indices on the WISC-III and WISC-IV that tap into attention, significantly added to the predictions of reading and math achievement.

Examination of the individual effects of each of the variables of interest imply potential differences in how the measures of attention contribute to math achievement vs. reading achievement, and some differences in the WISC-III and WISC-IV samples. In both the WISC-III and WISC-IV samples, parent report of attention problems uniquely contributed to the variance accounted for in math achievement, but not reading achievement. Working Memory/Freedom from Distractibility was also an important predictor in both math and reading achievement, however, it appeared that WISC-III Freedom from Distractibility was just short of significance in accounting for unique variance in the prediction of reading achievement. Taken together, these results suggest that intelligence and attention problems are related to lower achievement, and that observable difficulties maintaining attention, as captured by parent report of attention problems, might be particularly important in math abilities.

It is possible that this finding reflects the unique role of attention in completing the mathematical computations necessary on achievement tests. The current study utilized the Math Composite on the WIAT-II as a measure of mathematical achievement. The subtests that factor into the Math Composite score require children to calculate basic addition, subtraction, multiplication, and division facts in a series of increasingly complex written mathematical problems. Children are also asked to solve a series of verbally presented mathematics problems (Weschler, 2002). As with most mathematical calculations, these tasks require a great deal of sustained attention, particularly as the sequence becomes more complex and involves multiple problem solving steps.

Children with attention problems are likely to miss important parts of the instructions, neglect a necessary step in an equation, or even fail to discriminate a distinct feature of the mathematical concept, such as mistaking a subtraction sign for an addition sign (Mercer, 1997; Zentall, 2007).

Taken together, the findings from the current study are consistent with the literature that attention problems are predictive of children's achievement (Brock, Rimm-Kaufman, Nathanson, & Grimm, 2009; McClelland, Morrison, & Holmes, 2000). More specifically, the current study provides evidence that children's attention problems, as assessed by parent report and child performance, are associated with reading and math achievement above and beyond verbal and nonverbal intellectual abilities. Specifically, parent reported and WISC-III attention sensitive measures account for 12.1% and 22.3% of the variance in reading and math achievement, respectively. Whereas parent report of attention and WISC-IV measures of attention account for 5.7% of the variance in reading achievement and 5% of the variance in math achievement. Additionally, the current study suggests that observable attention problems, as captured by parent report of inattention, seem to be a particularly important factor in math achievement. Moreover, this study adds to the current literature by replicating the association between cognitive variables and attention in predicting achievement in the most recent addition of the WISC.

CHAPTER 5

IMPLICATIONS, LIMITATIONS & FUTURE DIRECTIONS

To the author's knowledge, no other study has been done that compares the relations of the WISC-IV and WISC-III measures of intelligence to emotional and behavioral adjustment. The present study is an important initial step to examine the validity of the WISC-IV in relation to adjustment, attention, and achievement beyond the original standardization sample. Following analyses, this study found significant discrepant relations between IQ and behavior for the WISC IV compared to the WISC III. Specifically, it appears that in the earlier addition of the WISC, IQ scores were significantly related to behavior problems. However, these same relations did not hold up with the WISC-IV. There are likely several contributing factors to these differences. However, one idea that should be given particular weight is that perhaps the newest version of the WISC is better at assessing intelligence independent of behavior problems, and that some of the specific revisions to the WISC may account for these apparent differences in relations.

Additionally, the current study contributes to the literature by examining the combined and the unique contribution of intelligence, attention, and behavior to achievement among a diverse sample of urban youth. Of particular importance, it appeared that the relation between WISC-III IQ and total problem behaviors observed in this study is best understood in the context of academic achievement. It is likely that children's ability to learn and gain from academic instruction reciprocally interacts with behavior problems. Moreover, attention may be an important additional factor to consider in attempting to better understand children's achievement. Regression

analyses revealed that attention variables independently predict performance on measures of math and reading achievement, and that parent report of inattention might be particularly important in the prediction of math achievement.

Taken together these results have important implications for youth, academic interventions, and the Psychoeducational assessment process. Although not an explicit goal of the WISC-IV, the finding that WISC-III scores have a stronger relationship to behavior problems suggests that the newest version of the WISC may be better at teasing out problems from intelligence. However, early WISC-IV research on samples of children with clinical diagnoses was consistent with WISC-III profile data, in both the standardization sample and a clinically referred population (Landwher, 2010; Mayes & Calhoun, 2007; Wechsler, 2003). This suggests that further research is needed to continue identifying cognitive profiles of children with emotional and behavior problems.

Additionally, the current results suggest that early academic intervention programs would be served best by screening based on caregivers reports of inattention and that comprehensive evaluations are needed to capture the multiple factors important to understanding child reading and math achievement. Furthermore, given the relations of child and family demographic variables such as child age and ethnicity to most of the domains of interest in the current study, this should be taken into account when policymakers and educational specialists are considering factors that may confer risk for lower academic achievement.

It is worth mentioning that there are several shortcomings to the methodology used in the current study. In particular, the sample of WISC-III and WISC-IV data were gathered at different time periods and are likely not equivalent samples in some ways

that we did not assess. If possible, a future study could improve on the current one by administering both the WISC-III and WISC-IV a few months apart in a counter balanced manner to the same group of children, thus minimizing potential sample differences. This study also utilized a clinical sample of children referred for academic or behavioral concerns, which may limit the generalizability of the results. On the other hand, these data provide important information on the WISC IV among a clinically referred sample, which is a group most likely to be tested with the WISC IV. Nonetheless, the lack of a non-clinical comparison group prevents cross-validation of the findings. The correlational and cross-sectional nature of the current study prohibits exploration of causal pathways between the domains of functioning assessed. Future research might improve on the current study by utilizing a control group, randomly selected sample, or longitudinal study design.

Additionally, as previously discussed, the study failed to measure and account for the potential contributing effects of variables such as parent and school factors shown in the literature to be related to the achievement, intelligence, and behavioral domains of functioning. Furthermore, children's adjustment was measured simply by obtaining parent report of symptoms, and it is possible that a teacher report, self-report, or structured diagnostic interview might better capture, or at least add to a more comprehensive assessment of child well-being. A more complete evaluation would potentially allow for exploration of WISC-III and WISC-IV profile differences for specific diagnostic categories, which was not possible in the current study.

Table 1

Demographics and Significance Testing for Differences between WISC-III and WISC-IV

	% (N)	WISC-III (N=98)	WISC-IV (N=223)	TOTAL (N=321)	Sig
Gender					χ^2 (1) = 2.43 p = .13
% Boys		59.2% (N=58)	68.2% (N=152)	65.4% (N=210)	
% Girls		40.8% (N=40)	31.8% (N=71)	34.6% (N=111)	
Ethnicity					χ^2 (2) = .03 p = .90*
% Caucasian		42.9% (N=42)	43.0%(N=96)	43.0% (N=138)	
% African American		46.9% (N=46)	49.3% (N=110)	48.6% (N=156)	
% Asian		1.0% (N=1)	2.2% (N=5)	1.9% (N=6)	
% Hispanic/Latino		3.1% (N=3)	.9%(N=2)	1.6% (N=5)	
% Other		5.1% (N=5)	4.5% (N=10)	4.7% (N=15)	
	M (SD)				
Age		9.21 (2.81)	9.73 (2.87)	9.67 (2.86)	t (318)=-1.49 p = 0.13
Income		48,219 (45,597)	48,408 (50,859)	43,388 (50,222)	t (197)=-.16 p = 0.99
Mother Education					χ^2 (2) = 1.61 p = .45
% Partial HS/HS diploma		12.2% (N=12)	17.5% (N=39)	15.9% (N=51)	
% Some College		34.7% (N=34)	30.9% (N=69)	32.1% (N=103)	
% College/Grad degree		39.8% (N=39)	44.8% (N=100)	43.3% (N=139)	
Married 2-Parent Home		50% (N=49)	43.9% (N=98)	45.8% (147)	χ^2 (1) = 3.71 p = .06

*Chi-square calculation for ethnicity was calculated dichotomously (African American vs. Caucasian) since a valid chi-square can not be calculated with a cell count < 5.

Table 2

One-way ANOVA Comparing WISC-III and WISC-IV Groups on Key Study Variables

	M (SD)	WISC-III	WISC-IV	ANOVA F (df) sig
Child Behavior Checklist		N=90	N=202	
	Attention Problems	61.61 (10.59)	62.68 (10.62)	*F* (1, 290)=.64 *p* = .43
	Internalizing	53.62 (10.45)	55.63 (10.71)	*F* (1, 290) =2.22 *p* = .14
	Externalizing	55.27 (10.97)	55.09 (12.23)	*F* (1, 290)=.01 *p* =.91
	Total Problems	56.56 (10.86)	57.03 (11.53)	*F* (1, 290)=.11 *p* =.74
Wechsler Individual Achievement Test-II		N=50-55	N=190-209	
	Reading Composite	100.42 (18.72)	98.42 (20.52)	*F* (1, 250) =.41 *p* =.52
	Mathematics Composite	98.05 (19.41)	98.35 (21.95)	*F* (1, 262) =.01 *p* =.93
	Total Composite	100.50 (17.89)	99.11 (19.59)	*F* (1, 238) =.21 *p* =.65

Notes. *N*'s range due to occasional missing data

Table 3

Means and Standard Deviations for Ethnicity and Gender on Key Study Variables

M (SD)	WISC-III FSIQ	WISC-IV FSIQ	WIAT-II Total	Total Problems
Gender				
Girls	99.53 (21.12)	97.21 (17.75)	99.08 (19.50)	56.45 (11.40)
Boys	98.72 (19.21)	98.20 (17.92)	99.55 (19.14)	57.12 (11.28)
Ethnicity				
Caucasian	105.93 (20.20)	103.35 (16.13)	101.98 (9.14)	58.40 (10.64)
African American	94.11 (17.98)	91.31 (16.05)	95.88 (18.65)	55.76 (11.58)
Asian	121.00*	129.60 (5.13)	124.40 (23.70)	44.40 (13.76)
Hispanic/Latino	80.33 (15.63)	82.00 (9.90)	88.33 (10.02)	52.40 (12.70)
Other	101.20 (12.03)	112.00 (18.92)	106.75 (11.70)	59.53 (10.37)
Total	99.44 (19.63)	98.20 (17.93)	99.38 (19.25)	56.88 (11.31)

*SD not calculated because there was only 1 participant, thus only a mean could be provided

Table 4
Correlations between Parent Report of Emotional and Behavior Problems and Intelligence Scores

	Internalizing *r*	Externalizing *r*	Total Problems *r*
Child Behavior Checklist			
Internalizing	1.00	.52**	.79**
Externalizing	.52**	1.00	.87**
Total Problems	.79**	.87**	1.00
WISC-III			
Full Scale IQ	-0.07	-.20*	-.26**
Verbal IQ	-0.02	-.24*	-.25**
Performance IQ	-0.12	-0.13	-.24*
Verbal Comprehension	-0.02	-.24*	-.24*
Perceptual Organization	-0.14	-0.12	-.22*
Freedom from Distractibility	-0.16	-.25**	-.32**
Processing Speed Index	-0.13	-.22*	-.30**
WISC-IV			
Full Scale IQ	0.03	0.01	-0.05
Verbal Comprehension	0.05	0.01	-0.04
Perceptual Reasoning	0.01	-0.04	-0.07
Working Memory	0.08	0.09	0.02
Processing Speed	-0.02	0.03	-0.02

Note: * Significant at the 0.05 level (1-tailed)

** Significant at the 0.01 level (1-tailed)

Table 5

Means and standard deviations for WISC-III and WISC-IV factor/index scores and WIAT Reading and Math Comprehension for children above and below clinical cutoffs for total problem behaviors.

M (SD)	Non Sig Problems	Clinically Sig Problems	Total
WISC-III	N=53	N=32	N=85
Verbal Comprehension	104.85 (17.73)	99.31 (18.51)	102.76 (18.12)
Perceptual Organization	103.51 (18.22)	98.25 (20.19)	101.53 (19.04)
Freedom from Distractibility	100.64 (18.54)	94.44 (16.21)	98.31 (17.86)
Processing Speed	101.83 (18.14)	99.78 (17.47)	101.06 (17.82)
WISC-IV	N= 114	N=88	N=202
Verbal Comprehension	101.75 (17.15)	102.32 (16.84)	102.00 (16.98)
Perceptual Reasoning	101.66 (18.10)	100.69 (16.53)	101.24 (17.39)
Working Memory	94.79 (16.18)	97.57 (15.62)	96.00 (15.96)
Processing Speed	93.25 (13.58)	93.69 (13.98)	93.44 (13.72)
WIAT-II	N= 131-138	N=98	N= 226-236
Math Composite Score	100.38 (22.45)	96.89 (17.58)	98.93 (20.60)
Reading Composite Score	99.79 (21.43)	98.00 (18.19)	99.04 (20.11)

Table 6

Regression of WISC-III Overall IQ, Age, and the Interaction of Age and IQ, on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		57.17	1.11	
Centered WISC-III		-0.13	0.06	-0.23*
Centered age		0.84	0.40	0.22*
R^2	.113*			
Step 2				
(Constant)		57.28	1.13	
Centered WISC-III		-0.12	0.06	-0.21
Centered age		0.88	0.41	0.23*
Interaction (WISCIII*age)		0.01	0.02	0.07
ΔR^2	.004			

Note: *p <.05

Table 7

Regression of WISC-III Overall IQ, Age, and the Interaction of Age and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		54.31	1.07			55.67	1.16	
Centered WISC-III		-0.01	0.06	-0.02		0.51	0.41	0.13
Centered age		1.23	0.38	0.33*		-0.10	0.06	-0.18
R^2	.110*				.058			
Step 2								
(Constant)		54.21	1.09			56.02	1.16	
Centered WISC-III		-0.02	0.06	-0.05		0.65	0.42	0.17
Centered age		1.19	0.39	0.32*		-0.06	0.06	-0.11
Interaction (WISCIII*age)		-0.01	0.02	-0.06		0.04	0.02	0.21
ΔR^2	.003				.038			

Note: *p <.05

Table 8

Regression of WISC-IV Overall IQ, Age, and the Interaction of Age and IQ, on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		56.93	0.81	
Centered WISC-IV		-0.02	0.05	-0.04
Centered age		0.60	0.28	0.15*
R^2	.025			
Step 2				
(Constant)		56.98	0.81	
Centered WISC-IV		-0.02	0.05	-0.03
Centered age		0.60	0.28	0.15*
Interaction (WISCIV*age)		0.01	0.02	0.04
ΔR^2	.002			

Note: *p <.05

Table 9

Regression of WISC-IV Overall IQ, Age, and the Interaction of Age and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		55.51	0.75			55.03	0.87	
Centered WISC-IV		0.03	0.04	0.04		0.01	0.05	0.02
Centered age		0.57	0.26	0.15*		0.30	0.30	0.07
R^2	.024				.005			
Step 2								
(Constant)		55.52	0.76			55.03	0.87	
Centered WISC-IV		0.03	0.04	0.05		0.01	0.05	0.02
Centered age		0.57	0.26	0.15*		0.30	0.30	0.07
Interaction (WISCIV*age)		0.00	0.02	0.02		0.00	0.02	0.00
ΔR^2	.000				.000			

Note: *p <.05

Table 10

Regression of WISC-III Overall IQ, Gender, and the Interaction of Gender and IQ, on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		58.01	1.49	
Centered WISC-III		-0.15	0.06	-0.27*
Gender		-2.86	2.23	-0.13
R^2	.086*			
Step 2				
(Constant)		57.94	1.50	
Centered WISC-III		-0.11	0.08	-0.20
Gender		-2.78	2.24	-0.13
Interaction (WISCIII*gen)		-0.07	0.12	-0.09
ΔR^2	.003			

Note: *p <.05

Table 11

Regression of WISC-III Overall IQ, Gender, and the Interaction of Gender and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		53.21	1.49			56.79	1.52	
Centered WISC-III		-0.04	0.06	-0.07		-0.12	0.06	-0.21*
Gender		1.04	2.24	0.05		-3.11	2.28	-0.14
R^2	.007				.061			
Step 2								
(Constant)		53.04	1.48			56.84	1.53	
Centered WISC-III		0.06	0.08	0.10		-0.15	0.08	-0.26
Gender		1.24	2.22	0.06		-3.17	2.30	-0.15
Interaction (WISCIII*gen)		-0.18	0.11	-0.24		0.06	0.12	0.07
ΔR^2	.028				.003			

Note: *p <.05

Table 12

Regression of WISC-IV Overall IQ, Gender, and the Interaction of Gender and IQ, on Parent Report of Total Problems and Externalizing Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		56.95	0.98	
Centered WISC-IV		-0.03	0.05	-0.05
Gender		0.32	1.76	0.01
R^2	.003			
Step 2				
(Constant)		56.92	0.99	
Centered WISC-IV		-0.01	0.06	-0.02
Gender		0.29	1.77	0.01
Interaction (WISCIV*gen)		-0.06	0.10	-0.05
ΔR^2	.002			

Note: *p <.05

Table 13

Regression of WISC-IV Overall IQ, Gender, and the Interaction of Gender and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		55.61	0.92			55.13	1.05	
Centered WISC-IV		0.02	0.04	0.03		0.01	0.05	0.01
Gender		0.04	1.64	0.00		-0.12	1.87	-0.01
R^2	.001				.000			
Step 2								
(Constant)		55.57	0.92			55.12	1.05	
Centered WISC-IV		0.04	0.05	0.06		0.01	0.06	0.02
Gender		0.00	1.64	0.00		-0.13	1.88	-0.01
Interaction (WISCIV*gen)		-0.07	0.10	-0.06		-0.02	0.11	-0.02
ΔR^2	.003				.000			

Note: *p <.05

Table 14

Regression of WISC-III Overall IQ, Ethnicity, and the Interaction of Ethnicity and IQ, on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		57.93	1.75	
Centered WISC-III		-0.16	0.06	-0.29*
Ethnicity		-2.69	2.47	-0.12
R^2	.081*			
Step 2				
(Constant)		57.74	1.81	
Centered WISC-III		-0.14	0.09	-0.25
Ethnicity		-2.61	2.49	-0.12
Interaction (WISCIII*ethn)		-0.06	0.13	-0.07
ΔR^2	.003			

Note: *p <.05

Table 15

Regression of WISC-III Overall IQ, Ethnicity, and the Interaction of Ethnicity and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		55.00	1.75			55.51	1.79	
Centered WISC-III		-0.04	0.06	-0.07		-0.13	0.06	-0.22
Ethnicity		-2.63	2.47	-0.13		-0.59	2.53	-0.03
R^2	.016				.047			
Step 2								
(Constant)		55.24	1.80			55.09	1.84	
Centered WISC-III		-0.07	0.09	-0.13		-0.07	0.09	-0.12
Ethnicity		-2.73	2.48	-0.13		-0.42	2.53	-0.02
Interaction (WISCIII*ethn)		0.07	0.13	0.09		-0.13	0.13	-0.15
ΔR^2	.004				.013			

Note: *p <.05

Table 16

Regression of WISC-IV Overall IQ, Ethnicity, and the Interaction of Ethnicity and IQ, on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		59.59	1.21	
Centered WISC-IV		-0.08	0.05	-0.12
Ethnicity		-4.41	1.78	-0.20*
R^2	.034*			
Step 2				
(Constant)		59.46	1.26	
Centered WISC-IV		-0.06	0.08	-0.08
Ethnicity		-4.41	1.78	-0.20
Interaction (WISCIV*etn)		-0.04	0.11	-0.04
ΔR^2	.001			

Note: *p <.05

Table 17

Regression of WISC-IV Overall IQ, Ethnicity, and the Interaction of Ethnicity and IQ, on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		58.20	1.15			56.73	1.32	
Centered WISC-IV		-0.04	0.05	-0.06		-0.02	0.06	-0.02
Ethnicity		-4.77	1.69	-0.22*		-2.39	1.93	-0.10
R^2	.042*				.009			
Step 2								
(Constant)		58.02	1.20			56.79	1.38	
Centered WISC-IV		-0.01	0.07	-0.01		-0.03	0.09	-0.04
Ethnicity		-4.77	1.69	-0.22*		-2.39	1.94	-0.10
Interaction (WISCIV*etn)		-0.06	0.10	-0.06		0.02	0.12	0.02
ΔR^2	.002				.000			

Note: *p <.05

Table 18

Hierarchical Regression of WISC-III Index Scores on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step1				
(Constant)		46.62	4.52	
Ethnicity		1.01	1.10	0.10
Age		0.88	0.42	0.23*
R^2	.059			
Step 2				
(Constant)		70.74	9.26	
Ethnicity		0.80	1.06	0.08
Age		0.76	0.40	0.20
Perceptual Organization		0.03	0.08	0.06
Freedom from Distractibility		-0.15	0.09	-0.25
Processing Speed		-0.11	0.08	-0.18
ΔR^2	.116*			
Step 3				
(Constant)		69.51	9.94	
Ethnicity		0.91	1.11	0.09
Age		0.78	0.41	0.20
Perceptual Organization		0.02	0.09	0.04
Freedom from Distractibility		-0.17	0.10	-0.28
Processing Speed		-0.11	0.08	-0.18
Verbal Comprehension		0.04	0.10	0.06
ΔR^2	.001			

Note: *p <.05

Table 19

Hierarchical Regression of WISC-III Index Scores on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step1								
(Constant)		43.65	4.30			47.93	4.60	
Ethnicity		-0.13	1.05	-0.01		1.39	1.12	0.14
Age		1.13	0.40	0.30*		0.51	0.42	0.13
R^2	.093*				.033			
Step 2								
(Constant)		55.03	9.28			64.14	9.64	
Ethnicity		-0.25	1.06	-0.03		1.33	1.10	0.13
Age		1.05	0.40	0.28*		0.46	0.42	0.12
Perceptual Organization		-0.01	0.08	-0.03		0.09	0.08	0.16
Freedom from Distractibility		-0.07	0.09	-0.13		-0.17	0.09	-0.28
Processing Speed		-0.02	0.08	-0.03		-0.08	0.08	-0.13
ΔR^2	.025				.081			
Step 3								
(Constant)		48.56	9.74			66.95	10.31	
Ethnicity		0.35	1.09	0.04		1.07	1.16	0.10
Age		1.16	0.40	0.31*		0.42	0.43	0.11
Perceptual Organization		-0.08	0.09	-0.14		0.12	0.09	0.21
Freedom from Distractibility		-0.17	0.10	-0.28		-0.13	0.10	-0.21
Processing Speed		-0.01	0.08	-0.02		-0.08	0.08	-0.14
Verbal Comprehension		0.19	0.10	0.33		-0.08	0.11	-0.14
ΔR^2	.039				.007			

Note: *p <.05

Table 20

Hierarchical Regression of WISC-IV Index Scores on Parent Report of Total Problems

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		53.78	3.42	
Ethnicity		-1.24	0.86	-0.10
Age		0.55	0.28	0.14
R^2	.033			
Step 2				
(Constant)		55.17	7.47	
Ethnicity		-1.30	0.86	-0.11
Age		0.49	0.29	0.12
Perceptual Reasoning		-0.10	0.07	-0.15
Working Memory		0.09	0.07	0.12
Processing Speed		0.01	0.07	0.01
ΔR^2	.011			
Step 3				
(Constant)		55.68	7.52	
Ethnicity		-1.29	0.87	-0.11
Age		0.51	0.29	0.13
Perceptual Reasoning		-0.08	0.07	-0.13
Working Memory		0.10	0.08	0.14
Processing Speed		0.02	0.07	0.02
Verbal Comprehension		-0.04	0.07	-0.06
ΔR^2	.002			

Note: *p <.05

Table 21

Hierarchical Regression of WISC-IV Index Scores on Parent Report of Internalizing Problems and Externalizing Problems

	Dependent Measures							
	Internalizing Problems				Externalizing Problems			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		52.38	3.19			55.44	3.66	
Ethnicity		-0.99	0.80	-0.09		-1.45	0.92	-0.11
Age		0.51	0.26	0.14		0.22	0.30	0.05
R^2	.020				.017			
Step 2								
(Constant)		49.73	6.96			52.11	7.91	
Ethnicity		-1.01	0.80	-0.09		-1.54	0.91	-0.12
Age		0.48	0.27	0.13		0.15	0.31	0.03
Perceptual Reasoning		-0.03	0.06	-0.05		-0.15	0.07	-0.22*
Working Memory		0.09	0.07	0.13		0.17	0.08	0.23*
Processing Speed		-0.02	0.07	-0.03		0.03	0.07	0.04
ΔR^2	.009				.031			
Step 3								
(Constant)		49.65	7.02			52.35	7.98	
Ethnicity		-1.01	0.81	-0.09		-1.54	0.92	-0.12
Age		0.48	0.27	0.13		0.16	0.31	0.04
Perceptual Reasoning		-0.04	0.07	-0.06		-0.15	0.08	-0.21
Working Memory		0.09	0.07	0.13		0.18	0.08	0.24*
Processing Speed		-0.03	0.07	-0.03		0.04	0.07	0.04
Verbal Comprehension		0.01	0.07	0.01		-0.02	0.07	-0.03
ΔR^2	.000				.000			

Note: *p <.05

Table 22

Hierarchical Regression of Parent Reported Total Problems, and WISC-III Index Scores on WIAT-II Total Achievement Scores

	WIAT-II Total Achievement			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		121.46	10.83	
Ethnicity		-2.38	2.78	-0.13
Age		-1.69	0.99	-0.27
R^2	.079			
Step 2				
(Constant)		150.99	15.36	
Ethnicity		-1.96	2.60	-0.11
Age		-0.66	1.01	-0.10
Total Problems		-0.71	0.28	-0.40*
ΔR^2	.135*			
Step 3				
(Constant)		9.29	17.43	
Ethnicity		0.62	1.52	0.04
Age		0.07	0.58	0.01
Total Problems		-0.25	0.16	-0.14
Verbal Comprehension		0.47	0.13	0.45*
Perceptual Organization		0.05	0.12	0.04
Freedom from Distractibility		0.38	0.15	0.34*
Processing Speed		0.14	0.11	0.13
ΔR^2	.580*			

Note: *p <.05

Table 23

Hierarchical Regression of Parent Reported Total Problems, and WISC-IV Index Scores on WIAT-II Total Achievement Scores

	WIAT-II Total Achievement			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		119.67	6.26	
Ethnicity		-0.98	1.67	-0.04
Age		-1.92	0.51	-0.28*
R^2	.078*			
Step 2				
(Constant)		128.31	9.20	
Ethnicity		-1.15	1.67	-0.05
Age		-1.85	0.52	-0.27*
Total Problems		-0.16	0.12	-0.10
ΔR^2	.009			
Step 3				
(Constant)		15.95	10.67	
Ethnicity		0.36	1.11	0.02
Age		-1.45	0.35	-0.21
Total Problems		-0.08	0.08	-0.05
Verbal Comprehension		0.37	0.08	0.32*
Perceptual Reasoning		0.20	0.09	0.17*
Working Memory		0.41	0.09	0.33*
Processing Speed		0.04	0.08	0.03
ΔR^2	.527*			

Note: *p <.05

Table 24

Hierarchical Regression of WISC-III Index Scores and Attention Problems on WIAT-II Reading and Math Composite Scores

	Dependent Measures							
	WIAT-II Reading				WIAT-II Math			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		122.75	11.25			113.30	11.14	
Ethnicity		-3.01	2.89	-0.16		0.28	2.91	0.01
Age		-1.75	1.01	-0.26		-1.41	1.01	-0.21*
R^2	.082*				.045			
Step 2								
(Constant)		20.40	19.88			22.15	19.62	
Ethnicity		0.76	2.24	0.04		2.75	2.38	0.14
Age		-0.49	0.78	-0.07		-0.52	0.82	-0.08
Verbal Comprehension		0.76	0.17	0.68*		0.41	0.18	0.37*
Perceptual Organization		0.04	0.16	0.04		0.34	0.17	0.33*
ΔR^2	.434*				.384*			
Step 3								
(Constant)		54.09	26.08			62.63	27.75	
Ethnicity		1.30	2.19	0.07		2.98	2.30	0.15
Age		0.11	0.82	0.02		-0.02	0.83	0.00
Verbal Comprehension		0.69	0.17	0.62*		0.33	0.18	0.30*
Perceptual Organization		0.01	0.15	0.01		0.29	0.16	0.28*
Attention		-0.48	0.25	-0.25		-0.51	0.25	-0.27*
ΔR^2	.043				.052*			
Step 4								
(Constant)		35.52	25.91			36.11	24.96	
Ethnicity		-0.03	2.11	0.00		1.30	1.98	0.07
Age		0.15	0.79	0.02		0.10	0.74	0.01
Verbal Comprehension		0.48	0.18	0.43*		0.00	0.17	0.00
Perceptual Organization		-0.17	0.16	-0.16		0.08	0.15	0.08
Attention		-0.40	0.24	-0.21		-0.42	0.21	-0.23*
Freedom from Distractibility		0.38	0.20	0.33		0.65	0.18	0.55*
Processing Speed		0.19	0.14	0.17		0.17	0.14	0.15
ΔR^2	.078*				.171 *			

Note: *p <.05

Table 25

Hierarchical Regression of WISC-IV Index Scores and Attention Problems on WIAT-II Reading and Math Composite Scores

	Dependent Measures							
	WIAT-II Reading				WIAT-II Math			
	R^2	*b*	*SEb*	β	R^2	*b*	*SEb*	β
Step 1								
(Constant)		117.23	6.33			119.45	6.39	
Ethnicity		1.40	1.61	0.06		-0.91	1.61	-0.04
Age		-2.16	0.52	-0.30*		-1.99	0.53	-0.27*
R^2	.085*				.071*			
Step 2								
(Constant)		27.97	9.08			19.26	8.45	
Ethnicity		1.42	1.21	0.06		-0.93	1.13	-0.04
Age		-1.77	0.40	-0.24*		-1.46	0.38	-0.20
Verbal Comprehension		0.50	0.09	0.41*		0.44	0.08	0.36*
Perceptual Reasoning		0.34	0.09	0.28*		0.50	0.08	0.41*
ΔR^2	.395*				.479*			
Step 3								
(Constant)		37.82	12.05			32.49	11.00	
Ethnicity		1.62	1.22	0.07		-0.74	1.13	-0.03
Age		-1.74	0.40	-0.24*		-1.38	0.38	-0.19*
Verbal Comprehension		0.50	0.09	0.41*		0.43	0.08	0.35*
Perceptual Reasoning		0.32	0.09	0.27*		0.48	0.08	0.39*
Attention		-0.13	0.11	-0.07		-0.18	0.10	-0.10
ΔR^2	.004				.008			
Step 4								
(Constant)		30.05	12.59			22.60	11.53	
Ethnicity		1.55	1.16	0.07		-0.70	1.08	-0.03
Age		-1.77	0.39	-0.24*		-1.42	0.37	-0.19*
Verbal Comprehension		0.36	0.09	0.29*		0.29	0.08	0.23*
Perceptual Reasoning		0.13	0.10	0.11		0.30	0.09	0.24*
Attention		-0.13	0.10	-0.07		-0.19	0.09	-0.10*
Working Memory		0.45	0.10	0.34*		0.38	0.09	0.29*
Processing Speed		-0.02	0.09	-0.01		0.08	0.09	0.05
ΔR^2	.053*				.042*			

Note: *p <.05

Table 26

Hierarchical Regression of WISC-III Index Scores and WISC-III Verbal Comprehension subtests on Parent Report of Total Problem Behaviors

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		46.62	4.52	
Ethnicity		1.01	1.10	0.10
Age		0.88	0.42	0.23*
R^2	.059			
Step 2				
(Constant)		70.74	9.26	
Ethnicity		0.80	1.06	0.08
Age		0.76	0.40	0.20
Perceptual Organization		0.03	0.08	0.06
Freedom from Distractibility		-0.15	0.09	-0.25
Processing Speed		-0.11	0.08	-0.18
ΔR^2	.116			
Step 3				
(Constant)		72.41	9.76	
Ethnicity		0.95	1.17	0.09
Age		0.77	0.42	0.20
Perceptual Organization		0.01	0.09	0.02
Freedom from Distractibility		-0.17	0.10	-0.29
Processing Speed		-0.11	0.08	-0.18
Information		0.05	0.54	0.02
Similarities		0.03	0.49	0.01
Vocabulary		0.30	0.54	0.11
Comprehension		-0.18	0.49	-0.06
ΔR^2	.006			

Note: *p <.05

Table 27

Hierarchical Regression of WISC-III Index Scores and WISC-III Perceptual Organization subtests on Parent Report of Total Problem Behaviors

	Total Problems			
	R^2	*b*	*SEb*	β
Step 1				
(Constant)		46.62	4.52	
Ethnicity		1.01	1.10	0.10
Age		0.88	0.42	0.23*
R^2	.059			
Step 2				
(Constant)		69.80	9.81	
Ethnicity		0.92	1.11	0.09
Age		0.77	0.41	0.20
Verbal Comprehension		0.05	0.09	0.08
Freedom from Distractibility		-0.17	0.10	-0.28
Processing Speed		-0.10	0.07	-0.17
ΔR^2	.116			
Step 3				
(Constant)		73.14	10.97	
Ethnicity		0.50	1.13	0.05
Age		0.64	0.42	0.17
Verbal Comprehension		-0.05	0.11	-0.09
Freedom from Distractibility		-0.15	0.10	-0.25
Processing Speed		-0.07	0.08	-0.11
Picture Completion		0.91	0.49	0.31
Block Design		0.70	0.48	0.25
Object Assembly		-0.40	0.49	-0.13
Picture Arrangement		-0.93	0.43	-0.34*
ΔR^2	.085			

Note: *p <.05

Figure 1

Correlation of WISC-IV Full Scale IQ to Parent Report of Total Problems

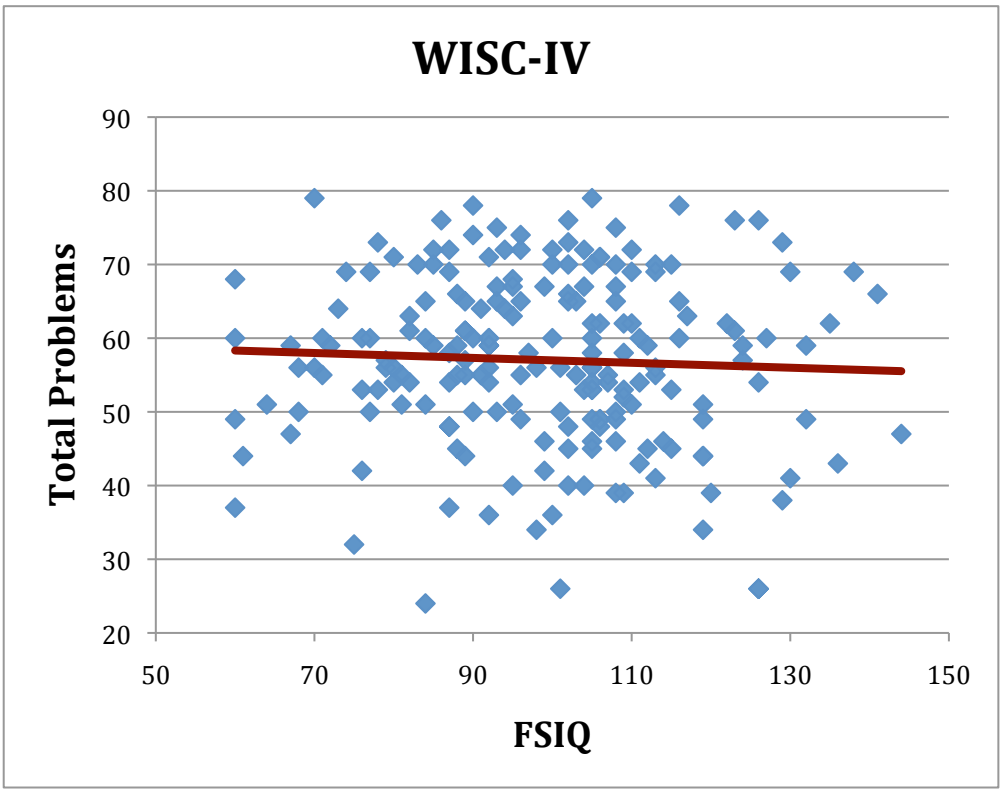
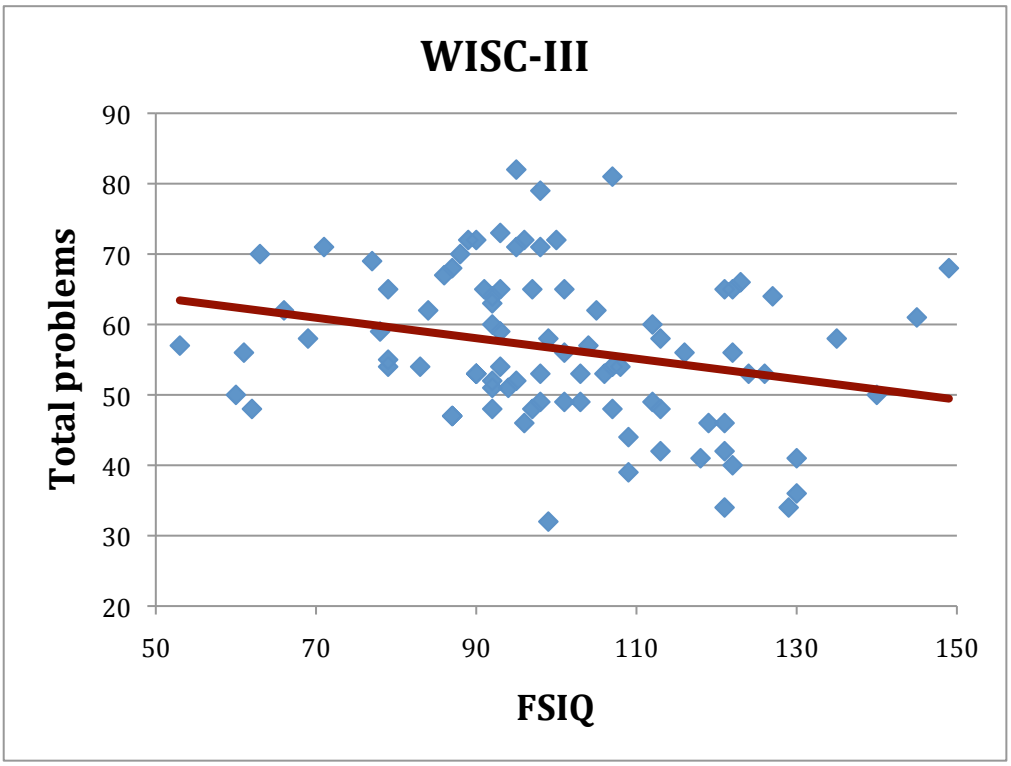


Figure 2

Correlation of WISC-III Full Scale IQ to Parent Report of Total Problems



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ABSTRACT

TELL ME MORE ABOUT IT: A QUERY INTO INTELLIGENCE SCORES AND THEIR RELATIONS WITH ACHIEVEMENT AND PROBLEM BEHAVIOR

by

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August 2012

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Research has demonstrated negative outcomes associated with significant childhood cognitive, behavioral, emotional, or academic problems. These associations may reflect the importance of cognitive skills for mediating social and emotional functioning, however the directions of these relations remain a point of contention. Additionally, most of the child research is based on early editions of the Wechsler Intelligence Scale for Children. Little attention has been given to examining the relations between behavioral adjustment, achievement, and IQ utilizing the Wechsler Intelligence Scale for Children (WISC-IV). The WISC-IV uses different subtests, index scores, and norms than its predecessors and has been described as being better designed to produce more reliable and valid intellectual profiles.

The current study included 321 children referred for academic concerns, and sought to improve on prior studies by comparing WISC-IV and WISC-III profiles as they related to parent report of child emotional and behavioral problems in a diverse, primarily low-income sample. The current study found significant differences between

the WISC III and WISC IV in their relation to behavior problems. The potential contributing factors to these differences were discussed. Additionally, intellectual abilities were significantly associated with children's reading and math achievement. Child attention problems, assessed by parent report and child performance, were associated with reading and math achievement over and above verbal and nonverbal intellectual abilities. Of particular interest, these results indicate that observable difficulties maintaining attention, as captured by parent report of attention problems, may be particularly important in math abilities. Taken together, these results have important implications for the psychological assessment process as well as interventions targeting improved outcomes for children's behavioral, emotional, and academic development.

AUTOBIOGRAPHICAL STATEMENT

Alicia received her Bachelor of Science degree in 2004 from John Carroll University in Cleveland, Ohio where she majored in Psychology and minored in Business. She is completing her clinical internship at Advocate Illinois Masonic Medical Center and is finishing her Ph.D. in Clinical Psychology at Wayne State University, with concentrations in Child Development and Statistics. Alicia's primary research interests are community-based preventive interventions and risk and protective factors in children's adjustment. Alicia has been involved in a variety of research project, both within the Wayne State University community and working in collaboration with colleagues across the country. Ultimately, it is her goal to develop effective and accessible interventions to address the health, behavioral, and psychosocial needs of children in urban underserved areas. Along these lines, Alicia will be starting a pediatric rehabilitation postdoctoral fellowship at Shriners Children's Hospital in Chicago as part of research team at Marquette University. Apart from her academic and clinical roles, she enjoys traveling, eating cookies, and spending time with friends and family.