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Relationship of human figure drawing with executive functioning and achievement

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Abstract

The purpose of the study was to investigate the relationship between aspects of children's human figure drawings to their executive functioning and academic achievement. Participants consisted of 80 third and fourth graders, ages 8 to 10 years, along with their parents. Correlational analysis showed no relationship between the developmental scoring of the Goodenough-Harris or Koppitz with measures of executive functioning, as measured by the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia, Isquith, Guy, & Kenworthy, 2000) and the Cognitive Assessment System (CAS; Naglieri & Das, 1997). However, Koppitz's emotional indicators were significantly correlated with all aspects of BRIEF and CAS. The Goodenough-Harris developmental scoring system was significantly correlated with math achievement, whereas Koppitz's emotional indicators were significantly correlated with mathematics and reading scores.

Chapter One

Overview of the Study

Some clinicians have postulated, for over a century now, that human figure tests provide insight into a child's developmental ability. One such clinician, Florence Goodenough, developed empirical evidence so that human figure drawings could be used to assess a child's developmental level quantitatively (Abell, Heiberger, & Johnson, 1994; Abell, Von Briesen, & Watz, 1996). Goodenough's scoring system was based on the belief that the more advanced a child is developmentally, the more realistic the details would be in the drawing (Abell et al., 1994). Due to an increased interest in using human figure drawings as measures of intelligence, many scoring systems were developed. The most widely used approaches were the Goodenough-Harris and Koppitz scoring systems for intellectual development and Koppitz's scoring system for emotional indicators. Koppitz created a list of emotional indicators for use on human figure drawings in efforts to determine a child's emotional adjustment (Porteous, 1996).

Considering the popularity of using human figure drawing scoring systems, the reliability and validity of the Goodenough-Harris and Koppitz scoring systems were examined. Abell, VonBriesen, and Watz (1996), Abell, Heiberger, and Johnson (1994), and Harris (1963) report a reliability coefficient of .90 or higher for the Goodenough-Harris scoring system for human figure drawings. On the other hand, Abell et al. (1994) and Harris (1968) lacked agreement in their validity findings. For example, Abell et al. (1994) found that the concurrent validity was poor between human figure drawings and the Stanford-Binet intelligence test, while Harris found it to be very good. In addition, Abell et al. (1996) found the concurrent validity coefficients between the scoring of human figure drawings and Wechsler intelligence tests to be poor while Harris found it to be good. Considering that the concurrent validity ranges from poor to high, the link of intelligence, achievement and the scores on human figure drawing tests continue to be investigated.

Many researchers have conducted studies to further examine the relationship between intelligence and academic achievement tests and the GHDS. For example, Carvajal, McVey, Sellers, Weyland, and McKnab (1987) analyzed the relationship between the scores of the Stanford-Binet IV, Peabody Individual Achievement Test – Reviewed, and Columbia Mental Maturity Scale, with the Goodenough-Harris Drawing Test. Abell et al. (1994) evaluated the cognitive scoring systems of the Bucks (1948) House-Tree-Person and the Goodenough-Harris Drawing Test (1963). Research continued with Aikman, Belter, and Finch (1992) when they examined the validity in assessing intellectual level and academic achievement through human figure drawings. Aikman et al. (1992) and Scott (1981) reported a consistent 10-point difference between intelligence quotient scores and the intelligence scores on the Goodenough-Harris scoring system for human figure drawings. Overall, the above research suggests that a relationship between intelligence and achievement test scores and human figure drawings shows considerable variability.

More recently, researchers have investigated the relationship between executive functioning and intelligence. Executive functioning, which is made up of components such as memory, learning, planning, organization, abstract thinking, and response inhibition, have been researched in the past (Duff, Schoenberg, Scott, & Adams, 2005).

Some research has shown that intellectual functioning is conceptually different than executive functioning. For example, Lezac (1995) found that if executive functions become impaired, a person might still maintain a high cognitive profile. Anderson, Bechera, Damasio, Tranel, and Damasio (1999) and Amador (2002) examined the difference between intelligence and executive functioning by comparing the measured cognitive abilities of IQ and executive processing skills. The overall conclusions from this study indicated that executive functioning measures differentiate the skills of a mentally impaired student from that of an intellectually normal student better than measures of intelligence. However, there are instances in which intellectual and executive functioning are related. For example, Kizilbash (1999) explored the relationship between executive functioning and IQ scores of preschool children with and without disruptive behavior problems. Kizilbash found that children with aggressive and disruptive behavior consistently demonstrated patterns of neuropsychological deficits; and showed a relationship between verbal and attentional functioning. Furthermore, Woods (2000) and Rosenthal, Riccio, Gsanger, and Jarratt (2006) found that there was a strong relationship between executive functioning and intellectual functioning.

The use of executive functioning instruments is now being included in many comprehensive psychoeducational batteries to assess children suspected of having disabilities. Many researchers have explored whether executive functioning can differentiate neuropsychological disorders that are commonly seen in schools, such as Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder, and Oppositional Defiant Disorder. In Woods' (2000) study, the results indicated that ADHD subjects demonstrated impairment on executive measures, which suggests that students with ADHD would show impairment in many school tasks.

Some of the aspects of executive functioning are involved with the scoring systems of the Goodenough-Harris and Koppitz. When drawing a human figure, a child must remember what aspects belong in a picture of a person, like the eyes, nose, and ears. Additionally, the child needs to plan out where each part of the drawing (eyes, ears, hands, etc) will go and how it will fit on the paper. Though memory and planning are clearly important aspects in this assessment, there has not been much research in this area. This leads the author to the question of whether or not there's a connection between the DAP and executive functioning and academic achievement? If so, can the DAP be used as a quick measure of executive functioning for school aged children?

Definitions of Terms

Human Figure Drawing: a task that requires a child to draw a whole person on a piece of paper

Executive Functioning: a person's level of higher order thinking, which is made up by many components that include memory, learning, planning, organization, abstract thinking, and response inhibition

Goodenough-Harris Scoring System: a scoring system, developed originally by Florence Goodenough in 1926, that is utilized with the human figure drawing to determine a child's developmental score

Koppitz Emotional Indicators: a scoring system that is utilized with the human figure drawing to determine a child's emotional adjustment

Koppitz Scoring System: a scoring system that is utilized on the human figure drawing to assess a child's developmental score via the number of expected (items expected to be present at the child's age) and exceptional (an item not expected at the child's age) items present in the drawing

Delimitations

The focus of this study was specifically looking at the relationship between particular measures of executive functioning and the Goodenough-Harris and Koppitz scoring systems within a general population of 3rd and 4th grade children.

Chapter Two

Literature Review

Much research has investigated whether the Goodenough-Harris and Koppitz Human Figure Drawing (HFD) scoring systems are comparable to other measures of intelligence and achievement. Past research has investigated the concept of executive functioning and defined it as higher order thinking ability. Comparisons of executive functioning measures to those of intelligence and academic achievement have also been researched. Presently in school systems, psychoeducational assessments are beginning to focus on aspects of executive functioning. A child's executive functioning skills are assessed and utilized to ascertain a child's strengths and weaknesses. In efforts to determine if measures such as the Goodenough-Harris and Koppitz scoring systems can be useful tools to ascertain executive functioning ability, the following areas are reviewed: (a) human figure drawing, (b) executive functioning, (c) connections between intelligence and achievement to human figure drawing, (d) connections between intelligence and executive functioning, and (e) executive functioning and achievement.

Human Figure Drawing

For more than 100 years, clinicians and psychologists have studied children's drawing as a measure of one's cognitive ability. In 1926, Florence Goodenough developed a drawing test called the Draw-A-Man test for use with children from 4 to 10 years of age. The Draw-A-Man test consists of having a child draw a whole person on a piece of paper that is scored via a list of items that are commonly present in drawings. Additionally, Goodenough provided empirical evidence that showed a child's drawing is a reflection of one's intellectual skills and development (Abell, Heiberger, & Johnson, 1994; Abell, Von Briesen, & Watz, 1996). It is believed that the more developed the child is intellectually, the more realistic the details that are incorporated into the drawings (Abell et al., 1994). Therefore, the clinician may view the picture and score the drawing with a developmental intelligence checklist. The more items checked on the list, the higher the level of developmental intelligence.

Goodenough's Draw-A-Man test underwent changes over the years. In 1949 Machover modified the Goodenough's Draw-A-Man scoring procedure and renamed it the Draw-A-Person test (Abell et al., 1994; Abell et al., 1996). Adopting the name Draw-A-Person (DAP), Goodenough and Harris revamped and renormed Goodenough's original scoring criteria to a list comprised of 71 items for females and 73 items for males (Harris, 1968). Continuing to undergo changes, the Goodenough-Harris developmental scoring (GHDS) system was reworked in 1968 by Elizabeth Koppitz, who utilized the Goodenough-Harris test as a template to develop a briefer scoring system called the Koppitz Developmental Inventory (KDI). The KDI eliminates the finer details from Goodenough-Harris' scoring list. According to Koppitz (1968), finer details are rarely seen at younger ages and therefore not needed to create an effective and efficient scoring system. More recently, Abell et al. (1996) found inconclusive results of the comparability of the KDI and GHDS systems.

In addition to the KDI, Koppitz developed a list of emotional indicators to be utilized on the DAP test. Koppitz theorized that the presence of certain characteristics in a human figure drawing indicated a child's emotional adjustment. Based on the number of emotional indicators present on a child's HFD, Glutting and Nestor (1986) were able to differentiate three categories of emotional adjustment: (a) well adjusted, (b) adequately adjusted, and (c) possibly maladjusted. These findings supported the use of emotional indicators on the DAP as an estimate of learning-related behavior. Moreover, Yama's (1990) study supported the notion that the use of emotional indicators on the DAP could be useful in schools. Overall, Yama found that emotional indicators were useful when used in context with artistic ability and bizarreness to determine a person's overall psychological and emotional adjustment.

Executive Functioning

Neuropsychology is the study of the relationship between the brain and behavior (Goldstein and Reynolds, 1999). In this discipline, it is believed that executive functioning controls and coordinates cognitive operations. Behavioral functions and executive processes are controlled by certain parts of the brain. Executive processes are also denoted as executive functions and are typically defined as higher order thinking, which is made up by many components, -- e.g. memory, learning, planning, organization, abstract thinking, and response inhibition. According to Dawson and Guare (2004), executive skills allow children in grades three through five to perform the following tasks: (a) bring papers, books, and assignments to and from school, (b) complete about an hour of homework, (c) keep track of a changing schedule, (d) save money for desired objects and plan to earn money, (e) run errands that may involve a time delay, (f) keep track of belongings, (g) plan simple school projects (e.g. a book report), and (h) inhibit and self-regulate behaviors (e.g. behave when the teacher leaves the room).

Brain damage effects on executive functioning. Researchers indicate that frontal lobe damage sustained in adulthood tends to spare intelligence, as determined by psychometric batteries (Warrington, James, & Maciejewski, 1986). An often cited example of a person who lived with damage in the executive structures of the brain was the person known as Phineas Gage. In 1848, Gage was involved in a railroad construction accident that sent an iron bar through his cheek, skull, and brain (see Appendix 1). Immediately after the accident, Gage quickly regained consciousness and was able to adequately communicate with those around him.

In the months to follow, certain changes were noted about Gage. Those who knew Gage before the accident described him as “responsible, intelligent, and socially well-adapted” (Damasio & Damasio, 1994, page 1102). After the accident, Gage experienced no impairments in movement, speech, memory, or intelligence and continued to appear able-bodied and learn new things (Damasio & Damasio). However, areas that are now considered to be executive functions appeared to be hampered in Gage. More specifically, he often became disrespectful and impulsive, used more profanity, and had a dramatically lowered sense of responsibility (e.g. trouble honoring commitments) (Damasio & Damasio; Wagar & Thagard, 2004). John Harlow, Gage’s doctor, theorized that Gage’s cognitive and behavioral changes were a result of damage to the frontal lobe, which moderates “intellectual faculty from animal propensities” (Damasio & Damasio, page 1103).

Damasio and Damasio (1994) utilized brain-imaging techniques to take a closer look at the projected areas affected by the iron rod penetrating the brain. These researchers theorized that Gage “exemplified a particular type of cognitive and behavioral defect caused by damage to ventral and medial sectors of the prefrontal cortex,” which is the most anterior area of the frontal lobe (Damasio & Damasio, page 1103). The most statistically and medically probable trajectory of the iron rod was logically ascertained, which indicated that the rod did damage to the theorized areas of the brain suspected by Damasio and Damasio. This information was consistent with 12 other patients with frontal lobe damage as examined by Damasio and Damasio. These researchers stated the following:

> “[The patients] ability to make rationale decisions in personal and social matters is invariably compromised and so is their processing of emotion. On the contrary, their ability to tackle the logic of an abstract problem, to perform calculations, and to call up

> appropriate knowledge and attend to it remains intact... The assignment of frontal regions to different cognitive domains is compatible with the idea that frontal neurons in any of those areas may be involved with attention, working memory, and the categorization of contingent relationships regardless of the domain. This assignment also agrees with the idea that in non-brain-damaged individuals, the separate frontal regions are interconnected and act cooperatively to support reasoning and decision making." (page 1104).

Overall, this research by Damasio and Damasio was termed the Somatic-Marker Hypothesis. In the end, the brain damage sustained by Gage and the research that followed illustrated that various brain structures work together to perform tasks. In Gage's case, higher order thinking skills, such as planning, organization, response inhibition, and behavioral control, were hampered by his frontal lobe damage.

Building from Damasio and Damasio's (1994) Somatic-Marker Hypothesis, Wagar and Thagard (2004) forwarded a neurological theory that involves cognitive and emotional information in effective decision-making ability. In this theory, the frontal lobe that is severely damaged is a part of the relay system with others areas of the brain, such as the amygdala and hippocampus, that are involved with regulating emotions.

Executive functioning assessment. Dawson and Guare (2004) acknowledge that the development of executive skills in the brain of a child and adolescent parallels the ability to act, think, and feel. The region of the brain that controls the executive components is on the left and right hemispheres in the frontal/prefrontal cortex. Dawson and Guare agreed with previous researchers who held that the neurological base for executive skills is the frontal cortex. Furthermore, Dawson and Guare believe that accurate assessment of executive skills is critical in identifying the child's overall strengths and weaknesses and to create effective interventions. Neuropsychological assessment taps into specific domains of mental-behavioral functioning (Goldstein & Reynolds, 1999). As such, the relationship between the brain and behavior are assessed and a plan of action can be created for those who need interventions.

Executive functioning development. Welsh, Pennington, and Groisser (1991) investigated the prefrontal development of executive functions in children. Their research determined that there were at least three stages of skill development. At age 6 years, the level of development results in organized and planned behavior (Passler, Isaac, & Hynd, 1985; Welsh et al.). By age 10 years, Welsh et al. determined that tasks that require "greater hypothesis testing and impulse control" developed (p142). Due to certain skills (verbal fluency, motor sequencing, and complex planning) not yet reaching the adult ability level at age 12, researchers determined that there must be another period of development during adolescence (Welsh et al.).

Executive functioning components in human figure drawing. In the past, the relationship between details included in a human figure drawing and memory was investigated in adults. Ericsson, Winblad, and Nilsson (2001) illustrated that the presence, or absence, of essential details in HFD could support a clinical evaluation of cognitive and memory decline. Overall, these researchers found a reduction in the number of details in HFD with the progression of dementia (episodic memory). Further, the decrease in details present in HFD was found by Lakin (1956) to be associated with lower memory and cognitive functioning.

Human Figure Drawings Connections with IQ and Achievement

The GHDS test manual states that the drawing test does not give an identical intelligence score as that from an individually administered IQ test (Harris, 1968). Rather, the DAP should be used as a screening tool to select students that need additional testing (Harris, 1963).

However, clinicians and researchers questioned its utility and ability to ascertain accurate IQ scores. As such, there have been many studies conducted to establish a definitive relationship between the GHDS and ones intellectual abilities and achievement.

Researchers have investigated whether the GHDS accurately assesses ability across the ages (i.e. from age 4 to 10). Strommen's (1987) research provided information about drawing development on the GHDS to further assess developmental intelligence. In general, he found that the human figure test was psychometrically sound and that human figure drawings showed developmental changes with age.

Some of the studies reviewed focused on the reliability and validity of the GHDS to intellectual and academic testing (e.g. Abell et al., 1994; Abell et al., 1996; Harris, 1963). Researchers attempted to increase validity of human figure drawing scoring by averaging the scores of two HFD to find an overall scoring quotient (Abell et al., 1994). These researchers believed that two HFD would yield more accurate results than just one HFD. Their results, however, did not support their hypothesis. The results did not show higher validity coefficients for either development or intelligence. On the other hand, Kastner, May, and Hildman (2001) were consistent with Wechsler (1991) and Lavin (1996), when their research on a predictive validity battery concluded that language based tests had a higher association with later academic success than tests with motor components, such as the DAP. In addition, Kastner et al. found that those with auditory-verbal learning disabilities had lower academic achievement scores.

Past research found connections between intelligence scores and DAP standard scores. Abell et al. (1994) found Pearson Product Moment Correlations of the Goodenough-Harris DAP standard scores with WAIS-R test results to have a modest relationship. Furthermore, Abell et al. (1994) were able to determine that using Buck’s system on one human figure can effectively and efficiently determine one's intelligence score. In a subsequent study, Abell et al. (1996) compared the DAP scores and again found a correlation between human figure drawing scores and intelligence scores. Abell et al. (1996) found that the Goodenough-Harris DAP standard scores are correlated more than Koppitz's scores with the WISC-III and Stanford Binet intelligence score. A result of this research indicates that one should come up with a similar estimate of cognitive status with an intelligence test as with a small sample of drawing ability.

Connections between human figure scores and full-scale intelligence scores also occurred in another perspective. Tramill, Edwards, and Tramill (1980) assessed the relationship between the WISC-R and Draw-A-Person on children with academic difficulties. The results of their Pearson Product Moment Coefficient correlations indicated a gender difference on the draw-a-person intelligence quotient and intelligence testing. Overall, females' with academic difficulties had standard scores on the DAP that approximated WISC-R scores than did males' with academic difficulty. The best intelligence subtest predictor of DAP intelligence for females was Arithmetic, whereas for males, it was Similarities.

Though the above studies support the connection between the draw-a-person and intellectual abilities and achievement, there are also discrepancies between these studies that can be divided into three areas. The first area of study examines whether the DAP underestimates intelligence. Another area of study investigates whether the DAP is a better estimate of lower intelligence than of average or high intelligence. The third area of study suggests that there is no significant correlation between DAP and intelligence and achievement scores.

The first area of study examined whether DAP standard scores underestimates a person's true intelligence. Although Abell et al. (1994), mentioned earlier, found a correlation between intelligence scores on the WAIS-R and the DAP scores, their t-tests on correlated observations for performance scale and full scale score indicated that the Goodenough-Harris underestimates full scale intelligence scores (FSIQ) by 16 points on a consistent basis. However, the Goodenough-Harris system was used with young adults rather than young children. On the other hand, Buck's system, which was created for young adults, gave a closer approximation to the WAIS-R performance scale and full scale. Yet, it too underestimated FSIQ by 10 points. Furthermore, the studies performed by Aikman, Belter, and Finch (1992) and Scott (1981) also showed a 10 point difference between standard scores on the DAP and the WISC-R and WAIS-R.

The second area of study investigated whether human figure drawing tests give a better estimate of lower intelligence than that of average or high intelligence. The results from Aikman et al.'s (1992) study that gauged the validity of the Goodenough-Harris Draw-A-Person in the assessment of intelligence and academic achievement are of interest. The Pearson Product Moment Correlations among the achievement scores, full scale IQ's, and drawing standard scores for male and female participants were found to have a statistically significant relationship. However, the best rate of accurate diagnosis was between achievement scores, full scale IQ's, and DAP standard scores in the lower intelligence range. Though their results were inconclusive, Abell et al. (1996) attempted to find support for the hypothesis that those with lower IQ scores or that those who are younger in years would be better suited for the use of human figure drawing systems.

Lastly, Carvajal, McVey, Sellers, Weyland, and McKnab (1987) show that there is no significant correlation between intelligence scores on the Stanford Binet-IV (SB-IV) and DAP Additionally, Aikman et al. (1992) also failed to show a correlation throughout the intelligence spectrum. Thus, they failed to support the belief that IQ tests and the DAP can be interchanged as a measure of intelligence. Both studies indicated that the DAP should not be substituted for an IQ test or achievement test, since the DAP appears to tap different abilities.

Connections between IQ and Executive Functioning

Intellectual functioning and executive functioning are conceptually different from each other. Lezac (1995) stated that if executive functions become impaired, a person might still maintain a high cognitive profile. Anderson, Bechera, Damasio, Tranel, and Damasio (1999) researched the difference between intelligence and executive functioning by comparing the measured cognitive abilities IQ to executive processing skills measured by the Wisconsin Card Sorting Test (WCST) of patients with prefrontal cortex injuries. The tests illustrated normal intelligence along side low levels of executive functioning skills. Another researcher that supported these results was Amador (2002), who investigated the executive functioning abilities of mentally impaired high school students. The overall conclusions from this study indicated that executive functioning assessments could differentiate the skills of a mentally impaired student from those of an intellectually normal student better than an IQ assessment.

However, research has also explored how executive functioning and intelligence are linked to one another. Kizilbash (1999) explored the relationship between executive functioning and IQ scores of preschool children with and without disruptive behavior problems. Overall, Kizilbash's (1999) research indicated that executive functioning and IQ scores were related to each other. Furthermore, Woods (2000) and Rosenthal, Riccio, Gsanger, and Jarratt (2006) found that there was a strong relationship between executive and intellectual functioning. Additionally, Rosenthal et al. found that the FSIQ was a predictor of results on parent ratings of attention and executive functioning.

Executive Functioning and Achievement

Overall, deficits in executive functioning can affect many aspects of student behavior and achievement. Intelligence and executive functioning are related factors that should be considered together when a child is suspected of having deficits in executive skills. In school, executive functioning skills range from reading ability, learning, and memory. Additionally, executive functioning has been related to other neuropsychological disorders that may affect a student in the classroom.

Gathercole and Pickering (2000) and McLean and Hitch (1999) found that executive functioning is a good predictor for performance in school. In schools, executive functioning skills are associated with mathematics, reading, writing, learning, memory, and planning. A relationship has been found between executive functioning skills (e.g. flexibility, planning, and inhibition) and certain neuropsychological disorders. Executive functioning can differentiate neuropsychological disorders, such as Attention Deficit Hyperactivity Disorder (ADHD), Conduct Disorder (CD), and Oppositional Defiant Disorder (ODD). Children with these disorders show poor performance in school. Goldstein and Reynolds (1999) stated that a child's educational cognitive skills or higher order information processing skills can be assessed through a neuropsychological evaluation, which may include traditional intelligence testing, tests of memory and learning, measures of verbal and nonverbal memory processes, measures of receptive and expressive vocabulary, assessment for specific deficits, and assessments of acuteness and chronicity.

Bull and Scerif (2001) examined how executive functioning skills are involved in the development of math skills. The researchers also wanted to determine if executive functioning were distinct sets of skills and if these skills extend into childhood. Using correlational analysis, Bull, Johnston, and Roy (1999) and Bull and Scerif showed that those with lower mathematical abilities exhibited poor inhibition. Bull and Scerif speculated that lower mathematical abilities could be due to having difficulty maintaining information in working memory. Bull et al. and Rourke (1993) also found that children who had lower mathematical ability had more difficulty shifting between tasks, which resulted in more perseverative mathematical responses.

Researchers in the past have noted that executive dysfunction may be the cause of poor reading ability. Swanson (1991) defined a reading disability as a discrepancy between a person's intellectual capacity and academic achievement. Condor, Anderson, and Saling (1995) stated that impairment in cognitive processes, neurological inefficiency, emotional disturbance, or environmental factors can all play a part in the discrepancy between intellectual capacity and academic achievement. These researchers also stated that in a young and developing population there is an interaction between executive functioning and intelligence. Moreover, weakened executive functioning could be the cause of poor reading skills, reading disabilities and poor writing ability and text comprehension (Cornoldi, 1990; Levin, 1990). However, the Condor et al. study found that children with reading disabilities can still utilize planned and strategic methods just as well as those without reading disabilities. Although younger children with a reading disability tend to take longer than those without a reading disability. Additionally, Condor et al. (1995) found that children with higher levels of strategy usage also have a higher level of intellectual functioning.

Research indicates that neuropsychological functions influence a persons writing abilities (Berninger, 1999; Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002; Lea & Levy, 1999; Levine et al., 1993). Working memory, attention, higher order cognition, and visual spatial abilities are some of the executive functioning skills that have been reviewed in terms of its affects on writing (Hooper et al.). Kellogg (1999) found that working memory is an important executive function in the act of writing because it involves self-monitoring, holding and maintaining ideas, and utilizing grammar. Hooper et al. suggested that certain executive functioning skills (initiating and shifting) separated good writers from poor writers. More specifically, their results showed that verbal organization and working memory are apart of the writing process.

Learning and planning. Learning and planning executive functioning skills were researched by Benton (2001), who studied the performance of children with academic learning disorders in various areas of executive functioning (e.g., planning, problem solving, mental flexibility). Three different results were obtained through this study. The first was that a different pattern of executive dysfunction emerged for math disability than for a reading disability or combination disabilities. Another was that reading and a combination of disabilities have similar patterns. Lastly, Benton's (2001) results suggested that treatment considerations should be sensitive to the differences of executive functioning.

Memory and planning. Goldstein and Reynolds (1999) connect attention with memory. They believe that attention is needed for a line of thought to become a memory. Memory and learning executive functioning skills were the focus in a study by Duff, Schoenberg, Scott, and Adams (2005). They researched the association between executive functioning and the standard measures of verbal and visual learning and memory. Generally, the authors thought that general intelligence was related to memory and executive functions and their results supported a strong relationship between executive functioning and memory. The association between executive dysfunction and visual memory impairment was supported in this study and was as strong as the verbal memory and executive function relationship. It has been indicated through this study that verbal and visual memory measures were related to executive function. The authors believed that overlap of memory and executive measures could be due to a superior cognitive function.

Neuropsychological Disorders. Many researchers have explored whether executive functioning can differentiate neuropsychological disorders, such as ADHD, CD, and ODD. Goldstein and Reynolds (1999) connect attention with memory in that they believe that attention is needed for a line of thought to become a memory. However, the results from the Woods (2000) study indicated that ADHD subjects demonstrated impairment on executive measures, which would mean that students with ADHD showed impairment in many school tasks. In addition, Piek et al. (2004) explored the relationship between motor coordination, executive functioning and attention in school-aged children. An association was found between executive functioning and hyperactive and impulsive symptoms. In another study, Viechnicki (2004) supported the connection between ADHD and executive functioning. Viechnicki (2004) studied the BRIEF results of teachers to utilize a more developmentally appropriate measure of executive function in efforts to determine if an ADHD child has an executive dysfunction. In general, this study provided proof that executive functioning deficits do exist in children with ADHD and can be used to develop treatments and/or interventions. In yet another study, Muir-Broaddus, Rosenstein, Medina, and Soderfberg (2002) show that a connection between ADHD and executive functioning exists. Muir-Broaddus et al. (2002) study suggests that children with ADHD have weaknesses on tests that are sensitive to frontal executive functioning.

Child populations of ADHD have established and replicated weaknesses in executive functioning. Lovejoy et al. (1999), Murphy, Barkley, and Buch (2001), and Nigg et al. (2005) confirmed executive functioning weaknesses in ADHD adults as well. These results enforce the belief that ADHD shares certain neurocognitive features with the syndrome in childhood and that executive functioning skills are weakened in those with ADHD.

Conclusions

Though the human figure drawing technique has been in use for over 100 years, there are discrepancies in the research on how effective it is in determining intelligence. There still are thoughts that the DAP may have outlived its purpose if it cannot be used as a quick measure of intelligence and developmental level. The articles generally suggest that the Goodenough-Harris draw-a-person test should not supplant intelligence tests.

Generally speaking, there is a difference between intelligence and executive functioning. However, intelligence is linked to executive functioning, which is quickly becoming a widely used area in schools to assess and help children with neuropsychological issues and learning disorders. Neuropsychological testing allows one to accurately assess executive skills, which is critical in identifying the child's strengths and weaknesses. Moreover, executive functioning is a better indicator of a child's ability than an intelligence test and provides more information for developing effective and efficient interventions.

Achievement and behavior are affected when a child has deficits in executive functioning. In general, when a child is suspected of having deficits in executive skills, the child's levels of intelligence and executive functioning skills should be considered together. Executive functioning skills range from reading ability, learning, and memory. All of these skills can be affected if there are deficits in executive functioning. Lastly, neuropsychological disorders that affect a student in the classroom have been linked to executive functioning skills.

Executive functioning is made up of many aspects, including memory, planning, and learning. Memory is one aspect of the Goodenough-Harris human figure drawing test, due to the fact that the child has to bring a portion of his or her memory into the drawing. For example, the child must remember what aspects belong in a picture of a person, like the eyes, nose, and ears.

Planning is also essential in the DAP assessment, since the child needs to plan out where each part of the drawing will go and fit on the paper. Although aspects of executive functioning seem related to the DAP, there has not been much research in this area, and therefore leads to the question: Is there is a connection between the DAP and executive functioning? A further question: Is the DAP related to academic achievement? As such, can it be used as a quick measure of IQ and executive functioning for the younger years? The purpose of these study is to answer these three questions.

Chapter Three

Methods

Participants

All students in 3rd and 4th grade students (approximately 500) in an upstate New York suburban district elementary school received a letter explaining the study and a parent permission form. Both students and their parents were asked to participate in the study. The school district primarily serves a upper middle class community. The request for participants was done in Spring and Fall 2005. Only those who had not previously participated in this study were eligible in Fall 2005.

A total of 110 parental permission forms were returned for both Spring and Fall 2005 assessment sessions. Of that 110, only 82 children (44 third grade, 38 fourth grade) completed the DAP and CAS and 80 parents completed the BRIEF questionnaire. The overall sample of 80 consisted of 42 female and 38 male students and their parent(s).

Instruments

Bender Gestalt II.

Behavior Rating Inventory of Executive Functioning (BRIEF) (Gioia, Isquith, Guy, & Kenworthy, 2000). The BRIEF canvases of eight constructs of executive functioning which include a child's ability to inhibit, shift, control emotions, initiate, plan/organize, organize materials, utilize working memory, and monitor. The 86 questions that comprise the BRIEF are answered as "Never," "Sometimes," or "Often" and are scored as 1, 2, or 3 respectively. Scoring of the BRIEF yielded standardized T-scores (M = 50, S.D. = 10). The test-retest reliability is reported as good, while the internal consistency is reported as high (Gioia, Isquith, Guy, & Kenworthy).

Draw-A-Person (Harris, 1968; Koppitz, 1968). The Draw-A-Person (DAP) was given to evaluate the participant's developmental, intellectual, and emotional characteristics. Scoring of the DAP is based upon the following three systems: (a) GHDS, (b) KDI, and (c) KEI.

The Goodenough-Harris manual uses standardized scoring (M = 100, S.D. = 10) that was normed on children aged 3 to 11 years old. It uses a point system where each listed detail is worth a point. A total score is obtained by summing the points obtained and then plotting the points according to the child's age to come to with an IQ quotient.

Though the KDI and KEI operate on point systems, they do not have standardized norms. According to the KDI, there are different "expected" and "exceptional" elements present in the drawings of various age groups. Expected features are those that children of specific age groups should incorporate into their drawings. Exceptional features, on the other hand, are details that are included in the drawing, but not expected. Expected and exceptional features are different for males and females, because females are expected to include more details. A score, between 1 and 8, is determined based upon the number of expected and exceptional items present in a drawing. On the KEI, a child is given a point for each characteristic that is considered rare or unusual and occur in only 15% of child's HFD's (Koppitz, 1968).

Cognitive Assessment System (Naglieri & Das, 1997). Planned Connections, a subtest from the Planning Scale of the Cognitive Assessment System (CAS), was administered as an additional measure of executive functioning. Standardized scoring (M = 10, S.D. = 3) for this subtest was utilized. To determine the participants' standardized score, the time taken on each portion of the planning section was added together and plotted against the participant's age and gender.

Planned Connections requires the student to create a plan of action, apply the plan, and, if the need arises, to make corrections to the plan (Naglieri & Das). The test-retest reliability of the planning scale of the CAS is reported as average, while the construct validity showed the changes (Naglieri & Das).

Academics. Reading achievement test scores for participating students on the English Language Assessment (4th grade) or DRP (3rd grade) were taken from student records. Also taken from student records were mathematic achievement scores on the Terra Nova. In order to compare reading scores on different achievement assessments across grades, stanine scores were utilized.

Procedure

This study was completed as a part of a larger study. Once the parental permission slip was returned, the student was assigned and identified by a testing number. Each student was sent home with a BRIEF questionnaire for the parent(s) to complete. The parent(s) were asked to complete each question on the form. The child participant returned the BRIEF form at the time of assessment. There was a total of 5 assessment sessions lasting 45-minutes with 20 to 25 student participants present. During the assessment period, the student participants sat in small groups (2 to 3 children at a table) in the cafeteria, facing the overhead projector.

Testing was conducted in the morning before school began in the cafeteria, which was a quiet area. Each participant was group administered the DAP and CAS, as well as other measures. First, students were asked to draw a whole person on their own piece of paper.

For the last measure, the planning portion of the CAS, instructions were administered to the large group, while timing was completed in smaller two to three person groups. On the first set of directions, participants were told to keep their pencils on the paper and connect the numbers in numerical order, smallest to largest. Participants were given a trial session and told if they were performing the function correctly before the timed sessions began for small groups. The second set of directions varied in that the participants were instructed to alternate between numbers and letters. Participants were told to connect the numbers to letters while increasing in numbers and up the alphabet. For example, students were to connect the number 1 to letter A, to number 2, to letter B, and so forth. Again, the students were given a practice section before timed sessions began for small groups. At the end of assessment, the measures were placed in each participant's numbered envelope.

After the dependent measures were collected, each participant's most recent stanine score on reading and math achievement tests were collected from school records. However, the 4^{th} grade participants take English Language Art (ELA) tests instead of reading tests. Therefore, all 4^{th} grade participants' ELA stanine scores were taken. The recruiting and assessment process was completed again in Fall 2005. For both assessment rounds, research assistants in the School Psychology program volunteered to monitor the participants during the assessment measures and to time the participants during the CAS portion of assessment.

Data Analyses

Trained advanced graduate students in the school psychology program, who were familiar in the administration and scoring of the measures, scored the protocols. The human figure drawings were scored in 3 different ways; the Goodenough-Harris scale, Koppitz scale, and for Koppitz Emotional Indicators. Scores for the CAS and BRIEF were found following the scoring manual for each assessment measure. Scores for each dependant measure was inputted into the SPSS database for analysis. Data analysis consisted of correlations and descriptive statistics.

Chapter Four

Results

Means and standard deviations for executive functioning measures are presented in Table 1. As can be gleaned from Table 1, all measures of executive functioning are in the average range, which would be expected given a nonclinical sample. However, there is a considerable range in the working memory (T-Score 17 to 83) and global (T-Score 8 to 76) categories.

Means and standard deviations for DAP measures are presented in Table 2. As can be seen from Table 2, the GHDS scores are within the average range as expected. The samples' average raw scores for the KDI and KEI are within the expected range.

Pearson Product Moment Correlations between executive functioning and 3 DAP measures are presented in Table 3. Neither the GHDS nor the KDI were correlated with the BRIEF or CAS ($p \geq .05$). However, 9 of 11 categories of the BRIEF, as well as the Planning portion of the CAS, were correlated with the KEI ($p \geq .05$ or $p \geq .01$).

Pearson Product Moment Correlations between academic achievement and 3 DAP measures are presented in Table 4. The KDI did not correlate with either of the two academic achievement measures ($p \geq .05$). On the other hand, the GHDS correlated with mathematical achievement ($p \geq .05$), while the KEI correlated with mathematical ($p \geq .01$) and reading achievement ($p \geq .05$).

Chapter Five

Discussion

The primary goal of this research was to investigate whether there is a relationship between DAP scores to measures of executive functioning and academic performance exists. Results indicated that there are relationships between measures of executive functioning and academic performance and Koppitz's emotional indicators for HFD; in addition, there is an association present between the GHDS and mathematical achievement.

When the DAP is scored in for emotional indicators, the correlation indicates that there are higher BRIEF scores when a child has more emotional indicators present in his or her drawing. Higher BRIEF scores indicate that there may be a problem in a student's executive functioning ability. This is in contrast to Koppitz's research on this scoring system (Koppitz, 1968). In addition, the higher the score on the BRIEF, the more emotional indicators found in the human figure drawing. When trying to account for the observed relationship, one may speculate that the KEI is related to measures of difficulties in behavioral regulation. One could argue that Koppitz's original studies are related to children with behavioral regulation difficulties. This relationship perhaps could be better clarified with a study that investigates the differences between children with and without aggression or anxiety, as to how they perform on the BRIEF and KEI.

The relationship between the Goodenough-Harris scoring criteria system to that of math performance indicates that higher developmental scores complement better math performance. The correlation found between academic achievement and DAP indicates that higher math performance goes hand in hand with higher DAP scores. When looking at this relationship, one could speculate that the relationship between math and the GHDS, but not the KDI, may be in part due to a small amount of variability across ages of the KDI. Koppitz's scale clumps scores together, whereas the GHDS shows greater variability between the ages. Further research in this area could be designed to differentiate the GHDS from the KDI. One may also speculate that a relationship between the GHDS to one area of academic achievement could be a result of the dimensions present in those subject areas. Reading details come in the form of letters, which is one-dimensional. Mathematics is multi-dimensional in that there are more details (e.g. adding, subtracting, multiplying, dividing, performing operations either horizontally and/or vertically). One may also theorize that the relationship between the GHDS and math could be due to long-term memory and/or attention to detail. For example, long-term memory is needed for math skills because a student would need to be able to remember how to perform math operations. Long-term memory is also needed on the GHDS, which credits finer detail, to remember what details to include in a human figure drawing. Further research would also be needed to examine these conclusions.

Though the results do not indicate that the GHDS or KDI scoring systems could be a potentially quick measure for executive functioning and academic achievement, the results appear to be promising for the KEI. Results of this study may indicate that the KEI was discounted to quickly in the past and may be a useful predictor for executive functioning and academic achievement; thus, more research is needed.

There are limitations to this research that should be considered in future research. One limitation is that there was one socioeconomic status present in the sample. Another limitation is that the sample was comprised of children from the general education population. Children with more emotional problems should be included in future research so that comparisons may be made between the two populations.

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Appendix A

Projection of Gage's Tamping Bar

Using the entering and exiting points obtained from Phineas Gage's skull, the path of the iron tamping bar is projected here (modified version - original obtained from Glynn, 2001).

Table 1

Descriptive Statistics for Executive Functioning Measures (†)

			Range	
Executive Functioning	M	SD	MIN	MAX
BRIEF				
Inhibit	49.40	10.35	15	74
Shift	49.19	10.71	14	80
Emotional Control	48.81	11.12	14	80
Initiate	48.89	10.63	11	78
Working Memory	51.69	11.41	17	83
Planning/Organize	48.98	11.51	15	80
Organize Materials	51.78	10.05	16	71
Monitor	48.50	10.56	12	75
Behavioral Regulation Index	48.98	10.61	10	78
Metacognition	46.31	12.11	10	79
Global	47.23	11.10	8	76
CAS				
Planning	11.04	3.11	1	17

Note: N = 80

† Standardized T-scores used in the BRIEF (M = 50, SD = 3); Standardized scores used in the CAS (M=10, SD=3).

Table 2

Descriptive Statistics for Human Figure Drawing (†)

			Range	
Human Figure Drawing	M	SD	MIN	MAX
GHDS	95.57	12.96	69	134
KDI	4.48	1.02	2	7
KEI	1.36	1.20	0	5

Note: Goodenough-Harris Developmental System (GHDS). Koppitz Developmental Inventory (KDI). Koppitz Emotional Indicators (KEI).

† Standardized scores used on the GHDS (M=100, SD=10); Raw scores used on the KDI and KEI.

Table 3

Pearson Product Moment Correlation Coefficients between Human Figure Drawing Scores and Measures of Executive Functioning

Executive Functioning	GHDS	KDI	KEI
BRIEF			
Inhibit	-.02	-.09	.19
Shift	-.02	.03	.29**
Emotional Control	.01	-.02	.27*
Initiate	.04	.00	.25*
Working Memory	.01	-.05	.20
Planning/Organize	-.06	-.11	.23*
Organize Materials	.07	-.06	.27*
Monitor	-.16	-.15	.23*
Behavioral Regulation Index	-.01	-.04	.29*
Metacognition	-.10	-.10	.25*
Global	-.08	-.09	.30**
CAS			
Planning	.13	.17	-.22*

Note: Goodenough-Harris Developmental System (GHDS). Koppitz Developmental Inventory (KDI). Koppitz Emotional Indicators (KEI).

* $p \geq .05$ (two-tailed).

**$p \geq .01$ (two-tailed)

Table 4

Pearson Product Moment Correlation Coefficients between Human Figure Drawing and Academic Achievement Correlations

Academics	GHDS	KDI	KEI
Mathematics	.29*	.23	-.36**
Reading	.19	.24	-.30*

Note: Goodenough-Harris Developmental System (GHDS). Koppitz Developmental Inventory (KDI). Koppitz Emotional Indicators (KEI).

* $p \geq .05$ (two-tailed)

** $p \geq .01$ (two-tailed)