THE RELATIONSHIP BETWEEN ANXIOUS/DEPRESSED AND WITHDRAWN SYMPTOMS ON COGNITIVE AND ACADEMIC MEASURES IN ELEMENTARY SCHOOL CHILDREN

by

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ABSTRACT

The purpose of this study was to determine the relationship between anxious/depressed and withdrawn symptoms and performance on a variety of cognitive and academic achievement measures. The sample included 343 subjects, drawn from a pool of subjects aged 6 to 11 years who were part of a sleep apnea study. A comprehensive battery of selected tests that measured cognitive and academic achievement function was administered to all sampled subjects. Parents of the subjects were given an instrument to complete in order to assess behavior function.

The obtained data were analyzed by using Pearson Product Moment Correlation Coefficient analyses, T test procedures, and chi-square analyses. A significant negative correlation was found between anxious/depressed and withdrawn symptoms and the following cognitive and academic measures: general intelligence including verbal and nonverbal abilities, language, specific executive function skills, attention and processing speed, psychomotor speed and coordination with the dominant hand trial, and a subtest assessing math problem solving skills.

There were statistically significant differences found between those subjects who obtained approaching borderline and clinically significant anxious/depressed, withdrawn, and both anxious/depressed and withdrawn symptoms on the following cognitive and academic measures: general intelligence including verbal and nonverbal abilities, language, specific executive function skills, attention and processing speed, psychomotor speed and coordination with the dominant hand, the interference and/or delayed recall

trial of a memory task, and basic reading, math problem solving, and early spelling/writing skills.

There was a significant difference found with regard to parent education level for children identified with withdrawn symptoms as compared to children without these symptoms but there were no other differences with regard to age, gender, ethnicity, or parent education level for children identified with anxious/depressed or withdrawn symptoms as compared to children without these symptoms. Additionally, Caucasian children performed significantly better than Hispanic children on a variety of the cognitive and academic measures.

Overall, these findings support the hypotheses that depressive symptomatology does impact performance on cognitive and academic measures. Additionally, methodological problems for exercising caution in the interpretation of obtained findings were discussed. The implications of these findings for psychological practitioners, educators, and physicians were described.

CHAPTER 1

INTRODUCTION

Educators as well as researchers have long been interested in understanding what causes children with normal intelligence to suffer from academic underachievement, particularly when these academic difficulties are not the result of physical, environmental or behavioral disadvantages. Childhood depression may provide the causal link. Emotional suffering, disrupted cognitive functioning, and deterioration in academic performance have all been theorized to be possible results of depression. Specific clinical features of depression such as diminished attention span, lethargy, poor concentration and memory, and abridged task perseverance are all factors that have emerged as obstacles to effective learning. Educators, psychologists, physicians, and parents are faced with the challenge of reduced educational achievement in children, which cannot be explained by the child's intellectual potential. Additionally, poor academic performance is associated with an increase in social and behavioral problems (Strauss, Lahey, & Jacobsen, 1982). For this reason, the relationship between depression, cognitive functioning, and overall academic performance in children has been the focus of a growing body of research for the past three decades.

Studies of adults with depression have consistently linked common complaints consisting of diminished concentration, slowed thinking, and poor memory (Brumback, Dietz-Schmidt, & Weinberg, 1977) to this phenomenon of reduced cognitive performance. Specifically, deficits on neuropsychological tests that assess learning and memory (McAllister-Williams, Ferrier, & Young, 1998) have been found. McAllister-

Williams et al. (1998) discussed that although neuropsychological impairment appears to be related to depression, they failed to find a direct correlation between the severity of a mood disturbance and neuropsychological impairment in a depressive illness, citing evidence of continued cognitive impairment despite mood improvement. Their results suggested that depressed mood and neuropsychological impairment may occur in parallel as a result of a common neurobiological disturbance in depressive illness. More recently, there has been an effort to link theories of cognitive neuropsychology to the anatomy and physiology of brain function. If depression is indeed a brain disease then neuropsychological impairments may lead to the relevant neural substrates(s). Thus, cognitive deficits reported in depression may reflect the disruption in the anatomy and function of certain neuronal pathways (Austin, Mitchell, & Goodwin, 2001).

Numerous studies have been done that have attempted to more clearly differentiate the characteristics that are associated with a Major Depressive Disorder (MDD) or depressive symptoms in children and adolescents. A number of researchers have considered the relationship between academic achievement and depressive characteristics. Others have looked more specifically at different aspects of overall cognitive functioning or on more explicit cognitive tasks.

It has proven difficult to confidently establish a similar direct correlation between depression and cognitive functioning in children as has been found in adults. This is understandable for a number of reasons. First, there are significant developmental differences in children across an age spectrum. That is, while most adults 21-81 years of age share the similarities common to adults, the rapid physical, emotional, psychological,

and intellectual/cognitive changes that occur between 2-18 years of age (and sometimes beyond), make it more difficult to identify the same "consistencies" in children. In other words, the fact that children are by definition in a state of rapid developmental transition, makes any study of them as a group difficult. Also, it is challenging to directly compare "adult" studies with "children" studies. Additionally, children are often being protected in the family environment and because of this they will not come forward to be studied unless their parents are interested and bring them, or some academic or behavioral problem dictates this. Thus, it is more difficult in children than it is in adults to conduct studies. Nevertheless, aware of these challenges it is still intuitively reasonable to suggest that there will be similar correlations in children and adults, even if they are more difficult to precisely identify and quantify. Researchers have, over the last three decades, considered it worthwhile to see if the correlations that have been established in adults between depression and cognitive impairment were present in children. Obviously, if we can identify those correlations and link depression to cognitive deficits in fairly specific ways it can be helpful in addressing both kinds of issues. As professionals trying to help children, we can be on the look out for depression or symptoms of depression and see if they correlate with poor academic performance. Then if the depression is treated, it may lead to better academic performance. Similarly, if weak cognitive areas are noted it would be helpful to test for depression to see if it is a cause or at least a contributing factor to poor cognitive functioning.

Three decades of studies were reviewed and the literature suggested that researchers pointed out a number of methodological and data control problems. For

example, a majority of the studies did not identify the specific criteria used for diagnosing depression nor did they operationally define depression. Many of the children involved in the research exhibited depressive symptoms but were not necessarily diagnosed with a MDD. Some studies looked at clinically depressed children while other studies looked at "depressive symptoms" and not just "depression" so this included behavioral variables associated with depression. Behavioral variables, such as aggression, opposition, hyperactivity, inattentiveness, sadness, and poor self-esteem, have made isolating depression and its effect on cognition challenging. The validity of the instruments used to screen for depression may have been insufficient, as children who are identified as being depressed have been assessed based on the criteria for adults. In addition, instruments that are used to measure depression like the Kovacs-Beck Child Depression Inventory (CDI; Kovaks & Beck, 1977) in children cannot be regarded, according to researchers like McGee, Anderson, Williams, and Silva (1986), as a pure measure of depression, and may in fact measure more general psychopathology. For example, Jacobsen, Lahey, and Strauss (1983) found that inattention, hyperactivity, conduct disorder, and sociability rather than depression alone were correlated with teacher's ratings on the CDI. Similarly, Saylor, Finch, Spirito, and Bennett (1984) reported that depressed children were identified as exhibiting more externalizing symptomatology according to teacher ratings on the CDI. This clearly contributes to variability in study findings attempting to link depression with academic achievement.

Additionally, the studies often used different measures for cognitive function and some of these measures may be more sensitive than others (e.g. measures of attention or

memory may be more sensitive than just overall general intelligence). Other studies have looked at broad categories like academic competence, but these were sometimes based on teacher or parent reports rather than actual grades or test scores. The means by which depressive symptoms were associated with relative poorer performance on specific cognitive skills like problem solving were often not clearly addressed. Also, the studies did not take into consideration the diagnostic concerns associated with the situational specificity of noticeable behavior patterns and certain developmental considerations.

Finally, more consistent longitudinal research is needed to determine the causal relation between depression and cognition. Many of the studies did not provide cross-sectional data on whether the impairments were simply simultaneous with the depression, if they persisted over time, or if the impairments had consequences for later functioning.

In summary, it has been difficult to confirm the extent to which children with depression or depressive symptoms have specific cognitive difficulties. The following extensive literature review discusses those correlations that have been found between depression in children and factors such as like locus of control, thinking speed or response latencies, conceptual/cognitive tempo, problem solving tasks, deficits in memory, social and cognitive competence, and the possible link between depression and behavioral problems.

Thus far, the research has not consistently provided conclusive directions with regard to assisting children with significant depressive symptomatology and maximizing opportunities for cognitive and educational development. This study responded to these issues by examining 343 elementary school children to determine if a relationship

between depressive symptomatology as assessed by the Anxious/Depressed and Withdrawn clinical scales of the CBCL and performance on a variety of cognitive and academic measures could be found. The study was designed to address two problems and challenges faced by researchers, which became apparent after the review of the relevant literature. First, a consistent measurement method to determine depression and cognitive and academic performance were applied across all tested subjects. Second, the study sample was extracted from a large group of children who participated in a study not ostensibly focused on depression. However, test methodologies included various measures that enabled us to extract statistically relevant information regarding the association between depression and cognitive ability and academic achievement. Thus, unlike many previous studies that have attempted to determine and measure these correlations in children, parents, teachers, and the test administrators had no pre-existing conceptions regarding the depressive symptomatology of the subject participants. The results discussed herein add to the body of research regarding the relationship between depressive symptoms and cognitive ability and academic achievement in children.

For the purpose of this study, relevant terms are operationally defined as follows: A subject's score on the Anxious/Depressed and Withdrawn clinical scales of the Child Behavior Checklist for Ages 4-18 (CBCL; Achenbach, 1991) defined depressive symptomatology.

The cognitive measures assessed global intellectual function, language, attention and processing speed, executive function skills, visual motor/visual spatial skills, motor skills and coordination, and learning and memory. Global intellectual function was

determined by a subject's obtained Full Scale IQ score on the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999). Language skills were determined by a subject's score on the Vocabulary subtest from the WASI. A subject's score on the Digit Span, Coding, and Symbol Search subtests from the Wechsler Intelligence Scale Children-Third Edition (WISC-III; Wechsler, 1991) defined attention and processing speed skills. Executive function skills were determined by a subject's score on the Similarities and Matrix Reasoning subtests from the WASI, the Animal Fluency task from the Controlled Oral Word Association (COWAT; Benton & des Hamsher, 1989), and the Trail Making Parts A and B (Reitan & Wolfson, 1993) test. The Block Design subtest from the WASI defined a subject's visual motor/visual skills. A subject's score on the Purdue Pegboard (Tiffin, 1968) determined psychomotor speed and coordination. The Children's Auditory Verbal Learning Test-2 (CAVLT-2; Talley, 1993) defined a subject's learning and memory skills. The academic achievement measures assessed basic reading, math problem solving, and early spelling/writing skills. The Letter-Word Identification subtest of the Woodcock-Johnson Psycho-Educational Battery-Revised Tests of Achievement (WJ-R; Woodcock & Johnson, 1989, 1990) determined a subject's basic reading skills, the Applied Problems subtest defined basic math problem solving skills, and the Dictation subtest determined basic spelling and early writing skills. The tests used to define these measures and constructs are described in detail in terms of their purpose, content, format, and psychometric properties in the methods chapter.

CHAPTER 2

LITERATURE REVIEW

This section presents a review of the pertinent literature which falls into six sub-categories, organized as follows: (a) summary/discussion papers and sequential case studies; (b) in-patient clinical studies reporting the impact of depression on cognitive tasks; (c) studies examining childhood depression and the effects of antidepressant treatment and/or psychopharmacotherapy on cognitive functioning; (d) studies examining the relationship of behavior to learning issues; (e) studies examining the relationship between depression and factors like locus of control, response latencies, conceptual/cognitive tempo, problem solving tasks, and social and cognitive competence using non-clinical samples; (f) summary of the literature review.

(a) Summary/discussion papers and broad case studies

Brumback and Weinberg (1977) postulated that childhood depression could be an important cause of behavior problems seen in children and concluded that impaired school performance needed to be included in the diagnostic criteria of depression in children. Weinberg, Rutman, Sullivan, Penick, and Dietz (1973) and Brumback, Dietz-Schmidt, and Weinberg (1977) found that the proper diagnosis of childhood depression could lead to successful treatment with antidepressant medications. Findings of these studies inferred that behavior problems stemming from depression could lead to poor academic performance and stressed the importance of early detection and appropriate treatment of children suffering from an affective disorder as a means to help prevent school and personal failure, social withdrawal, antisocial activity, and suicide.

Kashani et al. (1983) attempted to estimate the prevalence of major and minor depression in a general population sample as well as consider some of the characteristics (e.g., sex differences, SES, parents' and teachers' reports of behavior problems, and cognitive and motor development) associated with children who were identified as depressed. The sample in this study was part of a longitudinal study of the health, development, and behavior of children born at a particular hospital in New Zealand. Six hundred forty one children participated in this study ranging in age from 3 to 9 years. However, only 189 children were administered the full battery of tests due to limited resources. Additionally, the study only looked at the results from the children who were close to their ninth birthday. The measures used in this study included a child questionnaire based on the Diagnostic Statistical Manual Third Edition (DSM-III; American Psychiatric Association, 1980) criteria for depression and the childhood version of the Schedule for Affective Disorders and Schizophrenic, epidemiological version (SADS-E; Puig-Antich, 1980). Parents and teachers completed questionnaires based on the Rutter Child Scale (Rutter, Tizard, & Whitmore, 1970) and each child's behavior during testing was rated on scales from the Behavioral Profile from the American Collaborative Study (Public Health Service, 1963). Children were categorized after the diagnosis of depression was found, as present or past depression, and major or minor depression groups. Cognitive development was evaluated using the Auditory Reception and Verbal Expression subtests of the ITPA, the WISC-R, the Burt Word Reading Test, Revision 1974 (Scottish Council for Educational Research, 1976) and a spelling test from the Dunedin study (Silva, McGee, & Thomas, 1982). Each child

completed a brief form of the Student's Perception of Ability Scale (SPAS; Boersma & Chapman, 1979). Motor development was assessed in all of the children using the Arnheim and Sinclair Basic Motor Ability Test (Arnheim & Sinclair, 1974). Results indicated that 31 of the 189 children that were given the full battery of tests were diagnosed as having either major or minor depression. No differences associated with depression and gender and SES were found. The results of the motor development measure and the cognitive measures, which included verbal comprehension and expression, general intelligence, reading, and spelling, indicated no significant differences in performance associated with depression. However, the children diagnosed with current depression did have a negative perception of their own abilities as assessed with the SPAS, suggesting a relationship between depressed mood and poor self-concept or low self-esteem.

Lefkowitz and Tesiny (1985) attempted to determine the prevalence of childhood depression in a population of elementary school children and assessed whether there were certain correlates associated with childhood depression that could help clarify the nature of childhood depression. The participants included 3,020 children in the fourth and fifth grades in a variety of public elementary schools. The measures used to assess depression included the PNID and the CDI. Thirty-eight variables were chosen from the various tests administered to be in the domain of childhood depression as assessed by the PNID. The NSLOC was used to assess locus of control. The figure drawing Goodenough-Harris Draw-A-Person Test (Goodenough & Harris, 1963) was used to assess a general index of intellectual functioning. The children's personal records from school as well as

standardized reading and math scores and teacher ratings of study and work habits were reviewed. Of the children who participated in the study, 508 of their mothers were interviewed and given specific questionnaires and scales to fill out. These included measures from the Rip Van Winkle Child Rearing Questionnaire (Eron, Walder, & Lefkowitz, 1971), the PNID, the BDI, the Depression Adjective Checklist, Form E (Lubin, 1967), and the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975). Researchers found that the prevalence of depression in this regular population of public elementary school children was 5.2% and no significant gender differences were found. No significant results were found for males or females individually. There were modest negative correlations found between severity of depression and achievement and intelligence scores. For males and females, severity of depression showed a consistent decrease as reading scores increased and depression decreased as performance on the figure drawing test increased for both sexes. The researchers were however, not able to conclude whether poor academic achievement was an antecedent or consequence of depressive symptoms; it may have been both.

Livingston (1985) reviewed the literature on the association between depression and difficulties with learning and cognition in children and cited three previous studies, which he believed shed light on three broad questions in regard to the relationship between MDD and learning problems, which needed to be answered: Are learning difficulties caused or worsened by depression? Are children who have learning difficulties put at risk for a MDD? Are children put at risk for both MDD and particular learning difficulties based on some identifiable brain dysfunction? Staton, Wilson, and

Brumback (1981) supported the idea that children who did have learning difficulties were put at risk for MDD. Findings of a study done by Brumback, Staton, and Wilson (1980) suggested specifically that right hemisphere impairment was associated with children with a MDD, but these associations needed to be further clarified. Kashani, Cantwell, Shekim, and Reid (1982) found significantly more pre-existing reading and arithmetic difficulties among children with MDD as compared with children diagnosed with other disorders.

A study done by Kaslow and Wamboldt (1985), looking at pertinent intrapersonal and interpersonal factors associated with childhood depression, specifically identified the following factors: boredom; anhedonia; amplified disrupting and attention-getting behaviors; dysphoric affect; and sadness. Children who reported higher scores on depression instruments similarly reported lower self-esteem. Poorer performance was exhibited on the Block Design subtest of the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974), an Anagram task (Schneiderman, Reber, & Hainline, 1978), and the Matching Familiar Figures Test (MFF TEST; Kagan, 1966). Additionally, children who were perceived by their teachers as depressed were seemingly less successful academically and interpersonally, which led Kaslow and Wamboldt (1985) to hypothesize that children with depressed behaviors have lower ability to solicit help from their peers and teachers.

McGee and Williams (1988) in a commentary on the relationship between childhood depression and cognitive impairment noted that the measures commonly used to assess depression might in fact not be appropriate pure measures of depression.

Therefore, the studies reporting an association between depression and certain cognitive tasks have been difficult to replicate. Despite some methodological concerns, overall findings of studies suggest that depression has appeared to be related to low self-esteem and poor perception of academic ability. Therefore, the idea that school performance in children could eventually be impacted by poor concentration, low motivation, and apathy even if depression were identified appeared to be a reasonable hypothesis.

Kovacs and Goldston (1991) reviewed previous research in the area of childhood depression and its potential impact on cognitive and social functioning. Specific depressive symptoms like extended difficulties with concentration, anhedonia, psychomotor slowing, and a decrease in motivation to do well on more challenging tasks were found to be potentially impacting cognitive and academic functioning as well as appropriate interactions with peers and adults.

Overall, these studies acknowledge that children with depression often had disruptions in functional impairment in various cognitive and social domains and inferred a link between depression and these difficulties.

(b) In-patient clinical studies reporting the impact of depression on cognitive tasks

Colbert, Newman, Ney, and Young (1982) examined the prevalence of depression found in children who were referred for emotional and behavioral disorders to a child and family psychiatric unit. The results indicated that children with depression had poor school performance despite adequate intellectual ability and absence of a specific learning disability. Two hundred eighty-two children were administered the Wide Range Achievement Test (WRAT; Jastak & Jastak, 1976), the WISC-R, and the Peabody

Individual Achievement Test (PIAT; Dunn & Markwardt, 1981). Extensive testing was done using the Beery-Buktenica Developmental Test of Visual Motor Integration (VMI; Beery & Buktenica, 1967), the Benton Visual Retention Test (Benton, 1946), the Detroit Tests of Learning Aptitude (DTLA; Baker & Leland, 1967), and the Durrell Analysis of Reading Difficulty- Third Edition (DARD-3; Durrell & Catterson, 1980). Findings emerging from data obtained from these tests suggested that 153 (54%) of the children were identified as being depressed according to the DSM-III criteria. Results obtained from intelligence testing from these 153 children indicated a normal curve shifted slightly to the lower end. Examination of previous years' school records, their classroom teachers' comments, perceptions from the hospital family unit teachers, and academic achievement test results indicated that of the 79 (71%) of the 111 children attending regular classes, were underachieving considerably at one year or more below grade level in one or more academic areas in relation to their intelligence and grade placement. Interestingly, this study found a total of 53 children who their parents and teachers thought to be underperforming because of a learning disability, but actually only 11 (7.2%) of the 111 children were diagnosed as having a specific learning disability.

Kashani et al. (1982) investigated the prevalence of MDD in children as inpatients in a mental health center who were admitted as survivors of abuse, regarded as a danger to themselves or others, and who failed to respond to outpatient treatment. One hundred children over the course of 23 months were evaluated and 13 children were diagnosed with a MDD based on information obtained from parent interview and on the information obtained from the clinic professionals, and two child psychiatrists. In addition to 13

children being diagnosed with a MDD, eight children had an associated specific developmental disorder based on the DSM-III criteria. The preexisting developmental disorders (reading disorder or arithmetic disorder) that negatively impacted academic performance in the 13 children being treated psychiatrically for a MDD were considered by the educational evaluators to be beyond the children merely lagging behind in school and thus not necessarily a direct result of depression and/or lack of motivation. This led researchers to postulate that children may develop a secondary depression as a result of their inability to handle academic problems, rather than the depression being the cause of poor performance.

Weiner and Pfeffer (1986) examined 106 preadolescent psychiatric inpatients ranging in age from 6 to 12 years. The research attempted to assess if depression were consistently related to other psychiatric disorders and if it impacted children's intellectual and academic functioning and thus, was the basis for possible misdiagnosed learning disabilities. In addition, the relationships among depression, intelligence, and suicidal status were examined. The Spectrum of Suicidal Behavior Scale (Pfeffer, 1986) was used to ascertain a child's suicidal status and children were also administered the WISC-R as a measure of general intellectual functioning. Results from this study revealed that intellectual ability was not related to severity of depression or suicidal status and thus did not help identify those children at risk for MDD or suicidal behavior.

Hodges and Plow (1990) studied the intellectual ability and academic achievement of 76 preadolescent children, aged 6 to13 years, who were admitted in succession to a child psychiatric unit with a variety of pathologies. Children with

pervasive developmental disorder, organic brain syndrome, or mental retardation were excluded from the study. The children who met the DSM-III criteria for depression or anxiety were assessed using the DSM-III and the Child Assessment Schedule (CAS; Hodges, Kline, Stern, Cytryn, & McKnew, 1982; Hodges, McKnew, Burbach, & Roebuck, 1987). In addition, the children were administered the WISC-R and the Woodcock-Johnson Psychoeducational Battery (WJ; Woodcock & Johnson, 1977) to assess intellectual abilities and academic achievement, respectively. There were no significant findings from the analysis of children with depression and performance on the WISC-R. Children with an anxiety disorder, however, did have several statistically significant differences (lower FSIQ, Information, Vocabulary, Comprehension, Digit Span, Picture Completion, and Coding scores) when compared to the children without an anxiety disorder. Results from the WJ Achievement revealed no clear significant findings in children with an anxiety disorder. However, children who were depressed scored significantly lower on the mathematics and knowledge clusters.

Osborn and Meador (1990) examined whether male children who were depressed had short-term memory or encoding deficits as compared to their peers who were identified as non-depressed. Participants in this study included males aged 9 to 11 years. Males who were in the depressed group were from an outpatient mental health center and the males in the non-depressed control group were from a public school system. Depression was diagnosed using the DSM-III-R criteria for depression and a CDI score of 19 or above. All the participants were identified as having average FSIQ scores on the WISC-R. The children were administered words from a published teacher's wordbook

(Thorndike & Lorge, 1944) that consisted of 28 unrelated nouns that had a high frequency of recognition for children between the ages of 8 and 13 years. The children were presented five lists of words successively in an individual session. Each list of words was shown one word at a time and the males rehearsed the words out loud from the list during the five second intervals of stimulus (word) exposure. After the child was presented with the last word from the list, they were signaled and a recall period began in which they recalled as many words as they could from the list. Results indicated that the impact of depression on recall was significant as the males in the non-depressed group had an overall mean recall of 37.15% and the males in the depressed group has an overall mean recall of 30.83%. A significant difference between the interaction of the group by the serial position for average rehearsal set size and average repetition was also found. Thus, males in the depressed group showed a weakness in the effortful processing task of rehearsal both in repetition of words and in the size of their rehearsal sets at prior selected serial positions and they had less overall recall.

Lauer et al. (1994) reported that in children the relationship between cognitive performance and depressive symptoms was not clear. Following the work of researchers like Osborn and Meador (1990) who found a deficit on short-term memory processing measures, this study looked at memory functions and metamemory performance in children who were diagnosed with major depression or dysthymic disorder. It was hypothesized that the children who were depressed would demonstrate deficiencies on tasks involving effortful information processing and they would also have deficits in cognitive knowledge regarding the use of memory strategies. The sample consisted of

21children aged 9 to 12 years from inpatient or outpatient psychiatric clinic appointments. These children had been diagnosed with either major depression or a dysthymic disorder. Children were matched on age (within one year), gender, and FSIQ (within five points) with peers from the local community and nearby elementary school who served as the control group. Exclusionary criteria included a FSIQ of less than 85 or a score below 85 on a screen of specific subtests from the Woodcock-Johnson Psychoeducational Battery-Revised (WJ-R; Woodcock & Johnson 1989, 1990), taking psychotropic medications, other DSM-III diagnosis, present or past significant medical history, or a head injury with a loss of consciousness for more than five minutes. Depression was assessed using the DSM-III criteria for depression, the CDI, and the Children's Depression Rating Scale–Revised (CDRS-R; Poznanski, Cook, & Carroll, 1979). Children were administered the WISC-R, specific subtests from the WJ-R, a frequency-of-occurrence task, the Children's Auditory Verbal Learning Test (CAVLT; Talley, 1990), and the Metamemory Battery (Belmont & Borkowski, 1988). The severity of depression was evaluated by dividing the children into three subgroups: children who were highly depressed (n=10), with a CDI score range of 20 through 29; children who were identified as having low depression (n=11), with a CDI score range of 14 through 19; and children who were non-depressed (n=21), with a CDI score range of 0 through 11. Results indicated no significant differences between groups for age, gender, SES, FSIQ, WISC-R Factor Scores, or WJ-R Basic Skills. Significant differences were found between the depressed and non-depressed group on CDI and CDRS-R scores. No significant main effect differences were found on automatic memory tasks. Significant

differences were present between all three groups on immediate recall but not on learning over trials or delayed recall. There were also significant group differences found on the Metamemory Battery scores, as both of the depressed groups scores were comparable, but lower than the non-depressed group. Additionally, immediate recall deficits were found on the CAVLT in children who were in the severely depressed group relative to a group of children less depressed, and a group of children identified as non-depressed.

Horan, Pogge, Borgaro, Stokes, and Harvey (1997) after reviewing the extensive adult literature that suggested adults with depression had deficits in learning and memory, as reflected by their performance on tasks that required more effortful cognitive processing conducted a memory performance study in adolescents with a MDD. It was hypothesized that adolescents with depression would not perform as well on the CVLT normative standards. Fifty-six adolescent inpatients at a private psychiatric hospital were recruited to participate in this study. Two comparison groups consisted of adolescents diagnosed with Conduct Disorder using the Diagnostic Statistical Manual-Third Edition, Revised (DSM-III-R; American Psychiatric Association, 1987) criteria and 22 adolescents with dual diagnoses of these two disorders. Children with a FSIQ of less than 80 were excluded from the study. Diagnosis of a MDD was made using the Structured Clinical Interview for DSM-III-R (SCID; Spitzer, Williams, Gibbon, & First, 1990) and a thorough chart review. In addition, the Beck Depression Inventory (BDI; Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961) was administered to all of the patients. The WISC-R was administered to assess general intelligence. The California Verbal Learning Test (CVLT; Delis, Kramer, & Ober, 1983) and the Word Recognition

subtest from the Wide-Range Achievement Test-Revised (WRAT-R; Jastak, Wilkinson, & Jastak, 1984) were administered to assess verbal learning and memory. Results indicated that the patients with MDD had significantly higher scores than patients with dual diagnoses of Conduct Disorder and MDD on the Verbal IQ score from the WISC-R as well as significantly higher scores on the BDI than the Conduct Disorder group. Additionally, adolescents with MDD performed consistently lower on all aspects of the CVLT relative to the normative standards from the CVLT manual although the adolescents did not have a distinct profile of memory impairment that was different from the two comparison groups. Female adolescent patients performed more poorly than female adult patients on each of the CVLT-C variables. It was concluded that female adolescents with depression might experience a more malevolent form of depression and, in general, have a more unfavorable outcome and more significant overall cognitive impairment than male adolescents.

Cleaver and Whitman (1998) evaluated the patterns of learning disabilities in 484 adolescents and young adults ranging in age from 16 to 21 as inpatients at a psychiatric hospital. The hypotheses were that inpatients identified as having a nonverbal arithmetic disability would have higher depressive symptomatology and would be at higher risk for suicidal ideation and behavior, than those patients identified as having reading disabilities or more general learning disabilities. Results indicated that the nonverbal, arithmetic learning disabled group of inpatient adolescents and young adults did have the highest incidence of depressive symptomatology, but the group did not have higher rates of suicidal ideation or behavior as compared to the other groups. Accordingly, adolescents

and young adults with nonverbal learning disabilities were viewed by the researchers as being at a greater risk for depression than adolescents and young adults with verbal disabilities or more general learning disabilities.

Taghavi, Neshat-Doost, Moradi, Yule, and Dalgleish (1999) compared children and adolescents who were clinically anxious and mixed anxious-depressed who were being treated in a variety of settings to a control group in an attempt to examine the effects of a content-specificity theory. It was assumed, according to the theory, the individuals who were depressed would process certain emotional material in a biased manner, and individuals who were anxious would demonstrate specificity in regard to danger or threat-related stimuli. The sample included 24 children and adolescent patients who had a diagnosis of generalized anxiety disorder and 19 patients who had a diagnosis of mixed anxiety-depressive disorder. A group of 24 children and adolescents were used as controls and they had no history of an anxiety disorder or any other psychiatric disorder. The children and adolescents in the control group were assessed with the Reynolds Children's Manifest Anxiety Scale (RCMAS; Reynolds & Richmond, 1978) and parent and teacher reports. All the participants in the study were administered the RCMAS and the Depression Self-Rating Scale (DSRS; Birleson, 1981) to assess anxiety and/or depression. The British Picture Vocabulary Scale (BPVS, short form; Dunn, Whetton, & Pintille, 1981) and the Basic Reading Subtest of the Wechsler Objective Reading Dimensions Test (WORD; Rust, Golombok, & Trickey, 1993) were also given. In addition, the children were given the Attention Dot Probe Task. This consisted of 48 emotional words (e.g., 16 words related to physical threat like "explosion"; 16 words

related to social threat like “rejection”, and 16 words related to depression like “sad”). Each of the 48 emotional words was then matched with a neutral word for both length and frequency in random order using a probe task to detect latencies. Results revealed that there were no differences among the three groups as indicated by scores on the BPVS or WORD. Patients identified as anxious and mixed-anxious depressed had significantly higher scores on the RCMAS and the DSRS as compared to the control group. Additionally, patients who were anxious were characterized by a different pattern of attentional bias as compared to patients who were mixed-anxious depressed and the control group. The patients who were anxious exhibited bias for threat related stimuli but not depression related stimuli. The mixed anxious-depressed group was significantly more depressed than the group that was anxious and the control group but they did not show any attentional bias toward the depressed-related stimuli. The researchers concluded that the attentional bias among patients who were anxious depressed was due to anxiety rather than depression.

Gunther et al. (2004) analyzed fundamental performance on attention and memory tasks in children recruited from both an inpatient and outpatient department of child and adolescent psychiatry in an effort to resolve uncertainty reported in earlier literature as to whether neurocognitive abilities become disturbed when objective measures of attention and memory are applied. When disturbances in cognitive abilities were identified, it was difficult to ascertain which were related to anxiety disorders and which to depression. Thirty-four children with an anxiety disorder, 31 children with a depressive disorder (22 with MDD and 9 with dysthymic disorder), and 33 healthy

children who served as controls participated in the study. Children ranged in age from 6 to 17 years. Children were excluded from the study if they were on medication at the time of the study, if they had a FSIQ below 80 on the Wechsler Intelligence Scale for Children- Third Edition (WISC-III; Wechsler, 1991) or if they had a present or past diagnosis of Attention Deficit Hyperactivity Disorder (ADHD). Depression and anxiety were diagnosed using the Diagnostic Statistical Manual-Fourth Edition (DSM-IV; American Psychiatric Association, 1994), the German version of the CDI (Kovaks, 1985; Stiensmeier-Pelster, Schurmann, & Duda, 2000), and classification from the Kinder-Diagnostisches Interview bei psychischen Störungen im Kindes- und Jugendalter (K-DIPS; Unewehr, Schneider, & Margraf, 1995). The neuropsychological assessment for cognitive functioning included the Rey Auditory-Verbal Learning Test (RAVLT; Lezak, 1995) and two attention and/or alertness tasks. More specifically, there was a simple reaction time task, the Go/NoGo Paradigm (Fimm & Zimmermann, 2001) as well as a divided attention task, the Sustained Attention Task (de Sonneville, 2000). Neuropsychological variables were divided into two general content areas, mainly verbal or memory and attention. Results from the analysis indicated no main effect on free recall, working memory, or the learning curve on the RAVLT. A significant main effect across all three groups was found in the number of free recalled words after learning an interferences list of words, in long delay free recall, and in the recognition trial. Children with a depressive disorder performed worse than children with an anxiety disorder and children in the control group. There were no significant differences found between the children in the anxiety and control group. No significant differences were found between

any of the groups on the attention and/or alertness tasks. Both children with depression and children with anxiety did not show any deficits on attention tasks indicating these two groups had an undisturbed attentional performance. Consequently, a memory impairment specifically associated with childhood depression was concluded.

Lepisto et al. (2004) conducted an investigation to determine whether auditory sensory memory and/or attentional skills, like orienting and the assessment of novelty were impacted in children with major depression as previously reviewed literature suggested children with depression have some deficits and/or weaknesses in meta-memory and short-term memory (Kaslow, Rehm, & Seigel, 1984; Lauer et al., 1994; McGee et al., 1986). Ten children ranging in age from 10 to 12 years, who were identified as having major depression, but were not receiving any medication, and 10 children ranging in age from 10 to 13 years, without a diagnosis of depression, participated in the study as the controls. Children with or with a known history of bipolar disorder, panic disorder, psychosis, ADHD, dysphasia, suicidality, or in need of a hospitalization were excluded. Major depression was determined by the CBCL with a child receiving a total score of at least 51, and the CDI with a total score of at least 12. Auditory memory was examined by eliciting event-related potentials (ERP's), which investigate neural processing. Specifically, sound sequences were elicited in which a frequent (consonant-vowel syllable) was randomly replaced by either an infrequent deviant syllable or a novel sound. A long inter-stimulus interval was used in order to ensure the model was sensitive to a possible deficit in short-term memory in children with depression. Deviant sounds were then expected to elicit the mismatched negativity

(MMN) and later discriminative negativity (LDN) responses, reflecting impairment in auditory sensory memory. Novel sounds were expected to elicit the ERP components, P3a and Nc, because as distractibility increases the P3a and Nc responses become larger. The children also had an EEG recording while they were exposed to stimuli. The results from the analysis indicated that MMN and LDN were statistically significant at all electrodes in both groups of children. Children with depression had MMN and LDN that peaked significantly earlier than the children who were not depressed. No differences were found between the groups in the MMN and LDN amplitudes. The P1 enhancement was statistically significant at all the electrodes in the children who were the controls. However, in the children who were categorized as depressed the P1 enhancement was only significant at the F3, C3, and Cz electrodes, thus these children tended to have smaller P1 enhancements. Responses to novel sounds elicited in a prominent, biphasic P3a potential, followed by a large amplitude negativity, the Nc, were statistically significant for both groups of children at all the electrodes with the exception of the Oz. Children who were not considered depressed had a larger lP3a at the central electrode site rather than the frontal electrode site. Conversely, children who were identified as depressed had equally large lP3a at the frontal and central electrode site. No differences were found between the groups in lP3a latency or the amplitude or latency of the Nc. Accordingly, children who were depressed had shorter MMN and LDN latencies that suggested children with major depression might have enhanced neural excitability of the central auditory system most likely due to a lowered ability to inhibit sensory loads that could lead to increased irritability or increased distractibility.

Kyte, Goodyer, and Sahakian (2005) investigated if adolescents who had received a recent diagnosis of their first episode of major depression would demonstrate executive function difficulties in attentional flexibility, behavioral inhibition, and decision-making. The sample included 30 adolescents receiving outpatient mental health services for a first MDD and 49 children without a history of depression who served as the controls. Eighteen of the 30 children had a co-morbid diagnosis. Children were excluded if they had a prorated FSIQ of below 70 on the WISC-R. The Schedule for Affective Disorders and Schizophrenia Present and Lifetime version (K-SADS-PL; Kauffman, Birmaher, Brent, Rao, & Ryan, 1996) was used to diagnose depression and the participants also completed the Mood and Feelings Questionnaire (MFQ; Angold, Costello, Pickles, Winder, & Silver, 1987) to determine the presence and severity of depressive symptoms. Two subtests, Vocabulary and Block Design, from the WISC-III, UK Version were used to focus on verbal and performance abilities. Executive function skills were assessed using three tests from the Cambridge Neuropsychological Test Automated Battery (CANTAB; see http://www.camcog.com), an instrument that is apparently sensitive to determining the presence of cognitive deficits in depression. Attentional flexibility was assessed using the Intra-Dimensional, Extra-Dimensional Set-Shifting task derived from the Wisconsin Card Sorting Test (ID-ED task; Downes et al., 1989). The Affective Go, No-Go task (Murphy et al., 1999) was used to assess behavioral inhibition. Decision-making was evaluated with the decision-making task (Rogers et al., 1999). Results indicated no significant differences between the two groups in age, IQ, or MFQ scores. Rates of passing or failing on the ID-ED task did not differ significantly for the two

groups. Therefore, the researchers suggested that attentional flexibility may be unimpaired in a first MDD. A significant main effect was found for adolescents who were recently diagnosed as having a MDD on the target valence (happy vs. sad) with more errors being made on happy compared to sad targets, but not on condition (shift vs. non-shift). Children who were depressed appeared to exhibit a bias in processing negative emotional stimuli as evidenced by more accurate responses to sad target words. The children serving as the controls took a longer time to deliberate on their decisions in the context of betting their available points when compared to the children who were recently diagnosed as being depressed. The researchers stated that this might have been indicative of the children in the non-depressed group thinking that they were being tricked or possibly the children who were depressed were more impulsive. Consequently, these findings did suggest that specific patterns of neuropsychological functions might be relatively compromised in an adolescent's first episode of MDD.

The inpatient studies do suggest some causal link between depression and cognitive functioning. In particular, those studies that included an assessment of children with anxiety disorders suggest that this may be a more significant influence on cognition than depression alone. Additionally, these inpatient studies and clinical studies by definition included children who had some behavioral or psychiatric diagnosis. Thus, there is an imbedded sampling bias in all these studies because at least some of the subjects have been identified as having some significant impairment in a given area of functioning (e.g., behavioral, emotional, and/or psychological).

(c) Studies examining childhood depression and the effects of antidepressant treatment and/or psychopharmacotherapy on cognitive functioning

A number of studies have looked at the impact depression has on cognitive functioning as well as what effects psychopharmacology has on treating childhood depression. Weinberg et al. (1973), for example, investigated children who experienced affective disorders, specifically depression. Seventy-two children ages 6 to 12 years were referred by their classroom teachers and school principals to an educational diagnostic center because of behavioral concerns. Depression was identified using a set of 10 specific criteria as determined by a pediatric neurologist who interviewed both parent and child. A brief history of any family affective disorders in a genetically related family member was also taken. Forty-two children met the diagnostic criteria for depression. Of these children, half were reported mildly depressed and the other half was experiencing more significant depressive symptomatology. Moreover, 40 of the children diagnosed as depressed had a positive family history of affective disorders. Thirty children were identified as non-depressed as they had four or less depressive symptoms. The WISC-R and the Peabody Picture Vocabulary Test (PPVT; Dunn & Dunn, 1981) were administered to assess cognitive abilities. Results indicated that there were no significant differences between children who were identified as depressed and the children who were not depressed in terms of age, sex, grade, or performance on the WISC-R FSIQ or the PPVT score. Sixty-seven of the children were re-evaluated 3 to 7 months after the initial examination. Of the 34 children identified as being depressed, 19 received medication and 15 did not. The children, who were depressed and received

medication as an intervention, had significant improvements in the areas of mood, behavior, and attitudes toward school as well as school performance whereas the children who were depressed but not treated and the children in the non-depressed group did not have significant improvements.

Brumback et al. (1977) analyzed and clarified the criteria, diagnosis, and specific behavioral aspects of childhood depression as well as the treatment effectiveness of antidepressant medication using the same sample as Weinberg et al. (1973), (72 children referred to an educational diagnostic center for the assessment of learning and/or behavior problems as documented by the school). A pediatric neurologist interviewed the children and parents to determine the presence or absence of depressive symptoms based on the criterion for adults with depression with some variation so as to be more applicable to children. For example, a change in school performance, although not a specific criteria symptom of adult depression, could be seen as analogous to a change in attitude toward work, a commonly detected characteristic in adults who were depressed. Changes in school performance corresponded with the common adult depressive complaints of reduced concentration, slowed thinking and weak memory. Forty-two of the pre-adolescent children met the criteria for depression. Comparisons were made between children in the depressed and non-depressed groups across several domains, including grade placement, FSIQ as assessed by the WISC-R, and the PPVT, but there were no significant differences found.

Brumback et al. (1980) studied two male children, aged 6 and 10 years, with symptoms of depression and a family history of major affective illness. This research

was aimed at determining if children who were identified as having depression experienced changes in cognitive functioning, and if antidepressant medication treatment could be effective in treating these children and alleviating some of the cognitive changes. Using the CDRS-R, the CDI, Piers-Harris Self-concept Scale (Piers & Harris, 1964), and the Conners Parent Rating Scale (CPRS; Conners, 1970) depression was documented. The two children were also administered a battery of psychological tests that included the WISC-R, the WRAT, and specific subtests from the Reitan-Indiana Neuropsychological Test Battery (Reitan, 1964, 1969) that included the Halstead Categories Test and Trail Making Part A and B. In addition, the Illinois Test of Psycholinguistic Abilities (ITPA; Kirk, McCarthy, & Kirk, 1967) the Goodenough-Harris Draw-A-Person Test, and the VMI were administered. An Attention Test Battery comprised of a paired-associate learning task, which was copied off of a task depicted by Swanson and Kinsbourne (1976) and Swanson, Kinsbourne, Roberts, and Zucker (1978) as well as a Three-Stroop-like task (Stroop, 1935) were also administered. The researchers found that the intellectual performance of these two children with endogenous depression markedly improved after antidepressant drug treatment, with the greatest improvement occurring in visual perceptive abilities. Specifically, on the WISC-R there were clinically significant test score changes found on Similarities, Comprehension, Digit Span, Picture Arrangement, Block Design, Object Assembly, and Coding subtests. Clinically significant test score changes were also found on the Goodenough-Harris Draw-A-Person-Test.

Staton et al. (1981) specifically examined reported research findings that indicated an increase in Performance IQ scores on the WISC-R, which was interpreted as a measure of right hemispheric dysfunction, after antidepressant drug treatment. Children who were referred to a medical clinic for depression and hyperactivity behavior problems and who were identified as having a probable biological depressive disorder participated in the study. There were a total of 11 children included in the study, ranging in age and grade from 6 to 13years of age and from kindergarten to seventh grade. A symptom questionnaire, a clinical interview, the CDRS, the CDI, the Piers-Harris Self-concept Scale, and the Conners Parents Questionnaire (CPQ; Conners, 1970) were all used to assess depression. All 11 children met the DSM-III criteria for Major Depressive Episode. These children were then divided into two clinical subgroups: major depressive episode, melancholic subgroup; major depressive episode, non-melancholic subgroup. The children were administered an extensive battery of neuropsychological tests that included the WISC-R, the WRAT, the ITPA, the VMI, and Porteus Mazes (Porteus, 1965). Additionally, specific subtests from the Reitan-Indiana Neuropsychological Test Battery that included the Halstead Categories Test and Trail Making Test A and B were given. The paired-associate learning task, Stroop-like tasks, and the MFF Test were also presented. Children received the antidepressant medication after receiving the confirmation of a major depressive illness as well as completing the symptom-rating scales and the neuropsychological battery of tests. Three to six months later the children were given the symptom-rating scales and were reevaluated using the neuropsychological battery of tests. Results indicated that the melancholic subgroup performance was

significantly weaker than the non-melancholic subgroup on the Visual Reception subtest of the ITPA. Significant improvement was reported on all the symptom-rating scales following antidepressant treatment. In addition, significant improvement was found on the Piers-Harris Self-concept Scale, the CPQ, and the CDRS. The melancholic subgroup showed statistically significant improvement on the CDI scores between the treatment stages but the non-melancholic subgroup did not. The melancholic subgroup had a significant improvement on Verbal IQ, Performance IQ, and FSIQ from the WISC-R, but the non-melancholic subgroup did not show any significant changes. Therefore, the melancholic subgroup had significant improvement on the following WISC-R subtests: Similarities, Comprehension, Block Design, and Coding. The melancholic subgroup also had significant improvement on the Visual Reception subtest from the ITPA, the Halsted Categories Test, and on the response latencies of the MFF Test. Thus, a noticeable improvement was established in depressive symptoms as well as tests reflecting reasoning, judgment, visual perception and visuomotor coordination following tricyclic antidepressant treatment for children in the melancholic subgroup. The subgroup identified as major depressive episode, non-melancholic did have some improvement in tests scores following treatment, and there was also a decline in symptom ratings of behavior problems; however, the variability in the small sample size was too much to demonstrate significant change in cognitive function.

Wilson and Staton (1984) expanded on the previously reported findings of Brumback et al. (1980) and Staton et al. (1981), who found significant neuropsychological improvements associated with psychopharmacotherapy of small

samples of children identified as being depressed. The summary of findings was based on 75 children, aged 5 to 16 years. A diagnosis of MDD and the neuropsychological instruments were the same as used in the previously cited studies done by Brumback et al. (1980) and Staton et al. (1981). Antidepressant medication was initiated after completion of the test batteries. Each child was re-evaluated during clinical remission of symptoms at least three months after pre-testing. There were significant differences found on several subtests from the WISC-R including Similarities, Picture Completion, Picture Arrangement, and Block Design, suggesting significant changes on Verbal, Performance, and Full Scale IQ. There were also significant differences found on the ITPA Visual Reception and Auditory Association subtests, the VMI, and Goodenough-Harris Draw-A-Person Test. Additionally, significant differences were found on the Halstead Categories Test, Trail Making B, the Color Naming subtest from the Attention Test Battery, and the MFF Test. On self-report measures, children rated themselves more favorably and parent-report measures indicated that children had made behavioral improvements. It was concluded that such positive changes were related to a complexity of variables that included age, type of medication administered, and the presence or absence of pretreatment lateralized brain dysfunction. Therefore, children who showed greater pretreatment impairment of right hemisphere functioning as indicated by a lower Performance IQ score, showed greater improvement on both the cognitive and behavioral measures. Children showed greater self-esteem and this led to reducing problem behaviors associated with aggressions and hyperactivity. Overall, children treated with medication were calmer, happier, and less oppositional in the classroom as well as more

attentive, participated more effectively, and were better organized, and were more efficient time-managers.

Brumback and Staton (1982a, 1982b) continued to explore the possible association of childhood depression with learning disabilities, attentional disorders, and lateralized disturbances or dysfunction of the right cerebral hemisphere. Based on lateralized disturbances of cerebral hemisphere function, children with a left hemisphere type of learning disability, which was less common, tended to show trouble in areas related to language function and right body sensorimotor function whereas children with the more common right hemisphere type of learning disability tended to show trouble with spatial orientation, right-left orientation, ordering and sequencing, timing, music appreciation, and left body sensorimotor function. The previous conclusion of Brumback et al. (1980) and Staton et al. (1981) demonstrated that children who were depressed and who had a right-hemisphere type learning disability as well as neurological signs of right-hemisphere dysfunction, improved in performance after being treated with antidepressant medication, supported the hypothesis that childhood depression, attentional disorders, and right-hemisphere type learning disabilities were all connected with right-hemisphere function. Given that right hemisphere dysfunction has been implicated in the dysfunctions of the expression and modulation of emotions, it can be supposed that depression might be a physiological disturbance of right hemisphere function, rather than an anatomical disturbance of right hemisphere dysfunction assumed in children with learning disabilities. This creates symptoms of a learning disability or attentional disorder that go away with the reversal of the physiologic or depressive induced

dysfunction. Hence, an accurate diagnosis and treatment of depression in a child could potentially reverse or improve the related symptoms of a learning disability or an attentional disorder.

In a follow-up study, Brumback and Staton (1983) explored the possibility that right hemispheric learning disabilities could be the result of cerebral dysfunction, and, in turn might share a common pathophysiology associated with childhood endogenous depression. The investigation hypothesized that pharmacotherapy such as tricyclic antidepressants could be used to treat this cerebral dysfunction. Understanding lateralized cerebral hemispheric function and the proper steps evaluators should take in making the proper diagnosis of an apparent learning disability were outlined. Biological (physiological) and behavioral (psychological) symptoms of depression were also clearly reviewed.

For the most part these studies found that children who were identified as depressed and subsequently received psychopharmacotherapy improved in their depressive symptoms as well as in their performance on different aspects of cognitive function. Therefore, it seems that treatment may ameliorate possible long-term consequences of poor academic achievement or other aspects of behavioral functioning. Additionally, it would be important to keep in mind that the intellectual and educational potential of a child who is depressed would seem difficult to accurately assess until the remission of the depression has been achieved.

(d) Relationship of depression to behavior and learning issues.

Brumback et al. (1980) investigated the relationship between depression and intelligence scores and academic achievement skills as this has been seen by some researchers as a cause of behavioral disturbance and school difficulty in young children (Brumback and Weinberg, 1977; Weinberg et al., 1973) One hundred prepubertal children, ranging in age from 5 to 12 years, who were consecutively referred by teachers, school officials, or parents for an educational evaluation due to concerns of learning difficulties, participated in this study. Children with apparent neurological abnormalities were not included. Each child was administered the WISC-R or the Wechsler Preschool and Primary Scale of Intelligence (WPPSI; Wechsler, 1974), depending on age. The PPVT and WRAT were also given. An IQ of 75 as assessed by the WISC-R, WPPSI, or PPVT was required in order to be included in the study. Parents completed a behavioral checklist on their respective child and were interviewed separately by a school counselor and pediatric neurologist. Reports from teachers and school administrators were also reviewed. Children in the study were evaluated for the presence of childhood depression based on the criteria established by Brumback (1976). Results of this investigation showed that 62 of the 100 children of the children referred to the educational diagnostic center because of learning difficulty concerns matched the diagnostic criteria for childhood depression. There were no significant differences found for age, sex, grade, intelligence, or academic scores between groups of children identified as depressed or non-depressed. There were also no significant differences found in behavioral

symptoms. It was hypothesized that poor school performance could possibly be related to a disinterest in participation as well as self-defeated feelings.

Brumback (1985) re-analyzed the data collected from the above study done by Brumback et al. (1980). Specifically, the association between childhood depression and right cerebral hemisphere dysfunction was highlighted as it has been suspected that children with depression would have weaker scores on the Performance IQ from the WISC-R. The results were inconsistent with the work done by Kashani et al. (1983) and Stevenson and Romney (1984), neither of whom found any significant differences in scores between children who were identified as depressed and non-depressed on the WISC-R Verbal and Performance IQ. On re-analysis, the results indicated that deficits on Performance IQ were significantly more common in children with depression than in children who were identified as non-depressed. In addition, there was a statistically significant difference based on a 15-point discrepancy between the Verbal IQ and the Performance IQ of the children who were identified as either depressed or non-depressed. Thirty-four percent of children, who were depressed, as opposed to 14% of children who were not identified as being depressed, showed a relative deficit on the Performance IQ relative to the Verbal IQ. Of the children who were depressed, only 38% showed neither a Performance IQ nor a Verbal IQ deficit of 15 or more points, in contrast to the 67% for the children who were not depressed. Verbal IQ deficits relative to Performance IQ were also more common among the children who were depressed (28%) than among children who were not identified as depressed (19%). The findings supported Brumback and

Staton's (1983) earlier conclusion that depression could produce reversible cerebral dysfunction.

Mokros, Elva, Poznanski, and Merrick (1989) tested the hypothesis generated by Brumback's (1985) study and the empirical findings of Brumback and Staton's (1983) earlier work in an effort to resolve the mixed findings regarding the relationship between learning disabilities and depression. Mokros et al. (1989) aimed to see if children with learning difficulties who were depressed would show greater deficits in Performance IQ, and if these scores would be proportionally weaker than children with learning disabilities who were not depressed. Forty-six children, who had been referred for a possible mood disorder, participated in this study. They were administered the WISC-R, and children had to have a FSIQ over 75 to participate. Learning difficulties were identified in 42 of the 46 children based on the CDRS-R, which identified problems in school performance or the Schedule for Affective Disorders- Children's Version (Kiddie SADS; Puig-Antich & Chambers, 1986), which identified a diminished ability to think or concentrate. Depression was diagnosed with the Poznanski criteria, a modified version of the DMS-III criteria (Pozanski, Freeman, & Mokros, 1985). A total of 27 children were identified as having a MDD. These children were representative of one group and the remaining 15 were identified as the non-depressed group. The results failed to show a significant difference in performance deficit between children who were depressed and experienced learning difficulties as part of their depressive symptomatology and children who were identified as non-depressed. As a result, Mokros et al. (1989) concluded that

there was still a strong possibility of a link, but it could likely not be established on the basis of IQ data alone.

Leon, Kendall, and Garber (1980) examined similarities between childhood depression and the affective, motivational, cognitive, and somatic components characteristic of adult depression. Specifically, the consistency with which behavior problems and attitudes were manifested across a variety of situations (e.g., home versus school) was evaluated as was a child's psychosomatic complaints as noted by the parent. Additionally, motivation was assessed with response latencies on a motor performance measure to compare children who were identified as depressed and children who were not depressed. A child's attributions and personal expectations about intellectual and interpersonal experiences were examined to further evaluate the cognitive component of depression and to see if those children identified as depressed tended to attribute failure to internal attributions more so than those who were not identified as depressed. Participants in the study included 138 elementary school children in third through sixth grade. Depressed and non-depressed groups were formed based on a meaningful clinical cutoff on the Depression Scale of the Personality Inventory for Children (PIC; Wirt, Lachar, Klinedienst & Seat, 1977). There were 21 children in the depressed group and 21 children in the non-depressed group. Parents completed the CPRS as well as the Depression and Hyperactivity scales from the PIC. In addition, each child's classroom teacher filled out the Conners Teacher Rating Scales (CTRS; Conners, 1973). Children completed the CDI as well as several measures to assess cognitive abilities. These instruments included the PPVT, the Porteus mazes, and the Cognitive Processes

Inventory for Children (CPIC; Garber, 1980). No significant differences were found between children who were depressed and children who were not depressed on the PIC Depression and Hyperactive scales, the PPVT, the Porteus mazes, or the CDI. The results did not show a relationship between a motivational discrepancy in depression and general psychomotor speed or response latencies. Significant differences were found on the CPRS, CTRS, and CPIC for grade and sex. Children in the depressed group demonstrated significantly higher scores on several of the CPRS factors (e.g., Conduct Problem, Anxiety, Impulsive-Hyperactive, Learning Problem, Psychosomatic, Perfectionism, and Muscular Tension). Findings from the CTRS indicated that children in the depressed group were rated significantly higher on the Inattention-Passive factor. Parents rated children who were identified in the depressed group as manifesting a significantly greater frequency of behavior problems than children who were in the non-depressed group. However, teachers noted only more inattentive-passive behaviors among children in the depressed group. Additional findings revealed that children who were in the depressed group showed more anxiety-tension, learning, psychosomatic, and perfectionism problems regardless of the presence or absence of hyperactivity. Results obtained from the CDI and CPIC found that children who were identified as depressed did attribute positive events to external causes significantly more than children who were not identified as depressed. Children with high scores on the CDI also attributed negative events to internal causes significantly more than children with low CDI scores. There were no other significant findings reported based on CDI scores and the CPIC. Correlations within CPIC indicated that internal attributions for positive events correlated

significantly with ratings of positive affect for events, whereas both internal and external attributions for negative events correlated negatively with ratings for positive affect for events. Older children were significantly more likely to make internal attributions for positive events and less likely to make internal attributions for negative events than younger children. Thus, the researchers found some similarities between the adult manifestation of depression and childhood depression (affective, cognitive, and somatic). However, a motivational deficit as assessed by response latencies and generalized psychomotor speed slowing was not found. Further, there was a lack of consistency in behavior across settings but a number of mood and behavior features were noted by parent and teacher report. The researchers did propose that the affective state of a child, particularly depression, might be related to academic underachievement.

Strauss, Lahey, and Jacobsen (1982) looked at findings from several different researchers in order to formulate an accurate hypothesis regarding the clinical features of depression that seem to be incompatible with effective learning. Much of the research reviewed suggested that a child's affective states, particularly depression might be related to academic underachievement. Leon et al. (1980) and Tesiny, Lefkowitz, and Gordon (1980) suggested a child's emotional state and predominantly depression could be associated with poor academic achievement. Tesiny et al. (1980) also ascertained that peer ratings of depression were correlated with school achievement Leon et al. (1980) found that parents with children who were identified as being depressed rated their children as having significantly more learning problems than parents whose children were not identified as being depressed. The study investigated the relationship between

academic achievement and depressive characteristics in a sample of 103 elementary school children, ages 7 to 12 years, and in the second through seventh grades. Specific clinical features of depression like short attention span, lethargy, poor memory, and shortened task persistence that are possibly incompatible with effectual learning were considered in an effort to see if they did in fact cause academic underachievement. Depression was assessed using three different instruments. Children who participated in this study completed a CDI. Fellow classmates filled out the PNID and teachers filled out an information form regarding their perceptions of a child's level of depression. The Stanford Achievement Test (SAT; Kelley, Madden, Gardner, & Rudman, 1964) was administered to provide measures of reading and mathematics achievement as well as IQ scores. The Reading Recognition subtest of the PIAT was also administered. Results, after controlling the effects of IQ, depression measures were not significantly found to be correlated with any of the achievement measures. The subjects with high and low depression did not differ in their performance on academic achievement measures.

Stevenson and Romney (1984) attempted to assess the prevalence of depression in children with learning disabilities as well as identify specific variables that differentiated children who were depressed and had learning disabilities from children who were characterized as non-depressed with learning disabilities. Participants in this study included 103 children (ranging in age from 8 to13 years) who were enrolled in learning disability classes. They had a FSIQ range of 80-120 and they had a minimum of a two year delay in regard to grade appropriate academic functioning in one or more subjects. Depression was assessed using the CDI with a cutoff score of 19 being regarded as

significantly depressed based. Based on the CDI scores, the children were then divided into two groups, one being the "most depressed" and the other being the "least depressed" with 25 in each group. The Children's Personality Inventory (CPI; Porter & Cattell, 1979) was administered to measure aspects of personality. Self-esteem was assessed using the Culture-Free Self-Esteem Inventory (SEI; Battle, 1981). The mothers of the children were interviewed about their parental expectations of their child based on a specific technique of Rosen (1959). The researchers found that approximately 14% of the sample scored at or above the critical cutoff for depression. No significant differences were found between children in the most depressed group and least depressed group in regard to age, sex, or intelligence, which was similar to the Brumback et al. (1980) findings. There were no differences found in regard to type of learning disability as defined by academic and developmental difficulties. Significant differences were, however, found between the most depressed group and least depressed group of children with learning disabilities on all of the self-esteem variables and personality variables as anticipated.

McGee et al. (1986) tested the hypothesis that the symptomatology of childhood depression was associated with cognitive impairment on certain tasks as was demonstrated by Kaslow, Tanenbaum, Abramson, Peterson, and Seligman (1983) and Kaslow et al. (1984). The study included 792 children, age 11 years, who were part of a longitudinal investigation of the health, development, and behavior of a large sample of children born at a specific hospital in New Zealand. The children were interviewed with the Diagnostic Interview Schedule for Children (DISC-C; Costello, Edelbrock, Kalas,

Kessler, & Klaric, 1982) to assess depression, impulsivity, and inattention. Children also completed a shortened form of the Student's Perceptions of Ability Scale (SPAS; Chapman, Silva, & Boersma, 1983). Cognitive functioning was assessed using specific subtests from the WISC-R and these included the following: Information, Similarities, Arithmetic, and Vocabulary from the Verbal IQ; and Picture Completion, Block Design, Coding, and Object Assembly from the Performance IQ. Results from the analysis found significant correlations among the self-report measures, which included depression-inattention, depression-impulsivity, and inattention-impulsivity. Additionally, there were small but significant negative correlations between all the WISC-R subtests and the inattention measure. Impulsivity was only weakly related to performance on the Arithmetic subtest. Arithmetic and the Block Design subtests showed a small, but significant negative correlation with the depression measure. The SPAS and self-esteem measures were significantly related to measures of depression, inattention, and impulsivity. Moreover, a combination of the SPAS and self-esteem measures was best predicted by a linear arrangement of depression, inattention, and impulsivity. Hence, depression was significantly linked to lower self-esteem and a poor perception of ability in regards to academic abilities, which was consistent with the findings of Kashani et al. (1983) and Stevenson and Romney (1984). However, in general the results did not find that depression specifically impaired performance on complex cognitive tasks and this did not support the hypothesis of Kaslow et al. (1984). The researchers did suggest that a relationship might exist between depression and cognitive impairment when poor concentration is a major symptom of the child's depression.

Blumberg and Izard (1985) assessed the emotions, characteristic attributes or attributional style, and specific intellectual performances associated with children who were depressed based on CDI scores. The study was done in two stages. In the first stage, 146 children, who were in the fifth grade and were aged 10 to11 years, participated. The children were administered the CDI, the Differential Emotion Scale-Fourth Edition (DES-IV; Kotsch, Gerbing, & Schwartz, 1982), and the Children's Attributional Style Questionnaire (CASQ; Seligman & Peterson, 1985). In addition, teachers rated the children on a 10 point scale assessing the frequency of expression falling into three categories: discouraged, sad or depressed; mad or disgusted; shy or ashamed. Forty-five children from the original group were selected to participate in the second part of the study based on their CDI scores, which were broken down into three groups. The first group had children with scores of less than 2 on the CDI. The second group had children with scores greater than or equal to 19 on the CDI. The third, intermediate group had scores between 12 and 18 on the CDI. The children were individually administered a problem solving task, Block Design subtest from the WISC-R as well as verbal test, the PPVT. Results from the self report measures of emotion, attribution style, and depression, which were assessed using the DES-IV, CASQ, and CDI were significant. The DES-IV scales accounted for 78.1% of the variance in CDI scores for girls and 46.1% of the variance in CDI scores for boys. Additionally, positive and negative CASQ scales were correlated with CDI scores for 29.9% of the variance in girls' CDI scores and 21.5% of the variance in boys' CDI scores. Depressed girls performed more poorly than non-depressed girls on the problem solving Block Design

subtest. These results are similar to findings found in adults with depression. Conversely, there was no relation to boy CDI scores and performance on the Block Design subtest. Higher depressive symptoms and scores on the CDI were not related to performance on a verbal task for boys or girls.

Vincenzi (1987) reviewed the literature regarding the relationship between depression and learning and proposed that a child who has been identified as depressed may generate less effective means of coping, but does not necessarily lack skills. Depression might reduce an individual's cognitive capacity for effortful thinking, and this could in turn lead to making learning more difficult. This study examined the relationship between depression and reading achievement in two diverse groups of children. The first group lived in a low-income area with many social problems and the second group lived in a more low middle class area with fewer social issues. It was hypothesized that the lower income group would have higher rates of depression and therefore more learning problems. There were a total of 139 students who were in the sixth grade and from two different schools that participated in the research. Depression was assessed using the CDI. The following cutoff scores were used in the study: 0-9 indicated no depression, scores between 10-16 indicated mild depression, and scores above 16 indicated moderate to severe depression. Reading achievement was measured using the students' current reading levels as assessed by teachers, their fifth grade reading achievement scores representative of their standardized test scores, and their grade point averages (GPAs) for their sixth grade report period that was an average of all four major subject areas (reading, math, science, and social studies). A standardized test score, the

California Achievement Test (CAT; CTB/McGraw-Hill, 1986) instead of a teacher rated score, was also used to be representative of reading achievement scores. Results indicated that there were significant differences between schools on the depression score; the lower income school had a higher rate of children with depression. Also, significant differences were found between CAT scores but not on reading level or on GPA. A significant negative relationship existed between depression scores and reading achievement, between depression scores and reading level, and between depression scores and GPA. Thus, the level of depression was associated with each of the other variables. A positive significant relationship was found between school and reading achievement and a negative significant relationship was found between school and depression scores. No significant relationships were found between school and reading level and between school and grade point average. The significant correlation coefficients were found between depression score and reading level, depression and reading achievement, and depression and GPA. Consequently, depression was negatively associated with reading ability within each school as well as between the two schools.

McClure et al. (1997) examined the cognitive correlates of MDD during adolescence and looked at broader, neuropsychological functioning, memory, and executive functioning, which has been found in the adult literature (Burt, Zemba, & Niederehe, 1995; Cassens, Wolfe, & Zola, 1990). Modest, statistically significant associations have been made between IQ and the severity of depressive symptoms (Lefkowitz & Tesiny, 1985; Tesiny et al., 1980), although there have not been significant differences noted in IQ between children identified as depressed and those who are not

depressed. Weaker performances on measures of attention, coordination, and psychomotor speed have been documented (Kaslow & Rehm, 1983 & Kaslow et al., 1984). However, memory deficits in children with depressive symptoms appear to be less evident than what has been found in adults. Children who have exhibited severely depressed symptoms have had immediate recall deficits on a verbal list-learning task (Lauer et al., 1994). This study attempted to examine the patterns of cognition, self-perception, and motivation associated with depressive symptoms. Participants included 31, adolescent females ranging in age from 12 to 17 years. The females were from a local school district and they did not have a past history of a diagnosis with or treatment for a psychiatric disorder based on parent interview. The adolescent females were administered several behavioral and neuropsychological measures. General intelligence was assessed using the WISC-III. Academic measures were assessed using the reading and math portions of the WJ-R and the Spelling subtest of the WRAT-R. The CVLT-C, the Verbal Selective Reminding Test (Buschke, 1973), the Rey Osterreith Complex Figure-Recall (Lezak, 1983), and the Non-Verbal Selective Reminding Test (Fletcher, 1985) were given as measures of memory. The Judgment of Line Orientation (JLO; Benton, des Hamsher, Varney, & Spreen, 1983) was included to assess visual spatial perception. Executive functioning was measured using a variety of measures. The Tower of Hanoi (Loong, 1989) was used as a measure of planning and problem solving and the Rey Osterreith Complex Figure-Organization score (Waber & Holmes, 1985) was used to assess visual spatial organization. The Controlled Oral Word Association (COWAT; Benton & des Hamsher, 1989) and the Clinical Evaluation of Language

Functions Word Fluency (CELF; Wiig & Semel, 1980) were used to evaluate higher order verbal skills. There were different measures used to assess psychiatric symptomatology and specifically depressed symptoms based on self report and parent report and they included the following: the DSRS; RCMAS; sections of the Diagnostic Interview for Children and Adolescents (DICA-R-A; Reich, Shayka, & Taibleson, 1991); a computerized version of the Diagnostic Interview Schedule for Children-Revised Version 2.3 (DISC-R; Shaffer, Schwab-Stone, Fisher, Davies, Piacentini, & Gioia, 1988); and the CBCL. The females were divided into two subgroups based on the DICA-R-A, a depressed group and a not depressed group. Measures of self-perception were determined by using the Self-Perception Profile for Adolescents (SPP-A; Harter, 1988) and the Scale of Intrinsic versus Extrinsic Orientation in the Classroom (SIEOC; Harter, 1980). Results from the analysis found that when the two groups were compared on the DSRS, the DISC-R-A, and the CBCL adolescent females in the depressed group had significantly higher scores on the DSRS. However, there was no difference in academic achievement or IQ between the two groups and academic achievement and IQ were consistent within the depressed group. Significant differences were documented between the depressed group and not depressed group on the JLO, with the females in the depressed group having lower scores. There were no significant differences found between the two groups on measures of memory or executive functions. The depressed group had significant differences on the Scholastic and Global domains of the SPP-A. The two groups differed significantly on the SIEOC Preference for Challenge and Curiosity dimensions. The females in the depressed group reported on the dimensions

more extrinsic motivational orientations for learning. Thus, MDD in children appears to be associated with poorer performance on measures of attention, coordination, and psychomotor speed but there was minimal association with depressive symptomatology and verbal skills. Also, the females in the depressed group specified lower self-esteem and assessed themselves as less academically capable.

Rapport, Denney, Chung, and Hustace (2001) studied a conceptual model involving twofold developmental pathways, specifically behavioral and cognitive. This model has associated the internalizing dimension of behavior problems, often characterized by depressive symptoms, to later academic achievement (classroom performance) with moderate to strong correlations found between internalizing behavior problems in children and daily performance in the classroom. The model has also associated cognitive functioning as being related to internalizing symptomatology in children. This has included general cognitive abilities like intelligence as well as more specific abilities such as vigilance, memory, and information processing. Accordingly, a dual-pathway model was hypothesized linking internalizing behaviors in the classroom to select aspects of cognitive function and long-term academic achievement. Participants in this study included 325 children between the ages of 7 and 15 years. Children were administered the Kaufman Brief Intelligence Test (K-BIT; Horn & Cattell, 1966) as a measure of intelligence. The Kaufman Test of Educational Achievement (K-TEA Brief Form; Kaufman & Kaufman, 1998) was used as a measure of early educational achievement. Early internalizing behaviors were identified with the Child Behavior Checklist Teacher Report Form (CBCL-TRF; Achenbach, 1991). Classroom

performance was assessed using the Academic Performance Rating Scale (APRS; DuPaul, Rapport, & Perriello, 1991). The SAT was used to determine academic performance. A double letter (BX) version of the Continuous Performance Test (CPT; Chung, Denney, & Rapport, 2000) aided in the investigation of vigilance. Paired Associate Learning Tasks (PAL-T; Stevenson, 1972) helped measure short term memory. Results indicated that withdrawal did not contribute specifically to the prediction of cognitive functioning after controlling for anxiety/depressive symptoms and intelligence. On the other hand, anxiety/depressive symptoms did not contribute to the prediction of classroom performance after controlling for withdrawal symptoms and intelligence. Correlations between anxiety/depression and withdrawal symptoms with regard to intelligence were small and did not reach statistical significance. The total effect of children's IQ on SAT scores was significant and attributed to the indirect impact of intelligence mediated by classroom performance and cognitive functioning.

Rapport et al. (2001) found dissimilar results for anxiety/depression and withdrawal as both yielded small and non-significant total indirect effects on later achievement. Anxiety/depression symptoms as well as withdrawal symptoms added to the estimation of classroom performance and cognitive functioning ahead of the effects of intelligence and early achievement. Withdrawal symptoms continued to be related to classroom performance after controlling for its correlations with intelligence, early achievement, and anxiety/depressive symptoms without contributing uniquely to prediction of cognitive functioning. Conversely, anxiety/depressive symptoms calculated cognitive functioning after accounting for its correlations with intelligence, early

achievement, and withdrawal symptoms, but it had no distinctive relation to classroom performance. By incorporating early achievement into the model, the researchers found that it was highly correlated with intelligence and the addition of early achievement considerably reduced the direct and indirect effects on later academic achievement. Additionally, the direct effects on classroom performance and cognitive functioning were decreased. Thus, individual differences in measured intelligence among children were associated with variations in classroom performance and cognitive functioning. Classroom performance and cognitive functioning made unique contributions as predictors of later achievement above the influence of intelligence. Depressive and anxious features as assessed by the CBCL-TRF were correlated but were separate constructs. Anxiety/depression and withdrawal symptoms contributed to the prediction of classroom performance and cognitive functioning over and above the effects of intelligence. Therefore, classroom performance and cognitive functioning appeared to mediate the effects of internalizing behaviors and intelligence.

Emerson, Mullet, and Harrison (2005) noted the importance of examining the effects of anxiety and depression as a co-morbid condition since they commonly co-occur. Research findings from children populations have identified deficits in attention, visual recognition, motor functions, and reaction time with both anxiety and depression. There have been neuropsychological investigations done in adults that have identified dysfunctional hemispheric activation in anxious and depressed individuals, which has explained deficits like increased reaction time and impaired motor functions. They examined the hypothesis that children with high symptoms of anxiety and depression

would have difficulty performing on tasks that measure frontal lobe functioning. Participants in this study included 38 males from an urban public school, ranging in age from 9 to 11 years and in the fourth and fifth grades. The males were given the CDI and the State subscale of the State-Trait Anxiety Inventory for Children (STAIC; Spielberger, Edwards, Lushene, Montuori, & Platzek, 1973) to assess their depression and anxiety, respectively. Nineteen males received a score of 12 or more on the CDI and 34 or more on the STAIC and thus they were assigned to the anxious-depressed group. Within this group, 13 males were identified as moderately depressed according to their score on the CDI, which ranged from 12-18. The remaining six males were identified as highly depressed as they had a score on the CDI that ranged from 20-32. Nineteen males received a score of five or less on the CDI and a score of 24 or less on the STAIC. These males were assigned to the non-anxious-non-depressed group. Additional inclusion criteria included that the males who participated had to be right handed and this was assessed with the Lateral Preference Test. Vision and hearing also had to be within normal limits and the children had to have a FSIQ score on the WISC-III that ranged within 80-120. Males who were identified as having learning disabilities, ADHD, or other psychiatric disorders were excluded from the study. Trail Making Test (Forms A & B) and the Concept Formation subtest from the Woodcock Johnson Test of Cognitive Abilities-Third Edition (WJ-III COG; Woodcock, McGrew, & Mather, 2001) were used to assess frontal lobe functioning. The results showed that there were no significant differences in performance completion time on Trails A, a sequencing condition, between the males in both groups. However, significant differences were found on performance

completion time for Trails B, a sequential alternation condition, with the males in the anxious-depressed group demonstrating diminished speed in comparison to the non-anxious and non-depressed group. In addition, males who were in the anxious depressed group had significantly more errors on both Trails A and Trails B. Males who were in the non-depressed and non-anxious group were significantly more accurate on the Concept Formation subtest than the males in the anxious and depressed group. Thus, the evidence supported the idea that anxiety and depression affect functions that are associated with frontal lobe functioning in children as well as in adults.

In general, it seems important to recognize children identified as depressed could have had a history of cognitive difficulties or learning disabilities that preceded their emotional difficulties thus there is a possibility that symptoms are confused when considering the relation to depression and learning problems. Additionally, there could be a likelihood that poor school performance could be the result of an expression of a depression-related disinterest in participation or self-defeating feelings rather than depression itself reducing basic school skills as depressive symptomatology although not significantly related to actual performance on cognitive tasks was associated with lower general self-esteem and poor perception of ability regarding academic skills.

(e) Studies examining the relationship between depression and factors like locus of control and response latencies, conceptual/cognitive tempo, problem solving tasks, and social and cognitive competence using non-clinical samples.

Locus of Control

Tesiny et al. (1980) examined the relationship between childhood depression and locus of control as they relate to measures of intelligence and achievement related behavior. It had been established that children who perceive control of reinforcement as external have a tendency to perform lower on achievement tests than children who have an internal orientation. Therefore, the study anticipated that externality would be negatively related to both achievement and intellectual functioning and sought confirmation of the relationship to depression as well. The participants in this study included 944, fourth and fifth grade students from a public elementary school. Depression was assessed by a group administration of the Peer Nominated Inventory of Depression (PNID; Lefkowitz & Tesiny, 1980). Locus of control was assessed using the Children's Nowicki-Strickland Locus of Control Scale (NSLOC; Nowicki & Strickland, 1973). School achievement measures included the child's personal records, including standardized reading and math scores, and a teacher rating of work and study habits as well as the child's placement in their class with respect to school achievement. A figure-drawing general index of intellectual functioning was obtained using the Goodenough-Harris Draw-A-Person Test. Results indicated that individuals with external orientations had lower achievement scores than those with internal orientations. A modest negative correlation was found between depression and reading and math scores. Teachers' ratings of work and study habits and classroom achievement were, however, positively correlated with locus of control and there was a significant positive correlation found with such ratings and depression. The intellectual functioning index from the figure-

drawing task was moderate and a negative correlation was found between locus of control and depression. There was a significant positive correlation found between depression and externality. These findings suggested that a child's affective state and particularly depression might be related to academic underachievement.

Mullins, Siegel, and Hodges (1985) considered the relationship between a range of cognitive and other variables and children with depressive symptoms. Locus of control, which has consistently been found to have a strong relationship to children identified as depressed was examined. Interpersonal and impersonal problem solving capabilities and objective and subjective life stressors were examined as the question arises if children who have depressive symptoms also have a problem solving deficit. Participants included 134 children, non-referred public school children ranging in age from 9 to12 years, and in the fourth, fifth, and sixth grades. The children were assessed in two phases. In the first phase, the following tests were administered: the NSLOC, the CDI, and the Anagram task. During the second phase, children were administered the subsequent tests: the Social Means-Ends Problem solving Procedure (SMEPS; Shure & Spivack, 1972); the Emotional Means-Ends Problem solving Procedure (EMEPS; Siegel, Platt, & Peizer, 1976); the Optional Thinking Test (OTT; Platt & Spivack, 1977); and the Coddington's Life Events Scale for Children (CLESC; Coddington, 1972). Results revealed that 17 children were classified as depressed, which was determined by a cutoff score of 19 on the CDI. There were no significant differences found between children identified as depressed and children who were not depressed with regard to parent's marital status and SES. There was a strong positive relationship found between the level

of depressive symptoms and locus of control as assessed by the NSLOC. Accordingly, if a more external locus of control was found the higher the level of depressive symptoms was reported. The researchers found a relationship between levels of depressive symptoms and life stress as indicated by negative life events on the CLESC. Subsequently, as the number of negative life events was reported the level of depressive symptomatology substantially increased. No significant differences were found between depression scores on the CDI and scores on the SMEPS, EMEPS, and OTT. A moderate negative correlation between depressive symptomatology and the anagram task was found, indicating that a poorer performance on an impersonal problem solving task was associated with higher levels of depression. These findings were consistent with those of Kaslow et al. (1983). Thus, it appeared that a higher level of self-reported depressive symptoms was significantly related to an external locus of control, negative life events, a select aspect of interpersonal problem solving, and an impersonal problem solving capability.

Cognitive/Conceptual Tempo

Schwartz, Friedman, Lindsay, and Narrol (1982) looked at the type of conceptual tempo found in children who were depressed. Conceptual tempo was defined as the consistent tendency to display either slow or fast decision times when choosing one alternative from a selection of several possibilities. One-hundred six children who were in the fifth and sixth grades, participated in the study. Depressive symptoms were reviewed using the Self-Esteem Scale, an abbreviated 15-item version of the Piers-Harris Children's Self-Concept Scale, the NSLOC, the CDI, and the Moyal-Miezitis Stimulus

Appraisal Questionnaire (Moyal, 1977). Fifty-three children were identified as depressed and 53 children were identified as non-depressed. The conceptual tempo task was measured using the MFF Test. The Vocabulary and Block Design subtests from the WISC-R were administered in order to help specify the effects of intelligence. Results indicated that children who had been identified as depressed had significantly longer latencies, made more errors, and were less efficient on the MFF Test than children who were identified as not being depressed. Additional results indicated that even after variance due to intellectual differences was taken into consideration, the findings continued to be significantly associated with level of depression.

Fuhrman and Kendall (1986) attempted to explain more precisely the relationship between cognitive tempo and child behavior disorders. Specifically, the findings of Schwartz et al. (1982) were examined. They contended that cognitive tempo might be related to depression as they found that children who were identified as depressed responded less quickly, less accurately, and less efficiently than children who were identified as not being depressed on a problem solving task. One hundred fifty children participated in this study. The children were divided into three groups of fifty based on age (6 to 7 years of age, 8 to 9 years of age, and 10 to 11 years of age). The Child Behavior Checklist (CBCL; Achenbach & Edelbrock, 1983) was administered to both parents of each child to assess for specific behavior problems. The MFF Test and WISC-R was administered to all the children. Results from the analysis found that the hyperactivity symptoms reported on the CBCL were significantly negatively correlated with latency and positively correlated with errors and impulsivity on the MFF Test. No

other behavior problems including depression on the CBCL were significantly correlated with MFF Test scores. The findings did not support the presence of a relationship between childhood depression and cognitive tempo but instead found a significant relationship between cognitive tempo and hyperactivity.

Kendall, Stark, and Adam (1990) acknowledged the importance of looking at the nature of cognitive problems in children who were identified as depressed. Previous research had suggested differing conclusions regarding the relationship between cognitive tempo and depression in children. Schwartz et al. (1982) found that children who were depressed had significantly more errors, longer initial responses, and were more inefficient; however, Fuhrman and Kendall (1986) did not. The purpose of this Kendall et al.'s (1990) study was to perform a series of three studies that looked at cognitive problems among children who were depressed by measuring both cognitive deficiency or cognitive tempo and cognitive distortion in thinking with the idea that this may be what was related to the cognitive problem. Study one evaluated 47, sixth grade children who were not receiving any special education services. Seventeen of these children received a DSM-III diagnosis of MDD based on both child and parent responses on the Kiddie SADS, the CDI, and the Parent-Child Depression Inventory (P-CDI; Kovacs, 1985). My Standards Questionnaire (MSQ; Stark, Adam, & Best, 1990) was used to assess how they children evaluated themselves in specific aspects of life. The MFF Test was administered and latency to first response and the total number of errors were reported. Results revealed no significant between-group differences in age, sex, or ethnicity. Children who were identified as depressed did not differ significantly between

children who were not depressed in total number of errors or in response latency. Significant differences were found on the MSQ in how children who were depressed evaluated themselves, which was less favorably despite holding comparable standards. There was no significant correlation between parent ratings on the K-SADS and MFF TEST response latency or error scores.

Kendall et al.'s (1990) in another study attempted to replicate results of the first study using younger children. Thirty-eight children in the third, fourth, fifth, and sixth grades from four suburban schools participated. The same instruments were used to assess depression, negative self-evaluations, and cognitive tempo. Consistent with the first study, children who were depressed relative to those children who were not depressed rated themselves significantly more negatively. The difference between the evaluations of the younger and older children and the interaction effect was not significant. Thus, results from both of these studies indicated that children who were identified as depressed showed no deficit in information processing as assessed by the MFF Test, but did have a negative style of evaluating self.

Kendall et al.'s (1990) third study attempted to further assess if children who were depressed distorted their own self-perceptions. There were 36 children in the fourth, fifth, and sixth grades and from four suburban schools who participated in this study. Of the children selected to participate in the study, half reported a significant level of depressive symptomatology and half were identified as not depressed. The same measures were used to assess depression and cognitive tempo. Self-perceptions were assessed using the MSQ as well as something the researchers designed to be a parallel

measure to the MSQ, the Child's Standards Questionnaire. This measure could be completed by a third party (e.g., homeroom teacher) who knew the child and could observe and assess them based on their performance, abilities, and possessions in the same areas the child was evaluating themselves. Results from the study indicated that there were no significant differences between the groups in age, sex, or ethnicity. There was not a significant difference found between the standards and self-evaluation of children who were depressed and children who were not depressed, which was consistent with the other findings. However, a significant difference was found between the children who were depressed in their self-evaluations. In contrast to the children's self perceptions, a significant difference was not reported by teachers in their evaluations of the children who were depressed versus their peers who were not depressed. Thus, the findings held the hypothesis that cognitive distortion, and not cognitive deficiencies, distinguished the nature of cognitive disturbance in childhood depression, which was consistent with Kendall (1985). Results were consistent with the research investigations reported by Fuhrman and Kendall (1986) and contradictory to those reported by Schwartz et al. (1982). These results add support to the research that has suggested some children who have been identified as depressed exhibit a distorted style of thinking and negative self-perception rather than a deficiency in information processing.

Social and Cognitive Competence

Kaslow et al. (1983) looked at the possibility that children with depression could have difficulties with cognitive problem solving in an attempt to determine if the clinical representation of children with depression was analogous to adults with depression.

Forty school children between the ages of 9 and 11 years, and in the fourth and fifth grades, participated in the study. Children who participated in the study were not receiving any antidepressant medication and had not been diagnosed with a learning disability. The CDI was used to determine the level of depressive symptoms. An Anagram task was administered as well as the Block Design subtest from the WISC-R. Children were also given the PPVT within one month of their participation in the study. Significant results indicated that the higher the CDI scores were, the slower the child was to complete the Block Design task and to solve the Anagram task. However, scores on the PPVT, a receptive vocabulary measure, were not significantly related to higher CDI scores.

Kaslow et al. (1984) studied a sample of 108 elementary school children, 36 children each from the first, fourth, and eighth grades. The symptoms associated with depression, cognitive functioning, and aspects of social-cognitive functioning (e.g., self-esteem, attributional style and self control) were assessed in children identified as depressed and children identified as non-depressed to determine the extent to which depression affected cognitive performance. It was theorized that children who were depressed would selectively attend to negative events, establish more severe criteria for personal performance, evaluate personal performance in a more negative manner, demonstrate a more depressive attributional style, and discipline themselves more than reward themselves. Additionally, it was hypothesized that children who were depressed might have a selectively weaker performance on more complex cognitive tasks (e.g. the Block Design or Coding subtests from the WISC-R), but would demonstrate difficulties

on more simple tasks (e.g., Vocabulary or Digit Span subtests from the WISC-R or Trail-Making test). Three different age/grade groups were chosen to address the developmental differences and developmental changes that might exist. Participants included 36 children in each grade (grade one, four, and eight). Children were initially administered the CDI, the Coopersmith Self-Esteem Inventory (CSEI; Coopersmith, 1967), and the KASTAN Children's Attributional Style Questionnaire (Kaslow, Tanenbaum & Seligman, 1978). Three weeks later, basic demographic information was obtained and the children were given several self-report measures that included a CDI, a questionnaire designed to assess the presence and severity of depressive equivalent symptoms or masking symptoms, and a questionnaire designed to assess the child's family dynamics (e.g., enjoyment of family time, getting along with parents, psychological availability of parents). They were also administered the Social Cognitive Inventory (SCI; Kaslow, Schultz, & Rehm, 1980) and the Social Competence Scale of the CBCL. The children's teachers filled out the Achenbach Teacher Rating Scale (Achenbach, 1978). Each child completed a number of cognitive and social-cognitive tasks including the Block Design, Vocabulary, Digit Span, and Coding subtests from the WISC-R, the Trail-Making test, and the VMI. Results indicated that 23 children were depressed as defined by CDI scores of 11 or more. There was a significant relationship found between a child's CDI score and the number of masking symptoms present. Children who were depressed reported their family environment to be more negative. A lower summary score on the KASTAN Attributional Style Questionnaire as well as more internal attributions for failure and external attributions for success were found in the

children who were identified as depressed. Scores from the CSEI indicated a strong negative relationship between a child's self-esteem and a child's level of depression on the CDI. The SCI indicated that children who were depressed expected to perform more poorly, set more strict criteria for success and failure, were more likely to choose punishment than reward, and evaluated personal performance more negatively than the children who were not depressed. The children who were depressed had negative self-perceptions and their teachers reported that they showed more internalizing symptoms (e.g., depressed, anxious, schizoid, withdrawn, obsessive-compulsive, somatic complaints) than children who were identified as non-depressed. Analysis of the Social Competent Scale from the CBCL did not show a significant relationship between a child's level of depression and his or her participation in activities, interpersonal relationships, or quality of work. CDI scores were significantly and negatively correlated with performance on the Block Design, Coding, and Digit Span subtests from the WISC-R. There were no significant effects found on the Coding, Digit Span, and Vocabulary subtests from the WISC-R. No significant relationship was found between CDI scores and the Trail-Making test. Subsequently, the results of this study found that depression did not manifest itself differently in regard to grade and children who were depressed had impaired performance on some but not all cognitive tasks. Children who were depressed did have lower self-esteem, a more depressive attributional style, and more self-control deficits.

Sacco and Graves (1984) investigated the relationship between depressive symptoms in children and interpersonal problem solving factors and self ratings of

performance with the assumption that again, it would be similar to what has been found in the adult literature. Specifically, it was hypothesized that children who were identified as depressed would exhibit weaker performances on the Vocabulary subtest from the WISC-R, three questionnaire items designed to assess a child's self-ratings of their performance on the interpersonal problem solving task, and they would have negative self-ratings of their performance in comparison to children who were not seen as depressed. Ninety-five elementary school children ranging in age from 9 to 11 years and in the fourth and fifth grades participated in the study. Sixty-five children were administered the CDI. A depressed group was created with those children who received an 11 or higher on the CDI and a non-depressed group was formed with those children who had a CDI score of 4 or below. There were 20 total children in each group. Children in both groups were administered the Social Problem Situation Analysis Measure (SPSAM; Elias, Larcen, Zlotlow, & Chinsky, 1978) and the Vocabulary subtest of the WISC-R. Results indicated that children, considered depressed, scored significantly lower than children who were not depressed on the Vocabulary subtest, a different finding than most other studies. However, the correlation between the Vocabulary subtest and the CDI scores only approached marginal significance, indicating that interpersonal problem solving could be the result of differences in IQ versus depression levels. Consistent with this, the Vocabulary subtest scores were significantly correlated with the PMEPS scores. The dependent measures of the SPSAM were co-varied with the Vocabulary subtest and there was a significant group effect for PMEPS. Children who were depressed performed significantly lower than children who were not

depressed. The relationship between the Vocabulary subtest performance and the PMEPS if depression were held constant was not significant. Conversely, the relationship between depression level and PMEPS if the Vocabulary subtest performance were held constant was significant. Children who were identified as depressed scored significantly lower than children who were not depressed on a measure of social comparison and a measure of self-satisfaction from the PMEPS after the three self-ratings of interpersonal problem solving performance were co-varied with the Vocabulary subtest and PMEPS scores. Still, the group means on the self-evaluation did not differ significantly. Therefore, children who were identified as depressed demonstrated that they were lacking in some areas of problem solving and believed their performance on tasks was worse than their peers. Overall, the findings in this study indicated that children who reported more depressed symptoms as assessed by higher scores on the CDI demonstrated some areas of weakness in academic and interpersonal functioning (e.g., social problem solving situations) and had a more negative self-view of their own performance ability than the children who reported low depressive symptoms.

Blechman, McEnroe, Carella, and Audette (1986) considered the potential social and academic incompetence in children identified as depressed. It was hypothesized that children who were less socially or academically competent would have higher levels of depressive symptoms reported on peer nominated and a self-rating scales. Additionally, it was theorized that levels of depression could potentially distinguish academically skilled from socially skilled children. The final sample of children involved in the study included 169 who were in the third through sixth grade. The dependent variables were

comprised of specific questions from the PNID regarding happiness and depression that the peers who were evaluating the children in the study completed a Modified version of the Child Depression Inventory (MCDI; Kovaks, 1983), and the Perceived Competence Scale for Children (PCSC; Harter, 1982). It should be noted that no children in the depressed group scored above a 19, which is the score used to estimate clinical depression on the MCDI. The two independent variables included academic competence and social competence. Academic competence was measured using each student's performance on a standardized measure of math achievement measured by the SAT or by a teacher-made math test. Peer ratings were used as a measure for social competence. The children who acted as the peers were asked to rate on a five point Likert-type scale (1= not at all, 5= a lot) in terms of how much they liked to play with the children belonging to the depressed and non-depressed groups. Results of this study found significant differences between social and academic competence classification measures indicating that the two were relatively independent. In addition, it was confirmed that the competent group in comparison with the incompetent group scored higher on self-perceived general competence and self-perceived academic competence. No interaction effects for gender or ethnicity were found on the dependent variables. Findings for the peer nominated depression, peer nominated happiness, and self-rated depression scores differed significantly between groups. Thus, the competent group had significantly lower peer nominated and self rated depression scores and higher peer nominated happiness scores. Compared to the incompetent group, the other three groups had significantly lower peer nominated depression scores. The competent and socially skilled groups

when compared to both the incompetent and academically skilled groups had lower peer nominated happiness scores. The hypothesis did support the idea that children who were academically and socially incompetent had higher rates of peer nominated depression. The children who had higher scores on the MCDI were more clinically depressed among the academically and socially incompetent groups than the other three groups. Additionally, academically skilled and socially skilled children differed with respect to peer nominated happiness but not peer nominated depression, and these differences favored the socially skilled. Academically skilled children also viewed themselves as no more depressed than the competent or socially skilled, even though peers considered them no happier than the incompetent group and less happy than the socially skilled group. Though the results of this study did confirm that depression and skill deficiencies were correlated in children, they did not indicate the direction of causal effect that has been found in the adult literature stating that skill or attitude deficits cause depression. Nonetheless, the results from the study do confirm the importance of measuring both academic or cognitive deficits and interpersonal deficits when looking at the correlations seen in children identified with depressive characteristics.

Fauber, Forehand, Long, Burke, and Faust (1987) studied the relationship between child completed CDI scores and indices of their social and cognitive functioning from several different perspectives. Eighty-nine young adolescents, between the ages of 11 and 15 years participated in the study. Adolescents were given the CDI and the PCSC. Teachers and parents filled out the Teacher's Rating Scale of Child's Actual Competence (TRS; Harter, 1982). Mother-adolescent observations were made based on a

videotaped interaction. Both social problem solving skills and positive communication were assessed based on these interactions. The adolescent's most recent report card was used to record a GPA for math, English, science and social studies. This information was used as a measure of cognitive functioning. Results indicated that CDI scores were significantly, but negatively correlated with adolescent, mother, father, and teacher perceptions of the adolescent's social competence as well as with observational ratings of the adolescent's positive communication. CDI scores and observational rating of the adolescent's social problem solving skills were not significant. Objective measures of academic achievement or cognitive variables were significantly and negatively correlated with adolescent, mother, father, and teacher perceptions of the adolescent's actual cognitive competence, as well as with the adolescent's grade point average. As a result of this information, adolescents' self-reported depressive symptoms as indicated on the CDI were associated with both subjective insights and objective measures of their social and cognitive functioning. Adolescents with high CDI scores saw themselves as less competent in both social and cognitive functioning when compared to their peers with lower scores on the CDI. Mothers, fathers, and teachers also perceived adolescents who had higher CDI scores as less competent socially and cognitively than those with lower CDI scores. Objective measures of academic achievement (grades) and subjective measures of adolescents' social behavior (positive communication skills) were negatively correlated with their CDI scores. Relative to previous research, these findings provide evidence for a relationship between adolescents' CDI scores and their social and cognitive competence. The findings do not correspond with the findings of Strauss et al.

(1982) concerning the relationship between academic achievement and scores on the CDI although recent academic grades versus performance on the SAT were used as the measure for academic achievement.

Slotkin, Forehand, Fauber, McCombs, and Long (1988) further examined the relationship between early adolescent and parent completed CDI scores as predictors of social and cognitive functioning. Fauber et al. (1987) did find that young adolescent CDI scores were significantly correlated with the adolescents', parents', and teachers' ratings of the adolescents' level of cognitive functioning as discussed above. In addition, adolescents' CDI scores were inversely related to GPA. Participants included 85 young adolescents, aged 11 to 15 years. The CDI, the Child Depression Inventory-Parent From (CDI-P; Kazdin, Esveldt-Dawson, Sherick, & Colbus, 1985; Kazdin, Colbus, & Rodgers, 1986), and the BDI were used to assess depression in both the adolescents and their mothers. The TRS was used to assess cognitive and social functioning. The Revised Behavior Problem Checklist (RBPS; Quay & Peterson, 1983) was used to assess social functioning and specifically a Conduct Disorder and/or Anxiety-Withdrawal symptoms. The adolescents' most recent grades from their report cards for math, English, science, and social studies were used and converted into a GPA to also assess cognitive function. Results indicated that the CDI scores completed between the adolescent and mother were significantly correlated. In addition, child and mother completed CDI scores were significantly correlated with most measures of cognitive and social functioning, which included teacher-rated academic competence, GPA, and Anxiety-Withdrawal symptoms. However, the Conduct Disorder score was not significantly correlated. The relationship

between the mothers' BDI scores and the adolescents' CDI scores was significantly correlated suggesting that a mother's perception of her adolescent's depression could be at least partly a function of her own. Hence, both adolescents' and mothers' ratings of adolescent depressive symptomatology were related to aspects of their social and cognitive function.

Cole (1990) examined the relationship between depressive symptoms and social and academic competence to review whether significant correlations existed between ratings of depression, academic competence, and social competence documented in the earlier literature (Fauber et al., 1987; Jacobsen, Lahey, & Strauss, 1983; Lefkowitz & Tesiny, 1985; Leon et al., 1980; Slotkin et al., 1988, & Tesiny et al., 1980) could be confirmed. Participants included 750 fourth grade students from 22 public elementary schools. The instruments used included the following: CDI, the Children's Loneliness Questionnaire (CLQ; Asher, Hymel, & Renshaw, 1984), Harter's Self-Perception Profile for Children (SPPC; Harter, 1985), the PNID, and the TRS. Researchers found that females were regarded as significantly more competent than males on peer and teacher ratings. Males manifested significantly higher scores on self and teacher rated academic competence as compared to females indicating that the males overestimated their academic competence in relation to how teachers rated it. The correlation between CDI scores and self and teacher reported discrepancies was significant suggesting that children who underestimated their academic competence in relation to their teachers' ratings were more apt to report depressive symptoms. No significant differences were found between CDI scores and self and peer reported discrepancies. Thus, depressive

symptoms were strongly correlated with social and academic competence, which seemed to have a cumulative effect on symptoms of depression. Consequently, children who are relatively incompetent in both the social and academic domains may be at particular risk for depression as negative self-perceptions put a child at risk for low self-esteem and possible depression symptomatology.

Cole, Martin, Powers, and Truglio (1996) conducted a confirmatory factor analysis and structural equation model looking at the correlation between dimensions of depression and social competence and dimensions of depression and academic competence as there have been many methodological problems when attempting to attain empirical support for these potential relationships. Both Strauss et al. (1982) and Fauber et al. (1987) considered that academic deficits as related to motivational, cognitive, and attentional problems were often symptomatic of depression and could lead to weaker school performance, lower grades, poor teacher ratings, and potentially lower achievement test scores in children identified as depressed when compared to peers identified as not depressed. Participants for the first part of the study done in the fall semester were comprised of 1,011 elementary school children, and there were 945 of these students who participated in the second part of the study done in the subsequent spring semester. The sample was comprised of third and sixth graders with ethnically heterogeneous backgrounds. Children who were in a self-contained special education classroom or who had poor reading or attentional skills were excluded from the study. Depressive symptoms were obtained by using the CDI, which both the child and parents filled out, the PNID, and the Teacher's Rating Index of Depression (TRID; Cole, 1995).

Academic competency and social competency were determined using the SPPC, the Peer Nominations Measure of Competence (PNMC; Cole, 1990, 1991; Cole & White, 1993), and the TRS. Results were computed for four groups of children based on whether or not they had any missing parent data. Thus, there were two groups of children in the third and sixth grade with complete data and then two groups of children in the third and sixth grade with missing parent data. Major findings that came out of confirmatory factor analysis and structural equation model revealed greater evidence of convergent and discriminatory validity of the measures used to assess depression, social, and academic competence than had been obvious in prior studies. Depression correlated highly with academic competence in both the fall and spring semesters. However, the correlation between depression and social competence was stronger, especially in sixth graders. Additionally, in the sixth grade sample of children there was evidence consistent with a social competence deficit model of child depression. The factor structure representing underlying constructs were found to be stable over a six-month period. No evidence was found to support either an academic competence deficit model or a model in which depressive symptomatology diminished social or academic competence. Thus, regarding academic deficits it could be speculated that the motivational, cognitive, and attentional problems, so often symptomatic of depression, lead to diminished school performance, lower grades, poorer teacher evaluations, and possibly lower achievement test scores in students who are identified as depressed rather than those attained by students who are not depressed.

Edelsohn, Ialongo, Werthamer-Larsson, Crockett, and Kellam (1992) investigated the meaning of depressive symptomatology in early elementary school children from diverse backgrounds. It was proposed that the diverse context from which children come might lead to a variation in their cognitive developmental course, which in turn might influence a child's vulnerability to depressive experiences. Participants were first grade children from several public schools, ranging in age from five to nine years. There were 677 children who had complete data. However, 945 children had data on at least four of the seven variables and 861 children had data on five of the seven variables. Children who were receiving special education services or who were in gifted classroom were excluded from the study. The CDI was used to measure symptoms of depression. The Teacher Observation of Classroom Adaptation-Revised (TOCA-R; Werthamer-Larrson, Kellam, & Wheeler, 1991) was used to determine the child's adaptation to classroom demands. The Peer Assessment Instrument (PAI) a modified version of the Revised-Pupil Evaluation Inventory (R-PEI; Pekarik, Prinz, Leibert, Weintraub, & Neale, 1976) assessed the behaviors of children surrounded by their peers in the classroom. The CAT Form E and CAT Form F, standardized achievement batteries, were used to determine abilities in verbal domains such as reading, spelling and language and quantitative topics including computation, concepts and application. The findings indicated that depressive symptoms in children appeared to be moderately related to developmental tasks like academic achievement, peer relations, and attention/concentration in the classroom. Thus, a child's ability to negotiate developmental demands academically in the classroom and socially with peers appeared

integrally connected to his or her psychological well being. Children's reports of depressive symptomatology were relatively stable from the fall to spring of first grade over a two week and 4 month interval and the relationship between depressive symptoms and the various indices of social and academic functioning remained stable over the four month test interval arguing against the idea that the relationship between self-reported depressive symptoms and academic and social functioning were artifactual or a temporary phenomenon.

Ialongo, Edelsohn, Werthmaer-Larsson, Crockett, and Kellam (1996) considered the extent to which cognitive and social impairment are related to anxious symptoms alone and depressive symptoms alone. The findings of Edelsohn et al. (1992) described above suggested that depressive symptoms could be associated with impairments in areas of social and academic functioning. Participants in this study were the same as reported in Edelsohn et al. (1992). The instruments used to assess the children were also the same with the exception of one new measure, the Revised Children's Anxiety Scale (RCMAS; Reynolds & Richmond, 1985), which was used to measure symptoms of anxiety. Thus, the other measures included the CDI, the TOCA-R, the PAI, and the CAT Form E and CAT Form F. Results from this study were based on the largest number of participants available for the particular analysis being done. Children were classified into groups and labeled: anxious or depressed, anxious alone, depressed alone, or with co-morbid anxiety and depression. Males identified as anxious alone or depressed alone showed significantly greater impairment across a variety of areas in both social and cognitive functioning than males who were not identified as anxious or depressed.

Anxious and depressive symptoms alone in females were not associated with a wide range of social or cognitive impairments. Only modest support was found for depressive symptoms alone in males being more significant than anxious symptoms alone in social and cognitive impairment. Males who exhibited both anxious symptoms and depressed symptoms were three times more likely to have the lowest scores on the achievement tests. Additionally, males who exhibited co-morbidity with anxious and depressed symptoms were twice as likely as anxious males alone to be in the upper quartile of concentration problems. Females with co-morbidity symptoms exhibited a significant association with greater cognitive and social impairment in achievement and shy behaviors. Females with depressive symptoms alone showed significant impairment in teacher rated concentration problems. Interestingly, these results were different than what Lefkowitz and Tesiny (1985) found, reporting females showing a greater relationship between depressive symptoms and social and cognitive functioning as compared to their male counterparts.

Ialongo, Edelsohn, and Kellam (2001) wanted to expand on their previous research regarding first graders' reports of depressed mood to a larger set of social adaptability and mental health outcomes. More specifically, the aim was to see to what degree children's reports of depressed mood and feeling in first grade were predictors of their subsequent adaptive and academic functioning. The participants were the same as reported in Edelsohn et al. (1992) and Ialongo et al. (1996). Instruments that were used to assess the children's depressive symptoms included the CDI, the Mood and Feelings Questionnaire- Parent Short Form (MFQ-PS; Angold, Costello, Pickels, Winder, &

Silver, 1987), and the Composite International Diagnostic Interview (CIDI-UM; Kessler et al., 1994). To obtain the results for this study, the researchers looked at the first grade self reports of depressed mood to see if they had predicted parent report of child mental health services for depressed mood and feelings or teacher reports of the need for the child to receive mental health services for behavioral and emotional problems based on their perception, which the parents and teachers reported on when the children were in the fourth and sixth grade. The power of children's self reports versus parent reports was contrasted. Additionally, suicidal ideation and a potential MDD were assessed when the children were 14 years of age. Reviewing the school records from the first grade, special education records, GPA from the sixth grade, and the CAT Form E and CAT Form F assessed academic functioning. Results were looked at across first, fourth, sixth, and eighth grade. Statistically significant findings for males and females were different. For males the following were significant relating to first grade self-reports of depressed mood: an increase in the odds of an episode of MDD (within the last year), a report of suicidal ideation, receiving mental health services on the basis of parent reports, being perceived by sixth grade teacher that they needed mental health services, and experiencing five or more depressive symptoms during a two week period of time in the fourth grade according to the parent report on the MFQ. However, for females no significant relationship was found between females' reports of depressed mood in first grade and parent report of needing mental health services or sixth grade teacher report of needing mental health services. Regarding academic performance, a statistically significant relationship was found between first grade males and females and depressed

mood on each of the academic outcomes, excluding grade retention in females. When looking at males' academic outcomes, there was a significant relationship found between parent perceptions of child mood and sixth grade GPA, the receipt of special education services, and having been evaluated for special education services. No significant academic outcomes were generated for females. Parent perceptions of a child's depressed mood in fourth grade and a diagnosis of MDD or suicidal ideation in eighth grade were not significant for males but they were for females. Parent report of a child's mood significantly predicted males' mental health service use and teacher's perceptions of the child's need for this type of service, but again not females. These findings did not necessarily suggest a causal relationship between a depressed mood in first grade and later mental health and academic problems as the results might simply reflect the idea that children who are not able to meet the expectations of first grade are likely to experience emotional distress as a result. Nevertheless, these early academic failures may set the stage for subsequent failures and, thus, increased punishment and reductions in reinforcement from parents, teachers, and peers.

(f) Summary of literature review

The studies reviewed address associations between depressive symptomatology and cognitive, academic achievement, and affective measures from a variety of perspectives. However, the conclusions emerging from the findings of many studies should be considered with caution. There were some methodological concerns with regard to the generalizability of the findings about the relationship between depressive symptomatology and cognitive and academic measures. For example, it is evident that

several studies lacked specific criteria for diagnosing and operationally defining depression in children and adolescents and simply relied on criteria established for diagnosing depression in adults. Valid and reliable measures of depression in children or adolescents need to be consistently applied in order to draw reliable conclusions regarding the impact of the diagnosis.

Similarly, the studies reviewed employed a wide variety of cognitive measures and the variability among these different instruments in regards to specificity and sensitivity is not well addressed in the articles. In several studies, children who had a negative perception of their own abilities on depressive measures and thus a poor self-concept did not do as well on certain cognitive tasks, indicating a possible relationship between depressed "mood" and self-esteem. Many studies have found a significant relationship between "behaviors" associated with depressive symptoms and weaker cognitive performance, but failed to establish a similar significant link with the subjects' overall general intelligence. In other studies, diagnostic concerns with respect to situational specificity of the marked behavior patterns in children and adolescents with depressive symptoms were not distinctively addressed.

The research has associated depressive symptoms with low self-perception of academic ability and social skills. Thus, lower self-esteem, one major effect of depression may be what is causally linked to reduced academic achievement rather than depression itself. Several of the studies attempted to identify neurobiological factors associated with depression and cognitive function and this is an area that requires further research.

Overall, the literature does suggest that depression symptoms appear to have considerable predictive power with respect to cognitive functioning, academic performance, and overall psychological well-being; however, the inability of researchers to firmly establish a causal relationship between depression and weak cognitive functioning and poor academic achievement in children of normal intelligence suggests that the explanations are more complex and varied than assumed.

CHAPTER 3

METHOD

Consistent with the overall purpose of the study, this chapter is devoted to a presentation of the basic research hypotheses, sample size and sample characteristics, procedures, instruments used for collecting data, and statistical analyses to examine the variability of the proposed hypotheses.

The following null hypotheses were tested using 0.05 alpha levels:

1. Hypothesis I: Subjects obtaining a clinically significant T score above or equal to 70 on the Anxious/Depressed clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the Anxious/Depressed clinical scale.

2. Hypothesis II: Subjects obtaining a clinically significant T score above or equal to 70 on the Withdrawn clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the Withdrawn clinical scale.

3. Hypothesis III: Subjects obtaining a borderline clinically significant T score equal to or above 65 on the Anxious/Depressed clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the Anxious/Depressed clinical scale.

4. Hypothesis IV: Subjects obtaining a borderline clinically significant T score equal to or above 65 on the Withdrawn clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the Withdrawn clinical scale.

5. Hypothesis V: Subjects obtaining a T score approaching borderline and clinical significance, above or equal to 60, and the subjects scoring below 60 on the Anxious/Depressed clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures.

6. Hypothesis VI: Subjects obtaining a T score approaching borderline and clinical significance, above or equal to 60, and the subjects scoring below 60 on the Withdrawn clinical scale from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures.

7. Hypothesis VII: Subjects obtaining a T score approaching borderline and clinical significance, above or equal to 60, and the subjects scoring below 60 on both the Anxious/Depressed and Withdrawn clinical scales from the CBCL will not differ significantly in their performance on the selected cognitive and academic measures.

8. Hypothesis VIII: There will be no significant differences among Caucasian and Hispanic subjects in regards to their performance on the selected cognitive and academic measures.

9. Hypothesis IX: There will be no significant differences among those subjects obtaining a T score approaching borderline and clinical significance, above or equal to

60, and the subjects scoring below 60 on the Anxious/Depressed clinical scale from the CBCL in regard to age, ethnicity, gender, or parental education level.

10. Hypothesis X: There will be no significant differences among those subjects obtaining a T score approaching borderline and clinical significance, above or equal to 60, and the subjects scoring below 60 on the Withdrawn clinical scale from the CBCL in regard to age, ethnicity, gender, or parental education level.

11. Hypothesis XI: There will be no significant differences among those subjects obtaining a T test score approaching borderline and clinical significance, above or equal to 60, and the subjects scoring below 60 on both Anxious/Depressed and Withdrawn clinical scale from the CBCL in regard to age, ethnicity, gender, or parental education level.

Subjects

The sample of this study was drawn from a pool of subjects who were part of the Tucson Children's Assessment of Sleep Apnea study (TuCASA), which examined sleep patterns in children aged 6 to 11 years. The study began in 1999 and data were used from children recruited during the 1999-2000, 2000-2001, 2001-2002, 2002-2003 school years. All participants were recruited from a large school district in Southern Arizona, which has a population that fairly represents school-age children living in Southern Arizona.

A total of 19 schools agreed to take part in the study. The total population of children in the schools was 7,055. A questionnaire screening form was mailed out to the parents of all the children attending the district's 19 selected schools. Parents of the children in the participating schools were asked to complete a 15 item screening

questionnaire inquiring about symptoms indicating sleep problems attributable to breathing difficulties during sleep. The number of questionnaires returned was 2,327 (33 % response rate). The total number of parents who agreed to be contacted on the returned questionnaires was 1,219 or 52.4%. The ethnicity of the parents agreeing to be contacted was 51% Caucasian and the remaining 49% were Hispanic, "Other," or of "Mixed" ethnic background.

Parents who returned the questionnaires and indicated that they were interested in participating in the study were then contacted by phone and were asked about their child's medical history to see if the child qualified for the study. Children who had the following were excluded from the study: tonsillectomy, had a history of asthma or other respiratory disorders, a head injury with loss of consciousness, other major medical conditions, attention or other significant behavior disorders, learning disabilities or disorders (including mental retardation), regularly took any type of medication and/or had taken medications on the day of the evaluation, or they were physically ill the day of the evaluation.

Parent consent and child assent were obtained prior to participation. After taking all of the exclusionary variables into account the total number of individuals who qualified for having a sleep study was 503 and this breakdown was 58% Caucasian, 42% Hispanic as there were no "Other" or "Mixed" ethnic backgrounds included in this total number. The sample had relatively equal numbers of males and females. The final number of subjects comprising the sample consisted of 480 children, because 23 children were excluded for a variety of reasons relevant to the sleep study being conducted.

Of these 480 children, a total of 137 children were excluded from the cognitive and behavioral analyses. Ninety-two of the 137 children were excluded because their parents did not follow through with setting up an appointment for their child to complete the cognitive and academic achievement evaluation, the parents did not complete the behavioral function questionnaire, or the children did not speak English and since cognitive and academic evaluation measures were only valid for English speakers they were not able to participate. Forty-five of the 137 children were excluded from the cognitive testing and behavioral analysis for the reason that despite the initial parent report regarding their child's medical history, the children did meet the exclusionary criteria of having undergone a tonsillectomy, had a history of asthma or other respiratory disorders, a head injury with loss of consciousness, other major medical conditions, attention or other significant behavior disorders, learning disabilities or disorders (including mental retardation), regularly took any type of medication and/or had taken medications on the day of the evaluation, or they were physically ill the day of the evaluation. Thus, the final number of participants in the study for whom sleep, cognitive, academic, and behavioral function data was collected was 343.

Of these participants, the gender break down was 174 (50.7%) females and 169 (49.3%) males. The ethnicity breakdown was 215 (45.4%) Caucasian children and 128 (38.1%) Hispanic children. There were 161 (46.9%) children who were aged 6 to 8 years and 182 (53.1%) of the children were aged 9 to 11 years. Seven children or <1% had parents with less than an eighth grade education level. There were 117 (34%) children who had parents that had 9 to 12 years of education. There were 219 (63.8%) children

who had parents that had 13 to 24 years of education. The characteristics of the sample used for the study is summarized in the following table.

Table 1

Characteristics of Sampled Subjects

	Total Sample Size (N) = 343	
Sample Characteristics	N	%
Gender		
Boys	169	49.3
Girls	174	50.7
Ethnicity		
Caucasian	215	45.4
Hispanic	128	38.1
Age Category		
6-8 years old	161	46.9
9-11 years old	182	53.1
Parent Education		
8 years or less	7	0.02
9-12 years	117	34.1
13-24 years	219	63.8

Materials

Global intellectual function was assessed by use of the Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999), a brief and reliable measure of intelligence, which provided a Full Scale IQ, Verbal IQ, and Performance IQ for each child. The average reliability of WASI subtests obtained from the norming sample ranged from 0.87 to 0.92. For VIQ, PIQ, FSIQ-4, and FSIQ-2 the average reliability coefficients of the 11 age groups for the WASI were 0.93, 0.94, 0.96, and 0.93, respectively. The

WASI correlates significantly with the subtests of the Wechsler Intelligence Scale for Children-Third Edition (WISC-III; Wechsler, 1991) as indicated by correlation coefficients of 0.72, 0.69, 0.74, 0.82, 0.76, and 0.87 for Vocabulary, Similarities, Block Design, VIQ, PIQ, and FSIQ-4, respectively (Wechsler, 1999), suggesting that the WASI is a reliable measure to use for evaluating general intellectual ability of children.

Language was evaluated with Vocabulary from the WASI, a task requiring the subject to provide verbal definitions of words (Wechsler, 1999). WASI Vocabulary performance is expressed as a T score with a mean of 50 and a standard deviation of 10, and a higher score indicates better performance. This evaluation measure has a significantly high degree of reliability and correlates significantly with the subtests of the WISC-III.

Attention and processing speed were evaluated with Digit Span, Coding, and Symbol Search from the Wechsler Intelligence Scale for Children-Third Edition (WISC-III, Wechsler, 1991). These tasks assess forward and backward digit repetition, psychomotor speed, and scanning speed and accuracy, respectively. The respective reliability coefficients for these subtests are as follows: Digit Span 0.85, Coding 0.79, and Symbol Search 0.76. The respective reliability ranges for 6 to 16 years of age for Digit Span, Coding, and Symbol Search were respectively, 0.79-0.91, 0.70-0.90, and 0.69-0.82. The Processing Speed factor score reliability range for ages 6 to16 years of age was 0.80-0.91 with the average being equal to 0.85 (WISC-III, Wechsler, 1991).

Executive function was evaluated with five measures that require attention and higher order problem solving. Similarities and Matrix Reasoning from the WASI were

administered and also used to obtain IQ scores (Wechsler, 1999). These measures require super-ordinate concept formation and the completion of visuospatial patterns, respectively. Dependent measures were T scores, which have a mean of 50 and a standard deviation of 10, with higher scores indicating better performance. Trail Making Part A and Trail Making Part B (Reitan & Wolfson, 1993), measures requiring conceptual tracking and rapid set-shifting ability by connecting consecutive numbers and consecutive numbers and letters in an alternating sequence, respectively, were also completed. Raw scores for each of these were converted to age corrected *z* scores, which have a mean of 0 and standard deviation of 1, and a lower score indicates faster completion time. Reported reliabilities for Trail Making Part-A and Trail Making Part-B were reported at 0.98 and 0.67, respectively (Spreen & Strauss, 1998). Animal Fluency from the Controlled Oral Word Association (COWAT; Benton & des Hamsher, 1989), a semantic fluency task in which children were asked to name as many animals as possible in a minute was also administered. Raw scores for this measure are also converted to age corrected *z* scores with a mean of 0 and standard deviation of 1, but on this measure a higher score indicates more animals named (Spreen & Strauss, 1998).

Visual motor/visual spatial skills were evaluated with Block Design from the WASI, a task requiring reproduction of designs with colored blocks (Wechsler, 1999). WASI Block Design performance is expressed as a T score, which has a mean of 50 and a standard deviation of 10, and a higher score indicates better performance. As mentioned this evaluation measure has a significantly high degree of reliability and correlates significantly with the subtests of the WISC-III.

Psychomotor speed and coordination were assessed with the Purdue Pegboard (Tiffin, 1968). This task assesses the ability to quickly place pegs into round holes with the dominant hand, non-dominant hand, and both hands simultaneously. Raw scores are transformed to age corrected *z* scores that have a mean of 0 and standard deviation of 1. A lower score indicates faster performance. The reliability coefficients of this test increase as the number of trials increases with single test reliability ranging from 0.63 to .82 (Tiffin, 1968). The triple test reliability, corrected for by the Spearman Brown formula, ranges from 0.82 to 0.91 (Tiffin, 1968).

Learning and memory were evaluated with the Children's Auditory Verbal Learning Test-2 (CAVLT-2; Talley, 1993). This multi-trial word list learning task provides standard scores with a mean of 100 and standard deviation of 15 for each of the 5 learning trials, an interference trial following the learning trials, during which a second, distracter word list is presented, and immediate and delayed recall of the original list. Additionally, standard scores for learning across trials (Level of Learning), learning of the distracter list (Interference trial), and free recall following both short and long delays of the two list presentations were calculated (Immediate Recall and Delayed Recall trials, respectively). On the aforementioned measures, higher standard scores indicate better recall. Raw scores for recognition accuracy and intrusions were also obtained. A higher recognition score indicates a greater number of items correctly identified on a recognition test. A lower number of intrusions indicate fewer errors (false positive identifications) on the test. Since the CAVLT-2 has a free recall format and serial administration of the learning list, generalizability theory was used to provide the generalizability coefficients

for this particular evaluation (Talley, 1993). Using this theory, this evaluation method has generalizability coefficients ranging from 0.56 to 0.82 for the Learning Trial scores and 0.62 to 0.88 for the Summary Scale scores; these coefficients, though they might appear low, actually are significant given the nature of the generalizability theory (Talley, 1993).

Academic achievement was assessed by the use of three subtests from the Woodcock-Johnson Psycho-Educational Battery-Revised Tests of Achievement (WJ-R; Woodcock & Johnson, 1989, 1990). Measures of basic reading, math problem solving, and spelling/early writing skills were obtained using the Letter-Word Identification, Applied Problems, and Dictation subtests, respectively. A Skills Cluster Score, a composite reflecting performance on all three measures was then derived. Each has a mean of 100 and standard deviation of 15, and higher scores reflect better performance. Letter-Word Identification assesses the ability to form picture-word relationships, identify letters, and read single words. Applied Problems assesses skill in analyzing and solving practical mathematics problems presented visually or verbally. Dictation requires the ability to use and control a pencil, write letters and spell words. In older children, it assesses knowledge of punctuation, capitalization, and word usage. The reliability of this evaluation technique for the aforementioned subtests is shown in the following: Using the split-half procedure, the respective reliability coefficients for the Measure of Letter-Word Identification subtest, the Applied Problems subtest and the Dictation subtest are respectively, 0.92, 0.91, and 0.92. The respective reliability ranges for 2 to18 years of age for the measure of Letter-Word Identification subtest, the Applied Problems subtest

and the Dictation subtest are respectively, 0.88-0.96, 0.84-0.93, and 0.83-0.94 (Woodcock & Johnson, 1989, 1990).

Behavioral function was evaluated with a parent report questionnaire, the Child Behavior Checklist for Ages 4-18 (CBCL; Achenbach, 1991). The CBCL is a standardized parent report measure of psychosocial function. Reliability coefficients are measured in terms of intraclass correlation coefficients (ICCs). The CBCL has ICCs ranging from 0.927 to 0.959 for the 20 competence items and 118 specific problem items, respectively ($p<.001$) (CBCL; Achenbach, 1991). Furthermore, this evaluation method has an ICC for test-retest reliability of 0.996 for the 20 competence items and 0.952 for the 118 specific problem items (both $p<.001$) (CBCL; Achenbach, 1991). This measure provides T scores with a mean of 50 and standard deviation of 10 for a child's overall competence in Activities, Social function, and School; eight Clinical Scales; and composite T scores for Internalizing and Externalizing behaviors and the Total Score on the checklist. The Clinical Scales are Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, and Aggressive Behavior. The Internalizing T score reflects parent report on the Withdrawn, Somatic Complaints, and Anxious/Depressed clinical scales. The Externalizing T score reflects parent report on the Delinquent Behavior, and Aggressive Behavior Scales. For the Activities, Social function, and School T scores, a higher score indicates higher competence. On the other scales higher scores indicate possible clinical concerns.

Design and Procedure

Cognitive evaluations were conducted in the Pediatric Neuropsychology Clinic at the University of Arizona Health Sciences Center. Parents were contacted with a telephone call regarding their child's availability for a cognitive evaluation. After parents agreed, an appointment was scheduled within several weeks of the polysomnogram (PSG) for the child to have the cognitive evaluation and for the parents to complete a behavioral function questionnaire.

The cognitive evaluation consisted of several tests completed in a fixed order that included the following: CAVLT-2, WASI, WISC-III, WJ-R, Trail Making Tests Parts A and B, Animal Fluency, and Purdue Pegboard. The comprehensive battery of tests was administered to each child and scored according to standardized instructions by a neuropsychology postdoctoral fellow, one other graduate student, and this investigator. The tests chosen were designed to assess global intellectual function, language skills, attention and processing speed, executive function skills, visual motor skills, psychomotor speed and coordination, learning and memory, and academic achievement. These specific measures used to evaluate function in each of these domains were described above. Results obtained from the cognitive evaluation were compared to published norms for each of the tests used. The total administration time took approximately three hours.

A parent or guardian completed a paper and pencil measure, the CBCL, a behavioral function questionnaire, while their child was participating in the evaluation. Parents also completed a general information form in order to obtain demographic data

on parent's education level and ethnic background, and child's educational, psychological, and medical history. The child or the child's parent was given $25.00 for participation and parking fees were paid. Feedback regarding the findings of the cognitive evaluation was summarized in a letter sent to the parents. If the parents had any questions regarding the findings they were encouraged to call the Pediatric Neuropsychology Clinic at the University of Arizona Health Sciences Center.

Consistent with the hypotheses stated above three sets of statistical analyses were performed. Statistical tests were performed using Intercooled Stata, version 9.0 for Windows and SPSS 15.0 for Windows. A significance alpha level of 0.05 was used for all statistical tests.

One of the analyses was Pearson Product Moment Correlation Coefficient, a measurement of the degree of scatter, which were used to indicate the relationship between the CBCL selected clinical scales, Anxious/Depressed and Withdrawn, and overall cognitive and achievement measures. The objective of this analysis was to investigate the nature of the relationship between independent and dependent variables by examining the significance of co-variation of two sets of scores.

The second set of analyses consisted of analysis of data by use of T test procedures in which equal variances were assumed. The purpose of this study was to examine the existence of statistically significant differences between subjects who obtained scores that were approaching clinical significance ($\leq$60, $\leq$65, and $\leq$70) on the Anxious/Depressed and Withdrawn clinical scales of the CBCL as compared to their counterparts who scored below these values.

Finally, a set of chi-square analyses were performed to determine whether observed performance patterns of sample subjects in terms of gender, age, ethnicity, and parent education level between the groups were statistically significant. With regard to these background variables a 2×2 contingency chi-square analyses were performed and as stated above an alpha level of 0.05 was used to test the hypotheses with regard to the determination of differences in performance patterns on the Anxious/Depressed and Withdrawn clinical scales from the CBCL for subjects differing in gender, age, ethnicity, and parent education level.

CHAPTER 4

RESULTS

This chapter examines each of the hypotheses tested and catalogs the results, pointing out where statistically significant correlations and differences on cognitive and academic achievement measures were found in relation to increasing anxious/depressed, withdrawn, or both anxious/depressed and withdrawn symptoms on the clinical scales of the CBCL.

In accord with the overall focus of this study, the relationship between depressive symptomatology and measures of cognitive and academic achievement indicators was explored. The analysis of this relationship in terms of cognitive and academic measures revealed that there was a significant negative correlation as indicated by the correlation coefficient among certain components of global intellectual function as assessed by the WASI for both anxious/depressed and withdrawn symptoms on the CBCL. Specifically, WASI FSIQ was significantly correlated with anxious/depressed ($\underline{r} = -0.12$, $r^2 = 0.01$, $p = 0.03$) and withdrawn ($\underline{r} = -0.15$, $r^2 = 0.02$, $p = 0.01$) symptomatology in a negative direction. Anxious/depressed symptoms were significantly correlated with WASI Performance IQ ($\underline{r} = -0.12$, $r^2 = 0.01$, $p = 0.03$) in a negative direction. Withdrawn symptoms were significantly correlated with WASI Verbal IQ ($\underline{r} = -0.17$, $r^2 = 0.03$, $p = 0.01$) in a negative direction. There were no significant findings between anxious/depressed symptoms and WASI Verbal IQ nor were there significant findings between withdrawn symptoms and WASI Performance IQ.

The results from the analysis found a significant negative correlation between withdrawn symptoms and language as assessed by the Vocabulary ($\underline{r}$ = -0.20, r^2 = 0.04, p = 0.00) subtest of the WASI. However, there was not a significant relationship found between anxious/depressed symptoms and language.

There was a significant correlation found between anxious/depressed and withdrawn symptoms and certain attention and processing speed measures. Both the Digit Span ($\underline{r}$ = -0.11, r^2 = 0.01, p = 0.04) and Symbol Search ($\underline{r}$ = -0.19, r^2 = 0.04, p = 0.00) subtests from the WISC-III had significant correlations with anxious/depressed symptomatology in the negative direction. However, the Coding subtest from the WISC-III did not significantly correlate with anxious/depressed symptoms. These same measures were significant and negatively correlated for withdrawn symptoms, Digit Span ($\underline{r}$ = -0.11, r^2 = 0.01, p = 0.04) and Symbol Search ($\underline{r}$ = -0.15, r^2 = 0.02, p = 0.01) subtests. Again, the Coding subtest did not have a significant correlation with withdrawn symptomatology.

In the areas of executive function as assessed with the WASI, withdrawn symptomatology was significantly correlated with both Similarities ($\underline{r}$ = -0.13, r^2 = 0.02, p = 0.02) and Matrix Reasoning ($\underline{r}$ = -0.11, r^2 = 0.01, p = 0.04) in a negative direction. For anxious/depressed symptoms, a significant negative correlation was found with Matrix Reasoning ($\underline{r}$ = -0.12, r^2 = 0.02, p = 0.03), but not Similarities. There were no significant correlations found between anxious/depressed and executive function skills as assessed with verbal fluency (Animal Fluency) and Trail Making Part A. However, there was a significant negative correlation found between anxious/depressed symptoms and Trail

Making Part B ($\underline{r}$ = 0.13 r^2 = 0.02, p = 0.02). There were no significant relationships found between withdrawn symptomatology and these executive function measures.

No significant findings were found between anxious/depressed and withdrawn symptoms and visual spatial/visual motor skills as assessed with the Block Design subtest from the WASI.

There was a significant negative correlation found between anxious/depressed symptoms and psychomotor and coordination skills with the dominant hand on the Purdue Pegboard ($\underline{r}$ = -0.18, r^2 = 0.03, p = 0.00). This significant negative correlation was also found with withdrawn symptoms and the dominant hand on the Purdue Pegboard ($\underline{r}$ = -0.11, r^2 = 0.01, p = 0.04). There were no other significant findings between anxious/depressed and withdrawn symptoms and motor skills.

On the learning and memory measure, the CAVLT-2, no significant correlations were found with anxious/depressed or withdrawn symptoms.

Table 2

Correlations Between Clinically Significant Anxious/Depressed and Withdrawn Symptoms and Selected Cognitive Measures

Cognitive Measures	Anxious/Depressed	*p*-value	Withdrawn	*p*-value
WASI FSIQ	-0.12	0.03*	-0.15	0.01**
WASI Verbal IQ	-0.09	0.109	-0.17	0.00**
WASI Performance IQ	-0.12	0.03*	-0.08	0.15
WASI Vocabulary	-0.10	0.06	-0.20	0.00**
WASI Similarities	-0.08	0.16	-0.13	0.02*

WASI Block Design	-0.09	0.09	-0.03	0.57
WASI Matrix Reasoning	-0.12	0.03*	-0.11	0.04*
WISC-III Coding	-0.01	0.92	-0.08	0.14
WISC-III Symbol Search	-0.19	0.00**	-0.15	0.01**
WISC-III Digit Span	-0.11	0.04*	-0.11	0.04*
Animal Fluency	0.10	0.06	0.00	0.95
Trail Making Part-A	-0.05	0.33	-0.06	0.32
Trail Making Part-B	-0.13	0.02*	-0.06	0.25
Purdue Pegboard Dominant	-0.18	0.00**	-0.11	0.04*
Purdue Pegboard Non-dominant	-0.09	0.10	-0.01	0.86
Purdue Pegboard Both	-0.03	0.62	-0.05	0.33
CAVLT-2 Level of Learning	-0.04	0.44	-0.09	0.12
CAVLT-2 Interference	-0.08	0.15	-0.10	0.06
CAVLT-2 Immediate Recall	0.00	0.97	-0.04	0.44
CAVLT-2 Delayed Recall	-0.06	0.32	-0.07	0.19

p-value * = < 0.05, ** = < 0.01

On measures of academic achievement there was a significant relationship found between anxious/depressed symptoms and basic math problem solving skills as assessed with the Applied Problems ($\underline{r} = -0.17$, $r^2 = 0.03$, $p = 0.00$) subtest from the WJ-R. This significant relationship was also found between withdrawn symptoms and the Applied Problems ($\underline{r} = -0.17$, $r^2 = 0.03$, $p = 0.00$) subtest. There were no other significant relationships found between anxious/depressed and withdrawn symptoms in other

academic achievement skill areas (Letter-Word Identification and Dictation, respectively).

Table 3

Correlations Between Clinically Significant Anxious/Depressed and Withdrawn Symptoms and Selected Academic Achievement Measures

Academic Measures	Anxious/Depressed	*p*-value	Withdrawn	*p*-value
WJ-R Letter-Word Identification	-0.06	0.26	-0.07	0.19
WJ-R Applied Problems	-0.17	0.00**	-0.17	0.00**
WJ-R Dictation	-0.10	0.08	-0.07	0.18

p-value * = < 0.05, ** = < 0.01

Results Associated with Hypothesis 1

There were 16 (4.7 %) of subjects who had a clinically significant T score above or equal to 70 on the Anxious/Depressed clinical scale of the CBCL. Only one significant difference was found between subjects obtaining a clinically significant on this clinical scale as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on this clinical scale. Subjects who had a clinically significant T score had a significantly lower performance with the dominant hand ($p = 0.04$) on a psychomotor speed and coordination task, the Purdue Pegboard, than those matched subjects who scored below 60 on the Anxious/Depressed clinical scale. Thus, the null hypothesis with respect to this cognitive variable was rejected. There were no significant differences found with the non-dominant hand or both hands in psychomotor speed and coordination skills. The results

from the analysis found that there were no significant differences among the components of global intellectual function as assessed by the WASI, which included WASI FSIQ, Verbal IQ, and Performance IQ. No significant differences were found in the areas of language (Vocabulary subtest from the WASI), attention and processing speed (Digit Span, Coding, and Symbol Search subtests from the WISC-III), or in visual motor/visual spatial skills (Block Design subtest from the WASI). There were no significant differences found between the two groups in the areas of executive function, which included a verbal fluency task (Animal Fluency), Trail Making Parts A and B, and the Similarities and Matrix Reasoning subtests from the WASI. Performance on the learning and memory measure, the CAVLT-2, was not significant across trials.

Table 4

Mean Differences for Subjects with Clinically Significant Anxious/Depressed Symptoms as Compared to Matched Subjects Showing No Significant Anxious/Depressed Symptoms on Cognitive Measures

Dependent Cognitive Measures	Anxious/Depressed			Matched Non-Anxious/Depressed			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WASI FSIQ	16	101.63	16.94	103.19	10.41	0.31	0.10
WASI Verbal IQ	16	103.13	15.74	103.31	11.85	0.04	0.18
WASI Performance IQ	16	99.50	16.21	102.06	12.02	0.51	0.31
WASI Vocabulary	16	52.31	10.50	50.75	9.56	-0.44	0.60

WASI Similarities	16	51.06	9.48	53.44	6.72	0.82	0.10
WASI Block Design	16	50.69	9.67	52.88	7.29	0.72	0.40
WASI Matrix Reasoning	16	47.63	11.97	49.75	10.73	0.53	0.85
WISC-III Coding	16	10.88	3.10	10.31	2.12	-0.60	0.13
WISC-III Symbol Search	16	10.63	3.26	11.94	2.38	1.30	0.14
WISC-III Digit Span	16	8.56	3.35	9.94	2.82	1.26	0.52
Animal Fluency	16	0.97	1.32	0.82	1.03	-0.36	0.93
Trail Making Part-A	16	0.40	0.83	0.20	1.27	-0.52	0.95
Trail Making Part-B	16	0.15	0.77	0.44	0.97	0.92	0.81
Purdue Pegboard Dominant	16	-1.41	1.36	-0.57	0.80	2.14	0.04*
Purdue Pegboard Non-dominant	16	-1.03	1.26	-0.48	1.01	1.33	0.29
Purdue Pegboard Both	16	-0.76	1.12	-0.67	1.30	0.21	0.81

CAVLT-2 Level of Learning	16	102.81	13.02	106.69	18.45	0.69	0.24
CAVLT-2 Interference	16	96.88	20.56	93.06	13.24	-0.62	0.07
CAVLT-2 Immediate Recall	16	103.69	11.03	109.00	13.88	1.20	0.65
CAVLT-2 Delayed Recall	16	100.94	13.43	104.31	17.85	0.60	0.59

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

There were no significant differences found between these two groups on academic achievement measures assessing basic reading, math problem solving, and spelling/early writing skills (Letter-Word Identification, Applied Problems, and Dictation, respectively).

Table 5

Mean Differences for Subjects with Clinically Significant Anxious/Depressed Symptoms as Compared to Matched Subjects Showing No Significant Anxious/Depressed Symptoms on Academic Achievement Measures

Dependent Academic Measures	Anxious/Depressed			Matched Non-Anxious/Depressed			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	16	99.00	14.04	102.00	14.80	0.59	0.62
WJ-R Applied Problems	16	104.75	17.04	105.94	12.76	0.22	0.32

WJ-R Dictation	16	93.13	10.18	94.63	12.41	0.37	0.22

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 2

There were only 8 (2.3%) subjects who had a clinically significant T score above or equal to 70 on the Withdrawn clinical scale of the CBCL. No significant differences were found between subjects obtaining a clinically significant T score on this clinical scale as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the same scale. Thus, subjects who had a clinically significant T score on the Withdrawn clinical scale did not perform significantly worse on any of the cognitive measures when compared to their matched peers. The results from the analysis found that there were no significant differences among the components of global intellectual function as assessed by the WASI, which included WASI FSIQ, Verbal IQ, and Performance IQ. No significant differences were found in the areas of language (Vocabulary subtest from the WASI), visual motor/visual spatial skills (Block Design subtest from the WASI), attention and processing speed measures (Digit Span, Coding, and Symbol Search subtests from the WISC-III), or on psychomotor speed and coordination tasks (Purdue Pegboard). There were also no significant differences found between the two groups in the areas of executive function, which included verbal fluency (Animal Fluency), Trail Making Parts A and B, and the Similarities and Matrix Reasoning subtests from the WASI. Performances on the learning and memory measure, the CAVLT-2, were not significant across trials.

Table 6

Mean Differences for Subjects with Clinically Significant Withdrawn Symptoms as Compared to Matched Subjects Showing No Significant Withdrawn Symptoms on Cognitive Measures

Dependent Cognitive Measures		Withdrawn		Matched Non-Withdrawn			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WASI FSIQ	8	103.38	14.42	108.13	12.52	0.70	0.64
WASI Verbal IQ	8	102.75	16.77	111.38	13.27	1.14	0.63
WASI Performance IQ	8	103.63	14.07	103.00	9.49	-0.10	0.59
WASI Vocabulary	8	51.13	10.51	54.25	9.07	0.64	0.66
WASI Similarities	8	51.75	9.44	59.38	7.95	1.75	0.78
WASI Block Design	8	52.13	8.99	53.38	7.87	0.30	0.85
WASI Matrix Reasoning	8	52.00	11.10	50.88	6.60	-0.25	-0.27
WISC-III Coding	8	10.38	2.97	10.50	2.07	0.10	0.62
WISC-III Symbol Search	8	9.63	3.20	12.63	1.92	2.27	0.21
WISC-III Digit Span	8	8.00	2.07	11.25	3.50	2.26	0.15

Animal Fluency	8	0.64	0.83	0.50	0.81	-0.33	0.95
Trail Making Part-A	8	-0.09	0.87	0.87	0.39	3.99	0.70
Trail Making Part-B	8	0.21	0.69	0.62	0.86	1.06	0.79
Purdue Pegboard Dominant	8	-1.30	2.21	-0.57	1.13	0.84	0.25
Purdue Pegboard Non-dominant	8	-1.03	2.31	-0.72	1.06	0.34	0.25
Purdue Pegboard Both	8	-0.96	1.20	-0.48	0.92	0.88	0.20
CAVLT-2 Level of Learning	8	106.88	15.20	99.75	11.15	-1.07	0.94
CAVLT-2 Interference	8	106.13	16.85	91.88	14.16	-1.83	0.37
CAVLT-2 Immediate Recall	8	103.88	14.08	100.25	13.46	-0.53	0.93
CAVLT-2 Delayed Recall	8	102.25	15.23	101.75	13.65	-0.07	0.70

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

There were no significant differences found between these two groups on the measures of academic achievement skills assessing basic reading, math problem solving, and spelling/early writing (Letter-Word Identification, Applied Problems, and Dictation, respectively).

Table 7

Mean Differences for Subjects with Clinically Significant Withdrawn Symptoms as Compared to Matched Subjects Showing No Significant Withdrawn Symptoms on Academic Achievement Measures

Dependent Academic Measures	Withdrawn			Matched Non-Withdrawn			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	8	101.38	14.67	110.75	14.52	1.29	0.69
WJ-R Applied Problems	8	107.38	20.00	112.75	13.44	0.63	0.53
WJ-R Dictation	8	95.13	10.76	100.63	12.36	0.95	0.78

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 3

There were 29 (8.5%) of subjects who had a borderline clinically significant T score of 65 on the Anxious/Depressed clinical scale of the CBCL. Only one significant difference was found between subjects obtaining a T score of 65 on the Anxious/Depressed clinical scale as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the same

scale. Subjects who had a borderline clinically significant T score of 65 on the Anxious/Depressed clinical scale had a significantly lower performance with the non-dominant hand trial on a psychomotor speed and coordination task, the Purdue Pegboard ($p = 0.01$) test, than those matched subjects who scored 60 or below on this scale. Therefore, the null hypothesis with regard to this cognitive variable was rejected. There were no other significant differences found with the dominant hand or both hands on the Purdue Pegboard test. The results reflected no significant differences among the components of global intellectual function as assessed by the WASI, which included WASI FSIQ, Verbal IQ, and Performance IQ. No significant differences were found in the areas of language (Vocabulary subtest from the WASI), attention and processing speed measures (Digit Span, Coding, and Symbol Search subtests from the WISC-III), or in the area of visual motor/visual spatial skills (Block Design subtest from the WASI). There were also no significant differences found in executive function skills as assessed with a verbal fluency task (Animal Fluency), Trail Making Parts A and B, and the Similarities and Matrix Reasoning subtests from the WASI. Performance on the learning and memory measure, the CAVLT-2, was not significant across trials.

Table 8

Mean Differences for Subjects with Borderline Anxious/Depressed Symptoms as Compared to Matched Subjects Showing No Significant Anxious/Depressed Symptoms on Cognitive Measures

Dependent Cognitive Measures	Anxious/Depressed			Matched Non-Anxious/Depressed			
	N	Mean	Standard Deviation (SD)	Mean	SD	*t*-value	*p*-value
WASI FSIQ	29	101.61	14.96	101.66	13.03	0.01	0.57
WASI Verbal IQ	29	103.86	14.73	102.55	12.50	-0.36	0.35
WASI Performance IQ	29	98.82	14.49	100.24	14.03	0.38	0.88
WASI Vocabulary	29	52.04	10.04	51.66	8.69	-0.15	0.50
WASI Similarities	29	52.32	8.74	51.41	8.58	-0.40	0.55
WASI Block Design	29	49.93	9.37	50.93	9.94	0.39	0.72
WASI Matrix Reasoning	29	48.00	11.44	49.00	10.14	0.35	0.73
WISC-III Coding	29	10.64	2.83	10.00	3.15	-0.81	0.62
WISC-III Symbol Search	29	11.21	3.30	11.76	3.35	0.62	0.53

WISC-III Digit Span	29	9.07	3.23	9.45	3.14	0.45	0.69
Animal Fluency	29	3.38	12.58	0.69	1.10	-1.15	0.08
Trail Making Part-A	29	0.36	1.05	0.10	1.56	-0.72	0.44
Trail Making Part-B	29	0.07	0.77	0.30	1.08	0.90	0.61
Purdue Pegboard Dominant	29	-1.27	1.22	-0.88	1.05	1.29	0.83
Purdue Pegboard Non-dominant	29	-0.95	1.23	-0.73	0.82	0.79	0.01**
Purdue Pegboard Both	29	-0.73	1.04	-0.89	1.07	-0.56	0.73
CAVLT-2 Level of Learning	29	105.61	14.23	100.76	15.29	-1.24	0.75
CAVLT-2 Interference	29	95.29	17.52	96.76	17.26	0.35	0.29
CAVLT-2 Immediate Recall	29	104.5	17.26	99.76	17.26	-1.04	0.95
CAVLT-2 Delayed Recall	29	102.14	17.46	100.48	15.86	-0.38	0.26

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

There were no significant differences found between these two groups on the measures assessing academic achievement skills, which included basic reading, math problem solving, and spelling/early writing (Letter-Word Identification, Applied Problems, and Dictation, respectively).

Table 9

Mean Differences for Subjects with Borderline Anxious/Depressed Symptoms as Compared to Matched Subjects Showing No Significant Anxious/Depressed Symptoms on Academic Achievement Measures

Dependent Academic Measures	Anxious/Depressed			Matched Non-Anxious/Depressed			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	29	102.25	13.88	106.03	13.13	1.06	0.76
WJ-R Applied Problems	29	103.61	15.29	105.28	13.96	0.43	0.80
WJ-R Dictation	29	94.14	9.23	94.83	13.35	0.23	0.13

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 4

There were 20 (5.8%) subjects who had a borderline clinically significant T score of 65 on the Withdrawn clinical scale of the CBCL. Significant differences were found between subjects obtaining a T score of 65 on the Withdrawn clinical scale as compared to a matched sample of subjects in terms of gender, age, ethnicity, and parent education level who scored below 60 on the same scale. Subjects who had T score of 65 on the

Withdrawn clinical scale performed significantly worse on the executive function task, Trail Making Part-B ($p = 0.02$), rejecting the null hypothesis with respect to this cognitive variable. There were no other significant differences found on executive function tasks including Trail Making Part-A, Animal Fluency, and the Similarities and Matrix Reasoning subtests from the WASI. A significant difference was found on one attention and processing speed measures from the WISC-III, Digit Span ($p = 0.03$), again rejecting the null hypothesis with regard to this cognitive variable, but not on the other attention and processing speed subtests (Coding and Symbol Search). The results from the analysis found no significant differences among the components of global intellectual function as assessed by the WASI, which included WASI FSIQ, Verbal IQ, and Performance IQ. No significant differences were found in the areas of language (Vocabulary subtest from the WASI), visual motor/visual spatial skills (Block Design from the WASI), or across various trials on a psychomotor speed and coordination task (Purdue Pegboard test). Performance on the learning and memory measure, the CAVLT-2, was not significant across trials.

Table 10

Mean Differences for Subjects with Borderline Withdrawn Symptoms as Compared to Matched Subjects Showing No Significant Withdrawn Symptoms on Cognitive Measures

Dependent Cognitive Measures	Withdrawn			Matched Non-Withdrawn			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WASI FSIQ	20	97.65	12.18	106.30	11.87	2.28	0.95
WASI	20	98.80	13.11	106.40	10.50	2.02	0.26

Verbal IQ							
WASI Performance IQ	20	96.80	13.25	104.35	12.96	1.82	0.86
WASI Vocabulary	20	48.85	9.26	54.35	6.43	2.18	0.07
WASI Similarities	20	49.45	9.16	53.75	7.48	1.63	0.31
WASI Block Design	20	48.70	8.25	53.50	10.28	1.63	0.08
WASI Matrix Reasoning	20	47.05	11.20	51.80	8.40	1.52	0.27
WISC-III Coding	20	10.50	2.44	11.60	3.03	1.26	0.21
WISC-III Symbol Search	20	10.45	2.86	13.55	2.74	3.50	0.93
WISC-III Digit Span	20	8.80	2.95	9.75	2.07	1.18	0.03*
Animal Fluency	20	0.53	0.79	1.00	1.32	1.33	0.08
Trail Making Part-A	20	-0.01	0.62	0.46	1.22	1.52	0.07
Trail Making Part-B	20	0.03	0.92	0.67	0.51	2.96	0.02*
Purdue Pegboard Dominant	20	-1.13	1.63	-0.76	1.05	0.85	0.28
Purdue Pegboard	20	-0.86	1.55	-0.65	0.88	0.55	0.15

Non-dominant							
Purdue Pegboard Both	20	-0.89	0.96	-0.97	1.22	-0.23	0.48
CAVLT-2 Level of Learning	20	102.55	12.99	104.05	20.53	0.28	0.12
CAVLT-2 Interference	20	97.85	18.27	100.10	14.24	0.43	0.25
CAVLT-2 Immediate Recall	20	101.15	14.99	106.85	16.43	1.15	0.87
CAVLT-2 Delayed Recall	20	99.90	12.97	104.05	18.24	0.83	0.43

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

There were no significant differences found between these two groups on the measures of academic achievement skills assessing basic reading, math problem solving, and spelling/early writing (Letter-Word Identification, Applied Problems, and Dictation, respectively).

Table 11

Mean Differences for Subjects with Borderline Withdrawn Symptoms as Compared to Matched Subjects Showing No Significant Withdrawn Symptoms on Academic Achievement Measures

Dependent Academic Measures		Withdrawn		Matched Non-Withdrawn			
	N	Mean	SD	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	20	103.30	13.38	103.25	25.04	-0.01	0.34
WJ-R Applied Problems	20	102.50	15.42	110.25	11.61	1.80	0.44
WJ-R Dictation	20	94.30	12.17	96.45	11.13	0.58	0.99

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Although a cut-off T score above or equal to 70 is the clinically significant number for all scales on the CBCL, as mentioned above there were only 16 (4.6%) children who had T scores above or equal to 70 on the Anxious/Depressed clinical scale and 8 (2.3%) children who had T scores above or equal to 70 on the Withdrawn clinical scale. In addition, a cut-off T score equal to 65 is considered borderline clinically significant, but again there were only 29 (8.5%) children who had T scores above or equal to 65 on the Anxious/Depressed clinical scale and 20 (5.8%) children who had T scores above or equal to 65 on the Withdrawn clinical scale. Therefore, those subjects who scored above or equal to 60 on these clinical scales were compared to all those subjects who scored below 60 on these same scales in regard to their performance on all

the cognitive and academic measures as these subjects were certainly approaching the borderline and clinically significant T score numbers of 65 and 70, respectively.

Results Associated with Hypothesis 5

There were 66 (19.2%) of subjects who had a T score approaching borderline and clinical significance, above or equal to 60, on the Anxious/Depressed clinical scale of the CBCL. Significant differences in performances on various cognitive measures were found between those subjects who obtained a T score above or equal to 60 and the subjects scoring below 60 on this clinical scale. Specifically, those subjects with scores below 60 on the Anxious/Depressed clinical scale performed better on all components of global intellectual function as assessed by the WASI. This included the WASI FSIQ (p = 0.00), WASI Verbal IQ (p = 0.01), and the WASI Performance IQ (p = 0.00). Therefore, in the areas of language as assessed with the Vocabulary subtest (p = 0.01) from the WASI, visual motor/visual spatial skills as assessed with the Block Design (p = 0.01) subtest from the WASI, and some areas of executive function that included the Similarities (p = 0.03) and Matrix Reasoning (p = 0.00) subtest from the WASI there were also significant differences between these two groups. Performance on two attention and processing speed measures, the Symbol Search (p = 0.00) and Digit Span (p = 0.00) subtests from the WISC-III, was similarly significantly higher for subjects who scored below 60 on the Anxious/Depressed clinical scale. On two executive function tasks, Animal Fluency (p = 0.03) and Trail Making Part-B (p = 0.01), children who had a T score below 60 had significantly stronger performances than those children who were at or above 60 on the Anxious/Depressed clinical scale. There was a significantly better

performance with the dominant hand ($p = 0.01$) on a psychomotor speed and coordination task, the Purdue Pegboard test, in children who had a T score below 60. Therefore, the null hypothesis was rejected as there were significant differences found among the subjects who obtained a T score above or equal to 60 and the subjects scoring below 60 on the Anxious/Depressed clinical scale and these various cognitive measures. There were no significant differences found between the two groups on the Coding subtest from the WISC-III, Trail Making Part-A, or on any trials of the CAVLT-2. No significant differences were found with non-dominant hand or both hands on the Purdue Pegboard test.

Table 12

Mean Differences for Subjects Approaching Borderline and Clinically Significant Anxious/Depressed Symptoms as Compared to Subjects Showing No Significant Anxious/Depressed Symptoms on Cognitive Measures

Dependent Cognitive Measures	Anxious/Depressed			Non-Anxious/Depressed				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WASI FSIQ	66	102.24	12.89	277	107.66	13.88	2.89	0.00**
WASI Verbal IQ	66	104.27	13.45	277	108.79	12.83	2.55	0.01**
WASI Performance IQ	66	99.47	12.37	277	105.51	13.98	3.22	0.00**
WASI Vocabulary	66	51.92	9.35	277	54.96	8.09	2.65	0.01**
WASI	66	53.18	8.52	277	55.76	8.86	2.14	0.03*

Similarities								
WASI Block Design	66	49.73	8.61	277	52.94	9.65	2.48	0.01**
WASI Matrix Reasoning	66	49.45	10.10	277	53.54	9.86	3.01	0.00**
WISC-III Coding	66	11.38	2.92	277	11.01	2.89	-0.93	0.35
WISC-III Symbol Search	66	11.47	3.55	277	12.71	3.05	2.883	0.00**
WISC-III Digit Span	66	9.11	3.07	277	10.21	2.86	2.79	0.01**
Animal Fluency	66	2.01	8.23	277	0.880	1.33	-2.17	0.03*
Trail Making Part-A	66	0.35	0.86	277	0.757	4.30	0.757	0.45
Trail Making Part-B	66	0.17	0.89	277	0.49	0.91	2.467	0.01**
Purdue Pegboard Dominant	66	-1.00	1.14	277	-0.63	1.06	2.47	0.01**
Purdue Pegboard Non-dominant	66	-0.79	1.04	277	-0.56	1.10	1.57	0.12
Purdue Pegboard Both	66	-0.66	1.05	277	-0.60	1.07	0.43	0.67

CAVLT-2 Level of Learning	66	105.11	13.93	277	105.72	14.56	0.31	0.76
CAVLT-2 Interference	66	98.14	18.31	277	100.02	16.03	0.84	0.40
CAVLT-2 Immediate Recall	66	105.07	14.56	277	104.77	16.56	-0.14	0.89
CAVLT-2 Delayed Recall	66	101.73	15.98	277	104.11	15.30	1.13	0.26

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Performance on two tests of academic achievement from the WJ-R, Applied Problems ($p = 0.00$) and Dictation ($p = 0.01$), which assess basic math problem solving and spelling/early writing skills, was significantly better for those subjects who scored below 60 on the Anxious/Depressed clinical scale of the CBCL as compared to those subjects who had a T score at or above 60. The null hypothesis with respect to these academic variables was rejected. No significant differences were found between the two groups in basic reading skills (Letter-Word Identification subtest from the WJ-R).

Table 13

Mean Differences for Subjects Approaching Borderline and Clinically Significant Anxious/Depressed Symptoms as Compared to Subjects Showing No Significant Anxious/Depressed Symptoms on Academic Achievement Measures

Dependent Academic Measures	Anxious/Depressed			Non-Anxious/Depressed				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	66	104.27	16.62	277	108.38	16.36	1.83	0.07
WJ-R Applied Problems	66	105.59	14.32	277	112.15	14.43	3.33	0.00**
WJ-R Dictation	66	94.11	11.48	277	98.37	11.97	2.60	0.01**

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 6

A total of 54 (15.7%) subjects had a T score approaching borderline and clinical significance, above or equal to 60, on the Withdrawn clinical scale of the CBCL. Significant differences in performance on various cognitive tests was found between those subjects who obtained a T score above or equal to 60 and the subjects scoring below 60 on the Withdrawn clinical scale from the CBCL. Specifically, those subjects with scores below 60 on this clinical scale performed better on most components of global intellectual function as assessed by the WASI. This included the WASI FSIQ (p = 0.01), WASI Verbal IQ (p = 0.00), and the WASI Performance IQ (p = 0.05). In the

areas of language, the Vocabulary ($p = 0.00$) subtest from the WASI was significant as were executive function skills assessed by the Similarities ($p = 0.01$) and Matrix Reasoning ($p = 0.03$) subtests from the WASI. Performance on two attention and processing speed measures, the Symbol Search ($p = 0.03$) and Digit Span ($p = 0.03$) subtests from the WISC-III, was significantly better for the subjects who scored below 60 on the Withdrawn clinical scale. Subjects who had a T score below 60 had a significantly stronger performance with the dominant hand ($p = 0.01$) on a psychomotor speed and coordination task, the Purdue Pegboard, than those children who were at or above 60 on the Withdrawn clinical scale. Performance on the CAVLT-2 was significant for the Interference trial ($p =0.02$) and Delayed Recall trial ($p =0.05$). Consequently, the null hypothesis that there would be no significant differences among the subjects who obtained a T score above or equal to 60 and the subjects scoring below 60 on the Anxious/Depressed clinical scale on the various cognitive measures was rejected. There were no significant differences found between the two groups on the remaining measure of attention and processing speed, Coding from the WISC-III, or on the remaining executive function tasks including verbal fluency (Animal Fluency) and Trail Making Parts A and B. Visual motor/visual spatial skills as assessed with the Block Design subtest from the WASI were not significant nor were there significant differences found with the non-dominant hand or both hands together on the Purdue Pegboard test. No significant differences were found on the remaining CAVLT-2 learning and memory trials.

Table 14

Mean Differences for Subjects Approaching Borderline and Clinically Significant Withdrawn Symptoms as Compared to Subjects Showing No Significant Withdrawn Symptoms on Cognitive Measures

Dependent Cognitive Measures	Withdrawn			Non-Withdrawn				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WASI FSIQ	54	102.35	12.87	289	107.41	13.89	2.49	0.01**
WASI Verbal IQ	54	103.15	13.16	289	108.81	12.86	2.96	0.00**
WASI Performance IQ	54	100.91	14.02	289	104.99	13.77	1.99	0.05*
WASI Vocabulary	54	51.24	8.75	289	54.96	8.23	3.02	0.00**
WASI Similarities	54	52.44	9.09	289	55.79	8.71	2.57	0.01**
WASI Block Design	54	50.80	8.99	289	52.61	9.62	1.28	0.20
WASI Matrix Reasoning	54	50.13	11.30	289	53.24	9.70	2.11	0.04*
WISC-III Coding	54	10.78	3.05	289	11.14	2.87	0.84	0.40
WISC-III Symbol Search	54	11.61	3.53	289	12.63	3.10	2.18	0.03*
WISC-III	54	9.19	3.00	289	10.15	2.89	2.24	0.03*

Digit Span								
Animal Fluency	54	0.79	1.06	289	1.15	4.07	0.64	0.53
Trail Making Part-A	54	0.28	0.81	289	0.75	4.22	0.80	0.43
Trail Making Part-B	54	0.37	0.16	289	0.44	0.05	0.50	0.62
Purdue Pegboard Dominant	54	-1.06	1.31	289	-0.64	1.03	2.63	0.01**
Purdue Pegboard Non-dominant	54	-0.74	1.22	289	-0.58	1.07	0.96	0.33
Purdue Pegboard Both	54	-0.73	1.05	289	-0.59	1.06	0.89	0.38
CAVLT-2 Level of Learning	54	103.41	16.02	289	106.01	14.10	1.22	0.22
CAVLT-2 Interference	54	94.96	16.29	289	100.54	16.40	2.30	0.02*
CAVLT-2 Immediate Recall	54	102.61	15.65	289	105.24	16.26	1.10	0.27
CAVLT-2 Delayed Recall	54	99.80	15.02	289	104.37	15.43	2.01	0.05*

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Performance on an academic achievement test from the WJ-R Applied Problems ($p = 0.01$), which assesses math problem solving skills, was significantly better for those subjects who scored below 60 on the Withdrawn clinical scale from the CBCL as compared to those subjects who had a T score at or above 60. The null hypothesis with respect to this academic variable was rejected. There were no significant differences found between these two groups on other measures of academic achievement skills assessing basic reading and spelling/early writing, (Letter-Word Identification and Dictation, respectively).

Table 15

Mean Differences for Subjects Approaching Borderline and Clinically Significant Withdrawn Symptoms as Compared to Subjects Showing No Significant Withdrawn Symptoms on Academic Achievement Measures

Dependent Academic Measures	Withdrawn			Non- Withdrawn				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	54	104.65	15.99	289	108.14	16.53	1.43	0.15
WJ-R Applied Problems	54	106.19	15.47	289	111.77	14.32	2.60	0.01**
WJ-R Dictation	54	95.98	12.25	289	97.85	11.93	1.04	0.30

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 7

There were 34 (9.9%) subjects who had a T score approaching borderline and clinical significance, above or equal to 60, on both the Anxious/Depressed and Withdrawn clinical scales of the CBCL. The results from the analysis found that those subjects who obtained a T score above or equal to 60 on both these clinical scales had a significantly weaker performance on all components of global intellectual function as assessed by the WASI, which included the WASI FSIQ ($p = 0.00$), Verbal IQ ($p = 0.00$), and Performance IQ ($p = 0.00$). Thus, in the areas of language as assessed with the Vocabulary ($p = 0.00$) subtest from the WASI, visual motor/visual spatial skills as assessed with the Block Design ($p = 0.01$) subtest from the WASI, and some executive function areas including the Similarities ($p = 0.00$) and Matrix Reasoning ($p = 0.01$) subtests from the WASI there were significant differences between these groups. Performance on most of the attention and processing speed measures, Symbol Search ($p = 0.00$) and Digit Span ($p = 0.00$) subtests from the WISC-III, was again significantly better for those children who did not score above 60 on both the Anxious/Depressed and Withdrawn clinical scales. Subjects who had a score at or above 60 on both these clinical scales had a significantly weaker performance than those who did not on the Purdue Pegboard psychomotor speed and coordination task, with the dominant hand ($p = 0.00$) trial. On the Delayed Recall trial ($p = 0.05$) of the CAVLT-2, children with scores below 60 on the Anxious/Depressed and Withdrawn clinical scales had a significantly stronger performance than their peers who scored above 60 on both scales. Accordingly, the null hypothesis that there would be no significant differences found on the various cognitive measures among the two groups of subjects who scored above 60 on both the

Anxious/Depressed and Withdrawn clinical scales and those who did was rejected. No significant differences were found on the remaining cognitive measures, which included the Coding subtest from the WISC-III, semantic verbal fluency, Trail Making Parts A and B, performance with the non-dominant hand and both hand trials on the Purdue Pegboard, and performance on the remaining CAVLT-2 trials (Level of Learning, Interference Trial, and Immediate Recall).

Table 16

Mean Differences for Subjects Approaching Borderline and Clinically Significant Anxious/Depressed and Withdrawn Symptoms as Compared to Subjects Showing No Significant Anxious/Depressed and Withdrawn Symptoms on Cognitive Measures

Dependent Cognitive Measures	Anxious/Depressed and Withdrawn			Non-Anxious/Depressed And Withdrawn				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WASI FSIQ	34	99.18	11.99	257	107.65	13.98	3.37	0.00**
WASI Verbal IQ	34	101.03	14.35	257	108.94	13.01	3.30	0.00**
WASI Performance IQ	34	97.09	10.71	257	105.37	13.77	3.37	0.00**
WASI Vocabulary	34	50.47	9.90	257	55.14	8.18	3.05	0.00**
WASI Similarities	34	50.41	9.25	257	55.75	8.95	3.26	0.00**
WASI Block Design	34	48.18	6.51	257	52.76	9.55	2.72	0.01**

WASI Matrix Reasoning	34	48.38	10.75	257	53.57	9.71	2.89	0.00**
WISC-III Coding	34	10.94	3.04	257	11.05	2.87	0.21	0.84
WISC-III Symbol Search	34	11.00	3.59	257	12.72	3.05	3.02	0.00**
WISC-III Digit Span	34	8.44	3.09	257	10.19	2.89	3.30	0.00**
Animal Fluency	34	0.89	1.08	257	0.90	1.35	0.06	0.95
Trail Making Part-A	34	0.15	0.75	257	0.78	4.46	0.79	0.43
Trail Making Part-B	34	0.12	1.05	257	0.47	0.89	2.01	0.04*
Purdue Pegboard Dominant	34	-1.17	1.13	257	-0.62	1.02	2.97	0.00**
Purdue Pegboard Non-dominant	34	-0.90	0.99	257	-0.57	1.07	1.72	0.09
Purdue Pegboard Both	34	-0.84	1.07	257	-0.60	1.07	1.19	0.23
CAVLT-2 Level of Learning	34	103.82	14.86	257	105.95	14.26	0.82	0.42
CAVLT-2 Interference	34	95.29	16398	257	100.46	16.02	1.76	0.08

Trial								
CAVLT-2 Immediate Recall	34	102.70	15.59	257	104.94	16.49	0.76	0.45
CAVLT-2 Delayed Recall	34	98.73	14.54	257	104.30	15.25	2.01	0.05*

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Subjects who did not have a T score above or equal to 60 on both the Anxious/Depressed and the Withdrawn clinical scales scored significantly higher than those subjects who did on all the specific academic achievement tests administered, which assessed basic reading, math problem solving, and spelling/early writing skills. These findings demonstrated significance on the Letter-Word Identification ($p = 0.03$), Applied Problems ($p = 0.00$), and Dictation ($p = 0.04$) subtests of the WJ-R. The null hypothesis with respect to these academic variables was rejected.

Table 17

Mean Differences for Subjects Approaching Borderline and Clinically Significant Anxious/Depressed and Withdrawn Symptoms as Compared to Subjects Showing No Significant Anxious/Depressed Symptoms and Withdrawn on Academic Achievement Measures

Dependent Academic Measures	Anxious/Depressed and Withdrawn			Non-Anxious/Depressed and Withdrawn				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word	34	101.62	17.10	257	108.27	16.63	2.19	0.03*

Identification								
WJ-R Applied Problems	34	103.85	15.47	257	112.31	14.41	3.19	0.00**
WJ-R Dictation	34	93.52	13.90	257	98.24	12.25	2.05	0.04*

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 8

There were significant differences noticed between Caucasian and Hispanic subjects of approximately similar levels of intellectual ability as indicated by their IQ scores being in the average range. The results from the analysis found that on all components of global intellectual function as assessed by the WASI, including WASI FSIQ ($p = 0.00$), Verbal IQ ($p = 0.00$), and Performance IQ ($p = 0.00$) Caucasian subjects scored significantly higher than Hispanic subjects. Therefore, in the areas of language as assessed with the Vocabulary ($p = 0.00$) subtest from the WASI, visual motor/visual spatial skills as assessed with the Block Design ($p = 0.00$) subtest from the WASI, and some areas of executive function that included Similarities ($p = 0.00$) and Matrix Reasoning ($p = 0.00$) from the WASI there were also significant differences between Caucasian and Hispanic subjects. Performance on most attention and processing speed measures as assessed with the Symbol Search ($p = 0.00$) and Digit Span ($p = 0.00$) subtests from the WISC-III was again significantly better for Caucasian than Hispanic subjects. Caucasian subjects performed significantly better than Hispanic children on the Purdue Pegboard, a psychomotor speed and coordination task, with both their dominant ($p = 0.00$) and non-dominant ($p = 0.00$) hand. On the Interference trial ($p = 0.00$) of the

CAVLT-2, Caucasian subjects had a significantly stronger performance than their Hispanic peers. Thus, the null hypothesis that there would be no significant differences among the 343 subjects of different ethnic backgrounds on the various cognitive and academic measures was rejected. No significant differences were found on the remaining cognitive measures, which included the Coding subtest from the WISC-III, semantic verbal fluency, Trail Making Parts A and B, performance with both hands on the Purdue Pegboard, and performance on the Level of Learning, Immediate Recall, and Delayed Recall trial of the CAVLT-2.

Table 18

Mean Differences Between Caucasian and Hispanic Subjects on Cognitive Measures

Dependent Cognitive Measures	Caucasian			Hispanic				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WASI FSIQ	215	109.21	14.49	128	102.26	11.48	4.63	0.00**
WASI Verbal IQ	215	110.67	13.12	128	103.30	11.60	5.26	0.00**
WASI Performance IQ	215	106.55	13.76	128	100.69	13.33	3.85	0.00**
WASI Vocabulary	215	56.18	8.28	128	51.34	7.77	5.35	0.00**
WASI Similarities	215	56.75	8.81	128	52.76	8.34	4.14	0.00**
WASI Block Design	215	53.56	9.90	128	50.24	8.52	3.16	0.00**

WASI Matrix Reasoning	215	54.13	9.56	128	50.43	10.37	3.36	0.00**
WISC-III Coding	215	11.26	2.84	128	10.78	2.96	1.49	0.14
WISC-III Symbol Search	215	12.93	3.19	128	11.71	3.04	3.48	0.00**
WISC-III Digit Span	215	10.42	2.94	128	9.30	2.79	3.49	0.00**
Animal Fluency	215	0.97	1.35	128	1.29	5.93	-0.76	0.45
Trail Making Part-A	215	0.85	1.84	128	0.40	1.02	1.02	0.31
Trail Making Part-B	215	0.45	0.94	128	0.40	0.86	0.52	0.60
Purdue Pegboard Dominant	215	-0.58	1.13	128	-0.91	0.98	2.77	0.00*
Purdue Pegboard Non-dominant	215	-0.503 (1.171)	1.17	128	-0.77	0.92	2.19	0.03*
Purdue Pegboard Both	215	-0.530 (1.097)	1.10	128	-0.75	0.99	1.87	0.06
CAVLT-2 Level of Learning	215	106.70 (15.04)	15.04	128	103.76	13.18	1.83	0.07
CAVLT-2 Interference	215	101.62 (15.64)	15.64	128	96.36	17.37	2.89	0.00**

CAVLT-2 Immediate Recall	215	104.86 (17.05)	17.05	128	104.77	14.64	0.05	0.96
CAVLT-2 Delayed Recall	215	104.30 (15.76)	15.76	128	102.55	14.87	1.01	0.31

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

There were significant differences noticed between Caucasian and Hispanic subjects of approximately similar levels of academic achievement ability as indicated by their performance on academic measures being in the average range. Caucasian subjects scored significantly higher than Hispanic subjects on specific subtests of academic achievement skills assessing basic reading, math problem solving, and spelling/early writing skills. These findings demonstrated significance on the Letter-Word Identification ($p = 0.00$), Applied Problems ($p = 0.00$), and Dictation ($p = 0.00$) subtests of the WJ-R. The null hypothesis with respect to these academic variables was rejected.

Table 19

Mean Differences Between Caucasian and Hispanic Subjects on Academic Performance Measures

Dependent Academic Measures	Caucasian			Hispanic				
	N	Mean	SD	N	Mean	SD	*t*-value	*p*-value
WJ-R Letter-Word Identification	215	110.47	15.42	128	102.76	17.09	4.30	0.00**
WJ-R Applied	215	114.38	13.64	128	105.03	14.39	6.02	0.00**

Problems								
WJ-R Dictation	215	100.22	11.69	128	93.06	11.14	5.57	0.00**

p-value * = < 0.05, ** = < 0.01, no *t*-values are significant

Results Associated with Hypothesis 9

As previously noted, there were 66 (19.2%) subjects who had a T score approaching borderline and clinical significance, above or equal to 60, on the Anxious/Depressed clinical scale of the CBCL. Males represented 38 (22.6%) of the subjects and females represented 28 (16%) of the subjects. There were 31 (19.3%) subjects between the ages of 6 to 8 years and there were 35 (19.2%) subjects who were between the ages of 9 and 11 years. There were 37 (17.1%) subjects who had parents with 13 to 24 years of education, and 23 (20.4%) had parents with 9 to 12 years of education. Only one subject, who represented 14.3% of this sample's parent education level, had less than eight years. There were 35 (16.3%) Caucasian subjects and 31 (24.2%) Hispanic subjects who had a T score above or equal to 60 on the Anxious/Depressed clinical scale. These subjects were compared to the remaining 277 subjects who had scores below 60 on the Anxious/Depressed clinical scale. There were no significant differences among the two groups of subjects in regard to age, ethnicity, gender, or parental education level.

Table 20

Showing Differences for Approaching Borderline and Clinically Significant Anxious/Depressed and Non-Anxious/Depressed Symptoms with Regard to Gender, Ethnicity, Age, and Parent Education Level

	Non-Anxious/Depressed		Anxious/Depressed			
	N	%	N	%	x^2	*p* value
Gender						
Male	130	77.4	38	22.6		
Female	147	84.0	28	16.0		
					2.42	0.12
Ethnicity						
Caucasian	180	83.7	35	16.3		
Hispanic	97	16.3	31	24.2		
					3.26	0.07
Age Category						
6-8 years old	130	80.8	31	19.3		
9-11 years old	147	80.8	35	19.2		
					0.00	1.00
Parent Education						
8 years or less	6	85.7	1	14.3		
9-12 years	90	79.7	23	20.4		
13-24 years	179	82.9	37	17.1		
					0.59	0.74

p value for Chi Square Test * = ≤ 0.05, ** = ≤ 0.01

Results Associated with Hypothesis 10

As mentioned above, 54 (15.7%) subjects had a T score approaching borderline and clinical significance, above or equal to 60, on the Withdrawn clinical scale of the CBCL. There were 29 (17.3%) male subjects in this group and 25 (14.3%) female subjects. There were 28 (17.4%) subjects between the ages of 6 and 8 years and 26 (14.3%) subjects between the ages of 9 and 11 years. Of this group of subjects, 26 (12%) had a

parent education level that was between 13 to 24 years. There were 21 (18.6%) subjects who had parents with 9 to 12 years of education. Three subjects (42.9%) had a parent with an education level that was less than eight years. There were 31 (14.3%) Caucasian subjects and 23 (18%) Hispanic subjects. These subjects were compared to the remaining 289 subjects who had scores below 60 on the Withdrawn clinical scale. There was a significant difference found between the subjects in regard to parent education level (p = 0.03). The null hypothesis was therefore rejected as there was a significant difference found between the two groups in regard to this demographic variable. No significant differences were found between the two groups of subjects in regard to age, ethnicity, or gender.

Table 21

Showing Differences for Approaching Borderline and Clinically Significant Withdrawn and Non-Withdrawn Symptoms with Regard to Gender, Ethnicity, Age, and Parent Education Level

	Non-Withdrawn		Withdrawn			
	N	%	N	%	x^2	p value
Gender						
Male	139	82.7	29	17.3		
Female	150	85.7	25	14.3		
					0.57	0.45
Ethnicity						
Caucasian	184	85.6	31	14.4		
Hispanic	105	82.0	23	18.0		
					0.76	0.38
Age Category						

6-8 years old	133	82.6	28	17.4		
9-11 years old	156	85.7	26	14.3		
					0.62	0.43
Parent Education						
8 years or less	4	57.1	3	42.9		
9-12 years	92	81.4	21	18.6		
13-24 years	190	88.0	26	12.0		
					6.92	0.03*

p value for Chi Square Test * = $\leq$ 0.05, ** = $\leq$ 0.01

Results Associated with Hypothesis 11

As previously discussed, 34 (9.9%) subjects had a T score approaching borderline and clinical significance, above or equal to 60, on both the Anxious/Depressed and Withdrawn clinical scales of the CBCL. There were 20 (14.2%) male subjects in this group and 14 (9.3%) females. There were 17 (11%) subjects between the ages of 9 and 11 years and 17 (12.5%) subjects between the ages of 6 and 8 years. There were 17 (9.1%) subjects who had parents with an education level that was between 13 to 24 years and 12 (12.9%) subjects had parents with 9 to 12 years of education. One child, representing 20% of the group, had a parent education level reported at less than eight years. There were 17 (9.3%) Caucasian subjects and 17 (15.7%) Hispanic subjects. These subjects were compared to the remaining 309 subjects who had scores below 60 on both the Anxious/Depressed and Withdrawn clinical scale. No significant differences were found among the two groups of subjects in regard to age, ethnicity, gender, or parental education level.

Table 22

Showing Differences for Approaching Borderline and Clinically Significant Anxious/Depressed and Withdrawn and Non-Anxious/Depressed and Withdrawn Symptoms with Regard to Gender, Ethnicity, Age, and Parent Education Level

	Non-Anxious/Depressed and Withdrawn		Anxious/Depressed and Withdrawn			
	N	%	N	%	x^2	*p* value
Gender						
Boys	121	85.8	20	14.2		
Girls	136	90.7	14	9.3		
					1.66	0.20
Ethnicity						
Caucasian	166	90.7	17	9.3		
Hispanic	91	84.3	17	15.7		
					0.16	0.10
Age Category						
6-8 years old	119	87.5	17	12.5		
9-11 years old	138	89.0	17	11		
					2.74	0.69
Parent Education						
≤8 years	4	80.0	1	20.0		
9-12 years	81	87.1	12	12.9		
13-24 years	170	90.9	17	9.1		
					1.44	0.49

p value for Chi Square Test * = ≤ 0.05, ** = ≤ 0.01

CHAPTER 5

DISCUSSION

The purpose of this study was to determine if there was a relationship between depressive symptomatology and performance on a variety of cognitive and academic achievement measures in elementary school children aged 6 to 11 years. The results of this study do suggest that there is a relationship between depressive symptomatology and certain cognitive and academic measures.

Findings regarding the correlations between anxious/depressed and withdrawn symptoms and various cognitive and academic measures tested found that as anxious/depressed and/or withdrawn symptoms increased, various measures of cognitive and academic functioning were negatively impacted. For example, increases in both anxious/depressed and withdrawn symptoms were correlated with a decrease in general intellectual function, attention and processing speed, psychomotor speed and coordination with the dominant hand, and executive functioning as measured by superordinate concept formation and completion of visuospatial patterns, and math problem solving skills. Withdrawn symptomatology alone was correlated with lower Verbal IQ. Lower performance IQ, as measured with various nonverbal abilities, was correlated with increased anxious/depressed symptoms.

The cognitive and academic measure results were also analyzed as they related to scores that were borderline and clinically significant (T scores over 65 and 70 on the CBCL clinical scales) with anxious/depressed and withdrawn symptoms. On the CBCL, a clinically significant score on the clinical scales is at or above 70 and a borderline

clinically significant score is at 65. As evident from the analyses, those subjects who had borderline clinically significant scores equal to 65 on the Anxious/Depressed and Withdrawn clinical scales were represented by 29 and 20 subjects, respectively. The sample size became even smaller when looking at those subjects who obtained a clinically significant score equal to or above 70 on these same scales as their representation was 16 and 8 subjects, respectively. Clearly, these small groups made it difficult to directly compare them to all the subjects who did not have borderline and clinically significant scores on the clinical scales. Therefore, the subjects who did have borderline and clinically significant scores were compared to a matched sample of subjects in regards to gender, age, ethnicity, and parent education level. When this was done, a small, significant relationship was found on certain cognitive and academic measures. A poorer performance on a psychomotor speed and coordination task with the non-dominant hand was significant for anxious/depressed symptoms. Certain executive function skills requiring conceptual tracking and rapid set-shifting were significant for withdrawn symptoms. Generally speaking, there was not a strong relationship found in regards to those subjects obtaining borderline and clinically significant anxious/depressed and withdrawn symptoms and those subjects without borderline and clinically significant symptoms who were matched to them in regards to age, gender, ethnicity, and parent education level on the various cognitive and academic measures. However, these findings may be the result of this small sample size and thus lack statistical power.

Due to the small sample size on the borderline and clinically significant scales from the CBCL, subjects whose scores were approaching borderline and clinical

significance, above or equal to 60, and those scoring below 60 on the Anxious/Depressed and Withdrawn clinical scales were compared with regards to their performance on the various cognitive and academic measures. This larger sample size made comparison to the overall study group more statistically reliable, with 66, 54, 34 subjects at 60 or above on the Anxious/Depressed, Withdrawn, or both Anxious/Depressed and Withdrawn, respectively. There were several significant findings. There was a relationship in general intellectual function including both verbal and nonverbal abilities among all three groups. There was also a significant relationship among all three groups in the areas of language, attention and processing speed, executive function skills assessing superordinate concept formation and the completion of visuospatial patterns, and psychomotor speed and coordination with the dominant hand. The subjects with scores approaching borderline and clinical significance with anxious/depressed symptoms performed significantly worse on two executive function tasks including semantic verbal fluency and conceptual tracking and rapid set-shifting ability. Visual motor/visual spatial skills were significant for subjects in the anxious/depressed group and the group with both anxious/depressed and withdrawn symptoms. On delayed memory recall the group with both anxious/depressed and withdrawn symptoms performed significantly lower. In regards to academic achievement, performance was significantly worse among all three groups for basic math problem solving skills. There was a significant reduction in basic reading skills for the group with both anxious/depressed and withdrawn symptoms. Subjects with anxious/depressed symptoms and both anxious/depressed and withdrawn symptoms performed significantly worse on basic spelling/early writing skills.

Overall, these findings suggest there was a relationship between higher scores on the Anxious/Depressed and Withdrawn clinical scales of the CBCL and weaker performance on a variety of cognitive and academic measures. The directionality overall on general intellectual functioning scores as well as academic achievement scores suggests that individuals with higher scores on the Anxious/Depressed and Withdrawn clinical scales from the CBCL may have lower global intellectual functioning and academic achievement performance. However, the reverse might be true in that the individuals with lower general intellectual functioning and academic achievement scores may be more susceptible to developing depressive symptomatology.

Other findings of note included that no significant differences were found between those subjects with scores at or above 60 on the Anxious/Depressed and Withdrawn clinical scales and those subjects who had scores below 60 on these same clinical scales with regards to age, ethnicity, or gender. However, lower parent education level was significant for subjects scoring at or above 60 compared to those who scored below 60 on the Withdrawn clinical scale.

Although comparing the performance on the different cognitive and academic measures on the basis of ethnicity was not the purpose of this study, the data were available and so this comparison was made. Both the Caucasian and Hispanic children had similar levels of intellectual and academic achievement ability as indicated by their IQ and performance scores being in the average range. However, there were significant findings between Caucasian and Hispanic subjects with Hispanic subjects performing lower on a variety of cognitive and academic measures. A difference was noted in

general intellectual function, including both verbal and nonverbal abilities. Scoring differential also reached a level of statistical significance in the areas of language, attention and processing speed measures, executive function skills including superordinate concept formation and the completion of visuospatial patterns, visual motor/visual spatial skills, psychomotor speed and coordination with both the dominant and non-dominant hand, and performance on the Interference trial of a learning and memory task. There was also a significant relationship found on basic reading, math problem solving, and spelling/early writing skills. However, these findings could be the result of the cultural biases of the cognitive and academic measures used. Additionally, English was reported to be each child's primary language, but the extent to which Spanish was spoken in the home was not specifically measured. Thus, many of the tests that are language loaded could underestimate a child's ability. Also, there may be a discrepancy in learning and educational opportunities outside the home due to SES, both parents working, or cultural values in regard to education. In addition, various cultural factors could influence how the parents interpreted certain questions on the CBCL.

In conclusion, this study lends support to three decades of previous research that has sought to identify association between depressive symptomatology in children with their cognitive and academic achievement performance. The fact that the study group consisted of a relatively large sample of normal elementary school children, who had not been previously identified as having depression or exhibiting depressive like symptoms, lends support to the objective nature of this study. Further, consistency with regard to testing framework and methodology used to identify both anxious/depressed and

withdrawn symptoms and to measure cognition and academic performance was often missing in previous research. However, there were some clear limitations to this study. The relatively small sample sizes of subjects who scored above 65 or 70 on the CBCL Anxious/Depressed and Withdrawn clinical scales points to the need for conducting a similar study with a larger sample size to compare clinically significant scores on these same clinical scales in order to confirm any findings that were reported in this study. This small sample size could to some degree have been the result of self-selection although the subjects' parents did not know they were being analyzed for depressive symptoms per se. In addition, there was no random assignment of subjects to certain groups and consequently the robustness of these findings cannot be clearly determined. Other limitations to the study include that there was only one instrument used to assess depression, the CBCL. It may have been helpful to include either the CDI or the CDRS in addition to the CBCL.

Additionally, consistent longitudinal research is needed to precisely identify the causal association between depressive symptomatology and cognitive and academic functioning. Future research will benefit from large sample sizes, which include meaningful numbers of children from additional ethnic populations (e.g., Native American, Asian Americans, Black Americans, etc.). Instruments to measure depression should be consistent, both methodologically and diagnostically. More precise clinical criteria for defining depressive symptomatology are necessary and the development of new tools to assess depression specifically targeting children and adolescents would be helpful. As our understanding of the relationship between depression and cognitive

functioning increases, educators, psychologists, physicians, working with children and their parents will have better tools to address both issues with potential to improve psychological well being and academic performance.

APPENDIX A

PARENT SCREENING QUESTIONNAIRE

Tucson Children's Sleep Apnea Study (TuCASA)

INSTRUCTIONS FOR QUESTIONS: Below is a list of questions about your child. Please answer (by circling) each question in the best way that describes your child's recent behavior. Please complete and return the questionnaire even if your child does not have any sleep problems.

1 = Don't Know; 2 = Never; 3 = Rarely; 4 = Occasionally; 5 = Frequently; 6 = Almost Always

1. Does your child stop breathing during sleep?

1 2 3 4 5 6

2. Does your child struggle to breathe while asleep?

1 2 3 4 5 6

3. Do you ever shake your child during sleep to make him/her breathe again?

1 2 3 4 5 6

4. Do your child's lips ever turn blue or purple while he/she is sleeping?

1 2 3 4 5 6

5. Are you ever concerned about your child's breathing during sleep?

1 2 3 4 5 6

6. How often does your child snore loudly?

1 2 3 4 5 6

7. How often does your child have a sore throat?

1 2 3 4 5 6

8. Does your child complain of morning headaches?

1 2 3 4 5 6

9. Is your child a daytime mouth breather?

1 2 3 4 5 6

10. Is your child sleepy during the daytime?

1 2 3 4 5 6

11. Does your child fall asleep at school?

1 2 3 4 5 6

12. Does your child fall asleep while watching television?

1 2 3 4 5 6

13. Does your child have learning problems?

1 2 3 4 5 6

14. What is your child's date of birth?

_____ _____ _____
Month Day Year

_____
Name of School

(Circle): Boy 1 Girl 2

Weight: _____ (lbs)

Height: ___-____ (ft – in)

Teacher: _____

15. Which of the following best describes your child's ethnicity?

1 White or Anglo; 2 Hispanic; 3 African American; 4 Native American; 5 Asian American;
6 Other

This study is being conducted by the University of Arizona Health Sciences Center and is sponsored by the National Institutes of Health. During the years 2002-2003, we plan to ask about 200 parents for permission to record their child's sleep at home for one night. In addition, there will be a follow-up appointment in which the child will be administered

a battery of cognitive testing. Please sign below if we may contact you regarding this possibility.

Child's Name: _____
Last Name First Name

Parent or Legal Guardian Name: _____

Signature: _____

Zip Code: _____

Phone Number: _____

When is the best time to call? _____

Thank you for taking the time to complete this survey. All information is strictly confidential and will only be used for this study.

_____ (Please check) Please do not contact me further; however, I have answered questions 1-15 and am returning the questionnaire.

Text Box: Tucson Children's Sleep Apnea Study (TuCASA)

APPENDIX B

PARENT FEEDBACK LETTER

DATE, YEAR

Dear PARENT NAME,

Thank you for allowing us to examine NAME on DATE.
Evaluation results may be found below.

Standard scores and percentile ranks are included. Standard scores are typically used to summarize performances. They have a mean (or average) of 100 with a standard deviation of 15. Percentile ranks range on a scale from 0 to 100. They describe the percentage of children of the same age who received scores below the reported score. For example, a score with a 50th percentile rank means that 50% of the children who completed that test performed below the reported score. Higher percentile ranks indicate better performance. Scores between the 25th and the 75th percentile are considered to be in the Average Range.

Wechsler Abbreviated Scale of Intelligence (WASI)

	Standard Score	Percentile Rank
Full Four (Combined Score)*		
Verbal (Verbal Skills)*		
Performance (Performance Skills)		

Woodcock-Johnson Tests of Achievement - Revised

	Standard Score	Percentile Rank
Letter-Word Identification*		
Reading Fluency*		
Math Fluency*		
Writing Fluency*		

*Performance on these tests is dependent on English proficiency. If your child has difficulty with English or if English is a second language, he or she may have difficulty on these tests.

If you have any questions about this evaluation, please call Shannon Lundy at (520) 626-9548.

_____
Shannon Lundy, M.A.
Research Assistant

_____
Kris Kaemingk, Ph.D.
Assistant Professor
Section of Pediatric Neurology
Clinical Neuropsychologist
Licensed Psychologist

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