Running Head: Writing Development and ADHD Characteristics

The Development of Early Writing Abilities in Elementary Students Identified with the Characteristics of Attention Deficit Hyperactivity Disorder

Tina M. Newman

Department of Educational and Counselling Psychology

McGill University, Montreal

A thesis submitted in partial fulfillment of the requirements for the degree of

PhD in Educational Psychology

Major in School/Applied Child Psychology

Minor in Special Populations of Learners

Acknowledgements

Most importantly, I would like to express my appreciation to my supervisor Dr. Robert Bracewell. His continued support, guidance, thoughtful advice and assistance throughout this process made a significant contribution to the development and quality of this dissertation.

My thanks to my committee members, Dr. Susanne Lajoie and Dr. Ingrid Sladeczek, for their insightful comments and for their support. Thank you also to Dr. Lynn Senecal for her contributions to this dissertation and for the invaluable opportunities to learn from her.

To my friend and colleague, Dr. Tara Wilkie, my greatest appreciation for her assistance with the coding, for her support, and for travelling with me on this journey.

In addition to their friendship, I would like to thank Nancy Lavigne for translating the abstract, Cindy Finn and Marie Batiche for kindly reading and providing feedback on portions of my dissertation, and Marguerite Roy for assisting me with the analysis of the data.

My family, friends, and colleagues in the cognitive lab have helped me in numerous ways with their support and willingness to listen and I thank them all sincerely.

Abstract

This exploratory study examined the development of writing in students identified with varying levels of the two ADHD diagnostic characteristics of inattention and hyperactivity/impulsivity. Twenty-six academic screening files containing two prompted stories written at the beginning and end of grade 1, were studied. Eight of the files also contained a prompted story from the end of grade 2. In addition, each file contained a teacher completed behaviour rating scale assessing the student's levels of inattention and hyperactivity/impulsivity. The development of writing was examined through the use of four methodologies, a developmental writing content progression, a semantic analysis, a cohesion analysis, and a coherence measure. These methodologies were used to explore (a) general level of writing content, (b) idea production, (c) idea elaboration, (d) idea complexity, (e) cohesive ties, (f) cohesive errors, (g) adherence to the prompt, (h) adherence to a theme, and (i) interconnectedness of ideas.

The major findings indicate significant correlations for both inattention and hyperactivity/ impulsivity with general writing content, cohesive errors, and the interconnectedness of ideas. These results indicate that students with progressively higher levels of inattention or hyperactivity/impulsivity experience more difficulties with the early stages of writing, and in particular have difficulty providing the appropriate connections among their ideas. These findings are interpreted with respect to existing theories of executive function deficits in students with ADHD (Barkley, 1997a, 1997b) and implications for education are discussed.

Résumé

Cette étude exploratoire a examiné le développement de l'écriture des élèves identifiés avec divers niveaux de deux charactéristiques diagnostiques de ADHD: la difficulté de l'attention et l'hyperactivité/impulsivité. Vingt-six fichiers contenant de l'information sur le fonctionnement scolaire des élèves et deux récits, produits au début et à la fin de la première année scolaire, ont été étudiés. Ces récits ont été écrits en répondant à des questions spécifiques. Huit de ces fichiers contenaient également un récit produit à la fin de la deuxième année scolaire. De plus, chaque fichier contenait une évaluation de comportement completé par l'instituteur sur les niveaux de difficulté d'attention et d'hyperactivité/impulsivité chez les élèves. Le développement de l'écriture a été examiné en utilisant quatre méthodologies: une progression développementale du contenu de l'écriture, une analyse sémantique, une analyse de cohésion, et une mesure de cohérence. Ces méthodologies ont été utilisés pour explorer (a) le niveau général du contenu de l'écriture, (b) la production des idées, (c) l'élaboration des idées, (d) la complexité des idées, (e) les liens cohésifs, (f) les erreurs cohésives, (g) l'adhésion aux questions, (h) l'adhésion au thème, et (i) la connection entre idées.

Les résultats principaux démontrent des corrélations significatives pour les difficultés de l'attention et d'hyperactivité/impulsivité avec le contenu général de l'écriture, les erreurs cohésives, et la connection entre idées. Ces résultats indique que les élèves avec des niveaux progressivement plus élèvés d'inattention ou d'hyperactivité/impulsivité ont plus de difficultés au stage initial de l'écriture, et en particulier, ont des difficultés à faire les liens entres leurs idées. Ces résultats sont interpretés par rapport aux théories existantes de la fonction des déficits exécutif chez les élèves avec ADHD (Barkley, 1997a, 1997b), et peuvent contribuer a l'avancement de la recherche en éducation.

Table of Contents

INTRODUCTION 9

REVIEW OF THE LITERATURE 11

Attention Deficit Hyperactivity Disorder (ADHD) 11
Diagnosis, Prevalence, and Chronicity 11
Etiology 12
Cognitive Theories of ADHD 14
Assessment of ADHD 16
ADHD and Academic Performance 18
Written Expression 20
Beginning Writers 20
Models of Language Structure 21
Writing Analysis 22
Cohesion 23
Coherence 25
Semantic Analysis 26
Writing Disabilities Research 27
ADHD and Writing Research 29
Purpose 31
Contribution to the Literature 32

METHOD 33

Students 33
Materials 34
Behaviour Rating Scale 34
Texts 35
Story Prompt 36
Text Analysis Materials 36
Developmental Progression 36
Coherence Measure 38
Procedure 38
Screening 38
Data Analysis 40
Text Analysis Methodologies 40
Developmental Analysis of Writing Content 41
Semantic Analysis 43
Cohesion Analysis 47
Coherence 49
Summary 52

RESULTS 54

Data Preparation 54
Data Analyses 54

Relationship of the Variables to Each Other 54
Developmental Analysis of Writing Content 58
Semantic Structure 60
Idea Production 61
Semantic Elaboration 62
Semantic Complexity 64
Cohesion 65
Cohesive Ties 66
Cohesive Errors 67
Coherence 70
Further Exploration of Findings 75
Writing Content and Connecting Ideas 75
Semantic Elaboration and Complexity 77
Coherence 78
Summary 78

DISCUSSION 79

Discussion of Findings 79
Developmental Progression 79
Semantic Analysis 81
Cohesion and Coherence 82
Gender Differences 84
Subtype Differences 84
Connection to Cognitive Theory 86
Connection of Written to Oral Language 87
Educational Implications 87
Conclusion 89

REFERENCES 90

APPENDIX A – DSM-IV criteria for Attention Deficit Hyperactivity Disorder 108
APPENDIX B – ADHD Rating Scale 109
APPENDIX C – Table of student's stories and behaviour ratings 110
APPENDIX D – Sample of the instructions to students for the writing task 111
APPENDIX E – The analysis of coherence measure 112
APPENDIX F – Inter-rater reliability scores 113
APPENDIX G – Ethical approval 114

List of Tables

Table 1: Types of Cohesive Ties (Halliday & Hasan, 1976) 24
Table 2: Range of Raw Scores and Percentile Ranks for the Students in the Study 40
Table 3: Case Relations 44
Table 4.1: Dependency Logical Relations 45
Table 4.2: Derived Logical Relations – for Quantification 45
Table 4.3: Derived Logical Relations – (Algebraic, Tense, & Modality) 46
Table 4.4: Derived Logical Relations – for Identifying Relations 46
Table 5: Types of Cohesive Errors 49
Table 6: List of Variables 53
Table 7.1: Pearson Correlation Matrix of the Intercorrelations of the Writing Measures in the Study at Time 1 56
Table 7.2: Pearson Correlation Matrix of the Intercorrelations of the Writing Measures in the Study at Time 2 57
Table 8: Means and Standard Deviations for Developmental Level of Writing Content 58
Table 9: Number of Propositions Produced by the Students at Time 1 and Time 2 61
Table 10: Mean Number and Proportion of Semantic Relations Overall, Boys and Girls 63
Table 11: Mean Number and Proportion of Embedded Propositions 64
Table 12: Means and Standard Deviations of Number and Proportion of Cohesive Ties at Time 1 and Time 2 66
Table 13: Means and Standard Deviations of Number and Proportion of Cohesive Errors at Time 1 and Time 2 68
Table 14: Correlations Between Inattention and Hyperactivity/Impulsivity with Number and Proportion of Cohesive Errors at Time 2 for Overall (n=25), Boys (n=13), and Girls (n=12) 69
Table 15.1: Proportion of Clauses that Relate to a Theme at Time 1 and Time 2 71
Table 15.2: Proportion of Clauses that Relate to the Prompt at Time 1 and Time 2 71
Table 15.3: Proportion of Clauses that Relate to Each Other at Time 1 and Time 2 71
Table 16: F – Values for the Analysis of Gender Differences for Coherence Variables 72
Table 17: Correlations Between Inattention and Hyperactivity/Impulsivity with the Proportion of Clauses that Relate to Each Other at Time 1 and Time 2 for Overall, Boys, and Girls 73

List of Figures

Figure 1. Developmental Progression of Writing Content 37

Figure 2. Developmental Progression of Writing Content for Student 03 42

Figure 3. Correlation of teacher ratings of inattention and hyperactivity/impulsivity with the proportion of developmental stages of writing content attained for all the students, n=26, at screening time 1 and time 2. 60

Figure 4. Number and proportion of cohesive errors with respect to inattention and hyperactivity/impulsivity ratings at time 2, n=25 69

Figure 5. Proportion of clauses that relate to the theme with respect to inattention and hyperactivity/ impulsivity ratings at time 1, N = 16 74

Figure 6. Proportion of clauses that relate to each other with respect to inattention and hyperactivity/ impulsivity ratings at time 2, N = 25. 74

INTRODUCTION

The purpose of this study is to document the emerging writing abilities in grade 1 and grade 2 students who have been identified with the characteristics of Attention Deficit Hyperactivity Disorder (ADHD). In addition to the behavioural difficulties of inattention, impulsivity, and hyperactivity that are commonly associated with ADHD, children with this disorder also experience more difficulties than their peers with the academic demands of school. This study uses writing samples and behaviour checklists from grade 1 and 2 students from a suburban Quebec English school board to examine relations between writing and behavioural characteristics in order to identify early warning signs of academic difficulties associated with the characteristics of attention deficits. This research has implications for early identification and intervention with respect to academic difficulties associated with ADHD.

It has been proposed that the many diverse cognitive, behavioural, and academic difficulties associated with ADHD result from a central deficit in behavioural inhibition (i.e., the ability to self-regulate or inhibit a response) that in turn creates secondary deficits in a variety of other executive functions including working memory (Barkley, 1997a, 1997b). Academic tasks that rely on working memory and the other secondary areas of deficit are the tasks found to be most difficult for students with ADHD. Writing, with the multiple demands of mechanics and content, is perhaps the academic task that places the most demands on working memory, and is especially taxing as children first begin to develop the conceptual structures, abilities, and skills necessary for the creation of a coherent text. A variety of language mechanics, spelling, and productivity difficulties have already been noted in the writing of elementary students with ADHD (Elbert, 1993; Resta & Elliot, 1994). When these low-level processes, such as handwriting and spelling, are not automatic, they engage the resources of working memory, leaving fewer resources available for the higher-level demands of writing (Berninger, Graham, Vaughan, Abbott, Abbott, Rogan, Brooks, & Reed, 1997). To date there has been little systematic effort to examine the early signs of difficulties in the higher-level composing processes in the writing produced by young students with attention difficulties. Given the working memory, organization, and planning deficits of students with attentional disorders and the already noted difficulties these students have

with transcription skills, it is hypothesized that coordinating the complex, cognitive demands of writing will be troublesome for early writers who are demonstrating signs of ADHD. Specifically, the writing tasks that may be challenging for young students with attention difficulties are the higher-level content and organizational demands of writing, including the ability to express ideas on paper and connect these ideas to create a sense of a unified text for a reader.

REVIEW OF THE LITERATURE

Attention Deficit Hyperactivity Disorder (ADHD)

Diagnosis, Prevalence, and Chronicity

People have long recognized individuals who display symptoms of poor impulse control, inattention, and hyperactivity (e.g., in the 1800's "Fidgety Phil" was penned by physician Heinrich Hoffman, see Stewart, 1970). This array of symptoms was first clinically recognized as Minimal Brain Damage or Dysfunction in the 1950's when it was found that similar symptoms were present in children with known brain injury or damage (Dolphin & Cruikshank, 1951; Strauss & Kephardt, 1955). This symptom array, formerly known as "hyperkinetic child syndrome" (Chess, 1960) and "Hyperkinetic Reaction of Childhood"(American Psychiatric Association, 1968) is currently diagnosed as Attention Deficit Hyperactivity Disorder (DSM-IV, American Psychiatric Association, 1994) indicating the role of both inattention and hyperactivity in the disorder. The global description of the disorder has evolved over time from the focus on the hyperactivity features to one in which equal or greater weight is placed on the inattention features (Douglas, 1972). The current DSM-IV arranges the core symptoms into the two domains of inattention, and hyperactivity/impulsivity. To receive the diagnosis, the individual must meet the set criteria for one or both of these domains (see Appendix A). In addition, these symptoms must be present before the age of seven, they must be present for more than six months, and they must be evident in two or more settings. These diagnostic requirements are consistent with the evidence on the described symptoms, the chronicity, and the pervasiveness of this disorder (Barkley, 1998).

In Quebec, a Child Mental Health Survey based on DSM-III-R criteria found rates of ADHD at 3.8% to 9.8% among elementary school children (Breton, Bergeron, Valla, Berthiaume, Lambert, St-Georges, Houde, Lepine, 1999). More recently, an epidemiological study using the DSM-IV criteria has estimated that prevalence rates in the United States range between 3% to 5% of the school age population (Wolraich, Hannah, Pinnock, Baumgaertel, & Brown, 1996). These rates are consistent with other prevalence estimates from both clinic and community samples that range between 3% and 7% of school age children (Barkley, 1990), with boys three to nine times more likely to be diagnosed than girls. This overrepresentation of boys may be partially due to the

quantitative gender differences found in the expression of the disorder. Boys have been found to display more hyperactivity (Barkley, 1995), and more of the aggressive/impulsive behaviours than girls (Cantwell, 1996; Wolraich et al., 1996). With the more overt behaviours being the main triggers for referral, females may need more severe symptoms, in relation to their male peers, before the referral is evoked (Barkley, 1995).

ADHD has been found to be a chronic disorder, with 50-80% of children diagnosed with ADHD continuing to display symptoms into adolescence and 30-50% or more of those individuals continuing to meet diagnostic criteria into adulthood (Weiss & Hechtman, 1993). While the major contributions to our knowledge of this disorder come from school age children, primarily boys, the literature on preschool, adolescence, and adulthood is still growing. What is clear from the research is that this life long disorder impacts a significant number of people and exacts an impact on their lives that is broad ranging.

Etiology

There is considerable work still being conducted to determine the etiology of ADHD. It is generally believed that the symptoms seen in ADHD can result from a number of different factors, some factors having more evidence to support them than others. The strongest evidence at this point comes from hereditability research; however, the nature of what is inherited is still under investigation. The early belief that ADHD symptomology was due to some form of brain damage (i.e., minimal brain damage) has not been supported by any specific lesions in the brains of ADHD individuals. This belief has given way to the hypothesis that the behavioural symptoms evidenced must be caused by some differences in the structure and functioning of the brains of individuals with ADHD (Riccio, Hynd, Cohen, & Gonzalez, 1993). The developments in both genetic and neurological research is promising.

Although no specific genes have been proven to be the cause of ADHD, preliminary research has found evidence supporting differences in dopamine related genes in people with ADHD (e.g., Cook, Stein, Krasowski, Cox, Olkon, Kieffer, & Leventhal, 1995; Cook, Stein, & Leventhal, 1997; Lahoste, Swanson, Wigal, Glabe, Wigal, King, & Kennedy, 1996). In addition, researchers have found that family genetic

factors are a contributor to the etiology of ADHD. Twin and adoption studies have revealed that ADHD runs in families and that this is genetic rather than environmental (Barkley, 1990; Cantwell, 1975). Studies have found that identical twins have an 81% risk factor for the disorder (Gilger, Pennington, DeFries, 1992), while fraternal twins and full siblings have a 32% risk factor (Beiderman et al., 1995). This sibling rate is seven times that found within the general population. In addition, children run a 57% risk of having ADHD if either of their biological parents have the disorder (Biederman, et al., 1995). The exact nature of the characteristics being inherited has been investigated extensively in the neurological literature.

Neuroanatomical research has focused on the parts of the brain responsible for attention and motor activity, and some differences between people with and without ADHD have been found in these areas. The areas hypothesized to be involved with ADHD are the cortical (frontal) and subcortical structures (brain stem reticular activating system, thalamus, hypothalamus, and basal ganglia). Evidence for frontal lobe and specifically prefrontal region involvement has been found with PET scan studies with findings of reduced cerebral glucose metabolism in the superior prefrontal cortex and the promotor cortex (Zametkin, Gross, King, Semple, Rumsey, Hamburger, & Cohen, 1990). Other findings include decreased metabolic activity in the frontal lobes and basal ganglia (Lou, Henriksen, Bruhn, Borner, & Nielsen, 1989), and decreased slow wave activity in the frontal regions with decreased beta activity in the temporal regions (Mann, Lubar, Zimmerman, Miller, & Mnenchen, 1992). These findings suggest decreased cortical arousal in the areas of the brain responsible for executive functions and language. MRI findings of smaller right frontal lobe width and relative size differences in the right caudate nucleus (located in the basal ganglia) add confirming evidence to right hemisphere involvement and specifically frontal lobe and basal ganglia involvement in ADHD (Hynd, Semrud-Clikeman, Lorys, Novey, & Eliopulos, 1990; Hynd, Semrud-Clikeman, Lorys, Novey, Eliopulos, & Lyytinen, 1991).

Frontal lobe regions have also been the focus of the neurochemical research. This research has specifically focused on the role of the catecholamines (dopamine, norepinephrine) in ADHD. The catecholamines are implicated in a number of behaviours including attention, inhibition and response of the motor system, and motivation (Clark,

Geffen, & Geffen, 1987). A disorder of the dopaminergic circuits running between the frontal lobe and basal ganglia has been posited as a possible explanation of the underlying dysfunction in ADHD (Levy, 1991). The positive response of individuals with ADHD to antidepressant and CNS stimulant medications (e.g., Ritalin) suggests catecholamine abnormalities in ADHD.

Reviews of the neurological literature in concert with the clinical literature have favoured a deficient inhibitory-frontal system (Barkley, 1997a, 1997b; Hynd & Willis, 1988; Pennington & Ozonoff, 1996) and have led to much theorizing about the cognitive nature of ADHD.

Cognitive Theories of ADHD

As noted above, with no specific neurological/physical evidence, ADHD is currently diagnosed based on behavioural deficits in inattention and hyperactivity/ impulsivity. The descriptive diagnosis found in the DSM-IV; however, does not account for all the cognitive and behavioural deficits that are seen in individuals with ADHD. Theories of the disorder have attempted to account for the difficulties experienced by individuals with ADHD who meet the criteria for the different subtypes. Individuals who have the primarily inattentive type are often separated in the literature from those diagnosed with hyperactivity whether primarily hyperactive type or combined type (e.g., Lahey & Carlson, 1991).

All subtypes of the disorder are characterized by inattentive behaviour, poor school performance, and difficulties with social behaviour; however, individuals who are primarily inattentive have been described as more dreamy, lethargic, passive, more impaired in perceptual-motor speed, and more anxious. In contrast, individuals with hyperactivity have been found to have more externalising behaviours, greater motor activity, frequent off task behaviour during vigilance testing, and more impulsivity (Barkley, DuPaul, & McMurray, 1990; Lahey & Carlson, 1991). Some theories have attempted to account for both subtypes, while others posit that the subtypes may, in fact, be two distinct disorders with the inattention taking different forms (Barkley, 1997a).

Douglas (1988) was one of the first researchers to theorize about the nature of ADHD. She posited that individuals with ADHD had four major deficits: (a) poor investment and maintenance of effort, (b) deficient modulation of arousal to meet

situational demands, (c) a strong inclination to seek immediate reinforcement, along with (d) difficulties with impulse control. These four deficits were later thought to arise from a single core difficulty with self-regulation (Douglas, 1988). Other theories have posited core deficits in motivation (Glow & Glow, 1979), poor stimulus control, a lower sensitivity to reinforcement, or a deficiency in rule-governed behaviour (Barkley, 1989). One theory that gained prominence was an optimal stimulation theory (Zentall, 1985). The premise of this theory is that hyperactivity is a type of self-stimulation that arises from low levels of arousal and attempts to bring about an optimal arousal level. Most recent theories have examined both the cognitive and neurological literature and have proposed a central deficit in behavioural inhibition (Barkley, 1994, 1997a, 1997b; Schachar, Tannock, Marriott, & Logan, 1995).

Recently, Barkley (1996, 1997a, 1997b) has proposed a comprehensive, hierarchical, and unified theory of ADHD. This theory proposes a central deficit in response or behavioural inhibition that 'ripples' through the rest of the executive system all located in the prefrontal regions of the brain. Barkley (1997a, 1997b) proposes that response or behavioural inhibition is a continuum rather than a category, which accounts for the wide discrepancies in the severity of difficulties experienced by people diagnosed with ADHD. Response inhibition is believed to be important to the executive system because it creates a 'gap in time' that allows the executive functions to develop and work optimally. The four executive functions believed to be affected include non-verbal working memory, verbal working memory, self regulation of affect/motivation/ arousal, and reconstitution (i. e., analysis and synthesis of behaviour), each of which are dependent on this gap in time created by response inhibition for their effective execution. These secondary deficits along with the primary difficulty with behavioural inhibition are believed to lead to decreased motor control (i.e., hyperactivity) (Barkley, 1997a).

These executive functions, are important to students as they engage in their academic work and in particular when they are engaging in complex tasks. Evidence of these deficits has been found in a variety of studies. On the classic measures of executive functioning, e.g., the Wisconsin Card Sorting Task (Heaton, 1981), and the Tower of Hanoi, children with ADHD were found to have deficiencies that were independent of any comorbidity (Barkley, Grodzinsky, & DuPaul, 1992; Klorman, Hazel-Fernandez,

Shaywitz, Fletcher, Marchione, Holahan, Stuebing, & Shaywitz, 1999). In addition, studies examining specific executive functions have found evidence supporting the presence of deficits in a variety of areas.

Of specific interest to the tasks in this study, both working memory and reconstitution appear to present significant difficulties in the language development of students with ADHD. A number of studies have found both verbal and spatial working memory deficits in children with ADHD (e.g., Douglas & Benezra, 1990; Karatekin & Asarnow, 1998; Mariani & Barkley, 1997a). Specifically, one study examined Baddeley's (1966) phonological working memory using a speech discrimination task with children with ADHD (Norrelgen, Lacerda, & Forssberg, 1999). These authors found that children with ADHD had no specific difficulties with the speech discrimination task; however, when a working memory load was added to the task, children's performance deteriorated. On tasks requiring reconstitution, students with ADHD have been found to have difficulties with a number of oral production tasks. One study found that in assembling and combining words into ideas (verbal fluency), children often produced the parts correctly, but got them out of sequence (Tannock, Purvis, & Schachar, 1992). Further studies found that children with ADHD experienced more production difficulties giving an oral account of a story when the task required organization and planning without external structures or visual cues to support the planning (Zentall, 1988). These students have been found to be spontaneously talkative; however, they give few elicited responses and give shorter responses compared to their peers when asked to tell stories or respond to questions (Ludlow, Rapoport, Brown, & Mikkelson, 1979; Zentall, 1988).

Studies such as these have documented the array of executive function difficulties associated with ADHD and suggest that Barkley's theory is a useful model for characterizing this disorder (see Barkley, 1997b for a more extensive review). At present, the extensive research and theorizing about the disorder has not contributed to more objective means of assessing the disorder.

Assessment of ADHD

Despite the extensive research that has been conducted regarding ADHD, diagnosis continues to be controversial (Wolraich, 1999). There is currently no standard assessment of ADHD, and specific instruments or tests that definitively diagnose the

disorder are lacking. Objective assessment measures such as continuous performance tests (Corkum & Siegel, 1993) and neuro-imaging (Zametkin, et al. 1990) are inconsistent in their findings. Although neurological and familial factors have been implicated in the disorder, the current diagnosis is based exclusively on behavioural observations by adults who are closest to the child (Baumgaertel & Wolraich, 1998). Behaviour rating scales assessing attention, impulsivity and hyperactivity are the most widely used component of an ADHD assessment (Barkley, 1990). Use of these rating scales has been complicated by the finding that parent and teacher reports are often discrepant (Fergusson &Horwood, 1993). However, as the behaviours associated with ADHD are most apparent in situations demanding greater concentration and less interesting activities, observations in the school context by teachers would be a major consideration in the diagnosis. Teacher observations have been found to demonstrate both reasonable inter-rater reliability (Danforth & DuPaul, 1996) and agreement with direct observations (Wolraich, 1999). Thus, although teachers are not often consulted by physicians making the diagnosis (Jerome, Gordon, & Hustler, 1994) they appear to be in the best position to observe the children's behaviour and have been shown to convey an accurate portrait.

Children who display the most serious symptoms are easily identified; however, for other children the continuum of severity found with this disorder makes it less easy to determine where normality ends and the disorder begins (Wolraich, 1999). Thus, other methods of assessment continue to be explored. For clinical purposes, a psychoeducational battery, including cognitive and academic tests is one method of assessment that is currently in use. At the present time, this battery is used only to rule out other disorders and identify co-occurring difficulties (Zentall & Javorsky, 1995); however, recent studies have found that although the executive functions are dissociable from IQ, there is a small but significant impact of ADHD characteristics (especially hyperactivity and impulsivity) on IQ measures (Barkley, 1997b). This finding is important for clinical practice, but it is especially important in the context of research. Given that ADHD characteristics impact IQ scores, controlling for IQ in a research study will most likely eliminate some of the differences between groups that are the result of the variable of interest, ADHD (Barkley, 1997b). Therefore, for research purposes,

controlling for IQ is no longer considered appropriate (Barkley, 1997b). The exact impact of ADHD on academic performance is continuing to be investigated.

ADHD and Academic Performance

Students with ADHD demonstrate characteristic academic underachievement and are more likely than their peers to repeat grades, to be placed in special classes, to be diagnosed as learning disabled, and to receive tutoring (Biederman et al., 1996; Faraone et al., 1993). Research into the academic achievement skills of children and adolescents with ADHD have found 20 to 25% will have significant delays in math, reading, or spelling and 10 to 30% have problems with language (Barkley, 1990, 1998). These difficulties have been found to persist throughout their school career and a follow-up study found that rates of disability, repeated grades, need for extra help, and placement in special classes all significantly increased when these children were followed through their school career (Biederman et al., 1996). These increasing difficulties point to the necessity for early identification of needs and early intervention to prevent this downward trend in academic achievement.

The difficulties that children with ADHD experience at school are usually attributed to a lack of completion or effort rather than an inability to do the work, as characterized by their inconsistent performance. Ackerman, Anhalt, Holcomb, and Dykman (1986) report that there is a general belief among researchers and clinicians that where LD children are thought to be performing below their cognitive ability, but to the maximum of their academic ability, children with ADHD are believed to be performing below both their cognitive and academic potential. This belief is suggested by the findings that children with ADHD can improve their performance on tasks when there is a reward offered. Although, there is little evidence to distinguish these two groups of students on information processing tasks, the reasons behind their difficulties are believed to be different (August & Garfinkel, 1990). A recent study using effortful and automatic information processing tasks has demonstrated support for a distinction between ADHD and LD difficulties (Hazell, Carr, Lewin, Dewis, Heathcote, & Brucki, 1999). These researchers suggest that the learning difficulties experienced by students with ADHD are more complex than a simple lack of effort and are distinct from the deficits shown by students with learning disabilities. Hazell et al. (1999) used visual information processing

tasks, both serial and parallel, to assess effortful and automatic information processing. They have found that students with ADHD do not have a specific deficit in effortful processing, but likely have decreased overall processing speed. They suggest that this finding may be reflecting a deficit in their total attentional capacity rather than a deficit in their mental effort. Although these children often appear under motivated, these findings, along with the earlier findings of working memory deficits, suggest that the difficulties these students have at school are best attributed to deficits in a variety of cognitive capacities and processes as described in Barkley's theory (1997a, 1997b).

Most of the research aimed at improving these students academic work has focused on behavioural interventions aimed at keeping them interested, attending, and on-task (Fiore, Becker, & Nero, 1993). However, in addition to these motivation/arousal considerations, there are some cognitive and academic difficulties connected to the executive processes that are consistently found in students with ADHD.

Beyond studies of attentional and working memory capabilities, there is little research examining any academic tasks that rely on higher level cognitive processes with students with ADHD. However, one interesting line of cross-sectional research has investigated story comprehension, recall, and reasoning (Milich, Lorch, & Sanchez, 1999; Sanchez, Lorch, Milich, & Welsh, 1999). Using stories presented through the medium of television, these researchers have discovered that children with ADHD display significant developmental lags in comprehending causal connections in stories (Milich et al., 1999). This difficulty was more pronounced when distracters were present and further research revealed that this difficulty in identifying causal connections had an adverse effect on the child's ability to develop a coherent story representation (Lorch Milich, & Sanchez, 1998). Given these difficulties in identifying causal connections and developing coherent story representations, it would be expected that these students would experience equal or greater difficulties in the more difficult task of producing causal connections and creating a coherent story. Although, this has not been investigated in the educational field, the social cognition literature has offered some insights. A study looking at on-line patterns of representation in a social context, found that children with ADHD encoded as many cues as control children, but generated fewer inferential and causal integrating links in their picture-prompted stories (Milch-Reich, Campbell,

Pelham, Connelly, & Geva, 1999). The authors suggest that this less integrated network provides fewer paths for retrieving cues and may account for ADHD children's incoherent organization during narrative recall processes (Tannock et al., 1993). These integration deficits are consistent with Barkley's (1997a, 1997b) theory that reconstitution (i. e., analysis and synthesis of behaviour) is a significant difficulty for these students. In addition to oral discourse processing, difficulties with executive processes may also have an impact on these students' abilities in the area of written expression.

Written Expression

Beginning Writers

The development of writing skills is an essential component of the school curriculum, and during the early elementary school years students are introduced to a variety of writing activities including journal writing, and story writing from a prompt. Given increased content-area demands for writing and minimal competency writing requirements (Graham, Harris, MacArthur, & Schwartz, 1991), difficulties with the development and integration of the many skills necessary for writing can have a significant impact on the academic success of a student.

Writing is one of the most complex processes that we engage in. Often conceptualized as a complex and ill-defined problem-solving task, the production of writing demands the manipulation and coordination of both semantic and textual structures (Frederiksen, Bracewell, Breuleux, & Renaud, 1990). Young children are believed to simplify writing tasks by focusing on certain aspects of the system over others (Dyson, 1987). Descriptions of the speech/print connection in young children's writing has been documented extensively by longitudinal classroom researchers such as Donald Graves and colleagues (e.g., Calkins & Graves, 1980; Graves, 1983) and Britton, Burgess, Martin, McLeod, and Rosen (1975). These researchers have acknowledged the variability in children's early strategies; however, they have described general developmental patterns that are most often observed when children begin to write. Graves (1983) observed that children initially plan their written messages through drawing. Writing is thought, initially, to fulfill the same functions as drawing, and eventually drawing and other symbol systems are believed to ease the transition to writing for young

children (Dyson, 1985; Newkirk, 1987). This transition phase of writing has been described by children as 'copying off of the picture' (Dyson, 1987). A number of researchers have observed that these early attempts at written language take the form of labels, especially labels for pictures the children have drawn (e.g., Newkirk, 1987; Zecker, 1996). Children's next attempts at text often take the form of lists, initially with no sentence structure and then a move towards what has been referred to as an attribute series (Newkirk, 1987; Sowers, 1985). This type of text is described as connected, but randomly arranged statements about a topic, also called 'associative writing' (Bereiter & Scardamalia, 1982).

Eventually, as children become more adept at the encoding process, more attention is devoted to manipulating and reflecting on the content of their messages (Calkins & Graves, 1980). Children begin to relate ideas in a more orderly way, eventually building ordered paragraphs (Newkirk, 1987). Scardamalia and Bereiter (1985) have described a similar developmental trend towards more reflective writing. They describe children as moving from a 'knowledge-telling' strategy in which ideas are put down on paper as they enter the child's mind to a more organized approach to writing, a 'knowledge-transforming' strategy, in which ideas are committed to paper in relation to the major premise of the text. This increasingly reflective approach to writing is consistent with general developmental theories of children's thinking and language use (Piaget & Inhelder, 1969; Vygotsky, 1962).

Models of Language Structure

The challenge of assessing text produced by students at differing levels of ability has resulted in the development of numerous models of both the product and process of writing. Some of these models are specific to writing (e.g., Hayes & Flower, 1986) and others provide general models of discourse (Frederiksen, 1986; Kintsch, 1988). Theories of writing have been typically divided into those that focus on the process of writing (e.g., Hayes & Flower, 1986) and those that create models of how the text is structured (e.g., Frederiksen, 1986). Each of these approaches offer insight into the nature of written language development; however, given the nature of the data collected for this study, this review will focus on product oriented models.

Although numerous models of written production exist, the more precise cognitive models of discourse processing acknowledge the multiple levels of text representation involved in the generation of ideas (semantics) and the conveyance of these ideas in words and grammatical structures (syntactics) (e.g., Frederiksen, 1986). In Frederiksen's model, the major division in structure occurs between the linguistic representations and the semantic or conceptual representations. Within the linguistic representations, text involves letter/sound representations and syntactic structures and relations. Linguistic structures are thought to be important for analysis only for the role they play in marking or signalling the semantic structures of text (Frederiksen et. al. 1990). The semantic structures and relations are represented at the middle and upper levels of this model. The middle level reflects the propositional representations, or ideas, both those explicitly stated in the text and those inferred by the reader/listener from the context of the text. The upper level of this multilevel model represents the conceptual graph structures of a text. This involves the semantic networks that create an overall meaning from the individual ideas, and link this meaning with prior knowledge. In addition, this level identifies the concept of frames in text production and processing reflecting the special, high-level conceptual structures we have regarding specific types of text. For example, our experiences with text leave us with clear ideas about what constitutes "a story" or "a set of instructions." As noted above, this theory is a modular theory of text; however, it is also conceived of as a parallel model, reflecting the belief that the realization of each level of representation is occurring in concert with the other levels in a non-linear fashion (Frederiksen, 1986).

Writing Analysis

A number of methods of writing analysis have been developed (i.e., Hayes & Flower, 1980; Frederiksen, 1986; Kintsch &Van Dijk, 1978). These approaches are diverse in their scope and depth. Most popular in investigating the development of children's writing are the standardized assessments such as the Test of Written Language (TOWL-3) (Hammill & Larson, 1997) or the writing subtests of the Woodcock-Johnson Psychoeducational Battery - Revised (Woodcock & Johnson, 1989). These standardized tools assess the mechanics of writing as well as offering simple count measures of production and subjective ratings of quality of the content of writing samples. In order to

capture the complexity of language representation, more objective methods of analysis based on discourse theories have been developed. Methods based on discourse theories are designed to examine the specific linguistic and semantic structures specified by the above multi-level discourse theory. Analysis of text structure can be categorized based on which level is being analysed (Frederiksen et al., 1990). In particular, one analysis designed to capture linguistic information is the analysis of the cohesive devices outlined by Halliday and Hasan (1976). At the level of semantics, the most systematic and extensive methodology of assessing discourse uses propositional analysis and semantic frame analysis to achieve a detailed semantic description of the discourse (Bracewell, 1999; Bracewell & Breuleux, 1994).

Cohesion

One of the essential qualities of a text is that the ideas and sentences are tied together or interrelated. Cohesion is the linking of elements of the text through a variety of syntactic and lexical means. Research, theory, and common sense suggest that cohesion is critical in language use and communication (Halliday & Hasan, 1976). Halliday and Hasan (1976) have identified five cohesive relations that are found in texts, and tie ideas and sentences together for the reader. A cohesive tie exists when the meaning of an element can be interpreted only in relation to another element in the text (e.g., the use of a pronoun). These relationships or ties can be found between or across sentences or clauses (Halliday, 1985) (see Table 1).

A number of studies have addressed the issue of cohesion in children's writing and story telling with average achieving students (e. g., Cox, Shanahan, & Tinzmann, 1991; Crowhurst, 1987; Fitzgerald & Spiegel, 1986; Peterson, 1993; Spiegel & Fitzgerald, 1990). For children in the early elementary years, a number of studies have investigated aspects of cohesion and identified some developmental trends. Rental and King (1983) found that children developed in their ability to use cohesion between the first and second grades. In particular, one interesting developmental trend at this age is that students' use of reference decreased, while other means of creating cohesion – particularly lexical means- increased (King & Rental, 1981). In a further look at children's early use of reference, Cox and Sulzby (1984) looked at kindergarten and grade 2 children on both oral and written productions of narratives. They found that

children's use of reference in writing related to their use of reference in oral discourse. This is important to note with respect to children with ADHD as evidence mounts that these students experience a range of difficulties with coherent representation in both their oral production and comprehension of stories (e.g., Lorch et al., 1998; Zentall, 1988).

TABLE 1

Types of Cohesive Ties (Halliday & Hasan, 1976)

- Reference: Elements in the text direct the reader to something else for their interpretation. The three subcategories are: (1) pronomials (e.g., The girl made a wish. *She* wished for a cat.); (2) demonstratives (e.g., Our class went to the zoo. *That* was our first school trip.) and the definitive article (e.g., There were two hamsters in the cage. *The* larger hamster was a girl.); and (3) comparatives (e.g., John is a very kind person. *Such* people make good friends.)
- Substitution: One element is replaced with another element that has the same function (e.g., Yes, we went to a restaurant recently. We went to *one* last week.)
- Ellipsis: Words are omitted that can be inferred by the linguistic context (e.g., Would you like to go to the hockey game? Yes, I *would.*)
- Conjunction: Reflects certain logical relations that are present in the text, subcategories being: additive (e.g., and, also), adversative (e.g., but; however, only), continuative (e.g., anyway), temporal (e.g., next, then), and causal (e.g., so, therefore)
- Lexical Cohesion: Involves either (a) the reiteration of an element, e.g., repetition, or (b) lexical collocation i.e., the association of two words that often occur together *climb/ascent.*

Adapted from Halliday & Hasan (1976)

In general, the results of the cohesion research with the writing of young children, indicate that most students develop the ability to connect ideas using cohesive ties (Irwin, 1988). Although there are no studies examining children with ADHD and their use of cohesive relations, research with students who have learning or language difficulties is ongoing. Findings so far from this literature suggest that in the oral and written production of stories, students with learning or language difficulties have some

disruptions and inappropriate usage of cohesive relations (Cox, Shanahan, & Sulzby, 1990; Hedberg & Fink, 1996; Liles, 1985; Ripich & Grifith, 1988).

Coherence

Coherence is most often described as the global meaning of a text (Bamberg, 1984; de Beaugrande & Dressler, 1981; Fitzgerald & Spiegel, 1986; Hasan, 1984; Van Dijk, 1980). Although it has often been related to, or confused with, cohesion, there is a general consensus that the use of cohesive ties are a necessary, but not sufficient condition for coherence (or how a text 'hangs together') (Cooper, 1988; Tierney & Mosenthal, 1983). In addition to these text based cues by the writer, coherence is believed to be based in the reader, i.e., the "continuity of sense" developed in the reader's long term memory (de Beaugrande & Dressler, 1981; Cooper, 1988). A number of models for assessing this quality of text have been developed ranging from more reader based holistic ratings (Bamberg, 1984) to more text based analysis that examine the contribution of each idea or cohesive tie to the overall theme or structure (de Beaugrande, 1980; de Beaugrande & Dressler, 1981; Van Dijk, 1980; Hasan, 1984). From these models, methods of assessing coherence have been developed and applied to the writing produced by students.

In an expansion of cohesion analysis, Hasan (1984) developed a methodology for assessing coherence, called the cohesive harmony index. Textual coherence in this assessment is based on a measure of two categories of cohesive chains. Identity chains have a semantic basis and reflect coreferentiality, while similarity chains reflect coclassification or coextension. Although some studies have found that this text-based method of assessing coherence reflects a developmental trend (Rental & King, 1983), it has been found to be unrelated to quality of writing and is unrelated to multi-factor holistic ratings of coherence (Spiegel & Fitzgerald, 1990). As a text-based measure, the cohesive harmony index may not be capturing some of the essential features of coherence. Speigel and Fitzgerald, (1990) noted that the use of a small range of the cohesive variables may not account for various reader variables such as memory span (i.e., whether the reader makes the connection between elements that are at various distances in the text) and pragmatic aspects of coherence (i.e., the readers perception that elements are related). In addition, researchers have argued that this 'bottom-up'

procedure for addressing coherence may fail to capture the macrostructural aspects of coherence (Mosenthal & Tierney, 1984). For example, the cohesive harmony index fails to account for the difference in coherence caused by presenting two clauses in a different order.

In contrast, a measure of coherence developed by Bamberg (1984) based on work on coherence by Van Dijk (1977, 1980) and Halliday and Hasan (1976) uses a holistic 4 point rating scale from coherent to incoherent based on multiple factors. These factors include (a) an identified and sustained topic, (b) the creation of a context or situation, (c) an organized presentation of details according to a plan, (d) an effective use of cohesive devices, (e) a final statement that provided closure, and (f) a smooth discourse indicated by a lack of mechanical and grammatical errors. Research conducted with this measure found developmental differences in coherence and in addition concluded that coherence was related to quality of writing using this measure (Bamberg, 1984; Fitzgerald & Spiegel, 1986). This relationship between coherence and quality of writing is supported in the literature (Witte & Faigley, 1981). This more holistic type of rating of coherence may reflect more closely how children's writing is assessed by teachers, while the multi-factor quality of this analysis allows one to examine the strategies of the writer in conjunction with the role of the reader in constructing the coherence of a text.

Although a number of different measures have been used to assess coherence, there is a consistent finding that children improve in their ability to create coherent written texts as they move through elementary and secondary grades (Bamberg, 1984; Fitzgerald & Spiegel, 1986; Golden & Vukelich, 1989; Speigel & Fitzgerald, 1990; Wright & Rosenberg, 1993).

Semantic Analysis

The theories of discourse structure propose that people represent and process discourse at multiple levels involving both linguistic and semantic structures. There is a general belief that people represent the meaning or semantic information of text or speech at two levels. The first level is more detailed and is referred to as the "microstructure" or propositional level (Meyer, 1975; Kintsch, 1974; Frederiksen, 1972). These propositions represent basic chunks of conceptual information. At the second, more global, level, variously referred to as the frame or macrostructure (Frederiksen, 1972; Kintsch, 1974),

the chunks of meaning are represented in networks or representational frames. These general discourse models have provided a basis for a number of discourse analysis methodologies. Because these methods of analysis are theory-driven, they are both descriptive and predictive (Spivey, 1997). In addition, the level of detail provided by these methodologies gives a high level of descriptive power (Senecal, 1998).

Frederiksen's (1986) propositional analysis and Senecal's (1998) Idea Unit analysis focus their inquiry on the basic units of meaning and relationships among these units of meaning that are either encoded in a text or logically inferred by the reader. Propositions are composed of a predicate or relational concept and one or more arguments (Crammond, 1998). At its simplest level, this is often stated as the concept-relation-concept triple in which: (a) the concepts are defined as objects, actions, or properties; and (b) the relations among concepts are defined as case relations (e.g., Agent, Result) or as logical relations (e.g., Condition, Category) (Bracewell & Breuleux, 1994). By further defining the links (both text-based and prior knowledge based) between the propositions, a network of propositions can be constructed. The coherence of the network is achieved by the labelled relations that provide the links between concepts. This structure provides a semantic network by which the meaning of the text is represented.

The examination of these multiple levels of representation allows a researcher to capture the complexity of text production. The detailed semantic analysis provides a database of semantic structures produced by the writer that can then be used to study objects of interest to the researcher (Bracewell, 1999). For example, in studies of children's text production, researchers have used detailed semantic analysis to examine both children's creation of stories (e.g., Frederiksen, Donin-Frederiksen, & Bracewell, 1987; Senecal, 1998) and children's ability to create argument structures (Crammond, 1998).

Writing Disabilities Research

Given the complex nature of the writing task and the multiple levels of language representation that must be manipulated, it is not surprising that there are students who experience difficulties in the area of written expression. Although much of the research on students with learning disabilities has focused on reading difficulties, there is a growing body of research in the area of writing disabilities in the elementary grades (e.g.,

Englert & Raphael, 1988; Englert & Thomas, 1987; Graham & Harris, 1999; Graham, Harris, MacArthur, & Schwartz, 1991; Keefe, Davis, & Andrew-Becks, 1997; Montague, Maddux, & Derishiwsky, 1990; Newcomer & Barenbaum, 1991). Researchers have documented difficulties with virtually every aspect of written language production. These students have been found to have difficulties with mechanics, syntax, spelling, vocabulary, revision, fluency, and quality (Newcomer & Barenbaum, 1991). In addition, they also experience more deficiencies in text structure knowledge – both story (Montague et. al., 1990) and expository (Englert & Thomas, 1987. Thomas, Englert, and Gregg (1987) found that children with learning disabilities often use strategies similar to those used by younger students. In particular, they found these students frequently use Scardamalia and Bereiter's (1985) "knowledge-telling" strategy, in which ideas are generated from memory and written down without regard to their relevance for genre or readership.

Recent research has turned a focus on the role of working memory in written expression (McCutchen, 1994; 1995), and suggests that the difficulties many children have in compositional fluency and quality result from working memory being burdened with non-automatized transcription skills (e.g., Berninger, 1999). This orientation, introduced by a number of developmental writing researchers (e.g., Bereiter, 1980; Graves, 1982; Scardamalia, 1981), has been investigated extensively in the last few years. Using word count measures of fluency and overall ratings of compositional quality, researchers have used structural equation modelling to demonstrate a path from handwriting to both compositional fluency and compositional quality in the primary grades (Graham, Berninger, Abbott, Abbott, & Whitaker, 1996). In addition, these researchers found that explicit intervention in handwriting and spelling improved students' writing performance on these general measures of writing quality and fluency (Berninger et al., 1997). It is speculated that the non-automatization of retrieving the sounds and symbols of language and producing the symbols/letters by hand may affect the degree to which capacity-limited working memory resources can be devoted to high-level cognitive processes (Berninger, 1999; Lahey & Bloom, 1994). This research could be significant for children with ADHD who have been found to struggle with their handwriting and spelling.

ADHD and Writing Research

The writing difficulties experienced by students with ADHD have not been documented as extensively as those of students with learning disabilities. However, there is evidence to suggest that writing is a problem area for these students. Anecdotal and research evidence has noted difficulties in transcription skills, i.e., handwriting (Lerer, Artner, & Lerer, 1979; Lerer, Lerer, & Artner, 1977; Peeples, Searls, Wellingham-Jones, 1995), language mechanics and spelling (Elbert, 1993), and repeated failures to get their ideas and thoughts on to paper (Elbert, 1993; Ingersoll, 1998; Resta & Eliot, 1994).

Difficulties in written expression by students with ADHD often lead to incomplete assignments or render their written work unreadable or incomprehensible to teachers (Ingersoll, 1998), resulting in frustration and increased difficulties in school as the demands for written work become greater. Many students with ADHD cope in the elementary grades and begin to experience difficulty as they reach middle school and high school (Ingersoll, 1998). One contributing factor to this decline may be this difficulty with written expression.

Resta and Elliot (1994) and Elbert (1993) completed the most extensive examinations of written expression in students with ADHD. Resta and Elliot (1994) used The Written Language Assessment (Grill & Kirwin, 1989) to look at the creative, expressive, and instructive writing of boys with ADHD compared to their peers age 8 to 14 years old. These researchers looked at 5 different aspects of writing: (a) general writing ability; (b) productivity; (c) word complexity; (d) readability; and (e) a composite written language score. Significant differences were found for each factor except for the measure of readability, where readability was defined as the relationship between the average number of syllables and sentences in a text (Resta & Elliot, 1994). The authors note that this assessment emphasizes quantity over quality (Resta & Elliot, 1994). In the only other study that examined writing and ADHD, Elbert (1993) examined the writing of both boys and girls, age 6 to 12, who were clinically referred for ADHD. This study used writing subtests of The Woodcock-Johnson Psychoeducational Battery (WJ-R) (Woodcock & Johnson, 1989) and The Wide Range Achievement Test (WRAT-R) (Jastak & Wilkinson, 1984) and found that children with ADHD have significantly more difficulties with spelling, fluency, and dictation in comparison to their same age peers

(Elbert, 1993). As with the previous study, the measures used in this study offer count measures of writing qualities, (e.g., word production, and words spelled correctly), however, these measures do not capture the quality and organization of the ideas produced by the students. These studies, using standardized writing assessment tools, are presently the only comprehensive examinations of the writing produced by students with ADHD. There is currently a dearth of classroom based research in this area and there continues to be a need to examine the idea generation of these students. Results from these earlier studies and anecdotal teacher reports suggest that these areas may also be difficult for children with ADHD.

As described in theories of discourse processing, there are a number of higher level cognitive demands placed on a writer (e.g., to meet the purpose of the task and to 'juggle' the multiple levels of representations of discourse). In addition to these multiple demands, beginning writers have the additional demands of lower level skills (e.g., motor planning and motor production) that have not yet been mastered. As found in the learning disability literature, these low-level processes need to become automatic for the writer to have working memory resources for the higher level cognitive processes involved in composing (Berninger et al., 1997; McCutchen, 1988, 1995). Problems with handwriting and spelling may be engaging the resources of working memory to the degree that the semantic demands of the task, the compositional fluency and quality are negatively impacted (Graham et al., 1997). Difficulties with transcription skills are prevalent among students with ADHD, leading one to suspect that this group of students may experience more difficulties with the higher level demands of text processing.

In addition, the process of writing has been described as a problem-solving task that is continually being redefined during the text production as the writer organizes and reorganizes their knowledge (Bracewell & Breuleux, 1994). Children with ADHD have been shown to experience significant difficulties with organizing and sustaining their attention (Barkley, 1990; 1998) and are known to have difficulties organizing their oral recounts of stories (Dienska, DeJonge, & Sanders-Woudstra, 1985; Ludlow et al., 1980; Zentall, 1988). It would therefore be predicted that a problem-solving task such as writing, that depends on working memory to develop, organize, expand, and relate ideas would present a significant difficulty for students with ADHD who already have a

significant working memory load with the transcription of text. Difficulties organizing a written text should be seen in the compositional quality and coherence of the text.

Purpose

Research has documented the difficulties students with ADHD have with working memory, organization, and planning. These skills are necessary for integrating the multiple demands of discourse production as evidenced in the difficulties these students have organizing and planning their oral story production. When stories become written text, the demands of transcription skills (e.g., handwriting and spelling) are added to an already complex task. It has been found in the learning disabilities research that when transcription skills are not automatized, as have been noted with students with ADHD, working memory resources are not available for the higher level semantic demands of writing. The purpose of the proposed study is to explore the developing writing skills of grade 1 and 2 students identified with the characteristics of ADHD. Identifying early difficulties can lead to better intervention programs for these students.

This study sets out to explore the nature of the relationship between ADHD characteristics and writing content development. Specifically, the impact of the characteristics of inattention and hyperactivity on the developmental progression, semantic elaboration and complexity, cohesion, and coherence of writing in grade 1 and grade 2 students. This study will explore whether the features of inattention and hyperactivity contribute in the same manner and to the same degree to the above writing characteristics. Finally, the role of gender on the nature of these relationships will be explored.

It is hypothesized, given the deficits students with ADHD have with executive processing and the deficits already demonstrated in the surface features of writing, that coordinating the complex, cognitive demands of written discourse production will be troublesome. It is proposed that these students will have difficulty with working memory, organization, and the planning demands of writing, resulting in decreased performance in both syntactic and semantic production in comparison with their age matched peers. Specifically, ADHD features will have an impact on their idea or proposition generation, as well as the cohesion and coherence of their stories, affecting their ability to connect

their ideas with both syntactic and semantic structures and create a sense of a unified story for a reader.

Contribution to the Literature

This study offers a number of contributions to the existing literature. Although there is literature documenting the difficulties students with ADHD have with the surface features of written expression (e.g., handwriting, spelling), less is known about the semantic features of the writing produced by these students. In addition, there is a lack of studies employing methodologies designed to describe higher-level text development (most notably discourse analysis techniques). Previous research on the semantic features of the writing produced by students with ADHD has relied on standardized assessment protocols. This study will contribute to the research by using discourse analysis techniques to analyse samples of writing produced by students in the classroom.

In addition, the literature examining how difficulties with the surface features of language contribute to difficulties with compositional quality and fluency has: (a) only studied children with writing disabilities, not students with ADHD, and (b) used measures of compositional quality and fluency that are more discriminative, rather than descriptive in their nature.

Finally, ADHD is often viewed in the research literature as an either/or diagnosis despite evidence that there is a continuum of severity found in people diagnosed with the disorder. The current study will reflect this reality by examining the writing development in relation to this continuum of difficulty.

METHOD

Students

Twenty-six students, enrolled in regular stream classes at a suburban elementary school, participated in the study. The school was in Quebec's English public sector and the majority of the students enrolled in the school were anglophone Quebecers from the surrounding working to middle socioeconomic status neighbourhood. The two classes were successive cohorts of grade 1 students who had the same teacher for the year the samples were chosen, as well as the previous year when the students were in kindergarten. Therefore, the writing curricula and other educational experiences of the two classes were largely consistent. The first cohort, consisting of eight students, completed writing samples at two points in grade 1 and again at the end of grade 2. The second cohort, consisting of 18 students, completed writing samples at two points in grade 1. All of the students were receiving English instruction with one hour per day of French as a second language. The majority of children in these two classes came from primarily English or bilingual (French/ English) linguistic homes. This was expected given the population in this area.

In addition to the English stream from which the classes were chosen for this study, the school also housed a French Immersion stream. In Quebec, the French Immersion programs are a popular choice for parents; however, parents will often transfer their children to the English stream if they have encountered difficulties in the French Immersion program. This transfer means that the proportion of students with learning difficulties is higher in the English stream programs than would be expected in a typical suburban school board. This school was chosen for the study because of its high number of students with learning difficulties, combined with experienced and knowledgeable teachers in grades 1 and grade 2. The teachers were interested in exploring and discovering the best possible resources and strategies for helping their students.

The students had all participated in a school board academic and behavioural screening project developed to guide early intervention strategies for children in kindergarten, grade 1, and grade 2. Students were selected for the study if their screening files contained complete data sets and if the student had no primary learning or cognitive

disability. The screening files contained writing samples and behavioural data for each student. The students' behaviour ratings ranged from students who were displaying no behavioural difficulties, to those who displayed significant difficulties (see behaviour ratings below).

Materials

The materials and instruments used in the study consisted of both screening instruments and measures used in the analysis of the writing samples. The screening instruments included a teacher completed behaviour rating scale for each student, texts written by the students, and the writing prompt from which the texts were written. The materials required for the text analysis methodologies included a developmental writing content progression and a measure of writing coherence. These are described fully in the subsections that follow.

Behaviour Rating Scale

Behaviour rating scales are a primary means of screening and identifying children with ADHD (DuPaul, Power, Anastopoulos, Reid, McGoey, Ikeda, 1997). With the publication of the DSM-IV (APA, 1994), rating scales for ADHD were revised to reflect the two-dimensional structure and specific symptoms required for the diagnosis (DuPaul, et. al., 1997). Specifically, the criteria for ADHD in the DSM-IV now include nine inattention criteria and nine hyperactivity/ impulsivity criteria (APA, 1994). This two-dimensional structure is supported in the theoretical literature (e. g., Barkley, 1997a, 1997b; Lahey & Carlson, 1992), and in the factor analytic research on the disorder (e. g., DuPaul, 1991).

The behaviour rating scale that was used in this study was part of an assessment package developed by the school board from which the data were obtained. It is designed to assess a number of behavioural characteristics including inattention and hyperactivity/ impulsivity. There are a total of 50 statements reflecting both positive and negative behaviours that may be seen in the classroom. The teacher provides a response for each statement on a 4-point Likert scale ranging "0" (never or rarely) to "3" (very often) (see Appendix B for a copy of the behaviour rating scale). Eighteen of these statements reflect the 18 DSM-IV symptoms of ADHD assessing both Inattention and Hyperactivity/Impulsivity (see Appendix A for DSM-IV diagnosis of ADHD). These 18

statements also comprise the ADHD rating scales of the Disruptive Behavior Rating Scale - Teacher Form (Barkley, 1998) and the ADHD Rating Scale-IV (DuPaul, Power, Anastopoulos, & Reid, 1998). Only these statements assessing hyperactivity/impulsivity and inattention were used for this study.

Psychometric data for a teacher rating scale containing the 18 symptoms of ADHD rated on a 4-point Likert scale are available through the work of DuPaul, et al., (1998) for the ADHD Rating Scale - IV. These authors collected US normative data on 2000 randomly selected students according to US census data distributions for ethnic group and region. The normative sample used approximately equal number of boys and girls aged 4 to 19 years attending kindergarten to grade 12. The effects of age and gender were found to be significant and therefore norms are presented for each gender and for 4 separate age groups (i.e., 5 to 7, 8 to 10, 11 to 13, and 14 to 18). High levels of both internal consistency (alpha coefficients Inattention = .96 and Hyperactivity/Impulsivity = .88) and test-retest reliability (Pearson product-moment correlation coefficients Inattention = .89 and Hyperactivity/Impulsivity = .88) were obtained. In addition, subscale scores on the Teacher Rating Scale correlated significantly with questionnaires used to assess ADHD (i.e., Connors Teacher Rating Scale –39) as well as with direct observations of off-task and fidgety behaviour, and academic performance (DuPaul, et al., 1998).

This school board's screening behaviour rating scale was chosen because of (a) its incorporation of DSM-IV criteria measured with the normed 4-point Likert rating scale, and (b) its standard use at this school board and teacher familiarity with the format.

Texts

The writing samples were selected from a board-wide screening project for grade 1 and grade 2 students. These writing samples were selected because of the combination of a naturalistic context for writing and a standardized procedure in which the samples were written. Each child drew a picture and wrote a story based on a single oral prompt at two points in their grade 1 year. One class also completed another drawing and story in their grade 2 year. These repeated measures data offered an excellent opportunity to study developmental changes in students' writing in relation to the behavioural characteristics observed by the teachers. As noted earlier, there were a total of 26 students with both

behavioural and grade 1 writing data in the two classes. Longitudinally, a total of 12 females and 14 males completed both grade 1 writing samples; and of those, 8 students (2 female and 6 male) also completed a grade 2 writing sample (see Appendix C for students' texts).

Story Prompt

As noted above, the writing samples were inspired by a story writing prompt. The prompts were devised for the screening project by the school psychologist and a team of professionals from the school board from which the writing samples were obtained. Each prompt was based on a children's literature book that was read to the students immediately prior to the drawing and writing activity. In the fall of their grade 1 year, the activities were based on the Eric Carle (1975) story *The Mixed-Up Chameleon* and in the spring, the activities were based on the Simon James (1993) story *My Friend Whale.* In grade 2, the activities were based on the book *Liplap's Wish* by Jonathon London and Sylvia Long (1994). An example of the instructions for delivering the prompt is included in Appendix D. Although a different story and a slightly different prompt was used for each screening point, the general procedure remained the same. At each screening point the students were given an activity booklet that included an 11 x14 inch page that had space for a drawing and lines for writing their story. Additional paper was also made available to prevent the students from feeling constrained to limit their stories to the number of lines on the page.

Text Analysis Materials

There are four different text analysis methodologies used in this study. The methodologies for assessing cohesion and semantic structure are well established procedures in the literature and will be described further in the procedure section of this chapter. In contrast, the methodologies employed to assess developmental progression and coherence, although both are based on well established theory, require more explanation here to describe the particular structure of the assessment tool used.

Developmental Progression

As expected given the grade levels of the study, a number of the students' writing was at a very early stage of development. These students included those who refused to write, those who wrote random letters, and those who wrote single words in isolation or

in lists. In order to capture the developmental level of these students, an adapted form of the School Board's screening developmental checklist was used (see Figure 1). This checklist was developed by the school psychologist in conjunction with a team of professionals including other school psychologists, school psychology interns, speech and language pathologists, and curriculum specialists.

Writing Content The student:	Fall Grade 1	Spring Grade 1	Spring Grade 2
• develops his/her ideas (i.e., sustains topics, provides details)			
• uses richer, more extensive descriptive language.			
• makes more complex links among ideas (e.g., because, if).			
• begins to use descriptive language.			
• writes simple narrative texts (i.e., stories, experiences).			
• uses simple connectors to link ideas (e.g., and, then).			
• writes meaningfully-linked sentences.			
• expresses ideas in sentence form.			
• links words to express an idea.			
• writes single words (in isolation, or in lists).			
• labels his/her drawings.			
• distinguishes writing from pictures.			

Figure 1. Developmental Progression of Writing Content

This measure used in the School Board Screening Project captures the developmental progression of early writing content from kindergarten to grade 2. The progression begins (at the bottom of the checklist) with a determination of whether the child can distinguish writing from pictures and then moves through the stages of labelling, connecting words to form ideas, connecting ideas and then connecting sentences, using simple and then more complex connectors, creating simple narratives, using descriptive language, and finally expanding and fully developing ideas. The requirements to meet each stage of development become increasingly more stringent.

This progression was employed for a number of reasons. Most importantly, this assessment reflected the developmental progression of writing content as described in the writing literature (e. g., Graves, 1983; Newkirk, 1987), it allowed for assessment of writing in a naturalistic context and provided more discrimination of stages in writing content development than standardized measures of writing (e.g., The Test of Early

Written Language, Hresko, 1988), and as it was developed by the school board psychologist, it reflected the content of the language arts curriculum the children in the study were exposed to.

Coherence Measure

The analysis of coherence was based on a combined count and holistic measure devised by the researcher, consisting of eight questions (See Appendix E). Coherence was defined as the overall property of unity, the global meaning, or how well a text holds together (Bamberg, 1984; de Beaugrande & Dressler, 1981; Fitzgerald & Spiegel, 1986; Hasan, 1984; van Dijk, 1980). The measure included questions based on Bamberg's (1984) coherence measure. These questions related to whether the text identified and sustained a topic or theme and whether the ideas were connected to each other. With respect to the theme, if a topic or theme could easily be discerned by a reader, this was also considered to be a defined theme for such young writers. Further questions from Bamberg's scale were not included because the students were too young to have mastered the skills necessary to meet the requirements. For example, a question concerning a closing statement to a piece of writing was not included.

Because the students were also writing in response to a prompt, this external contextual information was considered important in the creation of coherence. Questions regarding the prompt were included for analysis (e.g., the number of total clauses in the piece that responded to the prompt). In addition, because the children were also asked to draw a picture the measure included questions of how well the picture contributed to the coherence (i.e., did the picture respond to the prompt and was the theme of the picture the same as the theme of the text?). The drawing was considered an important aspect to explore as developmental research suggests that children will often use their picture to support or guide their written messages (Dyson, 1987; Graves, 1983).

Procedure

Screening

The screening project, designed and implemented by the school psychologist, a team of professionals, and the classroom teachers, was designed to guide early intervention for students who were demonstrating signs of academic and behavioural difficulties. A number of school related skills were assessed, including writing and

behaviour. The screening was piloted in the fall of the student's kindergarten year, but based on a different theme. Therefore, all of the students were familiar with the procedure and expectations of the screening. The screening was implemented when the students in this study were in grade 1 and one class was also screened at the end of grade 2. The screening was administered to the students in the fall term (November) and again in the spring term (April) of grade 1 and then again in the spring term of grade 2. A standard procedure was followed for each administration (see Appendix D for an example of the story prompt).

Following a reading of the children's literature book chosen for that time period, children participated in a large group brainstorming activity that drew the student's attention to an idea or event from the story. For the fall activities of grade 1, the children were asked "If you were granted the chameleon's wish, and could become any animal in the world, which one would you choose to be?" In the spring of grade 1, the question was "If you could sneak out at night to meet a secret friend (the boy in the book meets his friend Whale) who would you want this friend to be". The question in grade 2 was similar to the previous 'wish' question; however, the students were prompted more generally to think what they would wish for (as the book tells the story of Liplap's wish). The students' responses in the brainstorming were recorded on the blackboard or on chart paper for everyone to see. This activity created ideas for the student's drawing and writing. The students were asked to draw the animal they wished to be (fall) or the secret friend they wished to have (spring) or what they would wish for (grade 2) and then write the story of how their wish came true, how they met their secret friend, or what their wish was. Teachers and professionals were present to ensure that students had an idea for their story, and to offer encouragement. No specific content or mechanical support was offered to the students.

Following the second or third screening, the grade 1 or grade 2 teachers were requested to fill in the behaviour rating scale (described on page 34) on each student. The end of the school year was chosen as the time when the teachers would be most familiar with the students' behaviour. Both teachers had completed numerous behaviour checklists previously and were deemed, by the school psychologist, to be consistent and accurate in their assessments.

The information from the rating scales was matched with the writing samples and kept by the school board as archival data. The school board psychologist assigned a student ID number to each student. This number was placed on each of the students' writing samples and on the rating scale completed by the teacher for that student. All identifying information (e.g. student name and school name) was removed by the school psychologist before the writing samples were released to the researcher. Information from the behaviour rating scale was scored by the school psychologist. The school psychologist determined the score for each of the subscales of the rating scale for each child. This information was conveyed to the researcher using the numbers assigned to each student. This procedure afforded the students complete anonymity (see Appendix C for complete chart of student numbers, behaviour ratings, and students' texts). Analysis of ADHD symptomology was based on the two factors of Inattention and Hyperactivity/ Impulsivity, which were treated as continuous variables. Behavioural data were not conveyed to the researcher until the written texts had been analyzed. This allowed for a blind analysis of the writing samples. The range of raw scores and percentile ranks found for the girls and boys on the Inattention and Hyperactivity/ Impulsivity subscales of the behaviour rating scales is presented in Table 2.

Table 2

Range of Raw Scores and Percentile Ranks for the Students in the Study

	Inattenion		Hyperactivity/Impulsivity	
	Raw Score	Percentile	Raw Score	Percentile
Girls	0 to 18	1st to 88th	0 to 12	1st to 80th
Boys	0 to 22	1st to 93rd	0 to 25	1st to 96th

Data Analysis

Text Analysis Methodologies

All texts and pictures were photocopied on the original 11x14 inch paper. Originals were left with the teachers for the students' files. Names of the children had

previously been removed from the writing samples and a student ID number was present. The texts were transcribed and then analysed for (a) developmental level of writing content, (b) semantic complexity, (c) cohesion, and (d) coherence. Results of these analyses were combined with the behavioural data to form a database from which both empirical and qualitative investigations could be undertaken. Specifically, investigations were aimed at determining the relationship of ADHD characteristics to writing development.

Developmental Analysis of Writing Content

Children in grade 1 and 2 have a wide variability in the developmental level of their writing content. The writing that was collected from the screening project demonstrated that children's writing ranged from strings of letters and words to complex narratives. A developmental analysis was then needed for two reasons. The first was to document each child's progression in their writing content. The second reason was to determine which writing samples could be analysed further. In order to perform any semantic, cohesion, or coherence analysis the content of the writing had to reach, minimally, the stage where the children were connecting words to form an idea. Therefore, the first stage in the text analysis was to determine the developmental stage of the writing content of each piece of writing.

This analysis required that each piece of writing be assessed by the researcher for stage in the developmental progression shown in Figure 1. Starting at the beginning of the progression, the researcher noted whether each criterion had been attained by the student during this piece of writing. The first determination was to whether the students recognized the difference between pictures and writing. If the student had drawn a picture in the picture box and then indicated some form of writing (i.e., letters) on the lines of the page, then the student was judged to have met that stage of development. The requirements to meet further stages become increasingly more complex. Some of the stages were more objectively determined, for example, if the student wrote single words in isolation or in lists. Other determinations required a judgement by the rater (e.g., is the piece of writing a simple narrative text?). An example of a student's developmental progression at the three time periods is presented in the following example (spelling

corrected where possible to facilitate analysis of the content, and names of the school and the teacher changed to preserve anonymity):

Student # 03 (male)

Fall grade 1: At Oakridge Ibtmptcatulmsik. Iveywcice e a seea. CattheIcat.Cates.The. Dog with I cat. Othe I doglltI cat. The I Cat.

Spring grade 1: My POD. I go down the stairs no I don't. I go out of my boat I get eowmdc deswg A silly dog and I like Mrs. Robin.

Spring grade 2: A Kids Wish is a Fish. One night a kid was wishing on a shooting star. And two days later got his wish. And the next day his sister wished too. And soon enough she got her wish. and so the boy and so did the girl. The end

WRITING CONTENT The student:	Fall Grade 1	Spring Grade 1	Spring Grade 2
• develops his/her ideas (i.e., sustains topics, provides details).			
• uses richer, more extensive descriptive language.			
• makes more complex links among ideas (e.g., because, if).			
• begins to use descriptive language.			√
• writes simple narrative texts (i.e., stories, experiences).			√
• uses simple connectors to link ideas (e.g., and, then).		√	√
• writes meaningfully-linked sentences.			√
• expresses ideas in sentence form.			√
• links words to express an idea.		√	√
• writes single words (in isolation, or in lists).	√	√	√
• labels his/her drawings.	√	√	√
• distinguishes writing from pictures.	√	√	√

Figure 2. Developmental Progression of Writing Content for Student 03

In the fall of grade 1, the student demonstrated the ability to write single words in isolation. By the spring of the grade 1 year, this student had begun to connect words to form ideas, and had used simple connectors in his writing. At the end of grade 2, he demonstrates considerable development in his ability to construct meaningfully linked sentences and to develop a simple narrative using the beginnings of descriptive language (e.g., one night, shooting star, soon enough).

The children's attainment of each level of development in their writing samples was documented in the database. In addition, for the purposes of statistical analysis, the

total number of stages reached and the proportion of developmental stages reached (denominator = 12) were calculated.

An inter-rater reliability check was conducted on the developmental progression. Reliability was assessed through comparison of the author's analysis of writing samples with that of an independent rater. Agreement for each stage in the progression was assessed and calculated at 95% agreement (see Appendix F for a complete list of inter-rater reliability measures).

Semantic Analysis

The semantic analysis of the children's texts was based on Bracewell and Breuleux's (1994) adaptation of Frederiksen's (1974, 1986) theory of propositional representations in natural language. This procedure provides a detailed description of the semantic structure of written texts (Bracewell & Breuleux, 1994). The analysis describes the type of relations that exist between concepts within the propositions. From an analysis of the types of relations among the concepts, it is possible to determine the degree of semantic complexity and the degree of elaboration provided by the students in their writing.

This type of discourse analysis is normally carried out in steps (Frederiksen et. al., 1997). The first step of the propositional analysis involves dividing the texts into propositional or idea units. In the simple texts provided by these students, propositions were roughly equivalent to a clause. For example, the following text consists of five propositions.

- I wish to have a brother (1). Wishes are sometimes good (2). But if you exaggerate (3), the wish sometimes does not work (4). What is your wish (5).

At its simplest level, a proposition is composed of two concepts and the relation that connects them. For example, in the children's texts, there were propositions such as the following

1. I play

In this proposition, the concept *I* is related to the concept *play* with a relation of AGENT. *I* being the agent of the action "*to play.*" This would be represented in a node link diagram such as the following

In Frederiksen's (1974, 1986) work, the relations that exist between concepts can be case relations or some type of dependency or derived logical relation. The case relations specify the role of an object in relation to an action as in the above example "I play" where *I* is the agent of the action "*play*" (Bracewell & Breuleux, 1994). The relation of agency is one of a number of case relations that may exist between concepts in a proposition. Table 3 provides a description and example of each of the case relations that were used in the analysis of the children's texts.

Table 3

Case Relations

Relation	Definition	Example
AGENT	concept is the immediate cause of an action	I walk I — **AGENT** — walk
PATIENT	concept is a participant in an action	I like I — **PATIENT** — like
OBJECT	concept is affected by an action	The lizard caught a fly caught — **OBJECT** — a fly
RECIPIENT	action transfers a concept to another concept	I give him food give — **RECIPIENT** — him
RESULT	concept produced by an action	I went outside went — **RESULT** — outside
THEME	symbolic concept produced by an action	We play basketball play — **THEME** — basketball
GOAL	action is directed towards a future concept	I came to play came — **GOAL** — play

SOURCE: Adapted from Bracewell & Breuleux (1994) and Frederiksen (1975, 1986)

The second type of relation that exists between concepts are the logical relations, either dependency or derived. The dependency relations consist of relations such as CONDITIONS, CAUSES, and AND (i.e., unions) between concepts. These are described in Table 4.1. The forms of derived logical relations are more extensive and include quantitative relations, comparisons between concepts, tense and modality relations, and identifying relations . Descriptions and examples of these relations are included in Tables 4.2, 4.3, and 4.4.

Table 4.1

Dependency Logical Relations

Relation	Definition	Example
IF	Relation contraposes	If you exaggerate, the wish doesn't work **IF** [you exaggerate] [wish doesn't work]
CONDITION	Reduced set of implications, may not contrapose.	I give him food or he would not like me. **CONDITION** [no food] [not like me]
AND	Specifies a union of concepts.	The games were Digby and Pumba. Digby **AND** Pumba

SOURCE: Adapted from Bracewell & Breuleux (1994) and Frederiksen (1975, 1986)

Table 4.2

Derived Logical Relations – for Quantification

Relation	Definition	Example
NUMBER	Specifies a count for a concept.	This ticket can grant three of your wishes. 
DEGREE	Specifies extent for concepts that are not countable.	I was very happy 

SOURCE: Adapted from Bracewell & Breuleux (1994) and Frederiksen (1975, 1986)

Table 4.3

Derived Logical Relations – (Algebraic, Tense, & Modality)

Relation	Definition	Example
Algebraic		
EQUIVALENCE	Specifies concepts having the same value of a property.	We both grabbed our towels. (we) — **EQUIVALENCE** — (both)
ORDER	Specifies concepts that differ in the value of a property, and orders them.	He is faster than you (he) — **ORDER** — (you)
Tense		
PAST	Concept occurs before the present.	I played outside **PAST**
PRESENT	Concept occurs in the present.	I play outside **PRESENT**
FUTURE	Concept occurs after the present.	I will play outside **FUTURE**
Modality		
NECESSITY	Unstated conditions exist that make a concept a necessity.	You need to wait [you wait] **MODALITY: NEED**
ABILITY	Unstated conditions exist that will lead to a concept.	He can run fast [he run fast] **MODALITY: ABILITY**

SOURCE: Adapted from Bracewell & Breuleux (1994) and Frederiksen (1975, 1986)

Table 4.4

Derived Logical Relations – for Identifying Relations

Relation	Definition	Example
CATEGORY	Specifies that a concept is a member of a class of concepts.	I am a seal. (I) — **CATEGORY** 'am a' — (seal)
THEME	Specifies that a concept is a member of a class of concepts.	I wish I had a brother. [I wish] **THEME** [I had a brother]
IDENTITY	Specifies that one class of concepts has the same members as another class.	My friend is my teacher. (friend) — **IDENTITY** — (teacher)
ATTRIBUTE	Specifies a relation between a concept and a property concept.	He is nice (he) — **ATTRIBUTE** — (nice)
LOCATION	Specifies where a concept is with respect to another concept.	I went outside (I) — **LOCATION** — (outside)
TEMPORAL	Specifies a temporal property for a concept.	I make him eat everyday (eat) — **TEMPORAL** — (everyday)

SOURCE: Adapted from Bracewell & Breuleux (1994) and Frederiksen (1975, 1986)

Inter-rater reliability checks were conducted on the concepts and on the relations between the concepts. Agreement on the concepts was assessed at 98.8% and agreement on the relations between the concepts was assessed at 93.5% (see Appendix F for a complete list of inter-rater reliability measures).

The specification of the relations that exist between the concepts in the propositions of each child's piece of writing yields an analysis of the semantic structure of the text. From this structure, semantic complexity and elaboration can be examined. Semantic complexity was examined by looking at the number of embedded propositions in a piece of writing. For example, there is an embedded proposition in the sample below.

I wish I was a dog and a cat.

The proposition 'I was a dog and a cat' is a THEME of the proposition 'I wish' and is considered to be an embedded proposition. The number of embedded propositions to total number of propositions in a piece of writing allows a measure of a child's ability to manipulate semantic structures in more complex ways.

Assessing semantic elaboration was the final stage of the semantic analysis, which provided a general measure at how much elaboration a child worked into the text. Elaboration was measured as the total number of case and logical relations that were in each text with respect to the total number of propositions. At a minimum, a proposition has one relation linking two concepts. Elaboration occurs when a proposition consists of multiple relations and concepts. For example, the proposition expressed by the sentence, "One night, a kid was wishing on a shooting star", has four relations (temporal, agent, location, attribute) linking five concepts (one night, a kid, was wishing, a star, shooting).

Cohesion Analysis

The analysis of cohesion was based on Halliday and Hasan (1976) and Halliday (1985). In this work, the authors describe cohesion as the semantic and syntactic links used for constructing discourse (i.e., making connections between the linguistic units in texts). In their work, Halliday and Hasan (1976) used the cohesive ties to make links between sentences; however, other researchers have expanded this use to links between T-units (Fitzgerald & Spiegel, 1986). In general, cohesion can be thought to exist

between any bound units of discourse. This study will use the clausal unit of text described by Winograd's (1983) phrase structure grammar.

In general, there are four ways of creating cohesion in discourse: reference, substitution and ellipsis, conjunction (which includes additive, adversative, causal, and temporal links), and lexical cohesion (which includes collocation and reiteration). These have been described more fully in the literature review.

In addition, a measure was included to record cohesive errors. This last indicator of cohesion refers to cohesive ties that are missing or incorrect, and to unclear referents. For example, one child wrote the following

> I like to play (1). I play all the time (2). I go everyday (3). I go to the river (4). I treat him nicely (4). I make him eat every day (5). I play at night with him (6).

In clauses (4) (5) and (6) the child makes a reference to ***him*** and fails to supply us with any indication of who ***him*** refers to. Table 5 presents descriptions and examples of the types of cohesive errors found in the children's writing samples.

The cohesion analysis in this study initially involved labelling all the instances of the reference, substitution, ellipsis, and each of the conjunctive and lexical cohesion devices in the children's texts. Only links across clausal boundaries were coded. Following the labelling process, a number of cohesive measures were calculated. These measures included, (1) the number of each type of cohesive tie and the total number of cohesive ties in each text, (2) the proportion of each type of tie to total number of ties in each text, (3) the proportion of total number of ties to number of propositions/clauses in each text, and finally (4) the number and proportion of cohesive errors in each text. Inter-rater reliability checks were conducted on the cohesive ties and cohesive errors measures. Reliability on the cohesive ties was calculated at 88.9% and on the cohesive errors measure at over ninety-five percent (see Appendix F for complete listing of inter-rater reliability measures).

Table 5

Types of Cohesive Errors

Omissions	Elements were considered omission errors when their absence disrupts meaning or textuality. Omissions can take two forms; (a) elements in the text are not connected by a cohesive tie and the text would be improved by the use of one (e.g., I see a whale. I see a turtle.); (b) words are omitted (ellided) that need to be present (e.g., One night a kid was wishing on a shooting star and two days later got his wish. And the next day his sister wished too and soon enough she got her wish. And so the boy (missing: *got his wish*) and so did the girl.)
Incorrect signals	A cohesive tie is used incorrectly. This can take several forms (a) an element that directs the reader to something else in the text for its interpretation, but the referent is unclear or not present (e.g., When I wanted to go, I go at night. I like *him.*); (b) a conjunction is used, but the relation is illogical (e.g., One day, when the sun was up, I went to the river *and* my friend was a dinosaur.)
Nonfunctional repetitions	Elements in the text are repeated without adding any meaning (e.g., I sneak out the window and I lock the window and I go to my friend lion *and I go to my friend lion and I go to my friend lion.*)
Sequential order disruptions	Elements in the text are presented in an order that disrupts meaning or logic (e.g., I got out of my bed and I went to look in my mummy's room then I went to see my friend penguin. *I got dressed very, very hot.*)

Coherence

The coherence or how well a text "hangs together" is an important aspect of a piece of writing. In this study, the children were asked to both draw a picture and write their story, therefore, a measure of how well the text "hangs together" could be supplemented by a further analysis of how well the picture and the text related to each other. These two points of interest were explored with the use of the coherence measure seen in Appendix E.

An initial series of questions was directed towards determining the coherence of the text. The first question was aimed at defining a student's task representation. The

students were all provided with the same prompt, and asked to write "a story", however there were a number of different genres employed by the students. As noted earlier, some children refused to write and some wrote only random letters and words; therefore, further analysis of the coherence of the text was unnecessary. Beyond these initial stages of writing, some children did write in the genre of a personal narrative (Graves, 1983), while others framed their work as more of a "preference list", particularly in response to the "wish" prompts. For example, the first piece of writing would be considered a personal narrative, while the second piece of writing would be classed as a preference list.

A) One time I went to see my friend. It was a dinosaur. The dinosaur was a traks, but it is a nice traks. I played ball with my friend, the dinosaur, traks.

B) I want to be a seal because I want to be funny.

A few of the pieces of writing, although beyond the scope of random letters and words, failed to conform to any particular genre and were categorized as "other". For example, the following text (along with other coherence difficulties) does not conform to any genre.

C) There is a "rop" my friend. There is a password. It was Sarah. I like to swim in the water.

In order to provide a point of reference for the remainder of the questions regarding the piece of writing, the rater was asked to provide a count of the total number of clauses in each text. Further questions, required the rater to determine (a) how many of these clauses related to the given prompt; (b) how many of the clauses related to an easily discernable theme of the writing; and (c) how many of the clauses related to each other. In the student writing samples presented above, both sample A and sample C were responses to the prompt about telling the story of visiting your friend. Sample A has five clauses, all five of which relate to the prompt, all five of which relate to the discernable theme of visiting his friend dinosaur, and all five of which relate to each other. On the

other hand, sample C has four clauses, none of which relate to the prompt, none relate to any discernable theme of the writing, and only two clauses (There is a password. It was Sarah.) relate to each other.

The second part of the coherence questionnaire was aimed at determining the overall coherence of the writing with the picture. These questions began simply with a yes/no question regarding the presence of a picture, i. e., was there a discernable picture? Two further questions regarding how well the picture related to the prompt and how well the picture related to the theme of the writing were rated on a three-point scale. This scale required the rater to determine if yes - the picture does relate to the prompt/theme, somewhat - there is some relation of the picture to the prompt/theme, or no - there is no relation between the picture and the prompt/theme. In a final question, the value of the writing and the picture with respect to providing information to the reader was rated on a four-point multiple choice. Did the picture, the writing, both the picture and the writing, or neither the picture or the writing provide the reader with the most information with respect to the task demands. For the above writing sample A about the dinosaur, the student drew a picture of a boy and a dinosaur. Therefore, this picture was determined to (a) "yes" relate to the given prompt "draw a picture of your friend"; (b) "yes" relate to the theme of the writing (visiting his friend dinosaur); and (c) "both" the picture and the writing provided information in relation to the demands of the task.

An inter-rater reliability check was completed on this coherence measure by an independent rater. The concept of topic or theme was defined for the rater based on van Dijk (1980) terms "gist, upshot, or point." The rater was also given training on how to break a text into clauses and was provided with the prompts that the children were given to write their pieces. The results of the inter-rater reliability measure were calculated at between 85% and 100% for all of the questions except one. The question of which modality provided the most information with respect to the prompt was less reliable at 77% (see Appendix F for all the inter-rater reliability measures).

This coherence analysis conducted on each piece of writing yielded the following variables (a) the genre of the piece of writing (personal narrative, preference list, random letters and words, other; (b) the proportion of clauses relating to the prompt; (c) the proportion of the clauses relating to the theme; (d) the proportion of the clauses relating

to each other; (e) the relation of the picture to the prompt – yes, somewhat, no; (f) the relation of the picture to the theme of the writing – yes, somewhat, no; (g) the modality through which the students provided the most information with respect to the task – writing, picture, both, neither.

Summary

Students' texts were analysed for developmental progression, semantic complexity and elaboration, use of cohesive ties, cohesive errors, and coherence. A number of the measures allowed for the use of inferential statistics and these variables are presented in Table 6. In addition, all the measures were available for a qualitative analysis.

Table 6 List of Variables

Independent Measures
1. gender
2. teacher rating of inattention
3. teacher rating of hyperactivity/impulsivity
4. screening time (time 1 - fall grade 1, time 2 – spring grade 1, time 3 – spring grade 2)
Dependent Measures
Developmental level:
1. number and proportion of developmental stages obtained – denominator = total number of developmental stages in the progression (12).
Semantic complexity and elaboration:
1. number of propositions
2. number and proportion of embedded propositions (denominator = number of propositions)
3. number and proportion of semantic relations (denominator = number of propositions)
Cohesion:
1. number of clauses
2. number and proportion of cohesive ties (denominator = total number of clauses)
3. number and proportion of cohesive errors (denominator = total number of clauses)
Coherence:
1. proportion of clauses that relate to the prompt (denominator = total number of clauses)
2. proportion of clauses that relate to a theme (denominator = total number of clauses)
3. proportion of clauses that relate to each other (denominator = total number of clauses)

RESULTS

Data Preparation

The data from both the independent and dependent measures listed in Table 6 were entered into EXCEL (Microsoft software) data files. These files were formatted to permit (a) importing of the data to the SYSTAT (Macintosh/Version 5.2) statistical package, (b) conversion of frequencies into proportions, where necessary (see Table 6), and (c) repeated measures analysis of the data. A total of 26 students completed both the fall screening of grade 1(time 1) and the spring screening of grade 1 (time 2). This number of students allowed for some inferential statistical analysis for the overall sample and for boys and girls independently. The findings from these analyses could then be further explored through qualitative means for the writing samples in the two grade 1 screenings (time 1 and time 2) and for the writing samples produced by the eight students who completed the grade 2 (time 3) screening. The small number of students in the grade 2 sample did not allow for gender differences to be explored at time 3.

Initial analysis involved the exploration of relationships among the writing variables. Each variable was then explored for general findings and findings related to the characteristics of inattention and hyperactivity/ impulsivity. Finally, a more qualitative exploration of the data set is presented to further explore the themes that emerged from the quantitative analysis.

Data Analyses

Relationship of the Variables to Each Other

Given the nature of the writing characteristics under study, it was expected that there would be certain correlations among the variables. The developmental progression was designed to assess overall development of writing and was therefore expected to correlate with the other variables of interest that had more specific focuses of inquiry. Specifically, it was expected to correlate positively with semantic and coherence variables, as well as the cohesive ties variable, and was expected to correlate negatively with the proportion of cohesive errors variable. A matrix of the pair-wise correlations for all variables for time 1 and time 2 are presented in Tables 7.1 and 7.2 respectively.

An issue that arises with the computation of a large number of separate inferential statistics on a set of variables, such as these correlations, is that of an increased

probability of Type I error across the set of statistics. This threat does exist, of course, for the data presented in Tables 7.1 and 7.2 (as it does for analyses of variance in factorial designs where there are a large number of F tests); but it seems to be a minimal one for these data. For a set of 72 correlations, one would expect that three to four would be found to be statistically significant by chance at the .05 probability level. For these data, 25 of the 72 correlations were found to be significant, and in many cases the probability of the relation occurring by chance was far less than .05. Further, the occurrence of significant effects was not random and served to group a number of variables.

As expected, at time 1, significant positive correlations were found for developmental progression with all three semantic variables and all three coherence variables. The proportion of cohesive ties was positively correlated with developmental progression, and the cohesive errors variable was negatively correlated as expected; however, these relationships were not significant at time 1. This lack of significant findings for the cohesion variables may be due to a power problem – only a small number of students wrote a sufficient amount at time 1 for them to be included in the cohesion analysis. At time 2, the cohesion variables relationship to developmental progression were highly significant, as were the relationships between developmental progression and the majority of the semantic and coherence variables.

A number of other variables correlated significantly, especially variables that were measuring similar constructs. One very interesting measure was the measure of cohesive errors. This measure correlated significantly at both time periods with the coherence measures. This probably demonstrates that the making of cohesive errors has a significant impact on the coherence of a piece of writing.

Table 7.2

Pearson Correlation Matrix of the Intercorrelations of the Writing Measures in the Study at Time 2

	Writing Progression	Propositions (Production)	Relations (Elaboration)	Embed. Rel. (Complexity)	Cohesive Ties	Cohesive Errors	Relating to a Theme	Relating to the Prompt	Relating to Each Other
Writing Progression	1.000								
Propositions (Production)	- 0.085	1.000							
Relations (Elaboration)	0.267	0.462*	1.000						
Embed. Rel. (Complexity)	0.493**	- 0.208	0.111	1.000					
Cohesive Ties	0.495*	0.282	0.301	0.240	1.000				
Cohesive Errors	- 0.637***	0.059	0.174	- 0.142	- 0.113	1.000			
Relating to a Theme	0.670***	0.019	- 0.071	0.178	0.261	- 0.618***	1.000		
Relating to the Prompt	0.354	- 0.007	- 0.227	- 0.251	- 0.060	- 0.330	0.718***	1.000	
Relating to Each Other	0.769***	- 0.123	0.151	0.309	0.259	- 0.573**	0.581**	0.465*	1.000

significant correlations * $p < .05$, ** $p < .01$, *** $p < .001$

Table 7.1

Pearson Correlation Matrix of the Intercorrelations of the Writing Measures in the Study at Time 1

	Writing Progression	Propositions (Production)	Relations (Elaboration)	Embed. Rel. (Complexity)	Cohesive Ties	Cohesive Errors	Relating to a Theme	Relating to the Prompt	Relating to Each Other
Writing Progression	1.000								
Propositions (Production)	0.490*	1.000							
Relations (Elaboration)	0.454*	0.737***	1.000						
Embed. Rel. (Complexity)	0.732***	0.223	0.097	1.000					
Cohesive Ties	0.379	0.731**	0.732**	0.287	1.000				
Cohesive Errors	- 0.419	- 0.067	- 0.443	0.315	- 0.158	1.000			
Relating to a Theme	0.469	0.162	0.279	0.154	0.365	- 0.781**	1.000		
Relating to the Prompt	0.509	0.209	0.504*	0.294	0.409	- 0.760**	0.739***	1.000	
Relating to Each Other	0.734	0.433	0.662*	0.386	0.395	- 0.697*	0.992***	0.987***	1.000

significant correlations * $p < .05$, ** $p < .01$, *** $p < .001$

Developmental Analysis of Writing Content

Results of the developmental progression analysis for writing content revealed that at the time of the first screening (fall grade 1) all of the students demonstrated a minimal ability of distinguishing writing from pictures. This stage of development was demonstrated by drawing a picture in the picture box and providing some form of written language in the text box. As presented in Table 8, the mean achievement level for the entire group of students at this time period was approximately at the level of development at which they could express ideas in sentence form. At screening time 2 (Spring grade 1) the students mean achievement level rose to approximately level 8, which was equivalent to the ability to write simple narrative texts. The mean attainment levels of the boys and girls were approximately equivalent at the time of the first screening ($F = 0.271$, $p = 0.60$), and the observed difference in means at the second screening was found to be non-significant given the large standard deviations ($F = 3.775$, $p = 0.06$) (see Table 8 for means and standard deviations). This general trend of growth between time periods was also suggested by the small sample of students at time 3, where the mean achievement level rose to approximately level 10, or the ability to make more complex links among ideas. Also noted at time 3 was that level of development in writing content was not as disparate (standard deviation = 1.51) in comparison to the wide disparity among students abilities seen at time 1 and time 2 (see standard deviations Table 8).

Table 8

Means and Standard Deviations for Developmental Level of Writing Content

	Number of Developmental Levels Attained		Proportion of Developmental Levels Attained	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	5.23 (2.40)	8.15 (2.40)	.44 (.20)	.68 (.20)
Boys	5.03 (2.96)	7.36 (2.62)	.42 (.25)	.61 (.22)
Girls	5.50 (1.62)	9.08 (1.78)	.46 (.14)	.76 (.15)

Developmental progression was then examined in relation to level of inattention and level of hyperactivity/impulsivity. Specifically, the proportion of developmental

stage attained with respect to the total number of stages in the progression (12) was calculated for each student at each time period. Pearson product-moment correlations were calculated to determine the extent and nature of the relationships between inattention and hyperactivity/ impulsivity characteristics and the proportion of developmental stages attained at time 1 (fall) and time 2 (spring) of grade 1. (There were an insufficient number of students at time 3 to calculate correlations; however, this relationship will be explored qualitatively in later sections). The results of the correlational analysis at time 1 and time 2 revealed significant negative correlations between inattention and proportion of developmental stages attained at time 1 ($r = -.50$, $p < .01$) and at time 2 ($r = -.68$, $p < .01$). The analysis also revealed a significant negative relationship between hyperactivity/impulsivity and proportion of developmental stages attained at time 1 ($r = -.45$, $p < .05$) and at time 2 ($r = -.71$, $p < .01$). These results demonstrate that increases in students' inattention and hyperactivity/impulsivity ratings were significantly related to decreases in writing content development at both the beginning and end of grade 1. Figure 3 presents the relationships graphically.

Differences were found between girls and boys when writing content development was examined with respect to inattention and hyperactivity/impulsivity. The boys' data were consistent with the overall findings of significant negative correlations between inattention and writing content development at time 1 ($r = -.61$ $p < .05$) and time 2 ($r = -.66$, $p = .01$), and hyperactivity/impulsivity and writing content development at time 1 ($r = -.61$, $p < .05$) and time 2 ($r = -.77$, $p < .01$). In contrast, the girls showed no significant correlations between ratings of inattention or hyperactivity/impulsivity and writing content development. This discrepancy between boys and girls in the findings may be partially attributed to the reduced range of scores for the girls on inattention and hyperactivity/impulsivity compared to the boys (see Table 2, p. 39).

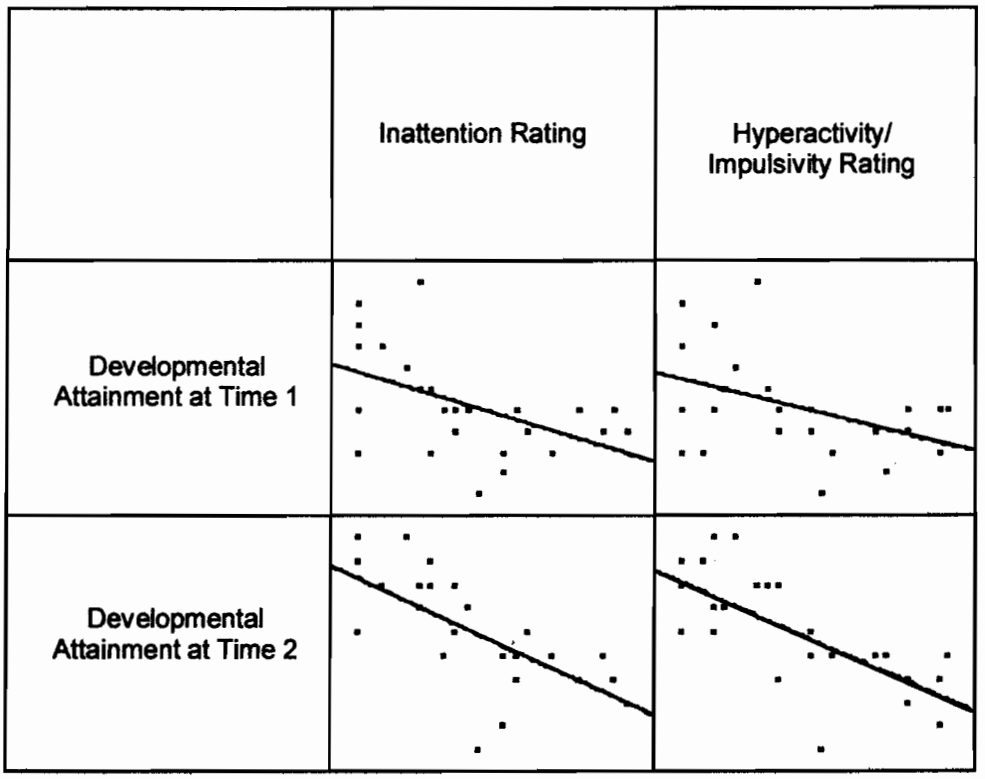

Figure 3. Correlation of teacher ratings of inattention and hyperactivity/impulsivity with the proportion of developmental stages of writing content attained for all the students, N=26, at screening time 1 and time 2.

Semantic Structure

The semantic analysis of the children's writing samples provided measures of (a) the number of ideas (number of propositions) in a writing sample, (b) the degree of semantic elaboration (number and proportion of semantic relations) in a writing sample, and (c) the semantic complexity (number and proportion of embedded propositions) in a writing sample. Means and standard deviations for each of these measures for the entire sample at time 1 and time 2 will be presented in order to establish the average level of ability at each time period. In addition, the means and standard deviations for the reduced sample at time 3 have also been included to offer confirmation of the trend in growth between time periods. Results of the correlations for each measure with respect to inattention and hyperactivity/impulsivity will then be presented for time 1 and time 2.

These relationships will be explored qualitatively in later sections for all three time periods.

Idea Production

At the time of the first screening the mean number of propositions produced by the students was approximately 2 per writing sample. By the time of the second screening, the students were producing a mean of approximately 5 propositions per sample (see Table 9 for means and standard deviations). This mean was approximately the same for boys and girls at both time 1 and time 2 ($F = 0.083$, $p = 0.77$; and $F = 0.606$, $p = 0.44$ respectively). Idea production at both time periods showed large variability and was positively skewed (see Table 9 standard deviations). The minimum/maximum numbers of propositions produced by the students were 0 to 10 propositions, and 0 to 21 propositions at time 1 and time 2, respectively. At time 3, the reduced sample of students were all including multiple ideas in their writing ranging from 3 to 14 propositions with a mean of 6 (SD = 3.46).

Table 9

Number of Propositions Produced by the Students at Time 1 and Time 2

	Number of Propositions	
	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	2.08 (2.58)	5.12 (3.82)
Boys	2.21 (3.40)	4.57 (2.17)
Girls	1.92 (1.17)	5.75 (5.17)

The number of propositions or ideas produced by the students was examined in relation to inattention and hyperactivity/impulsivity. Again, only time 1 and time 2 were analysed. Pearson product moment correlations were calculated for the entire sample and then for boys and girls separately. The overall correlations were not significant when the two genders were grouped. However, when the boys' sample was examined independently, significant negative correlations were found between inattention and number of propositions produced at time 2 ($r = -.65$, $p < .05$) and also for

hyperactivity/impulsivity and number of propositions produced at both time 1 ($r = -.61$, $p < .05$) and time 2 ($r = -.54$, $p < .05$). The analysis of the girls' writing sample revealed no significant negative correlations between inattention or hyperactivity/impulsivity and number of propositions produced. Thus, increases in inattention and hyperactivity/impulsivity are associated with decreases in idea production for boys, but not for girls. This is consistent with the findings presented above that increases in inattention and hyperactivity/impulsivity are not related to writing content development in grade 1 girls. Again, this finding may be partially attributed to the reduced range of inattention and hyperactivity/impulsivity ratings for girls.

Semantic Elaboration

A total of 22 writing samples at time 1 and 25 writing samples at time 2 were analysed for semantic elaboration. Four writing samples at time 1 and one writing sample at time 2 were not analysed because these children did not convey any propositions (ideas) in their writing samples. These writing samples came from children who refused to write (1 child at time 1), children who wrote only random letters and words (3 children at time 1), and a child who wrote "I balu lr not my mir", which, unfortunately was not translated by the teacher, and was determined to be phonetically indecipherable by three independent readers (time 2). At time 3, all eight children wrote a sufficient amount for the available analysis.

Semantic elaboration was analysed using a propositional analysis of the children's writing samples. In order to measure the degree to which the children elaborated their ideas, the total number of semantic relations and a proportion representing the number of semantic relations to number of propositions were calculated for each writing sample. As expected, given the developmental increase in number of propositions conveyed by the children, there was an increase from time 1 to time 2 in the mean number and proportion of relations represented in the children's writing samples. Boys and girls demonstrated approximately equal number and proportion of semantic relations at both time 1 and time 2. The means and standard deviations for the number and proportion of semantic relations for the overall sample and for the boys and girls independently are presented in Table 10. As with the measure of number of propositions, there was wide variability in the amount of elaboration provided by students (see Table 10 standard deviations). Students

demonstrated minimum/maximum values of 0 to 28 relations at time 1, and 0 to 55 relations at time 2. By time 3 the analysis of the reduced sample of students suggests that growth as well as wide variability in semantic elaboration continued for these students in to grade 2 (mean = 21.37, SD = 17.15).

Table 10

Mean Number and Proportion of Semantic Relations Overall, Boys and Girls

	Number of Semantic Relations		Proportion of Semantic Relations to Propositions	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	4.65 (6.90)	14.85 (10.09)	1.96 (1.25)	2.99 (0.63)
Boys	5.14 (8.94)	13.86 (6.15)	1.91 (1.28)	3.11 (0.57)
Girls	4.08 (3.63)	16.00 (13.56)	1.99 (1.28)	2.87 (0.70)

Semantic elaboration was analysed with respect to inattention and hyperactivity/ impulsivity characteristics at time 1 and time 2. Results of the overall analysis demonstrated no significant correlations between either inattention or hyperactivity/impulsivity and number or proportion of semantic relations at either time period. The results of the analysis when boys were looked at independently did show significant negative correlations between inattention and number of semantic relations at both time 1 ($r = -.66$, $p < .05$) and time 2 ($r = -.78$, $p < .01$). Boys also demonstrated significant correlations between hyperactivity/ impulsivity ratings and number of semantic relations at time 1 ($r = -.69$, $p < .05$) and time 2 ($r = -.84$, $p < .01$). Increases in inattention and increases in hyperactivity/impulsivity are related to decreases in number of semantic relations in boy's writing samples. These relationships are not significant when the girls are analysed independently. This difference in findings between boys and girls with respect to amount of elaboration is consistent with the above finding that only the boys produce fewer number of propositions with respect to increasing inattention and hyperactivity/impulsivity. With fewer propositions, there will be fewer number of semantic relations. That is, although these correlations when using raw counts were significant, the more important indicator is whether the proportion of semantic relations

(given the base of number of propositions written) is related to the inattention and hyperactivity/impulsivity measures.

When the proportion measure of semantic relations (i.e., number of relations/number of propositions) was examined, the relationships to both inattention and hyperactivity/ impulsivity were insignificant for the entire group and for both boys and girls. This is particularly interesting in relation to the sample of boys. Although boys produced fewer ideas and less total amount of elaboration when they are rated as having increasing inattention or hyperactivity/impulsivity, the proportion of elaboration provided in their writing was the same.

Semantic Complexity

Semantic complexity was examined through an analysis of the embedded propositions in the children's writing samples. Table 11 presents means and standard deviations of both the number and proportion of embedded propositions in the children's writing at time 1 and time 2. There were no significant differences between the girls and boys in the proportion of embedded propositions in their writing samples at time 1 ($F = 3.392$, $p = 0.08$) and at time 2 ($F = 0.150$, $p = 0.70$) and no significant interaction between time and gender ($F = 1.707$, $p = 0.20$). Again, a notable finding was the wide variability in student's scores on this measure (see Table 10 standard deviations). The range in the number of embedded propositions used by the children is apparent in the minimum/maximum scores of 0 to 7 and 0 to 13 at time 1 and time 2, respectively. At time 3, the increase and wide variability in students' semantic complexity appears to continue (mean = 4.62, SD = 5.55).

Table 11

Mean Number and Proportion of Embedded Propositions

	Number of Embedded Propositions		Proportion of Embedded Propositions	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	1.19 (1.83)	2.38 (2.69)	0.52 (0.58)	0.44 (0.32)
Boys	1.07 (2.34)	2.07 (1.64)	0.28 (0.38)	0.47 (0.34)
Girls	1.33 (1.07)	2.75 (3.57)	0.71 (0.66)	0.42 (0.30)

The children's ability to create semantic complexity in their writing was investigated in relation to the ratings of inattention and hyperactivity/impulsivity at time 1 and time 2. Semantic complexity, as measured by number and proportion of embedded propositions, was found to have few significant negative correlations with the behavioural ratings. For the overall data, only the correlation between inattention and proportion of embedded relations at time 1 was significant ($r = - 0.446$, $p < .05$). When the genders were analysed independently, the boys' results at time 1 showed significant negative correlations between inattention and number and proportion of embedded relations at time 1, as well as a significant negative correlation between hyperactivity/impulsivity and number of embedded propositions. By time 2, there were no significant findings with respect to inattention, and hyperactivity/ impulsivity was only significantly related to number of embedded propositions ($r = -.76$, $p < .05$). The analysis of the girls' results revealed no significant relationships between inattention or hyperactivity/impulsivity and semantic complexity. Given, that boys produced fewer total propositions with respect to inattention and hyperactivity/impulsivity, the number of embedded propositions produced by the boys would be expected to have a negative relation to the behaviour ratings. The finding that there were no significant differences in the number of embedded propositions produced by the girls and few significant differences in the proportion of embedded propositions produced by both boys and girls, suggests that semantic complexity is not strongly related to ratings of inattention and hyperactivity/impulsivity for boys.

Cohesion

Cohesion was measured by an analysis of the students' use of cohesive ties as well as the errors they made in creating cohesion. This analysis yielded number and proportion measures of both cohesive ties and cohesive errors. Proportions were calculated with respect to the number of clauses in a writing sample. Since cohesion is measured as ties that cross clausal boundaries, only those writing samples that contained more than one clause were included in the analysis of cohesive ties. At time 1 this limited the sample to a total of 13 (4 boys and 9 girls). At time 2, only one child was excluded from the analysis, leaving 25 children (13 boys and 12 girls). At time 3, all eight students who

completed this sample were included for analysis. As with the semantic measures, means and standard deviations are presented for all three time periods to establish the average level of attainment on these measures. Results from the correlations of cohesive ties and cohesive errors with inattention and hyperactivity/impulsivity are presented for time 1 and time 2. Qualitative analysis of these relationships are explored in further sections for all three time periods.

Cohesive Ties

Means and standard deviations for number and proportion of cohesive ties at time 1 and time 2 are presented in Table 12. The proportion of cohesive ties used by the students is approximately equal for boys and girls at both time 1 ($F = 0.002$, $p = 0.96$) and time 2 ($F = 0.016$, $p = 0.89$) and the interaction of time and gender was insignificant ($F = 0.681$, $p = 0.42$). Again, the most interesting observation is the large standard deviations, which indicate a wide discrepancy in students use of cohesive ties at both time 1 and time 2. Although developmental growth appears to be occurring between time 1 and time 2, the large standard deviations make this finding insignificant. However, the means and standard deviations of the proportions from time 3 suggest that increase in use of cohesive ties does occur (mean = 1.99, SD = .51)

Table 12

Means and Standard Deviations of Number and Proportion of Cohesive Ties at Time 1 and Time 2

	Number of Cohesive Ties Used		Proportion of Cohesive Ties Used	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	2.73 (5.02)	7.80 (6.34)	0.82 (0.83)	1.40 (0.42)
Boys	3.00 (6.63)	6.87 (3.76)	0.53 (0.80)	1.39 (0.41)
Girls	2.42 (2.23)	8.83 (8.36)	1.09 (0.80)	1.42 (0.45)

The relationships between the use of these cohesive ties and the behavioural characteristics of inattention and hyperactivity/impulsivity were examined with Pearson product-moment correlations. At time 1, with a restricted sample, there were no

significant correlations for the entire group or when the boys and girls are analysed independently. At time 2, when all but one child wrote a significant amount for analysis, a number of the relationships between behavioural characteristics and cohesive ties emerged as significant. The correlation between inattention and the number of cohesive ties was significant when the genders were grouped together ($r = -.43$, $p < .05$) and when the boys were analysed independently ($r = -.84$, $p < .01$). In addition, hyperactivity/impulsivity was found to be significantly correlated with number of cohesive ties for the entire group ($r = -.41$, $p < .05$) and for the boys ($r = -.88$, $p < .01$). When a proportion was calculated for cohesive ties to total number of clauses, the boys sample also demonstrated a significant correlation between hyperactivity/impulsivity and proportion of cohesive ties ($r = -.69$, $p < .01$). There were no significant findings when the sample of girls was analysed independently.

Cohesive Errors

The number and proportion of cohesive errors (see Table 5 for description of errors) were calculated for each writing sample. As cohesion was analysed across clausal boundaries, only students who had written more than one clause were included in this analysis. At time 1 a total of 13 students writing samples were analysed. At time 2 a total of 25 students writing samples were analysed for cohesive errors. At time 3, all eight students wrote a sufficient amount for analysis. An analysis of the means and standard deviations for the measures at time 1 and time 2 is presented in Table 13. Again, a striking finding, considering the small writing samples provided by the students, was the variability in children's cohesive errors (see Table 13 standard deviations). At both time 1 and time 2 the children's writing samples demonstrated from 0 to 4 errors in cohesion. There appear to be gender differences on this measure; however, due to large standard deviations, there were no significant gender differences in proportion of cohesive ties at time 1 ($F = 0.402$, $p = 0.53$), and the interaction of time and gender was insignificant ($F = 0.873$, $p = 0.37$). The only significant difference occurred at time 2 when the girls demonstrated a significantly lower proportion of cohesive errors ($F = 7.608$, $p = 0.01$). At time 3, again the most striking trend is the wide variability among students in their inclusion of cohesive errors in their writing (mean number of cohesive errors = 0.88, SD = .84). This suggests that at all three time periods, some children appear to have mastered

cohesion, and are able to avoid the making of cohesive errors, while other children are experiencing more difficulties with this aspect of writing.

In order to explore the possibility that this wide variability is related to ADHD characteristics, Pearson product-moment correlations were calculated to determine the magnitude and nature of the relationships between the behavioural characteristics (inattention and hyperactivity/impulsivity) and the two cohesive errors measures. The correlations were taken independently for time 1 and time 2 given the large differences in sample availability (n = 13 and n = 25 respectively) between the two time periods. As with the cohesive ties, at time 1 with the restricted sample, the correlations were insignificant for both inattention and hyperactivity/impulsivity with measures of cohesive errors. When the size and diversity of the sample increased at time 2 and the children were writing more, a number of significant correlations emerged between the behavioural characteristics and cohesive error measures (see Table 14).

Table 13

Means and Standard Deviations of Number and Proportion of Cohesive Errors at Time 1 and Time 2

	Number of Cohesive Errors		Proportion of Cohesive Errors	
	Time 1 Mean (SD)	Time 2 Mean (SD)	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	1.00 (1.35)	1.24 (1.16)	0.22 (0.28)	0.27 (0.28)
Boys	1.75 (1.26)	1.62 (1.19)	0.29 (0.28)	0.40 (0.32)
Girls	0.67 (1.32)	0.83 (1.03)	0.18 (0.30)	0.12 (0.14)

In an analysis of the entire group, correlations between both inattention and hyperactivity/impulsivity and the number of cohesive errors were found to be significant ($p < .05$ and $p < .01$ respectively). In addition, correlations between both behavioural characteristics and the proportion of cohesive errors were highly significant ($p < .001$, and $p < .001$) (see figure 4). These correlations for both the boys and girls analysed independently were also all positive relations (i.e., the greater the inattention or hyperactivity/impulsivity rating, the greater number and proportion of cohesive errors present). The correlations for the boys' sample were significant for both inattention and

hyperactivity/impulsivity with the proportion of cohesive errors ($p = .05$, $p < .05$ respectively).

Table 14

Correlations Between Inattention and Hyperactivity/Impulsivity with Number and Proportion of Cohesive Errors at Time 2 for Overall (n=25), Boys (n=13), and Girls (n=12).

	Group	Number of Cohesive Errors	Proportion of Cohesive Errors
Inattention	Overall	$r = .39$*	$r = .61$***
	Boys	$r = .35$	$r = .54$*
	Girls	$r = .22$	$r = .49$
Hyperactivity /Impulsivity	Overall	$r = .50$**	$r = .69$***
	Boys	$r = .49$	$r = .57$*
	Girls	$r = .21$	$r = .47$

significant correlations * $p<.05$, ** $p<.01$, *** $p < .001$

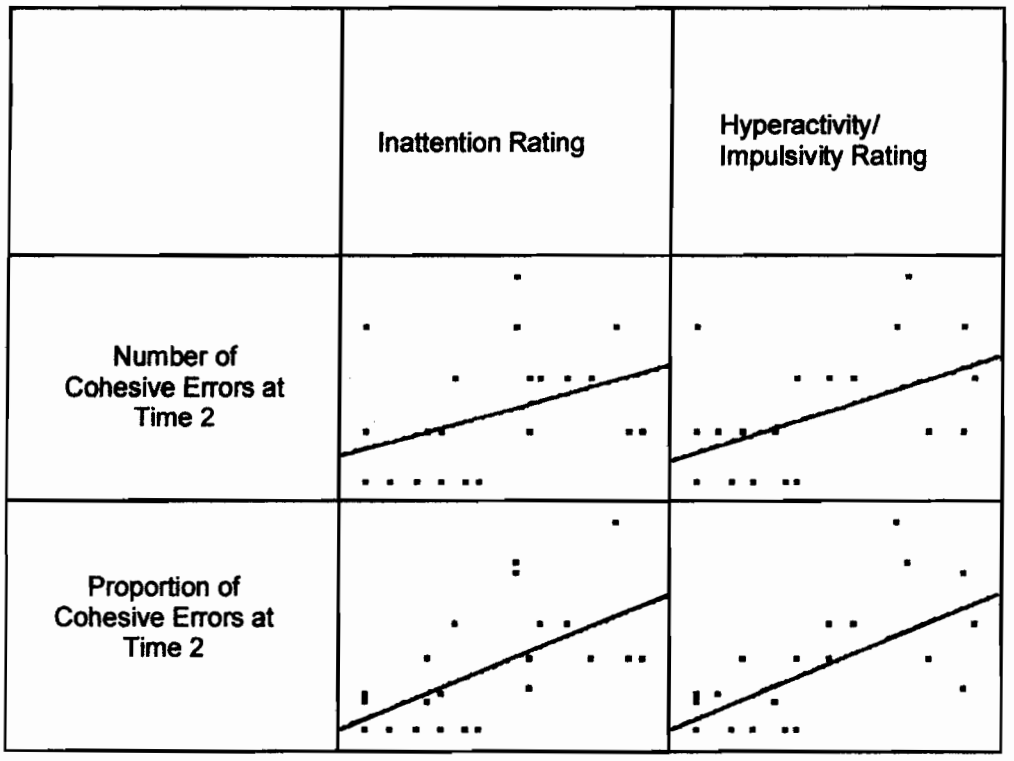

Figure 4. Number and proportion of cohesive errors with respect to inattention and hyperactivity/impulsivity ratings at time 2, N=25.

Coherence

A number of coherence measures were taken from the students' writing samples. Three of the measures discussing the relationship of the clauses to (a) a theme, (b) the prompt, and (c) each other, were analysed statistically. Proportions were calculated for each of these variables to produce the following three measures for analysis: (a) the proportion of clauses that relate to a theme, (b) the proportion of clauses that relate to the prompt, and (c) the proportion of clauses that relate to each other. This last measure required that there be at minimum two clauses in a writing sample; and therefore the sample size was reduced at time 1 to 13 students and at time 2 to 25 students. At time 3, all eight students wrote an adequate amount. Means and standard deviations for all three time periods are presented to establish the average pattern of growth for these measures. Each measure is then analysed to determine its' relationship with the features of inattention and hyperactivity/impulsivity at time 1 and time 2. Qualitative analysis of these relationships and the remaining coherence measures are presented in further sections for all three time periods.

Descriptive statistics were calculated for each of the proportions. Means and standard deviations for the entire sample, and then boys and girls independently. are presented for each measure in Tables 15.1, 15.2, and 15.3. In the boys' sample, there was a developmental trend for all three measures that was reflected in the overall findings. The boys' also demonstrated wide variability between students on each of the measures (see Tables 15.1, 15.2, 15.3 standard deviations). Conversely, the girls demonstrated significantly higher proportions than the boys on all the measures except the proportion of clauses relating to the prompt at time 2. The girls' proportions were relatively stable over the two time periods, with little variability among them. Gender differences were significant for all three variables at time 1 and for clauses relating to the theme and to each other at time 2 (see Table 16). The interaction of gender and time was also significant for all three variables (see Table 16). The results from the small sample at time 3 suggest that children's ability to relate clauses to the prompt and to a theme is well developed by grade 2. Proportion of clauses relating to a theme at time 3 was found to have a mean of .93 (SD = .14) and the proportion of clauses relating to the prompt at this time was found to have a mean of .96 (SD = .12). In contrast, there was greater variability

among students in their ability to relate clauses to each other (mean proportion of clauses relating to each other = .82, SD = .26). Gender differences were not explored at time 3 due to the small sample of students.

Table 15.1

Proportion of Clauses that Relate to a Theme at Time 1 and Time 2

	Proportion of Clauses that Relate to a Theme	
	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	.73 (.43)	.86 (.28)
Boys	.55 (.50)	.75 (.35)
Girls	.95 (.17)	.98 (.07)

Table 15.2

Proportion of Clauses that Relate to the Prompt at Time 1 and Time 2

	Proportion of Clauses that Relate to the Prompt	
	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	.63 (.48)	.89 (.26)
Boys	.35 (.49)	.85 (.28)
Girls	.95 (.17)	.93 (.24)

Table 15.3

Proportion of Clauses that Relate to Each Other at Time 1 and Time 2

	Proportion of Clauses that Relate to Each Other	
	Time 1 Mean (SD)	Time 2 Mean (SD)
Overall	.57 (.47)	.77 (.29)
Boys	.29 (.43)	.65 (.33)
Girls	.94 (.15)	.91 (.13)

Table 16

F – Values for the Analysis of Gender Differences for Coherence Variables

Proportion of Clauses	Time 1 F-value (p–value)	Time 2 F-value (p–value)	Interaction of Gender and Time F-value (p–value)
Relating to a Theme	7.03 (0.02)	4.89 (0.04)	8.56 (0.01)
Relating to a Prompt	16.39 (0.00)	0.68 (0.42)	11.26 (0.01)
Relating to Each Other	14.42 (0.01)	6.18 (0.03)	6.98 (0.02)

The three measures of coherence were also analysed with respect to the behavioural characteristics of inattention and hyperactivity/impulsivity at time 1 and time 2. The relationships between the behavioural characteristics and the proportion of clauses relating to the theme were generally insignificant for boys and girls at both time periods. The only significant negative relationship was found between hyperactivity/impulsivity and proportion of clauses relating to the theme at time 2 for the overall sample. In general, the findings suggested that the children were not writing enough at this point in time to make this a meaningful measure. Children in this sample wrote a small number of clauses, sometimes only one clause, thus increasing the probability that the clauses would all relate to the same topic. A similar finding was true in the measure regarding the proportion of clauses relating to the prompt. The small number of clauses written by the students increased the probability that all or none of the clauses would relate to the prompt, thus producing little variability. Significant findings for this measure emerged at time 1 for the relationship of inattention with proportion of clauses relating to the prompt in the overall sample ($r = -.69$, $p < .001$), and in both the boys' ($r = -.63$, $p < .05$) and girls' ($r = -.69$, $p < .05$) samples independently. In the overall sample, hyperactivity/impulsivity was also found at time 1 to have a significant negative relationship with clauses relating to the prompt ($r = -.69$, $p < .001$). These relationships had disappeared at time 2 as children began to write longer texts.

The final statistical measure of coherence in relation to inattention and hyperactivity/ impulsivity was the proportion of clauses that related to each other. As mentioned earlier, students had to have written more than one clause in order for their

writing sample to be included in this analysis. As with the cohesion analysis discussed above, this criterion limited the number of students' writing samples that were available for analysis. At time 1, only 13 students wrote a total of more than one clause. By time 2, twenty-five students had included more than one clause in their writing sample. Due to the difference in number of students, time 1 and time 2 were analysed separately. Correlations are presented in Table 17.

Pearson-product moment correlations for the overall sample were found to be highly significant at time 1 for both inattention and hyperactivity/impulsivity with respect to the proportion of clauses that relate to each other ($p < .001$, $p < .01$ respectively). These two correlations were also found to be significant at time 2 ($p < .05$, $p < .001$ respectively). Figure 5 and Figure 6 offer graphic representations of these findings. When the genders were viewed independently, the correlations for the boy's sample were also significant at time 1 for both inattention and hyperactivity/impulsivity, and at time 2 for hyperactivity/impulsivity. Although the girl's sample demonstrated a similar trend to the boys, the girl's sample was not significant at either time 1 or time 2.

Table 17

Correlations Between Inattention and Hyperactivity/Impulsivity with the Proportion of Clauses that Relate to Each Other at Time 1 and Time 2 for Overall, Boys, and Girls

		Proportion of Clauses that Relate to Each Other	
	Group	Time 1	Time 2
Inattention	Overall	$r = -.65^{**}$	$r = -.50^{*}$
	Boys	$r = -.84^{**}$	$r = -.41$
	Girls	$r = -.77$	$r = -.39$
Hyperactivity /Impulsivity	Overall	$r = -.79^{***}$	$r = -.67^{***}$
	Boys	$r = -.79^{**}$	$r = -.55^{*}$
	Girls	$r = -.40$	$r = -.53$

* significant correlations *$p<.05$, **$p < .01$, ***$p<.001$

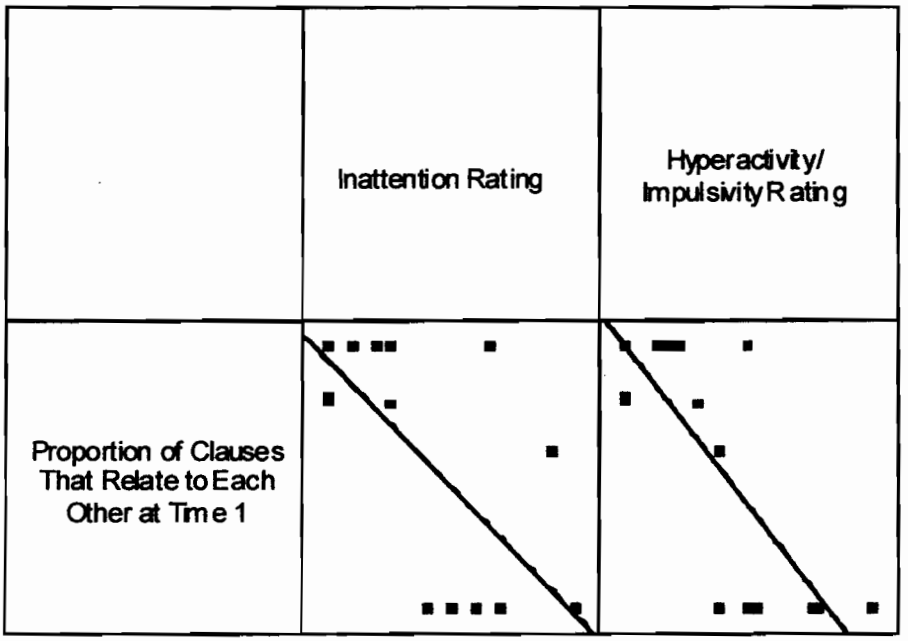

Figure 5. Proportion of clauses that relate to the theme with respect to inattention and hyperactivity/ impulsivity ratings at time 1, N = 16.

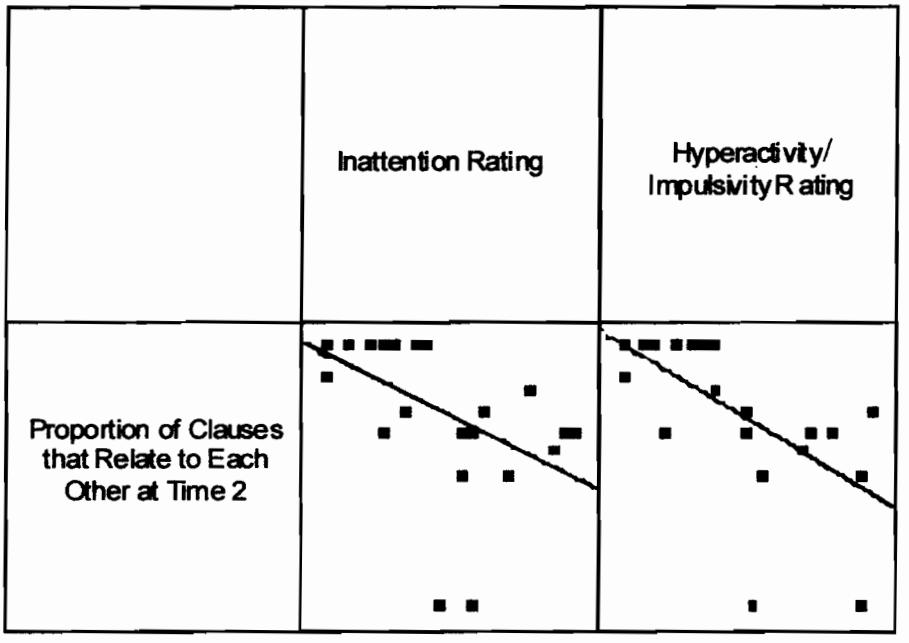

Figure 6. Proportion of clauses that relate to each other with respect to inattention and hyperactivity/ impulsivity ratings at time 2, N = 25.

Further Exploration of Findings

The findings from the correlations calculated at time 1 and time 2 suggest a number of interesting findings relating ADHD features and writing characteristics that can be explored by taking a qualitative look at the children's stories. In addition, the eight children's stories at time 3 offer information on the stability over time of the findings from the initial two time periods.

Writing Content and Connecting Ideas

Overall, the most significant findings from the correlations suggest that inattention and hyperactivity/impulsivity are related to children's development of writing content, and their ability to create both syntactic and semantic relations among the ideas they are conveying. The most significant findings emerge at time 2 when children are writing more and are most often found in the overall sample, with boys showing more significant effects than girls.

At time 1, although the writing samples are relatively short, one noticeable observation is that five of the children were unable to convey their ideas in writing in response to the prompt "What animal would you wish to be?" The five students were all boys and their responses ranged from one child who refused to write, three children who included random or copied letters and words in their response, and one child who wrote a list "1.I fix a supper 2. wso 3. viande 4. carrot 5. celery 6. pal 7. tomato 8. bakll 9. banana." Each of these children had ratings of inattention or hyperactivity/impulsivity that were in the mid to high range in comparison to their peers. In contrast, the majority of the children in the sample wrote the name of an animal often expressed in the form "I want to be . . ." and many provided at least one rationale for their choice with two students who had low ratings of inattention and hyperactivity/impulsivity providing multiple rationales for their choice.

The providing of a rationale or other connections of ideas converted to higher attainment in the developmental progression, as well as demonstrating an ability to use syntactic and semantic means to connect ideas (e.g., the appropriate use of "because" in the sample "I want to be a seal because I want to be funny"). Although there were no significant relations found between ADHD features and use or misuse of cohesive ties at time 1, the broader coherence ratings showed significant negative relationships between

the ADHD features and the proportion of clauses relating to each other. Even at this early stage there appear to be differences in children's ability to relate ideas and their ratings of inattention and hyperactivity/impulsivity. As the children begin to write more, the difficulties become more apparent. For example, one of the girls with high ratings of inattention and hyperactivity/impulsivity wrote a number of ideas at time 1 and made use of connectors in her writing; however, the application of the linking word "because" was overextended to uses that were inappropriate, "I wish I can be polarbear because I would be strong like a polarbear because I can be a fish because I like fish because that happened one time."

By time 2, significant relations were apparent between ADHD features and developmental progression, relating of clauses, as well as use and misuse of cohesive ties. Although the findings for boys and, more often, girls lacked significance, this may be a result of the small sample size and reduced range of scores for girls. The consistently significant findings for the overall sample suggests that the lack of specific gender findings may be related to factors other than the variables of interest. Both boys and girls with high inattention and hyperactivity/ impulsivity ratings appear to be demonstrating the same difficulties with the connecting of ideas. At this time, only one child was unable to convey his ideas in an identifiable way (I balu lr not my mir), and all but one of the rest of the children provided multiple ideas thus requiring that connections be made among them. One of the more striking lapses in creating links that was made by two of the children (1 boy and 1 girl) with higher inattention and hyperactivity/impulsivity scores was failing to provide a referent for the friend they were talking about in their story (e. g., "My friend just howled and he can run fast and can do a rest and he likes to see the stars"). As the children could choose any friend from the animal world to talk about, all the other children provided either clear evidence that their friend was human, or they provided the name of the animal they were talking about. Another child demonstrated an interesting pattern of stories. At both time 1 and time 2 he repeated clauses in his writing one or two times with no apparent additional meaning. For example, at time 2 he wrote:

> I sneak out the window. And I lock the window. And I go to my friend lion. And I go to my friend lion. And I go to my friend lion.

At time 3, although this child did not repeat ideas, his ideas were not related to each other in any readily apparent way:

> "I wish that I was a lizard now I wish I fox I wish I was a normal lizard because I have wings and flamingo feet" (the wish appears to mirror The Mixed-Up Chameleon story which was read to them as part of the initial screening a year and a half earlier).

In contrast, one child with lower behaviour ratings provided clear connections among the ideas in his writing sample:

> "I wish to have a big brother. Wishes are sometimes good, but if you exaggerate the wish sometimes doesn't work. What is your wish?"

At time 3, the sample size was more limited; however, as demonstrated in the examples above, relating of ideas both semantically and syntactically appears to continue to present difficulties for students with higher ratings of inattention and hyperactivity/ impulsivity.

Semantic Elaboration and Complexity

In contrast to the difficulties in connecting ideas, it appears that the proportion of semantic elaboration and complexity in the writing of these students is unrelated to ADHD ratings. At this young age, children are writing very little and there is some evidence that inattention and hyperactivity/impulsivity are related to smaller writing samples (especially among the boys); however, what is written appears to be equally complex and elaborated across behaviour ratings.

Coherence

Finally, there appears to be no relationship between the ADHD features and children's ability to relate their ideas to a theme and a prompt, although given the small number of ideas actually written by the students, this is only a preliminary finding. When children write only one or two clauses it is much easier to conform to a theme and keep the prompt in mind.

When the pictures drawn by the children were included in the coherence analysis, no significant findings emerged at any of the three time periods. Almost all of the students included a picture that related to the prompt and related to the theme of the writing. Only one child at time 1 included a picture that consisted entirely of scribbles and, although this was a child with high inattention and hyperactivity/impulsivity ratings, there were no other children who provided such a drawing.

Summary

Overall, the most significant findings from the correlations and qualitative explorations suggest that inattention and hyperactivity/impulsivity are related to children's development of writing content, and their ability to create both syntactic and semantic relations among the ideas they are conveying. Although no significant correlations were found for the girls' sample, this appears to be due to the small sample size and range of behaviour ratings. The significant gender differences found on the coherence measures initially, disappeared when these measures were assessed with respect to the ADHD characteristics.

The qualitative exploration suggests that both boys and girls with higher ADHD ratings experience difficulties connecting ideas syntactically and semantically. In contrast, it appears that the proportion of semantic elaboration and complexity in the writing of these students (both boys and girls) is unrelated to ADHD ratings. In addition, there appears to be no relationship between the ADHD features and children's ability to relate their ideas to a theme and a prompt, although given the small number of ideas actually written by the students, this is only a preliminary finding.

DISCUSSION

This chapter will discuss the results of this exploratory study, and the implications of these findings. Limitations of the current study, and directions for future research on children's writing development in relation to their behavioural characteristics, will also be discussed. Where appropriate, examples drawn from students' stories will be used to illustrate the study's findings, and to support arguments and interpretations.

Discussion of Findings

Four separate types of measures were used to assess the writing characteristics of the students in this study. Results from each of these measures will be discussed in relation to the behavioural ratings of inattention and hyperactivity/ impulsivity of the students. In addition, issues of gender and ADHD subtype differences that emerged in this study will be explored with respect to the literature in these areas. Subsequently, the results of the study will be discussed in relation to existing research and theories of ADHD, writing difficulties, and the connection of oral and written language. Finally, the educational implications of the results of this study will be addressed.

Developmental Progression

Developmental progression of the student's writing was evaluated using a measure constructed by the school board from which the screening files were obtained. It presented as a valid measure for this age group, as all of the students demonstrated writing content, at minimum, the first level of development and there were no students who reached the ceiling of the scale. There was an overall developmental increase in scores and all but one student demonstrated an increase between each time period, suggesting that this measure demonstrated good face validity. In addition, only approximately half of the students skipped 1 or 2 stages in the progression over the three time periods. This may be partially attributed to the design of the study in which only one writing sample was collected from each student at each time period. Coding only the observable skills from one writing sample may not have captured all of the writing content skills that a student is capable of performing. This type of scoring is consistent with the scoring procedure of standardized tests of achievement where only observed behaviours and not expected behaviours are noted (e.g., the Woodcock-Johnson Psychoeducational Battery – Revised, Woodcock & Johnson, 1989).

The highly significant relationship of inattention and hyperactivity/impulsivity with lower developmental attainment suggests that the writing of students with these behavioural characteristics is consistent with a younger or lower developmental level. In the writing literature discussed in earlier chapters, early writing begins as labels for the pictures the students have drawn, and moves to a more random list type format before children develop a more reflective, organized approach to writing (e. g., Dyson, 1987; Calkins & Graves, 1980). The developmental assessment used in this study reflects this growth in writing content development found in the research literature. The significant negative relationship of both inattention and hyperactivity/ impulsivity with the developmental attainment suggests that these students are lagging in their writing content development at a stage consistent with their levels of inattention and hyperactivity/ impulsivity. For example, in the writing samples below, the first is written by a student with high inattention and hyperactivity/impulsivity ratings and reflects a list type format. These ideas could be placed in any order and the content of the message would stay the same. In contrast, the second example, from a student with low ratings on both behavioural characteristics reflects a more narrative quality, demonstrating more reflection and planning of the content with causal and temporal connections between the ideas.

Example 1

I like my cat. I like to play with my cat. I love to play ball.

Example 2

At each night I sneak out of the house to go see my friend crocy to play with him or he would be sad and I give him food to eat or he would be hungry and he would not like me.

Biederman et. al. (1996) have found that the academic needs of students with ADHD increase throughout their school career. Given that this study has found significant relationships between writing development and ADHD characteristics at the

grade 1 level, writing may present an even more significant area of difficulty for these students as they progress through school. The demands for writing become much greater as students enter their secondary years of schooling. If the negative relationship between ADHD characteristics and writing development continues in the trend established in this study of grades 1 and 2, students with inattention and hyperactivity/ impulsivity difficulties would be at a distinct disadvantage in their academic achievement. Research exploring the relationship of ADHD characteristics and writing content development at the grade 2 level and at the higher levels of elementary and secondary schools would therefore be important to understanding these students and intervening to help them. Exploring not only the nature of the relationship, but also the degree of the relationship between ADHD characteristics and overall writing content development at different grades would give us insight into the specific nature of the academic difficulties these children are experiencing throughout their school career and would guide intervention work, particularly early intervention. Gender differences will be discussed in further sections.

Semantic Analysis

The discourse analysis used in this study provided an assessment of three separate features of the semantic structure of students' texts. Children's writing was assessed for idea production, elaboration, and complexity. The discourse analysis also yielded finer measures of the types of ideas produced and the types of relations used by the students, however, the small sample size of this study precluded a meaningful examination of the data at this much finer level of detail. This type of analysis would be interesting to explore in future research with a larger sample size.

The students' idea production increased across the time periods of the study and was approximately equal for boys and girls. The increase in idea production was expected as children not only gained in experience with the written language through their school work, but also made developmental changes through the passage of time. The equal performance of boys and girls on this measure was interesting to note as girls are often described in the research literature as acquiring language skills at a faster rate than boys at this age (e. g., Berninger & Fuller, 1992). Also interesting with this measure was the small amount of variability among the students in the number of ideas they conveyed in

their writing samples. In particular, at time 1, almost all of the students conveyed only a small number of ideas in their writing samples. This coincided with a lack of variability in the amount of elaboration and in the degree of complexity in the students' writing. The small number of ideas was accompanied by minimal elaboration of those ideas and a low degree of complexity in almost every students' writing samples at time 1 and time 2. As children are still in the very early stages of writing, this conveyance of only a small number of unelaborated and simple ideas could be expected.

The lack of variability among students in their idea production, idea elaboration and idea complexity may have contributed to the overall insignificant findings when idea production, elaboration, and complexity were related to inattention and hyperactivity/ impulsivity characteristics. Given this homogeneity among the students, no significant relationships to the ADHD variables were found for the overall sample at either time period. However, it was interesting to note that by time 2, the boys' results show a significant relationship between production of ideas and ADHD characteristics, but no corresponding relationship between proportion of elaboration or complexity of those ideas and ADHD characteristics. Previous studies have found that students with ADHD write less than their peers and, in fact, also give shorter oral responses when asked to respond to a prompt (e. g., Resta & Elliot, 1994; and Zentall, 1989, respectively). These previous findings of lower oral and written productivity among ADHD students did not determine if this was due to fewer ideas expressed, as suggested in this study, or to a lack of elaboration of the ideas. Given the small number and young age of students in the current study, further studies are needed examining the writing of students with ADHD characteristics to determine if the reduced productivity observed in previous studies is best explained by a smaller number of ideas, as suggested by the boys in this study, or can also be partially attributed to a smaller amount of elaboration of ideas. These findings would also be an important result to explore further at the higher grade levels and with larger samples.

Cohesion and Coherence

The findings from this exploratory study suggest that interrelating ideas with both linguistic and semantic connections presents significantly more difficulty to grade 1 and 2 students with the characteristics of ADHD. Although, this is a very early stage in writing

development, there are already significant correlations between ADHD characteristics and measures of idea interconnectedness. Students with progressively higher scores on both the inattention and hyperactivity/impulsivity ratings made more errors in creating cohesive connections in general and were rated as having fewer relations between their ideas on the coherence measure. These difficulties included such errors as missing and inappropriate causal connections (e.g., inappropriate use of "because"), missing reference ties (i. e., not explaining who "he" refers to), and placing ideas out of sequence. Although there were no significant correlations between production of cohesive ties and ADHD characteristics, the significant findings on both the cohesive errors and idea interconnectedness measures, in addition to the small sample size, suggests that this is a substantive area of difficulty for students with the characteristics of ADHD. Research with the longer writing samples produced by older students would provide an interesting look at students use of cohesion and idea interconnectedness in relation to behavioural characteristics.

The cohesive errors findings and the coherent interconnectedness findings in the present study are consistent with previous research in both the comprehension literature and the oral story telling literature with students who have ADHD. These previous sets of literature found that children with ADHD have more difficulties than their peers making specifically, causal and inferential connections among ideas, and in addition, these students often get the parts of a story correct, but place these parts in an incorrect sequence (Milch-Reich et al., 1999; and Tannock et al., 1993 respectively). Due to the small sample size, the current study did not conduct a specific analysis of errors in causal and inferential connections; however, these types of errors were included in the overall cohesive errors measure, which was determined to be significantly related to both inattention and hyperactivity/impulsivity ratings. Further research to document the most common types of errors made by the students would yield worthwhile data. It is possible, as in the oral language and comprehension literature, that it is the causal connections that present the most difficulties for these students, while other types of connections are acquired with more ease.

Gender Differences

In the field of ADHD, much of the research has focused on the difficulties experienced by boys; however, summaries of recent studies examining gender differences have shown that the divergences between the genders appear to be quantitative in nature rather than qualitative (Barkley, 1995). In other words, there appear to be no gender differences in the nature of the disorder, simply in the expression of the disorder in boys and girls (e.g., boys may be more severe in their level of hyperactive/impulsive behaviour). In the writing literature, only two previous studies have been conducted examining the writing content of students with ADHD, one of these studies included girls in the sample and no differences were noted between the genders (Resta & Elliot, 1994; Elbert, 1993). In the current study, the sample of girls was smaller in comparison to the boys and the range of scores on the behavioural ratings was limited. These sample characteristics are believed to have contributed to the overall lack of significant findings in the girls' results. However, on the measures of developmental progression, cohesive errors, and coherent interconnectedness of ideas on which the overall sample and the boys results were found to be significant, the girls' results followed the same trend as the boys results suggesting that girls are demonstrating similar patterns of writing behaviour in relation to ADHD characteristics as the boys. Even the significant gender differences found in the students ability to create coherence in their writing disappeared when coherence was investigated with respect to inattention and hyperactivity/impulsivity. These findings indicate that, as in the general ADHD research literature, any differences between the boys and girls may simply be quantitative in nature. This would be an important finding for academic intervention. If girls are demonstrating the same difficulties as boys, but to a lesser degree, it is possible that they would not be identified as early as the boys for academic intervention. Thus, it would be very important in future research to use a larger and more diverse sample of girls to explore any relationships between ADHD characteristics and writing development.

Subtype Differences

The students in this study had a range of ratings on both the inattention and on the hyperactivity/impulsivity ratings scales. Although both of these characteristics are part of the diagnosis of ADHD, students can be diagnosed based on one or the other of these

characteristics or on a combination of both of these characteristics. Previous research examining the different subtypes has found not only behavioural, but also academic, and cognitive differences between students who received a diagnosis of primary inattentive type and students who were diagnosed with primarily hyperactivity/impulsive or combined type (see Barkley, 1997b). Some researchers and theorists have proposed that these two subtypes are, in fact, two distinct disorders and not subtypes of the same disorder (e. g., Barkley, 1997). Therefore, it was important in this study to keep the ratings of each of these behavioural characteristics independent and not group them into a single ADHD rating.

As documented in Appendix C, some of the students in this study had higher ratings on one or the other of the behavioural characteristics, while others of the students had high ratings on both behavioural characteristics. By treating each behavioural scale independently, it was possible to note the correlations of each of these characteristics with the writing variables. Quite striking was the lack of differences noted between the two behavioural characteristics in relation to the writing variables. Both inattention and hyperactivity/impulsivity were found to be significantly related to the developmental progression, cohesive errors, and coherent interconnectedness of ideas. In addition, the relationships of the two behavioural characteristics with the other writing variables demonstrated similar trends, suggesting that they are comparably related to writing development. In total there were seventy-eight correlations tested for the relationship of ADHD characteristics with the 13 writing variables, over 2 time periods, for the overall sample and boys and girls separately. Of the seventy-eight correlations, fifty-two were not significant for either inattention or hyperactivity/ impulsivity, and sixteen were significant for both behavioural characteristics. Of the remaining ten relationships tested, the correlations for inattention and hyperactivity/impulsivity were within .3 of each other, with six of the correlations reaching significance for inattention and not hyperactivity/ impulsivity and four correlations reaching significance for hyperactivity/impulsivity and not inattention.

Elbert (1993) similarly found that students with both subtypes of the disorder had difficulties with written language, however, she found that the difficulties were more prominent in the group of students without the hyperactivity (primarily inattentive type).

Further studies examining the relative impact of the two behavioural characteristics on writing development in larger samples of students would provide interesting insight not only on the needs of these students, but also the nature of the subtypes of ADHD.

Connection to Cognitive Theory

Barkley (1997) has theorized that ADHD is a disorder of behavioural inhibition that "ripples" through the rest of the executive functions affecting such cognitive processes as working memory and reconstitution. These executive functions, particularly working memory and reconstitution, would be necessary in the creation of a coherent written text. Both working memory and reconstitution (i. e., analysis and synthesis) would facilitate the integration of many tasks that the student would have to negotiate during the writing process. If working memory is an area of difficulty as found previously in students with ADHD, it is possible that the students with higher inattention and hyperactivity/ impulsivity ratings do not have as many resources for managing all the task demands of writing. In addition, the evidence indicating difficulties with reconstitution is substantive in students with ADHD (see Barkley, 1997b) and may be contributing to the difficulties students with high levels of inattention and hyperactivity/impulsivity were found to be displaying in this study. In particular, the executive function deficits may have impacted on their ability to create connections among ideas, when resources were allocated to such task demands as handwriting, sound/symbol correspondence, and idea generation. The findings from the previous studies of ADHD and writing, along with the findings from the current study may be reflecting a difficulty with assembling and combining ideas and managing all of the task demands of writing. This would be consistent with Barkley's (1997a, 1997b) theory that reconstitution, or the analysis and synthesis of items, and working memory are executive functions disrupted by ADHD.

Writing disabilities research has shown that difficulties with handwriting have an impact on writing fluency and quality (e. g., Berninger, Graham, et. al., 1997). All of the writing tasks consume more resources in an early writer than one who has had more practice and has automatized some of the demands of these tasks. In addition, children who have difficulty with the tasks of handwriting, spelling, and other form features of

writing, may also be expending resources in executing these skills, leaving less working memory resources for the higher level demands of writing content.

Connection of Written to Oral Language

Finally, research that examines both children's oral and written language would provide interesting data. Children with ADHD have been shown in previous studies to be spontaneously talkative; however, this type of language is highly dependent on the environment, in that the language they are producing is in response to what is said by the other person (Bracewell, 1980). In contrast, children with ADHD have been found to be less productive on a prompted oral response task (Zentall, 1989), and in the current study, ADHD characteristics were highly related to lower developmental writing progression, and more errors in connecting ideas in their written work. Both prompted oral story telling and writing are less dependent on the environment and require extended interaction with and manipulation of language without feedback from another person (Bracewell, 1980). Given the difficulties students with ADHD have maintaining their involvement with any extended activities having little external reinforcement, it would not be surprising that both writing and prompted oral story telling would present such significant difficulties. Discourse analysis of the oral and written story telling abilities of students with ADHD to determine if the same types of difficulties are occurring in both modalities would provide interesting insight into the nature of the difficulties experienced by these students. Discourse analysis techniques would provide a greater power of explanation to the existing oral language literature and by comparing the oral to the written, it is possible to determine more precise intervention strategies to assist their development.

Educational Implications

Although this study is exploratory, its classroom-based data and use of naturally occurring curriculum offers many potential educational implications. Perhaps the most obvious implication of these results is the possibilities it provides for early intervention. The findings of this study suggest that even as children begin to acquire the skills of writing text, children with the features of ADHD have more difficulties than their peers with certain aspects of the writing process. In particular, the characteristics of ADHD were associated with lower general writing development and specifically associated with

more difficulties organizing and connecting ideas. Interesting to note is that these relationships were linear in nature, suggesting that there is not a single benchmark where it can be reliably said that only children with behavioural scores above this mark have difficulties. It appears that incrementally higher ratings of inattention and hyperactivity/impulsivity are associated with corresponding lower ratings of general writing development and organizing and connecting of ideas. With respect to educational intervention, this finding would suggest that children demonstrating any level of inattention or hyperactivity/impulsivity would benefit from assistance with their writing development. In particular, the more signs of these behavioural characteristics observed, the more difficulties these children may be experiencing with writing development.

In terms of guiding possible interventions, these findings suggest that there are particular aspects of the writing process that may be presenting more difficulties for students at this point in their writing development. With respect to the observed difficulties in creating connections, interventions can be aimed at providing assistance with both recognizing and creating appropriate connections among ideas - for example, highlighting and challenging students to recognize and create connections such as causal or temporal connections in the stories that are read to them as well as in the stories they create in both oral and written texts.

Indirect interventions aimed at automatizing the lower level skills of writing may also improve higher level skills of writing by providing more working memory resources for the writing content skills to develop (Berninger, 1999; Graham, et al., 1997). Research conducted with children who have writing disabilities (e. g., the research program at the University of Maryland reviewed in Graham, Harris, MacArthur, and Schwartz, 1991) has offered insights into the effectiveness of various intervention programs aimed at improving the writing of students who are experiencing difficulties. One study conducted with children in grade 1 found that having children practice writing letters from memory, in addition to providing the students with visual cues as to the shape of the letters improved students performance in handwriting as well as in compositional fluency (Berninger, Graham, Abbott, Abbott, Rogan, Brooks, & Reed, 1997). Studies such as these have highlighted the importance of automatic letter and sound/symbol retrieval for the higher level demands of written compositions. Given that a number of

studies have documented the handwriting and spelling difficulties of students with ADHD (Peeples, et al., 1995, Elbert, 1993, Lerer, et al., 1979), one possibility for intervention may be to work on the automatization of these basic skills.

Conclusion

In conclusion, the results of this research support the theory that the academic difficulties experienced by students with ADHD are the result of more than just a lack of effort or motivation. The ADHD characteristics of inattention and hyperactivity/ impulsivity were found to be significantly related with a number of writing variables including lowered overall writing content development and more difficulties in creating appropriate cohesive and coherent connections among ideas. These skills rely on working memory and reconstitution, two of the executive processes found to be disrupted in students with ADHD (Barkley, 1997a, 1997b). In contrast, ADHD characteristics were not as related to the semantic development (i. e., idea production, elaboration, and complexity) of the children's writing. These findings are unexpected and may be partially a result of the homogeneity of the semantic development of the children's writing due to the early stage of development. This would be an interesting avenue to explore in future research with older children. Finally, the classroom based nature of the study, the examination of ADHD features as continuous behaviours, and the descriptive nature of the writing analyses, lends this study to educational implications, in particular to early academic intervention. Explorations of the specific difficulties experienced by students with higher features of inattention and hyperactivity/impulsivity assists in the creation of optimal intervention programs designed to target the specific needs of students.

REFERENCES

Ackerman, P. T., Anhalt, J. M., Holcomb, P. J., & Dykman, R. A. (1986). Presumably innate and acquired automatic processes in children with attention and/or reading problems. Journal of Child Psychology and Psychiatry, 27, 513-529.

American Psychiatric Association. (1968). Diagnostic and stastical manual of mental disorders (2nd ed.). Washington, DC: Author.

American Psychiatric Association. (1994). Diagnostic and statistical manual of mental disorders (4th ed.). Washington, DC: Author.

August, G. J., & Garfinkel, B. D. (1990). Comorbidity of ADHD and reading disability among clinic-referred children. Journal of Abnormal Child Psychology, 18, 29-45.

Baddeley, A. D. (1986). Working memory. Oxford, England: Oxford University Press.

Bamberg, B. (1984). Assessing coherence: A reanalysis of essays written for the national assessment of educational progress, 1969-1979. Research in the Teaching of English, 18, 305-319.

Barkley, R. A. (1989). The problem of stuimulus control and rule-governed behavior in children with attention deficit disorder with hyperactivity. In J Swanson and L. Bloomingdale (Eds.), Attention Deficit Disorders (pp. 203-243). New York: Brunner/Mazel.

Barkley, R. A. (1990). Attention-deficit hyperactivity disorder: A handbook for diagnosis and treatment. New York: Guilford Press.

Barkley, R. A. (1994). Impaired delayed responding : A unified theory of attention deficit hyperactivity disorder. In D. K. Routh (Ed.), Disruptive behavior disorders: Essays in honor of Herbert Quay (pp.11-57). New York: Plenum Press.

Barkley, R. A. (1995). Sex differences in ADHD. The ADHD Report, 3(1), 1-4.

Barkley, R. A. (1996). Attention-deficit/hyperactivity disorder. In E. J. Mash & R. A. Barkley (Eds.), Child psychopathology (pp. 63-112). New York: Guilford Press.

Barkley, R. A. (1998). Attention-Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment (2nd ed.). New York: Guilford Press.

Barkley, R. A. (1997a). Behavioral inhibition, sustained attention, and executive functions: Constructing a unifying theory of ADHD. Psychological Bulletin, 121, 65-94.

Barkley, R. A. (1997b). ADHD and the Nature of Self Control. New York: Guilford Press.

Barkley, R. A., DuPaul, G. J., & M. B. McMurray (1990). Comprehensive evaluation of attention deficit disorder with and without hyperactivity as defined by research criteria. Journal of Consulting & Clinical Psychology, 58, 775-789.

Barkley, R. A., Grodzinsky, G., & DuPaul, G. J. (1992). Frontal lobe functions in attention deficit disorder with and without hyperactivity: A review and research report. Journal of Abnormal Child Psychology, 20, 163-188.

Baumgaertel, A., & Wolraich, M. L. (1998). Practice guideline for the diagnosis and management of attention deficit hyperactivity disorder. Ambulatory Child Health, 4, 45-58.

Bereiter, C., & Scardamalia, M. (1982). From conversation to composition: The role for instruction in a developmental process. In R. Glaser (Ed.), Advances in instructional psychology (Vol. 2, pp. 1-64). Hillsdale, NJ: Lawrence Erlbaum.

Berninger, V. W. (1999). Coordinating transcription and text generation in working memory during composing: Automatic and constructive processes. Learning Disability Quarterly, 22, 99-112.

Berninger, V. W. & Fuller, F. (1992). Gender differences in orthographic, verbal, and compositional fluency: Implications for assessing writing disabilities in primary grade children. Journal of School Psychology, 30, 363-382.

Berninger, V. W., Graham, S., Vaughan, K. B., Abbott, R. D., Abbott, S. P., Woodruff Rogan, L., Brooks, A. & Reed, E. (1997). Treatment of handwriting problems in beginning writers: Transfer from handwriting to composition. Journal of Educational Psychology, 89, 652-666.

Berninger, V. W., Yates, C., Cartwright, A., Rutberg, J., Remy, E., & Abbott, R. D. (1992). Lower-level developmental skills in beginning writing. Reading and Writing: An Interdisciplinary Journal, 4, 257-280.

Biederman, J., Faraone, S., Keenan, K., Knee, D., & Tsuang, M. T. (1990). Family genetic and psychosocial risk factors in DSM-III attention deficit disorder. Journal of the American Academy of Child and Adolescent Psychiatry, 29, 526-533.

Biederman, J., Faraone, S., Milberger, S., Guite, J., Mick, E., Chen, L., Mennin, D., Marrs, A., Oullette, C., Moore, P., Spencer, T., Norman, D., Wilens, T., Kraus, I. Perrin, J. (1996). A prospective 4 year follow up study of ADHD and related disorders. Archives of General Psychiatry, 53, 437-446.

Bracewell, R. J., & Breuleux, A. (1994). Substance and romance in analyzing think-aloud protocols. In P. Smagorinsky (Ed.), Speaking about writing: Reflections on research methodology (pp. 55-88). London: Sage.

Bracewell, R. J. (1999). Objects of study in situated literacy: The role of representations in moving from data to explanation. Written Communication, 16, 76-92.

Bracewell, R. J. (1980). Writing as a cognitive activity. Visible Language, 14, 400-422.

Breton, J. J., Bergeron, L., Valla, J. P., Berthiaume, C., Gaudet, N., Lambert, J., St-Georges, M., Houde, L., & Lépine, S. (1999). Quebec child mental health survey: Prevalence of DSM-III-R mental health disorders. Journal of Child Psychology and Psychiatry, 40, 375-384.

Britton, J., Burgess, T., Martin, N., McLeod, A., & Rosen, H. (1975). The development of writing abilities (11-18). London: Macmillan.

Calkins, L. M., & Graves, D. H. (1980). Research update: Children learn the writer's craft. Language Arts, 57, 207-213.

Cantwell, D. P. (1975). The hyperactive child. New York: Spectrum.

Cantwell, D. P. (1996). Attention deficit disorder: A review of the past 10 years. Journal of the American Academy of Child and Adolescent Psychiatry, 35, 978-987.

Carle, E. (1975). The mixed-up chameleon. New York: Harper Collins.

Chess, S. (1960). Diagnosis and treatment of the hyperactive child. New York State Journal of Medicine, 60, 2379-2385.

Clark, C. R., Geffen, G. M., & Geffen, L. B. (1987). Catecholamines and attention: II. Pharmacological studies in normal humans. Neuroscience & Biobehavioral Reviews, 11, 353-364.

Cook, E. H., Stein, M. A., Karsowski, M. D., Cox, N. J., Olkon, D. M., Kieffer, J. E., & Leventhal, B. L. (1995). Association of attention deficit disorder and the dopamine transporter gene. American Journal of Human Genetics, 56, 993-998.

Cook, E. H., Stein, M. A., & Leventhal, B. L. (1997). Family-based association of attention deficit/hyperactivity disorder and the dopamine transporter. In K. Blum (Ed.), Handbook of psychiatric genetics (pp. 296-310). New York: CRC Press.

Cooper, A. (1988). Given-new: Enhancing coherence through cohesiveness. Written Communication, 5, 352-367.

Corkum, P., & Siegel, L. S. (1993). Is the continuous performance task a valuable research tool for use with children with attention-deficit –hyperactivity-disorder? Journal of Child Psychology and Psychiatry, 34, 1217-1239.

Cox, B., & Sulzby, E. (1984). Children's use of reference in told, dictated, and handwritten stories. Research in the Teaching of English, 18, 345-365.

Cox, B. E., Shanahan, T. & Tinzmann, (1991). Children's knowledge of organization, cohesion, and voice in written exposition. Research in the Teaching of English, 25, 179-218.

Cox, B. E., Shanahan, T., & Sulzby, E. (1990). Good and poor elementary readers' use of cohesion in writing. Reading Research Quarterly, 25, 47-65.

Crammond, J. G. (1997). An analysis of argument structure in expert and student persuasive writing. Unpublished doctoral dissertation. McGill University, Montreal, Canada.

Crammond, J. G. (1998). The uses and complexity of argument structures in expert and student persuasive writing. Written Communication, 15, 230-268.

Crowhurst, M. (1987). Cohsion in argument and narrative at three grade levels. Research in the Teaching of English, 21, 185-201.

Danforth, J., & Dupaul, G. J. (1996). Interrater reliability of teacher rating scales for children with attention deficit hyperactivity disorder. Journal of Psychopathology and Behavioral Assessment, 18, 227-237.

de Beaugrande, R., & Dressler, W. (1981). Introduction to text linguistics. London: Longman.

de Beaugrande, R. (1980). Text, discourse, and process. London: Longman.

Dienske, H., de Jonge, G., & Sanders-Woudstra, J. A. (1985). Quantitative criteria for attention and activity in child psychiatric patients. Journal of Child Psychology & Psychiatry & Allied Disciplines, 26, 895-915.

Dolphin, J. E., & Cruikshank, W. M. (1951). Pathology of concept formation in children with cerebral palsy. American Journal of Mental Deficiency, 56, 386-392.

Douglas, V. I. (1972). Stop, look and listen: The problem of sustained attention and impulse control in hyperactive and normal children. Canadian Journal of Behavioural Science, 4, 259-282.

Douglas, V. I., & Benzra, E. (1990). Supraspan verbal memory in attention deficit disorder with hyperactivity normal, and reading disabled boys. Journal of Abnormal Child Psychology, 18, 617-638.

Douglas, V. I. (1988). Cognitive deficits in children with attention deficit disorder with hyperactivity. In L. M. Bloomingdale & J. A. Sergeant (Eds.), Attention deficit disorder: Criteria, cognition, intervention (pp. 65-82). London: Pergamon.

DuPaul, G. J. (1991). Parent and teacher ratings of ADHD symptoms: Psychometric properties in a community-based sample. Journal of Clinical Child Psychology, 20, 245-253.

DuPaul, G. J., Power, T. J., Anastopoulos, A. D., Reid, R., McGoey, K. E., & Ikeda, M. J. (1997). Teacher ratings of attention deficit hyperactivity disorder symptoms: Factor structure and normative data. Psychological Assessment, 9, 436-444.

DuPaul, G. J., Power, T. J., Anastopoulos, A. D., & Reid, R. (1998). ADHD Rating Scale – IV: Checklists, norms, and clinical interpretation. New York: Guilford Press.

Dyson, A. Haas. (1985). Individual differences in emerging writing. In M. Farr (Ed.) Advances in writing research: Children's early writing development (pp. 59-126). Norwood, NJ: Ablex.

Dyson, A. Haas. (1987). Individual differences in beginning composing: An orchestral vision of learning to compose. Written Communication, 9, 411-442.

Elbert, J. C., & Raphael, T. E. (1988). Constructing well-formed prose: Process, structure, and metacognitive knowledge. Exceptional Children, 54, 513-520.

Elbert, J. C., & Thomas, C. C. (1987). Sensitivity to text structure in reading and writing: A comparison between learning disabled and non-learning disabled students. Learning Disability Quarterly, 10, 93-105.

Elbert, J. C. (1993). Occurrence and pattern of impaired reading and written language in children with attention deficit disorders. Annals of Dyslexia, 43, 26-43.

Faraone, S. V., Biederman, J., Lehman, B. K., Spencer, T., Norman, D., Seidman, L. J., Kraus, I., Perrin, J., Chen, W. J., & Tsuang, M. T. (1993). Intellectual performance and school failure in children with attention deficit hyperactivity disorder and in their siblings. Journal of Abnormal Psychology, 102, 616-623.

Fergusson, D. M., & Horwood, L. J. (1993). The structure, stability, and correlations of the trait components of conduct disorder, attention deficit, and anxiety/withdrawal reports. Journal of Child Psychology and Psychiatry, 34, 749-766.

Fiore, T. A., Becker, E. A., & Nero, R. C. (1993). Educational interventions for students with attention deficit disorder. Exceptional Children, 60, 163-173.

Fitzgerald, J., & Spiegel, D. L. (1986). Textual cohesion and coherence in children's writing. Research in the Teaching of English, 20, 263-280.

Frederiksen, C. H. (1972). Effects of task-induced operations on comprehension and memory processes. In R. O. Freedle & J. B. Carroll (Eds.), Language comprehension and the acquisition of knowledge. Washington, DC: Winston.

Frederiksen, C. H. (1986). Cognitive models of discourse analysis. In C. R. Cooper & S. Greenbaum (Eds.), Written communication annual: Vol. 1. Linguistic approaches to the study of written discourse (pp. 227-272). Beverly Hills, CA: Sage.

Frederiksen, C. H., Bracewell, R. J., Breuleux, A., & Renaud, A. (1990). The cognitive representation and processing of discourse: Function and dysfunction. In Y Joanette and H. H. Brownell (Eds.), Discourse ability and brain damage: Theoretical and empirical perspectives (pp. 69-110). New York: Springer-Verlag.

Gilger, J. W., Pennington, B. F., & DeFries, J. C. (1992). Attention deficit disorder and reading disabled twins: Evidence for a genetic etiology. Journal of Abnormal Child Psychology, 20, 303-315.

Glow, P. H., & Glow, R. A. (1979). Hyperkinetic impulse disorder: A developmental defect of motivation. Genetic Psychology Monographs, 100, 159-231.

Golden, J. M., & Vukelich, C. (1989). Coherence in children's written narratives. Written Communication, 6, 45-65.

Graham, S., & Harris, K. R. (1999). Assessment and intervention in overcoming writing difficulties: An illustration from the self-regulated strategy developmental model. Language, Speech, & Hearing Services in the Schools, 30, 255-264.

Graham, S., Berninger, V. W., Abbott, R. D., Abbott, S. P., & Whitaker, D. (1997). Role of mechanics in composing of elementary school students: A new methodological approach. Journal of Educational Psychology, 89, 170-182.

Graham, S., Harris, K.R., MacArthur, C.A., & Schwartz, S. (1991). Writing and writing instruction for students with learning disabilities: Review of a research program. Learning Disability Quarterly, 14, 89-114.

Graves, D. H. (1982). How do writers develop? Language Arts, 59, 173-179.

Graves, D. H. (1983). Writing: Teachers and children at work. Exeter, NH: Heinemann.

Grill, J. J., & Kirwin, M. M. (1989). Written language assessment: Manual. Novato, CA: Academic Therapy Publishers.

Halliday, M. A. K., & Hasan, R. (1976). Cohesion in English. London: Longman.

Hasan, R. (1984). Coherence and cohesive harmony. In J. Flood (Ed.) Understanding reading comprehension (pp. 181-219). Newark, DE: International Reading Association.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of the writing processes. In L. W. Gregg and E. R. Steinberg (Eds.) Cognitive processes in writing (pp. 3-30). Hillsdale, NJ: Erlbaum.

Hayes, J. R., & Flower, L. S. (1986). Writing research and the writer. American Psychologist, 41, 1106-1113.

Hazell, P. L., Carr, V. J., Lewin, T. J., Dewis, S. A. M., Heathcote, D. M., & Brucki, B. M. (1999). Effortful and automatic information processing in boys with ADHD and specific learning disorders. Journal of Child Psychology and Psychiatry, 40, 275-286.

Hedberg, N. L., & Fink, R. J. (1996). Cohesive harmony in the written stories of elementary children. Reading and Writing: An Interdisciplinary Journal, 8, 73-86.

Hynd, G. W., Semrud-Clikeman, M., Lorys, A. R., Novey, E. S., & Eliopulos, D., (1990). Brain morphology in developmental dyslexia and attention deficit disorder/ hyperactivity. Archives of Neurology, 47, 919-926.

Hynd, G. W., Semrud-Clikeman, M., Lorys, A. R., Novey, E. S., Eliopulos, D., & Lyytinen, H. (1991). Corpus callosum morphology in attention deficit-hyperactivity disorder: Morphometric analysis of MRI. Journal of Learning Disabilities, 24, 141-146.

Ingersoll, B. D. (1998). Daredevils and daydreamers: New perspectives on attention deficit/hyperactivity disorder. New York: Doubleday.

Irwin, J. W. (1988). Linguistic cohesion and the developing reader/writer. Topics in Language Disorders, 8(3), 14-23.

James, S. (1993). My friend whale.

Jerome, L., Gordon, M., & Hustler, P. (1994). A comparison of American and Canadian teachers' knowledge and attitudes towards attention deficit hyperactivity disorder (ADHD). Canadian Journal of Psychiatry, 39, 563-567.

Karatekin, C., & Asarnow, R. F. (1998). Working memory in childhood-onset schizophrenia and attention-deficit/hyperactivity disorder. Psychiatry Research, 80, 165-176.

Kintsch, W., & van Dijk, T. A. (1978). Toward a model of text comprehension and production. Psychological Review, 85, 363-694.

Kintsch, W. (1974). The representation of meaning in memory. Mahwah,NJ: Erlbaum.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. Psychological Review, 95, 163-182.

Klorman, R., Hazel-Fernandez, L. A., Shaywitz, S. E., Fletcher, J. M., Marchione, K. E., Holahan, J. M., Stuebing, K. K., & Shaywitz, B. A. (1999). Executive functioning deficits in attention-deficit/ hyperactivity disorder are independent of oppositional defiant or reading disorder. Journal of the American Academy of Child and Adolescent Psychiatry, 38, 1148-1155.

Lahey, B. B., & Bloom, L. (1994). Variability and language learning disabilities. In G. P. Wallach & K. G. Butler (Eds.) Language learning disabilities in school-age children and adolescents: Some principles and applications (pp. 354-372). Needham Heights, MA: Allyn and Bacon.

Lahey, B. B., & Carlson, C. L. (1991). Validity of the diagnostic category of attention deficit disorder without hyperactivity: A review of the literature. Journal of Learning Disabilities, 24, 110-120.

Lahoste, G. J., Swanson, J. M., Wigal, S. B., Glabe, C., Wigal, T., King, N., & Kennedy, J. L. (1996). Dopamine D4 receptor gene polymorphism is associated with attention deficit hyperactivity disorder. Molecular Psychiatry, 1, 121-124.

Levy, G. (1991). The dopamine theory of attention deficit hyperactivity disorder (ADHD). Australian and New Zealand Journal of Psychiatry, 25, 277-283.

Liles, B. Z. (1985). Cohesion in the narratives of normal and language-disordered children. Journal of Speech and Hearing Research, 28(1), 123-133.

London, J. & Long, S. (1994). Liplap's wish. San Francisco. CA: Chronicle Books.

Lorch, E. P., Diener, M. B., Sanchez, R. P., Milich, R., & van den Broek, P. (1999). The effects of story structure on the recall of stories in children with attention deficit hyperactivity disorder. Journal of Educational Psychology, 91, 273-283.

Lorch, E. P., Mililch, R., & Sanchez, R. P. (1998). Story comprehension in children with ADHD. Clinical Child and Family Psychology Review, 1, 163-178.

Lou, H. C., Henriksen, L., Bruhn, P., Borner, H., & Neilson, J. B. (1989). Striatal dysfunction in attention deficit and hyperkinetic disorder. Archives of Neurology, 46, 48-52.

Ludlow, C. L., Rapoport, J., Brown, G. & Mikkelson, E. (1979). The differencial effects of dextroamphetamine on the language and communication skills of hyperactive and normal children. In R. Knights & D. Bakker (Eds.), Rehabilitation, treatment, and management of learning disorders. Baltimore: University Park Press.

Mann, C. A., Lubar, J. F., Zimmerman, A. W., Miller, C. A., & Muenchen, R. A. (1992). Quantitative analysis of EEG in boys with attention-deficit-hyperactivity disorder: Controlled study with clinical implications. Pediatric Neurology, 8, 30-36.

Mariani, M. A., & Barkley, R. A. (1997). Neuropsychological and academic functioing in preschool boys with attentio deficit hyperactivity disorder. Developmental Neuoropsychology, 13, 111-129.

McCutchen, D. (1988). "Functional automaticity" in children's writing: A problem in metacognitive control. Written Communication, 5, 306-324.

McCutchen, D. (1994). The magical number three, plus or minus two: Working memory in writing. In E. C. Butterfield & J. S. Carlson (Eds.) Advances in cognition and educational practice, Vol. 2 (pp. 1-30).

McCutchen, D. (1995). Cognitive processes in children's writing: Developmental and individual differences. Issues in Education. Contributions from Educational Psychology, 1, 123-160.

Meyer, B. (1975). The organization of prose and its effect on memory. Amsterdam: North Holland.

Milch-Reich, S., Campbell, S. B., Pelham, W. E., Connelly, L. M., & Geva, D. (1999). Developmental and individual differences in children's on-line representations of dynamic social events. Child Development, 70, 413-431.

Milich, R., Lorch, E. P., & Sanchez, R. P. (1999). Story comprehension in children with ADHD: What's the story? The ADHD Report, 7(2), 4-7.

Montague, M., Maddux, M., & Dereshiwsky, M. I. (1990). Story Grammar and comprehension and production of narrative prose by students with learning disabilities. Journal of Learning Disabilities, 23, 190-197.

Mosenthal, J. H., & Tierney, R. J. (1984). Cohesion: Problems with talking about text. Reading Research Quarterly, 19, 240-244.

Newcomer, P. L., & Barenbaum, E. M. (1991). The written composing ability of children with learning disabilities: A review of the literature from 1980-1990. Journal of Learning Disabilities, 24, 578-593.

Newkirk, T. (1987). The non-narrative writing of young children. Research in the Teaching of English, 21, 121-144.

Norrelgen, F., Lacerda, F., & Forssberg, H. (1999). Speech discrimination and phonological working memory in children with ADHD. Developmental Medicine & Child Neurology, 41, 335-339.

Peeples, E. E., Searls, D. T., & Wellingham-Jones, P. (1995). Attention-deficit hyperactivity disorder: A longitudinal case study of handwriting characteristics. Perceptual & Motor Skills, 81, 1243-1252.

Pennington, B. F., & Ozonoff, S. (1996). Executive functions and developmental psychopathology. Journal of Child Psychology & Psychiatry & Allied Disciplines, 37, 51-87.

Peterson, C. (1993). Identifying referents and linking sentences cohesively in narration. Discourse Processes, 16, 507-524.

Piaget, J., & Inhelder, B. (1969). The psychology of the child. New York: Basic Books.

Rental, V. M., & King, M. L. (1983). Present at the beginning. In P. Mosenthal, L Tamor, & S. A. Walmsley (Eds.) Research on writing, Principles and methods. New York: Longman.

Resta, S. P., & Eliot, J. (1994). Written expression in boys with attention deficit disorder. Perceptual and Motor Skills, 79, 1131-1138.

Riccio, C. A., Hynd, G. W., Cohen, M. J., & Gonzalez, J. J. (1993). Neurological basis of attention deficit hyperactivity disorder. Exceptional Children, 60, 118-124.

Ripich, D. N., & Grifith, P. L. (1988). Narrative Abilities of children with learning disabilities and non-disabled children: Story structure, cohesion, and propositions. Journal of Learning Disabilities, 21, 165-173.

Sanchez, R. P., Lorch, E. P., Milich, R., & Welsch, R. (1999). Comprehension of televised stories by preschool children with ADHD. Journal of Clinical Child Psychology, 28, 376-385.

Scardamalia, M., & Bereiter, C. (1985). The development of dialectical processes in writing. In D. Olsen, N. Torrance, & A. Hildyard (Eds.) Literacy, language, and learning: The nature and consequences of reading and writing. Cambridge: Cambridge University Press.

Schachar, R. J., Tannock, R., Marriott, M., & Logan, G. (1995). Deficient inhibitory control in attention deficit hyperactivity disorder. Journal of Abnormal Child Psychology, 23, 411-438.

Senecal, L. (1998). The idea structure of students' written stories in grades 3, 4, & 5. Unpublished doctoral dissertation, McGill University, Montreal, Canada.

Sowers, S. (1985). The story and the all-about book. In J. Hansen, T. Newkirk, and D. Graves (Eds.) Breaking ground: Teachers relate reading and writing in the elementary school (pp.73-82). Portsmouth, NH: Heinemann.

Spiegel, D.L., & Fitzgerald, J. (1990). Textual cohesion and coherence in children's writing revisited. Research in the Teaching of English, 24, 48-66.

Spivey, N. (1997). The constructivist metaphor: Reading, writing, and the making of meaning. New York: Academic Press.

Stewart, M. A. (1970). Hyperactive children. Scientific American, 222, 94-98.

Strauss, A. A., & Kephardt, N. C. (1955). Psychopathology and education of the brain injured child: Vol. II. Progress in theory and clinic. New York: Grune and Stratton.

Tannock, R., Purvis, K. L., & Schachar, R. J. (1992). Narrative abilities in children with attention deficit hyperactivity disorder and normal peers. Journal of Abnormal Child Psychology, 21, 103-117.

Tierney, R. J., & Mosenthal, J. H. (1983). Cohesion and textual coherence. Research in the Teaching of English, 17, 215-229.

van Dijk, T. A. (1977). Text and context: Explorations in the semantics and pragmatics of discourse. London: Longman.

van Dijk, T. A. (1980). Macrostructures: An interdisciplinary study of global structures in discourse, interaction, and cognition. Hillsdale, NJ: Erlbaum.

Vygotsky L. S. (1962). Thought and language (A. Kozulin, Ed. and Trans.). Cambridge, MA: MIT Press. (Original work published 1934)

Weiss, G., & Hechtman, L. T. (1993). Hyperactive children grown up (2nd ed.): ADHD in children and adolescents, and adults. New York: Guilford Press.

Winograd, T. (1983). Language as a cognitive process: Vol 1, Syntax. Reading, MA: Addison-Wesley.

Witte, S. P., & Faigley, L. (1981). Coherence, cohesion, and writing quality. College Composition and Communication, 32, 189-204.

Wolraich, M. L. (1999). Attention deficit hyperactivity disorder: The most studied and yet most controversial diagnosis. Mental Retardation and Developmental Disabilities Research Reviews, 5, 163-168.

Wolraich, M. L., Hannah, J. N., Pinnock, T. Y., Baumgaertel, A., & Brown, (1996). Comparison of diagnostic criteria for attention deficit hyperactivity disorder in a county-wide sample. Journal of the American Academy of Child and Adolescent Psychiatry, 35, 319-323.

Wright, R. E., & Rosenberg, S. (1993). Knowledge of text coherence and expository writing: A developmental study. Journal of Educational Psychology, 85, 152-158.

Zametkin, A., Nordahl, T. E., Gross, M., King, A. C., Semple, W. E., Rumsey, J., Hamburger, S., & Cohen, R. M. (1990). Cerebral glucose metabolism in adults with hyperactivity of childhood onset. New England Journal of Medicine, 323, 319-323.

Zecker, L. B. (1996). Early development in written language: Children's emergent knowledge of genre-specific characteristics. Reading & Writing: An Interdisciplinary Journal, 8, 5-25.

Zentall, S. S. (1985). A context for hyperactivity. In K. D. Gadow and I. Bialer (Eds.) Advances in learning and behavioral disabilities (Vol.4, pp. 273-343). Greenwich, CT: JAI Press.

Zentall, S. S. (1988). Production difficulties in elicited language but not in the spontaneous verbalizations of hyperactive children. Journal of Abnormal Child Psychology, 16, 657-673.

APPENDIX A

DSM-IV criteria for Attention Deficit Hyperactivity Disorder

DSM-IV (APA, 1994) Diagnostic Criteria for Attention-Deficit/Hyperactivity Disorder

A. Either (1) or (2):
   (1) six (or more) of the following symptoms of inattention have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

   Inattention
   (a) often fails to give close attention to details or makes careless mistakes in schoolwork, work, or other activities
   (b) often has difficulty sustaining attention in tasks or play activities
   (c) often does not seem to listen when spoken to directly
   (d) often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (not due to oppositional behavior or failure to understand instructions)
   (e) often has difficulty organizing tasks and activities
   (f) often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (such as schoolwork or homework)
   (g) often loses things necessary for tasks or activities (e.g., toys, school assignments, pencils, books, or tools)
   (h) is often easily distracted by extraneous stimuli
   (i) is often forgetful in daily activities

   (2) six (or more) of the following symptoms of hyperactivity-impulsivity have persisted for at least 6 months to a degree that is maladaptive and inconsistent with developmental level:

   Hyperactivity
   (a) often fidgets with hands or feet or squirms in seat
   (b) often leaves seat in classroom or in other situations in which remaining seated is expected
   (c) often runs about or climbs excessively in situations in which it is inappropriate (in adolescents or adults, may be limited to subjective feelings of restlessness)
   (d) often has difficulty playing or engaging in leisure activities quietly
   (e) is often "on the go" or often acts as if "driven by a motor"
   (f) often talks excessively

   Impulsivity
   (g) often blurts out answers before questions have been completed
   (h) often has difficulty awaiting turn
   (i) often interrupts or intrudes on others (e.g., butts into conversations or games)

B. Some hyperactive-impulsive or inattentive symptoms that caused impairment were present before age 7 years.

C. Some impairment from the symptoms is present in two or more settings (e.g., at school [or work] and at home).

D. There must be clear evidence of clinically significant impairment in social, academic, or occupational functioning.

E. The symptoms do not occur exclusively during the course of a Pervasive Developmental Disorder, Schizophrenia, or other Psychotic Disorder and are not better accounted for by another mental disorder (e.g., Mood Disorder, Anxiety Disorder, Dissociative Disorder, or a Personality Disorder).

APPENDIX B

ADHD Rating Scale

This student:	Never or Rarely	Sometimes	Often	Very Often
1. is willing to share (e.g., materials required for group work; belongings).	0	1	2	3
2. makes mistakes in schoolwork and/or on tests because s/he does not pay close attention to details (e.g., instructions).	0	1	2	3
3. argues with adults.	0	1	2	3
4. enjoys playing sports.	0	1	2	3
5. has difficulty organizing tasks.	0	1	2	3
6. loses his/her temper.	0	1	2	3
7. has difficulty focussing on tasks and play activities.	0	1	2	3
8. seems anxious/worried.	0	1	2	3
9. is considerate toward others.	0	1	2	3
10. is shy/timid.	0	1	2	3
11. does not follow through on instructions, or finish schoolwork or chores. (Note: <u>not</u> because s/he is defiant)	0	1	2	3
12. accepts responsibility for his/her actions.	0	1	2	3
13. does not seem to listen when spoken to directly.	0	1	2	3
14. has respect for adult authority/leadership (e.g., teachers; activity leaders).	0	1	2	3
15. loses things necessary for carrying-out tasks and projects (e.g., school supplies; books; equipment; game-pieces).	0	1	2	3
16. seems tired/lacks energy.	0	1	2	3
17. enjoys school.	0	1	2	3

This student:	Never or Rarely	Sometimes	Often	Very Often
18. fidgets with his/her hands or feet, or squirms in his/her seat.	0	1	2	3
19. is irritable (i.e., 'cranky' or moody).	0	1	2	3
20. seems forgetful in daily activities.	0	1	2	3
21. gets along well with classmates.	0	1	2	3
22. tries to be helpful to others.	0	1	2	3
23. 'takes care' with his/her work (e.g., is concerned about neatness).	0	1	2	3
24. annoys adults deliberately (i.e., 'on purpose'; to get a reaction).	0	1	2	3
25. leaves his/her seat in the classroom or at other times when staying seated is required (e.g., during meals; sitting in an audience).	0	1	2	3
26. lacks self-confidence.	0	1	2	3
27. is 'easy-going'.	0	1	2	3
28. interrupts/intrudes on others (e.g., 'butts' into conversations or games).	0	1	2	3
29. is overly talkative.	0	1	2	3
30. has difficulty 'waiting his/her turn' (e.g., in lines; in games; to speak).	0	1	2	3
31. daydreams.	0	1	2	3
32. runs about or climbs in situations in which this is inappropriate. (In adolescents, this may be limited to feelings of restlessness.)	0	1	2	3
33. enjoys reading.	0	1	2	3
34. boasts (i.e., 'brags' or exaggerates).	0	1	2	3

This student:	Never or Rarely	Sometimes	Often	Very Often
35. dislikes tasks that require sustained mental effort (e.g., homework or school projects).	0	1	2	3
36. is a 'loner'.	0	1	2	3
37. is patient.	0	1	2	3
38. has difficulty playing/engaging in leisure activities quietly.	0	1	2	3
39. likes being a 'leader'.	0	1	2	3
40. gets angry/resentful about things.	0	1	2	3
41. has friends.	0	1	2	3
42. seems to be 'on-the-go' or 'driven by a motor'.	0	1	2	3
43. is creative.	0	1	2	3
44. stays 'on-task' when doing his/her schoolwork.	0	1	2	3
45. blames others for his/her mistakes or misbehaviour.	0	1	2	3
46. blurts out answers before questions have been completed.	0	1	2	3
47. actively defies adults and/or refuses to follow rules.	0	1	2	3
48. shows interest in his/her appearance (e.g., clothes; hair).	0	1	2	3
49. is spiteful/vindictive toward others.	0	1	2	3
50. is cheerful/seems happy.	0	1	2	3

APPENDIX C

Table of student's stories and behaviour ratings

Children's Stories with Behavioural Data

	1-1	1-2	2-2
02 male Inattention-5 Hyper -7	I want to be a hamster. Because they ran very fast and they make babies. They can make lots of colours and what I eat is salad I want to be a I didn't turn back and I be a hamster and I want to be a hamster because a hamster is fun.	A dinosaur. I'm a dinosaur. I live in a cave. I'm called Dino. I have a friend he is called Saurus. I go at my friends cave and early early in the morning I go in my cave I do the dishes and	A brother I wish to have a big brother. Wishes are sometimes good. But if you exagerate, the wish sometimes dosen't work. What is your wish?
03 male Inattention-12 Hyperact. -24	At Oakridge Ibt mptcat ul msik.Iveywcice e a seea.CattheIcat.Cates.The. Dog with I cat.Othe I dogltI cat.The I cat	my POD. I go down the stairs no I don't. I go out of my boat I get eowmdc deswg A silly dog and I like Mrs Robin	a kids wish is a fish. One night a kid was wishing on a shooting star. And two days later got his wish. And the next day his sister wished too. And soon enough she got her wish . and so the box and so did the girl. The end
05 male Inattention-8 Hyperact. -9	AOA see whale AitNAtertAtwo AwhaleACGAJAN ('see whale' + random letters and copied words)	One time I went to see my friend it was a dinosaur. The dinosaur was a trakas. But it is a nice traks. I played ball with my friend the dinosaur traks. The end	My wish One day I made a wish of a new game for computers and I waited and waited till it comes true. And one day my mom bought it a toys-R-us and the games were Digby and Timon and Pumba and this weekend we're going again. The end

09 male Inattention-0 Hyperact. -0	I wish I can be a fish because I can go in the water because I love water the fish jump in the water the fish splash me all wet I am a fish I can go in the water I see a whale it is cool and I see a seashell	One day when the sun was up. I went to the river. And my friend my friend was a dinosaur. And my friend was not mean. He was friendly. One day my friend not there so I went to bed. And the next. morning he was not there. And the next morning he was not there	My three wishes. One day I wished to have legos. And I did have legos. That day was fun. My other wish was to have a new bike. That took a long time to have a bike. I am eight now I was six years old when I wished to have a bike. I don't have it I got my old one. My other wish was to have my own TV but that was when I made seven years old. My mom said when we're going to move. I said yah but that wish was true, but it was one of the old ones.
10 male Inattention-14 Hyperact. -12	cahier d'excicise (copied – in textbox) OOIF C'est moi (in picture box)	My friend penguin I got out of my bed and I went to look in my mummy's and daddy's room. And I went to see my friend penguin. I got dress very very hot.	My three wishes ticket It was night and I was walking along the road. And I saw a stranger and he said do you want this ticket and I said no. and he said this ticket can realize three of your wishes.
15 male Inattention-20 Hyperact. -18	I see whale I see whale Ivercsa I see a turtle	I sneak out the window. And I lock the window. And I go to my friend lion. And I go to my friend lion. And I go to my friend lion. The lion	My wish I wish that I was a lizard now I wish I fox I wish I was a normal lizard because I have wings and flamingo feet.
16 female Inattention-18 Hyperact. -9	I wish I can be a polarbear because I would (oab) be strong (stag) like a polarbear because because I can be a fish because I like fish because that happened 'oet' one time	When I wanted to go see my friend I go at night I like him he's my best friend I do basket ball I like him the end	My wish I wish that I will see in front of my window a snowstorm. Me and my family will jump in the snow I don't know what will

17 female Inattention-13 Hyperact. -12	I wish I was an animal only I don't know who. I love chameleons.	My pet is a rabbit. My rabbit is very nice. I sneak out of home when my mommy and my daddy are sleeping good my rabbit wears a red coat and he wears a pink skirt.	My wish I wish I was a princess. And I had a royal barge (bag) and I lived by I ocean blue. And then one day a big whale jump! Up from the ocean it was black and white. It was beautiful. The end.
101 female Inattention-0 Hyperact. -0	cat/I love (erased) I love cat. Because my tail is long	I called the bunny It rushed to me I was happy I played with the bunny I was very happy I love my bunny	
103 female Inattention-6 Hyperact. -8	I want to be a cat and a dog	I was tired 'watnart' to wait for my friend the monkey so I went to see him (in textbox) I am a monkey (in picture box)	
104 female Inattention-9 Hyperact. -3	The bunnyrabbit that's the (TheTa) best	At night I went to see my best friend the world Her name is Nayomi I like her a lot	
106 male Inattention-12 Hyperact. -19	(random letters)	My friend wolf. My wolf is fast fast the other 'fis' say he faster than you but the 'fis' is not fast(er) the(than) my friend wolf He is my I bestest friend	
107 female Inattention-4 Hyperact. -5	I want to be a rabbit because I want to be a animal	My friend is happy because I came to play we both grabbed our swimsuits and towels. And ran to the beach but the beach was closed and so we lied down and we saw a whole bunch of shooting stars. The End	

110 male Inattention-13 Hyperact. -24	The lizard caught a fly	My friend the whale. My whale always splash(es) on me. My friend is name is Michael I had a fun with my friend the whale don't forget his name is Michael	
111 female Inattention-5 Hyperact. -4	Polarbear because he's nice	last night I go to bed and my cat was on my (bed) I woke up and then	
112 male Inattention-22 Hyperact. -21	1 I fix a supper 2 'wso' 3 viande (meat) 4 carrot 5 celery 6 'pal' (patate) 7 tomato 8 'bakll' 9 banana	I like my cat. I like to play with my cat. I love to play ball.	
114 male Inattention-7 Hyperact. -25	I always want to be a toucan	I loved my friends they always having fun and they always go at night I was always there. The end	
115 male Inattention-21 Hyperact. -21	A black bear catch a fish	I love my bird he bring me to the shining to see the star	
116 male Inattention-16 Hyperact. -14	I be to a dog	My friend just howled and he can run fast and can do a rest and he likes to see the stars	
117 male Inattention-10 Hyperact. -13	(refused to write)	I balu lr not my mir	

118 female Inattention-6 Hyperact. -2	deer	outside at night I going on my horse and my horse is my best friend and is going to be for all the life and very nice and if I could kiss him I will but I can not	
119 male Inattention-0 Hyperact. -3	One day I wanted to be a bear I was never cold	At each night I sneak out. Of the house to go see my friend crocy (crocodile's name) to play with him or he would be sad and I give him food to eat or he would be hungry and he would not like me.	
120 female Inattention-0 Hyperact. -0	Polarbear	I am a duck a very nice duck I don't like to see people fighting. I don't like when I saw it today. I saw people fighting outside I didn't like that when there were people crying outside I went to see them but they pushed me on the floor and I hurt myself on the grass. They were starting to fight I go I saw a girl that starting to cry I cry I went to see her but He pushed me Now we're starting to play with a girl the girl was Marilee.	

121 female Inattention-0 Hyperact. -0	I am a bear that eat up a bird	I love my dog	
122 female Inattention-2 Hyperact. -0	I want to be a seal because I want to be funny	My friend hummingbird is her feathers are soft she landed in the garden she was hungry I like her so much she is special	
123 female Inattention-8 Hyperact. -3	I want to be a cat	My friend the star Beautiful is my friend	

APPENDIX D

Sample of the instructions to students for the writing task

Instructions to students:

In our book (holding up *The Mixed Up Chameleon*), each time the chameleon saw a new zoo animal, he wished that he could be like it, and do the things that it can do well. I can understand why the chameleon got so confused – so mixed up. There are so many kinds of animals in our world, who can do so many different things, that it was hard for him to decide which one he would most like to be.
How about you? If you were granted the chameleon's wish , and could become any animal in the world, which one would you choose to be?

(Brainstorm with students, using chart paper or the blackboard to write down ideas. If students do not provide a rationale for their choice, use a prompt such as,
"Oh my! And why would you wish to be a _____?")

Now that we have many ideas (sweep hand over list), you are going to write a story about your wish. First, in this big box (show Activity Booklet 'centrefold'), draw the animal that you would choose to be, if you were granted a wish. I'm going to draw a _____ in my box, because that's the animal I would choose to be, if I had the wish; your picture will be different (sweep hand over list).

(Draw a quick sketch to model the process to students.)

Next, in this space (sweep hand over lined area, but don't mention lines) write us the story of your wish. I'll start mine...

(Write a phrase or two, reading aloud as you do so, to model the process. Upon completion of the modelling, remove your sample from sight.

Let's go over the story ideas one more time, to help you decide what you want your story to be about. (Read aloud the ideas from the chart paper/blackboard, using a pattern such as, "If you were granted a wish , would you most like to be a _____? ...a _____? ...)

APPENDIX E

The analysis of coherence measure

Student #_____ Time Period 1-1 1-2 2-2

Analysis of Coherence

1. What genre does the child use in their writing?

Personal Narrative Preference List Other Random letters/words

2. How many main clauses are there in this piece of writing? _____

3. How many of the main clauses relate to the given prompt? _____

4. (a) Is there an idea or title at the beginning that is meaningful in relation to the topic/theme of the piece of writing? Yes No

OR Could a title reflecting the content of the writing be easily generated? (i.e., is there a main idea or theme?) Yes No

5. How many of the main clauses relate to this topic/theme? _____

6. How many of the main clauses are meaningfully related to the ideas directly before and/or after it in a sensible way? _____

7. (a) Is there a picture that accompanies the writing? Yes No

(b) Does the picture relate in a meaningful way to the prompt? Yes Somewhat No

(c) Does the picture relate in a meaningful way to the theme of the writing? Yes Somewhat No

8. What tells the most information in relation to the prompt?

Writing Picture Both Neither

APPENDIX F

Inter-rater reliability scores

Inter-rater Reliability

A School Psychologist with a PhD in Educational Psychology was asked to re-analyze nine of the writing samples produced by the students. Reliability figures (i.e., percentage of agreements) for the Developmental Progression, Cohesive Errors, and Coherence Variables are provided below.

In addition, 12 of the writing samples produced by the students were coded by a second independent rater for propositional concepts and relations, and cohesive ties. This independent rater is a Professor of Educational Psychology and has worked extensively with both propositional and cohesion analysis.

Variable	Inter-rater reliability
A) Stages of the Developmental Progression Reached	95%
B) Semantic Concepts	98.8%
C) Semantic Relations	93.5%
D) Number of Cohesive Ties	88.9%
E) Number of Cohesive Errors	95.4%
F) Number of Clauses	100%
G) Number of Clauses that Relate to the Prompt	100%
H) Number of Clauses that Relate to a Theme	95.1%
I) Number of Clauses that Relate to Each Other	95.3%
J) The Relation of the Picture to the Prompt	88.9%
K) The Relation of the Picture to the Theme of the Writing	88.9%
L) The Modality (picture or writing) that Provides the Most Information	77.8%

APPENDIX G

Ethical approval

MCGILL UNIVERSITY
FACULTY OF EDUCATION

CERTIFICATE OF ETHICAL ACCEPTABILITY FOR FUNDED AND NON FUNDED RESEARCH INVOLVING HUMANS

The Faculty of Education Ethics Review Committee consists of 6 members appointed by the Faculty of Education Nominating Committee, an appointed member from the community and the Associate Dean (Academic Programs, Graduate Studies and Research) who is the Chair of this Ethics Review Board .

The undersigned considered the application for certification of the ethical acceptability of the project entitled:

The Development of Early Writing Abilities in Students with Attention Difficulties

as proposed by:

Applicant's Name **Tina M. Newman** Supervisor's Name **Robert J. Bracewell, Ph.D.**

Applicant's Signature _____ Supervisor's Signature _____

Degree / Program / Course **Ph.D./School Psychology** Granting Agency _____

The application is considered to be:

A Full Review _____ An Expedited Review ✓

A Renewal for an Approved Project _____ A Departmental Level Review _____
Signature of Chair / Designate

The review committee considers the research procedures and practices as explained by the applicant in this application, to be acceptable on ethical grounds.

1. Prof. Evelyn Lusthaus
Department of Educational and Counselling Psychology
_____
Signature / date

2. Prof. John Leide
Graduate School of Library and Information Studies
_____
Signature / date

3. Prof. Margaret Downey
Department of Physical Education
_____
Signature / date

4. Prof. Lise Winer
Department of Second Language Education
_____ 12 Aug. 1999
Signature / date

5. Prof. Claudia Mitchell
Department of Educational Studies
_____ Aug 29/1999
Signature / date

6. Prof. Kevin McDonough
Department of Culture and Values in Education
_____ Sept. 7/99
Signature / date

7. Member of the Community – To be determined
_____
Signature / date

Mary H. Maguire Ph. D.
Chair of the Faculty of Education Ethics Review Committee
Associate Dean (Academic Programs, Graduate Studies and Research)
Faculty of Education, Room 230
Tel: (514) 398-7039/2183 Fax: (514) 398-1527

_____ Sept 8/99
Signature / date

Revised May, 1999

Revised May, 1999

MCGILL UNIVERSITY FACULTY OF EDUCATION

STATEMENT OF ETHICS OF PROPOSED RESEARCH

It is assumed that the responses to the questions below reflect the author's (or authors') familiarity with the ethical guidelines for funded and non funded research with human subjects that have been adopted by the Faculty of Education and that responses conform to and respect the Tri-council Policy Statement: Ethical Conduct for Research Involving Humans (1998).

1. Informed Consent of Subjects

Explain how you propose to seek informed consent from each of your subjects (or should they be minors, from their parents or guardian). Informed consent includes comprehension of the nature, procedures, purposes, risks, and benefits of the research in which subjects are participating. Please append to this statement a copy of the consent form that you intend to use.

The data for this research project are archival data collected by the school board. School board permission will be obtained for use of these data.

2. Subject Recruitment

2.1 Are the subjects a "captive population" (e.g., residents of a rehabilitation centre, students in a class, inmates in a penal establishment)?

N/A

2.2 Explain how institutional or social pressures will not be applied to encourage participation. (See attached guidelines)

N/A

2.3 What is the nature of any inducement you intend to present to prospective subjects to persuade them to participate in your study?

N/A

2.4 How will you help prospective participants understand that they may freely withdraw from the study at their own discretion and for any reason?

N/A

3. Subject Risk and Well-being

What assurance can you provide this committee (as well as the subjects) that the risks, physical and/or psychological, that are inherent to this study are either minimal or fully justifiable given the benefits that these same subjects can reasonably expect to receive?

There are no risks associated with this project. The data are archival and the identity of the students and teachers will not be known by the researcher.

4. Deception of Subjects

4.1 Will the research design necessitate any deception to the subjects?

No

4.2 If so, what assurance can you provide this committee that no alternative methodology is adequate?

N/A

4.3 If deception is used, how do you intend to nullify any negative consequences of the deception?

N/A

5. Privacy of Subjects

How will this study respect the subjects' right to privacy, that is, their right to refuse you access to any information which falls within the private domain?

N/A

6. Confidentiality/Anonymity

6.1 How will this study ensure that (a) the identity of the subjects will be concealed and (b) the confidentiality of the information which they will furnish to the researchers or their surrogates will be safeguarded? (See guidelines on confidentiality/anonymity section).

The data from the school board have number assignments. Any names or identifying information will be removed by the school psychologist before the information is released for use in this study. The writing samples contain no personal information as they were written from a standard prompt based on a book that was read to the students. The behavioural observations by the teachers were obtained in the form of a likert scale questionnaire with no personal comments or identifying information of either the teacher or the student.

6.2 If applicable, explain how data will be aggregated in such a way that even should the identity of the participants become known, no reasonable inference could be made about the performance, competence, or character of any one of these participants.
If data will not be aggregated, provide a detailed explanation.
For case study research see attached guidelines, section case studies.

The data will be aggregated to examine the relations between writing and several behavioural characteristics.

Signature of researcher: _____

If this project has been submitted to another ethics committee, please note the particulars:

Submit this statement to:
Office of the Associate Dean
(Academic Programs, Graduate Studies and Research)
Faculty of Education, Room 230
Tel: (514) 398-7039/2183
Fax: (514) 398-1527