THE WISC-III, THE WIAT–II AND THEIR CORRELATIONS IN A CANADIAN SAMPLE

by

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ABSTRACT

The study was conducted in order to compare WISC-III and WIAT-II scores from a sample of Canadian children to the standardization sample scores reported in the test manuals, which are based on an American sample. The correlations between the WISC-III IQ scores and the WIAT-II composite and subtest scores were also computed and compared to the correlations reported in the WIAT-II manual. While the mean WISC-III composite, index, and subtest scores from the current sample did not differ significantly from the mean scores reported in the manual, they were lower than expected. Likewise the WIAT-II composite and subtest scores from the Canadian sample were lower than expected. The correlations from the current sample did not differ from the correlations reported in the WIAT –II manual. It is thought that the lower than expected WISC –III and WIAT – II scores were due to sampling bias. The results are discussed in terms of neighbourhood effects and in the context of the Ontario Curriculum.

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INTRODUCTION

Psychological tests are valuable and very powerful tools. A test that is hastily administered or sloppily scored may have devastating effects on the client, especially if the client is a child. Improper use of psychological tests could lead to erroneous labels being attributed to a child. The life course of a child forced to live with an undeserved label such as 'intellectually deficient' may be forever changed. An inappropriate label may lead to a self-fulfilling prophecy; the child may never receive an education suited to her or his true abilities and improper diagnosis may lead to legal action against the psychologist (Sattler, 2001). On the other hand, a carefully administered test may reveal important information that allows a child to receive the help he or she needs. A test score may help a child qualify for a special program that otherwise she would not be eligible to partake in (Sattler, 2001, Gregory, 1996). The power encapsulated within psychological tests is so great that the Code of Fair Testing Practices for Education (1988) has been developed in the United States and in Canada the Canadian Psychological Association has published Guidelines for Educational and Psychological Testing (1986). Both publications outline issues that must be considered for the responsible and ethical use of psychological tests with children.

Not only is the responsible administration and scoring of the test important, but choosing an appropriate test with proper norms is also crucial. The Principles for Fair Student Assessment Practices for Education in Canada (Joint Advisory Committee, 1993) state that the psychologist or other mental health care professional administering the test must "ascertain whether the content of the assessment method and the norm group(s) or comparison group(s) are appropriate for the students to be assessed. For assessment

methods developed in other regions or countries, look for evidence that the characteristics of the norm group(s) or comparison group(s) are comparable to the characteristics of the students to be assessed." (p. 16-17). This principle is especially important for Canadian test users as many of the psychological tests used in Canada are developed and normed in the United States (Saklofske & Janzen, 1990).

The use of an appropriate comparison group is also very important for the diagnosis of learning disabilities. The most psychometrically sound method for learning disabilities diagnosis requires an intelligence test score, an achievement test score and the intercorrelation between the intelligence test and the achievement test (Reynolds, 1984-1985). The proper norm group must be used for both the intelligence test and the achievement test. Also, because the diagnosis of learning disabilities requires the correlation between the intelligence and the achievement tests "it is critical to know the relationship that exists between these two measures for the population to which the referred student belongs." (Slate, 1994, p. 279).

The current study compared scores from a Canadian sample to the American norms for an intelligence test and an achievement test that are often used in the diagnosis of learning disabilities. The correlations between the two measures found in the Canadian sample were also compared to the correlations found in the American normative sample. The special role played by standardized IQ and achievement tests in the diagnosis of learning disabilities and the importance of appropriate norms in the diagnosis of learning disabilities is also discussed.

The Wechsler Intelligence Scale for Children

When diagnosing disorders such as learning disabilities, individually administered tests are most often employed by professionals (Lerner, 2001). Individually administered tests have advantages over tests administered in a group setting (Aylward, 1992). Learning disabled children often also suffer from attention deficits. While individually administered tests allow the tester to monitor the child's attention and use attention keeping tactics, group-administered tests do not allow for individual attention to be given to a child who may be having trouble concentrating (Aylward, 1992). Most group tests require that the examinee read the questions and this may confound the results (Aylward, 1992). Finally, individually administered tests allow the professional conducting the examination to observe and make notes of any of the child's behaviours that may make classroom learning difficult (Aylward, 1992; Gregory, 1996).

Of the psychological tests in a school psychologist's repertoire, the IQ test is the most frequently administered individual test (Saklofske & Janzen, 1990). According to Truscott and Frank (2001) "IQ is a basic component of diagnosis of most educationally related exceptionalities, especially mental retardation and learning disabilities" (pg.320). The Wechsler series of intelligence tests is one of the most widely used measures of intellectual functioning (Kamphaus, 1993; Kamphaus, 2001). The Wechsler Intelligence Scale for Children (WISC) is an individually administered psychological test used to assess the intellectual capabilities of children between the ages of six years and sixteen years and eleven months (Wechsler, 1992). First published in 1949, the WISC is now in its third edition (Gregory, 1996) and, at the time of writing, the fourth edition of the WISC is in the process of publication. The WISC was first published as a downward

extension of the Wechsler-Bellevue intelligence test for adults (Gregory, 1996). While the original WISC was a popular choice among psychologists for almost twenty years several problems were found (Gregory, 1996). The standardization sample of the WISC did not include minority children, some items were found to be inappropriate for children, and pictures used in the test items did not depict female or African-American children (Gregory, 1996). To remedy these problems the WISC-R was published in 1974 (Gregory, 1996). In 1992 the third edition of the WISC became available (Kamphaus, 2001). Through the various revisions the basic structure of the WISC has not changed substantially (Kamphaus, 2001). Changes between the WISC-R and WISC-III include new realistic, colourful artwork, the elimination of items with clinical or emotional content, and the inclusion of new and additional items. Thirty-nine percent of the items on the WISC-III are new (Kaufman, 1993). Additional items were added in order to improve discrimination at both extremes of the ability spectrum (Kaufman, 1993).

The WISC-III consists of thirteen subtests, each of which measures a different aspect of intellectual functioning. The subtests are grouped together to yield three IQ scores, the Performance IQ, Verbal IQ, and Full Scale IQ. The Performance IQ consists of the scores from the Picture Completion, Coding, Picture Arrangement, Block Design, and Object Assembly subtests; the Symbol Search subtest and the Mazes subtest may be used as supplements (Wechsler, 1991). Picture Completion consists of colour pictures of common object and scenes. Each picture is missing an important component which the child must identify (Wechsler, 1991). Picture Completion requires that the respondent be able to differentiate essential from nonessential details and measures visual long-term memory (Sattler, 2001). In the Coding Subtest each of a series of simple shapes or

numbers is paired with a symbol. The child is required to draw the symbol in its corresponding shape or under its corresponding number according to a key within a time limit (Wechsler, 1991). To complete this task successfully the child must be able to concentrate, complete mental operations quickly and have visual-motor coordination (Sattler, 2001). The Picture Arrangement involves presenting the child with a set of colour pictures that depict a story. The pictures are placed before the child in a mixed-up order and the child must arrange them so they tell the story within a certain time limit (Wechsler, 1991). To complete this subtest successfully the respondent must demonstrate reasoning, concentration and attention to detail (Sattler, 2001). Block Design provides a measure of visual-motor coordination and processing of visual information (Sattler, 2001). In order to complete this subtest the child is presented a page with geometric patterns and is required to duplicate the pattern with a set of two-colour blocks (Wechsler, 1991). During the administration of the Object Assembly subtest the child is presented with puzzle pieces that when assembled form common objects (Wechsler, 1991). This subtest provides a measure of the child's visual processing and the ability to combine pieces into a cohesive whole (Sattler, 1992). Symbol Search is the newest WISC subtest. It was added to the test during the third revision (Kamphaus, 2001). In order to complete the Symbol Search subtest the child is presented with "a series of paired groups of symbols, each pair consisting of a target group and a search group. The child scans the two groups and indicates whether or not a target symbol appears in the search group (Wechsler, 1991, p. 6). Perceptual discrimination, speed of mental operation and attention are measured by this subtest (Sattler, 2001). Finally, the Mazes subtest requires the child to complete, with a pencil, a set of increasingly difficult mazes (Wechsler,

1991). This subtest measures the ability to plan, visual-motor skills and eye-hand coordination (Sattler, 2001).

Scores from the Information, Similarities, Arithmetic, Vocabulary, and Comprehension subtests are used to compute the Verbal IQ score. The Digit Span subtest is used as a supplementary subtest (Wechsler, 1991). The Information Subtest requires the child to answer questions orally about events, places, things and people" (Wechsler, 1991). This subtest measures factual knowledge and long-term memory (Sattler, 2001) and allows the examiner to gain insight into the child's linguistic, cultural, and educational background (Kamphaus, 2001). Pairs of words are orally presented to the child during the Similarities subtest. The child is required to "orally identify a unifying attribute" (Kamphaus, 2001, p.199) for the concepts. This subtest provides a measure of abstract and concrete reasoning skills (Sattler, 2001). Arithmetic involves presenting the child with math problems. The child responds orally (Wechsler, 1991). This subtest provides a measure of numerical reasoning, basic math processes and concentration (Sattler, 2001). The Vocabulary subtest requires the respondent to define words that are orally presented (Wechsler, 1991). Language development, memory and word knowledge are measured by this subtest. The Comprehension subtest requires the child to solve everyday problems when orally presented with questions (Wechsler, 1991). This subtest measures understanding of social rules and norms, common sense and application of everyday knowledge (Sattler, 2001). During the administration of the Digit Span subtest the child is presented with a sequence of numbers that the child is required to repeat exactly for the Digits Forward portion and in reverse for Digits Backward

(Wechsler, 1991). This subtest provides a measure of short-term auditory memory, attention span and concentration (Sattler, 2001).

The raw scores from each subtest are converted to scaled scores with the aid of tables provided in the WISC-III manual (Wechsler, 1991; Sattler, 2001). The scaled scores have a mean of 10 and a standard deviation of 3. The Verbal subtests and Performance subtests scores are combined to form the Full Scale IQ score. All the IQ scaled scores have a mean of 100 and a standard deviation of 15 (Wechsler, 1991).

Once the Verbal IQ and the Performance IQ scores are obtained the difference between the two may yield valuable information. While a PIQ-VIQ discrepancy may be statistically significant it may not be uncommon among children (Wechsler, 1991). However, a large discrepancy may be indicative of brain injury, sensory deficits, behavioural problems, and it may provide information about the child's cognitive style (Sattler, 2001). A discrepancy in which the Verbal IQ is greater than the Performance IQ score may be a sign that the child processes information more efficiently through auditory and vocal modalities rather than visual and motor modalities. The child may also be better at using previously acquired knowledge rather than immediate problem-solving skills (Sattler, 2001). Conversely, a large Performance IQ-Verbal IQ discrepancy may indicate that the child is better able to process information through visuospatial means rather than verbally. If the PIQ is much larger than the VIQ it may also be a sign that the child has language deficits (Sattler, 2001).

Factor analysis of the WISC-III revealed four distinct factors within the test items (Wechsler, 1991). The first factor was labelled the Verbal Comprehension Index and it consists of the scores from the Information, Similarities, Vocabulary and Comprehension

subtests (Wechsler, 1991). Verbal Comprehension provides a measure of verbal knowledge gained through informal and formal education (Sattler, 2001). The second factor is known as the Perceptual Organization Index and is made up of the scores from Picture Completion, Picture Arrangement, Block Design and Object Assembly (Wechsler, 1991). The Perceptual Organization Index is said to provide a measure of "the ability to interpret and organize visually perceived material within a time limit (Sattler, 2001, p.232). The Freedom from Distractibility Index is the third factor (Wechsler, 1991). It consists of scores from the Arithmetic and Digit Span subtests (Wechsler, 1991). This index measures the examinee's ability to concentrate, remain focused and control mental processes (Sattler, 2001). The final factor is labelled the Processing Speed Index (Wechsler, 1991). It is made up of the scores from the Coding and Symbol Search subtests. This index measures the ability to process visual information quickly. Concentration and hand-eye coordination are important skills for this index (Sattler, 2001).

The WISC in Canada

While shown to be reliable, valid, and an indisputably valuable tool, problems arise when the WISC is used by professionals outside of the United States where the test was developed (Violato, 1986).

Because of the difference in size that exists between the populations of the United States and Canada, it is often "more economical" to use tests developed in the United States than to create Canadian tests (Saklofske & Janzen, 1990). While very little is mentioned in the literature regarding the use of other measures of intelligence in

Canada, a great deal of has been written about the use of the WISC by Canadian practitioners. From the very first publication of the WISC, psychologists outside of the U.S. have found parts of the test problematic. Specifically, Canadian practitioners voiced concern regarding the content of the Information subtest (Vernon, 1975; Vernon, 1976; Vernon, 1977; Peters, 1976; Cyr & Atkinson, 1987; Dolan, 1987). The purpose of the Information subtest is to gauge "the knowledge that average children with average opportunities should have acquired through typical home and school experiences" (Sattler, 2001, pg.268). Some Canadian psychologists have pointed out that the factual information measured by this portion of the WISC depends upon exposure to American culture (Dolan, 1987).

The American bias of some of the questions presents at least two distinct problems. The first problem is that of compromised face validity for any administration of the WISC in countries other than the United States. A test is said to have face validity if it looks as though it measures what the test designers purport it to measure (Martin, 1996). Face validity says nothing about what the test actually quantifies however "the question of face validity concerns rapport and public relations" (Anastasi & Urbina, 1997, pg.117). An examinee is more likely to be co-operative, pay more attention and exert more effort if the test seems valid, appropriate and relevant (Anastasi & Urbina, 1997; Violato, 1986). The argument has been made that Canadian children completing the WISC may become frustrated and not put forth every possible effort because the questions being asked of them do not relate to their everyday lives and disregard their Canadian culture (Violato, 1986).

A second major problem created by American content in the Information subtest is the temptation to replace or alter the offending questions. Several Canadian psychologists suggested Canadianized alternative questions. Philip Vernon (1974, 1976, 1977) of the University of Calgary was one of the first Canadian psychologists to publicly suggest Canadian alternatives to problematic Information subtest questions. He reworded several questions to include uniquely Canadian content such as "Who invented the telephone?" and "Of which country was Canada a colony?"(Vernon, 1976, p.4). In his final report, Vernon (1977) suggested a total of eight Information questions on the WISC-R be replaced with Canadianized alternatives.

Many problems arise, however, when Canadianized alternatives are substituted for questions with an American bias. The items of the Information subtest are administered in order of increasing difficulty and discontinuation of the subtest happens after the child has five consecutive failures (Violato, 1986). Should the altered questions disrupt the "difficulty hierarchy" the validity of the subtest would be compromised (Violato, 1986). That is, should the Canadianized alternative be more difficult or easier than the American question it is replacing, the Information subtest score may not be an accurate measure of the factual knowledge possessed by the child.

Several studies were performed in an attempt to settle the issue. In 1970 Spreen and Tryk conducted research to test the suitability of the Canadianized alternatives. They altered two problematic Information subtest items found on the WISC. They concluded that only one of the substitute questions was an appropriate replacement for the original American item.

Marx (1984) conducted a study using Vernon's suggested changes. His sample consisted of children who received mental health services and normal children in Burnaby, British Columbia. Marx compared the proportions of the original American standardization sample who answered each item correctly to the Canadian sample. Half of the Canadian sample was given seven modified WISC-R Information subtest items and the other half were administered the original Information subtest questions from the American manual. The percentage of Canadian children who answered the manual items correctly was lower than the standardization sample for all but one of the items. As a measure of the difficulty of each question the items were ranked according to the percentage of children who answered it correctly. The question that was most often answered correctly was ranked number one and so on. The results of this analysis found only two of the modified items were transposed when compared to the rank order of the original manual items. The remaining five items occupied the same rank position as the manual items for the standardization sample. However, when Canadian students were compared to the American students with respect to the original items only two questions occupied the same rank position. Marx (1984) concluded that the manual items were more difficult for the Canadian participants than they were for the American students. The altered items were easier for the British Columbia sample then the corresponding original manual items. Overall, the modified items provided the Canadian children with higher Information subtest scores. Similarly, Cyr and Atkinson (1987) also found an improvement in Canadian student's performance on the Information subtest when the modified items were administered.

Beal (1988), however, found fault with Marx's research methods. She pointed out that while more of the Canadian sample passed the modified items than the manual items, Marx did not report a statistical test of the difference. Beal argued that the higher scores obtained when the Canadian alternatives were used represented inflated scores. Rather than putting the Canadian children on equal footing with their American counterparts, the Canadianized items compromised the validity of the test.

In order to avoid controversy, when the WISC-III was published in 1991 Canadian normative data was gathered and presented in the Canadian supplement (Wechsler, 1996). The WISC-III Canadian Study included 1100 Canadian children between the ages of six and sixteen. The sample was stratified according to the data from the 1986 Census along age, gender, ethnic origin, geographic region, and parental education level (Wechsler, 1996). Two sets of statistical analysis were conducted. The first analysis calculated the mean differences between the Canadian and American data in both scaled scores and IQ scores. Canadian children were found to perform significantly higher on all of the IQ scales and Index scores. The mean Canadian Full Scale IQ score was 3.34 points higher than the mean American score. Differences of 1.4 and 4.96 points were found for Verbal IQ and Performance IQ respectively. In terms of scaled scores only the Information and Arithmetic subtest scores were not found to be significantly above the American standardization mean (Wechsler, 1996).

The second analysis of the data compared the differences in the distributions between the American and Canadian data (Wechsler, 1996). The independent variable was the country of origin and the dependent variable was the IQ score as determined by the American norms. Adjustments were made to the Canadian data so there were no

mean differences from the American data. All IQ and scaled scores were then divided into six categories: 35-69 (intellectually deficient), 70-79 (borderline), 80-89 (low average), 100-119 (high average), 120-129 (borderline gifted), and 130-150 (gifted). The results of the statistical analysis revealed that the Canadian distributions of the Full Scale IQ, Verbal Comprehension Index, and Processing Speed Index differed significantly from the American distributions. The distributions of the Coding, Digit Span and Mazes subtests were also found to differ significantly from the American standardization data. Overall, the results of the second data analysis revealed that when the American norms were used more Canadian children than American children fall in the low average IQ range. However, more Canadian children fell in the high average range and high categories with regards to the individual subtests (Wechsler, 1996).

The Canadian-American IQ differences become especially important when the practices used to place students in special programs are considered. Programs for Gifted student provide a good example. A Full Scale IQ of 130 is typically required to be eligible for most enriched programs. When the American norms are employed only one percent of the Canadian normative sample met the criterion. However when the Canadian norms were used the figure doubled to two percent (Wechsler, 1996). Another important implication of the Canadian norms is that fewer Canadian children are expected to fall in the Borderline range (FSIQ 70-79) and more are expected to be classified in the broad average range (FSIQ 80-119) than when the American norms are used. In practical terms this means school boards in the future will provide more special programming for students with learning disabilities than for slow learners (Wechsler, 1996).

The WISC-III Canadian Study resulted in the publication of separate norms for Canadian children; however, none of the items appearing in the WISC-III were changed. Three items dealing specifically with American content were left intact. However, special guidelines were provided in the WISC-III Canadian Supplement allowing Canadian children to earn points for responses that were found to be unique to Canada (Wechsler, 1996).

The Wechsler Individual Achievement Test

Standardized achievement tests remain important components in the examination of students to determine if they are eligible for special education under categories as set-out by the DSM-IV and the American federal law known as IDEA (Gridley & Roid, 1998). Since its first publication in 1992 the Wechsler Individual Achievement Test (WIAT) has become a popular achievement test among psychologists. The WIAT is an individually administered, norm-referenced test developed to assess academic skills (Smith, 2001). The second edition was published in 2001 (The Psychological Corporation, 2001). Changes between the WIAT and the WIAT-II include an expanded age range. The original WIAT was only suitable through grade twelve while the new WIAT age range stretches to include students enrolled in higher education and non-student adults (Smith, 2001). Also, while the original WIAT was appropriate for children as young as 5 years of age, the WIAT-II can be used with 4 year olds (Smith, 2001). A new subtest designed to test reading skills at the subword level was included on the WIAT-II (Smith, 2001). The WIAT-II also includes approximately a dozen uniquely

Canadian items for use with Canadian students. The Canadian items depict Canadian money and metric measurements (Smith, 2001).

The WIAT-II consists of nine subtests that are grouped together to form five composite scores (The Psychological Corporation, 2001). The Reading Composite consists of scores from the Word Reading, Reading Comprehension, and Pseudoword Decoding subtests. The Word Reading subtest is designed to assess decoding and word-reading skills (Smith, 2001; Cohen, 1993). The student is required to match a printed word to the appropriate picture or read aloud words from a list (Smith, 2001; Cohen, 1992). During the Reading Comprehension subtest the student is required to read short passages aloud or silently (The Psychological Corporation, 2001). The examiner then asks the student questions used to gauge his or her comprehension of the content of the passage (Smith, 2001; Cohen, 1992). The Pseudoword Decoding subtest is a new addition to the WIAT-II (The Psychological Corporation, 2001). This subtest was designed to measure reading skills at the subword level (Smith, 2001). The child must use phonetic knowledge to read and pronounce nonsense words correctly (The Psychological Corporation, 2001; Smith, 2001).

The Mathematics composite includes scores from the Numerical Operations and Math Reasoning subtests (The Psychological Corporation, 2001).The Numerical Operations subtest is designed to assess math skills such as addition, subtraction, fractions, decimals, and basic algebra (Smith, 2001; Cohen, 1992). During the Math Reasoning subtest word problems are presented orally and visually (Smith, 2001; Cohen, 1992). The student must use problem solving skills and math skills (Smith, 2001; Cohen, 1992).

Scores from the Spelling and Written Expression subtest comprise the Written Language subtest (The Psychological Corporation, 2001). Words are dictated to the child during the Spelling subtest (Smith, 2001; Cohen, 1992). The examiner says the word, reads a sentence in which the word is used and says the word again. The student must write the word in the Response Booklet (Smith, 2001; Cohen, 1992). During the Written Expression subtest the examiner reads a prompt and the child is given fifteen minutes in which to write a response (Smith, 2001; Cohen, 1992).

The Oral Language Composite includes the scores from the Listening Comprehension and the Oral Expression subtests. Listening Comprehension is the seventh subtest administered (The Psychological Corporation, 2001). The items of this subtest consist of receptive vocabulary items in which the student points to the appropriate picture after the examiner says a word and items in which the examiner reads a sentence and the child must point to the corresponding picture (The Psychological Corporation, 2001; Smith, 2001; Cohen, 1992). The final subtest is Oral Expression. This subtest is designed to measure word fluency, sentence repetition, story generation, and giving directions (The Psychological Corporation, 2001).

The final composite is the Total Composite. It is made up of the scores from all of the individual subtests (The Psychological Corporation, 2001).

The WIAT-II has two major advantages over other achievement tests (Smith, 2001). A portion of the standardization sample of the WIAT was linked to the standardization samples of the WISC-III (Smith, 2001; Cohen, 1993). Because the WIAT was co-normed with the WISC-III it is especially useful for learning disability assessments (Slate, 1994). According to Saklofske (1992) "this permits a much more

accurate and meaningful comparison of achievement and intelligence in the psychoeducational assessment process" (p.1). The second feature of the WIAT that sets it apart from other achievement tests is that the content covered in the WIAT corresponds to the areas of learning disability specified in American federal law (Smith, 2001; Cohen, 1993, Sharp, 1992).

The WIAT in Canada

As with measures of intelligence, very little research has been conducted regarding the use of achievement tests developed in the United States by Canadian professionals. However, Michalko and Saklofske (1996) conducted a study of the psychometric properties and normative data of the WIAT with a group of Saskatchewan students. Ninety children from grades four, five, and six completed the WIAT. When compared to the American standardization sample the grade four participants were found to score significantly higher than the American students on the Basic Reading, Spelling, Reading Comprehension, Listening Comprehension and Oral Expression subtests. Significantly higher scores were also found on the Reading and Language composites. The grade five students scored significantly higher than their American counterparts on the Listening Comprehension and Oral Expression subtests and the Reading and Language composites. The grade six portion of the Canadian sample scored significantly higher on the Basic Reading, Spelling, Listening Comprehension, and Oral Expression subtests and the Reading and Language composites. All three groups scored significantly lower then the American standardization sample on the Numerical Operations subtest and the Math composite.

Michalko and Saklofske (1996) also evaluated the content validity of the WIAT. The researchers employed a curriculum development expert to rate the goodness of fit between the content of each of the WIAT subtests and the Saskatchewan curriculum. The expert found that the items of the WIAT did reflect the material prescribed by the Saskatchewan elementary school curriculum.

Currently, Canadian normative data is being collected for the WIAT-II. The Canadian edition of the WIAT-II contains all the same questions as the American version except that some items have been altered slightly to accommodate Canadian children. For example, items involving pictures of money show Canadian currency and measurements are given in metric rather than in imperial units.

Learning Disabilities

IQ tests and achievement tests play very important roles in the diagnosis of learning disabilities. Data gathered from the Canadian National Longitudinal Survey of Children and Youth found that during the 1995 school year teachers reported one in ten children received some form of special education because of a problem that limited their ability to do schoolwork (Bhatyretz & Lipps, 1999). Kavale and Forness (2000) reported that in the United States learning disabled students represented half of all students with disabilities and the group comprised over five percent of all children attending school. According to Canadian teachers, half of children who received special education services suffered from a learning disability (LD) (Bharyretz & Lipps, 1999). In the United States a national survey of school psychologists revealed that over half of the sample reported devoting more than forty percent of their time to activities related to the diagnosis of

learning disabilities (Ross, 1995). Learning disabilities affect a substantial number of North Americans and vast resources are being expended to combat the problem. However, given the significance of the problem posed by learning disabilities there is little consensus regarding what actual constitutes a learning disability. For the past forty years experts have struggled to define learning disabilities (Kamphaus, 1993; Kavale & Forness, 1985).

Learning Disabilities History

Learning disabled children are often described as "children with average or above-average ability who have the potential to learn, and their failure to learn is both unexpected and unexplained" (Meyer, 2000, pg. 317). The first attempt to explain learning difficulties in otherwise normal children was made in the 1940s (Kavale & Forness, 1985). Early researchers postulated that the failure to learn was caused by brain damage (Kavale & Forness, 1985). In the 1960s the 'minimal brain damage theory' gained popularity (Kavale & Forness, 1985). Like their predecessors, researchers believed that normal children who experienced academic difficulties suffered from brain damage. According to this particular theory only the brain centre involved with the process of learning suffered injury leaving the child's other mental functions intact (Kavale & Forness, 1985). The term "learning disability" was first coined by Samuel Kirk (Kavale & Forness, 1985). In 1963 a group of concerned parents of children who had been labelled such things as brain-damaged, handicapped and neurologically impaired met in Chicago (Lerner, 2000). Kirk addressed the group and during his speech criticized the minimal brain damage theory and suggested that the term 'learning

disabled' be used to describe the condition suffered by their children (Lerner, 2000; Sabatino, 1981). From that meeting the Association for Children with Learning Disabilities was formed (Lerner, 2000; Sabatino, 1981).

Striking similarities exist between the emergence of the learning disabilities fields in the United States and Canada. In Canada the staff at Montreal Children's Hospital were the first to recognize learning disability as a distinct disorder in the late 1950's (Wiener & Siegel, 1992). Edward Levinson was intrigued by children of average intelligence who struggled at school and along with three American psychologists he founded the Montreal Children's Hospital Learning Centre in 1960 (Wiener & Siegel, 1992). In 1963 three parents of children labelled brain-damaged, Doreen Kronick, Harry Wineberg, and Bob Shannon, formed the first chapter of the Association for Children with Learning Disabilities of Canada (Wong & Hutchinson, 2001). Between 1964 and 1967 the Ontario Association for Children with Learning Disabilities was actually affiliated with its American counterpart (Wong & Hutchinson, 2001). By 1968 all ten provinces had chapters of the organization (Wiener & Siegel, 1992; Wong & Hutchinson, 2001). In 1986 the A.C.L.D became the Learning Disabilities Association of Canada (L.D.A.C) (Wiener & Siegel, 1992). According to Wong and Hutchinson (2001) chapters of the L.D.A.C. operate in one hundred and forty communities across Canada. Through collaboration between parents and professionals the L.D.A.C. strive to protect the rights of learning disabled children and adults, heighten awareness of learning disabilities through the publication of books and newsletters and annual conferences (Weiner & Siegel, 1992). The L.D.A.C. also has a substantial influence over research and LD policy in Canada.

Learning Disabilities Definition

In his text entitled Educating Exceptional Children, Kirk first defined learning disabilities as "a retardation, disorder or delayed development in one or more of the processes of speech, language, reading, writing, arithmetic, or other school subjects resulting from a psychological handicap caused by a possible cerebral dysfunction and/or emotional or behaviour disturbances. It is not the result of mental retardation, sensory deprivation, or cultural and instructional factors" (Kirk, 1962, p.263 in Kavale & Forness 1985). Bateman (1965) took Kirk's definition one step further by introducing the concept of underachievement. Bateman described children with learning disabilities as displaying "an educationally significant discrepancy between their estimated intellectual potential and actual level of performance" (Bateman, 1965, p.220 in Kavale & Forness, 2000).

In the forty years since Kirk's first definition, numerous other definitions of learning disabilities have been proposed. The Diagnostic and Statistical Manual of Mental Disorders (APA, 1994) is a very important resource for psychologists and other mental health professionals. The most recent edition, the DSM-IV (APA, 1994) states that:

> "Learning disorders are diagnosed when the individual's achievement on individually administered, standardized tests in reading, mathematics, or written expression is substantially below that expected for age, schooling, and level of intelligence. The learning problems significantly interfere with academic achievement or activities of daily living that require reading, mathematical, or writing skills (p.46).

The DSM-IV (APA, 1994) goes on to state that learning difficulties cannot be considered a learning disorder if the primary cause of the problem is "lack of opportunity,

poor teaching, or cultural factors" (p.47). Individual's suffering from hearing or vision deficits, mild mental retardation, pervasive developmental disorders or communication disorders may only receive an additional diagnosis of learning disorder if their scholastic difficulties are significantly greater than what are usually associated with their original diagnosis (APA, 1994). The DSM-IV (APA, 1994) divides the general category of Learning Disorders into the more specific categories of Reading Disorder, Mathematics Disorder, Disorder of Written Expression, and Learning Disorder Not Otherwise Specified.

In Canada the Learning Disabilities Association of Canada has proposed its own definition of learning disabilities. The most recent revision put forth by the L.D.A.C. in 2002 states that:

> Learning Disabilities refer to a number of disorders which may affect the acquisition, organization, retention, understanding or use of verbal or nonverbal information. These disorders affect learning in individuals who otherwise demonstrate at least average abilities essential for thinking and/or reasoning. As such, learning disabilities are distinct from global intellectual deficiency.
>
> Learning disabilities result from impairments in one or more processes related to perceiving, thinking, remembering or learning. These include, but are not limited to: language processing; phonological processing; visual spatial processing; processing speed; memory and attention; and executive functions (e.g. planning and decision-making).
>
> Learning disabilities range in severity and may interfere with the acquisition and use of one or more of the following:
> - Oral language (e.g. listening, speaking, understanding);
> - Reading (e.g. decoding, phonetic knowledge, word recognition, comprehension);
> - Written language (e.g. spelling and written expression); and
> - Mathematics (e.g. computation, problem solving).
>
> Learning disabilities may also involve difficulties with organizational skills, social perception, social interaction and perspective taking.

> Learning disabilities are lifelong. The way in which they are expressed may vary over an individual's lifetime, depending on the interaction between the demands of the environment and the individual's strengths and needs. Learning disabilities are suggested by unexpected academic under-achievement or achievement which is maintained only by unusually high levels of effort and support.
>
> Learning disabilities are due to genetic and or neurobiological factors or injury that alters brain functioning in a manner which affects one or more processes related to learning. These disorders are not due primarily to hearing and/or vision problems, socio-economic factors, cultural or linguistic differences, lack of motivation or ineffective teaching, although these factors may further complicate the challenges faced by individuals with learning disabilities. Learning disabilities may co-exist with various conditions including attentional, behavioural and emotional disorders, sensory impairments or other medical conditions.

Dozens of definitions for learning disabilities have been put forth and the experts cannot seem to agree on any one. However, Lerner (2001) points out that most of the definitions share common elements. According to Lerner (2001) most definitions of learning disabilities share common themes of dysfunction of the central nervous system, deficits in psychological processing, academic difficulty, exclusion of other causes and discrepancy between achievement and ability. While not always specifically referred to, many definitions imply that learning disabilities result, at least in part from dysfunction of the central nervous system (Lerner, 2001). This theme is present in the L.D.A.C definition as it states that 'neurological factors' may cause learning disabilities.

The second shared theme refers to the many mental abilities that work together for learning to take place. If one or more of these abilities is lacking or not developing at the same rate as the others the symptoms of a learning disability may be present.

The third theme, academic difficulty, touches upon the different types of learning.

Learning disabilities are not confined to one area. While one child may have difficulty reading another child may read easily but have trouble learning concepts of mathematics. Both children may be considered learning disabled. The DSM-IV (APA, 1994) and the L.D.A.C definition list various academic areas, such as reading, mathematics and written expression, in which children may be considered learning disabled.

The exclusion of other causes is the fourth theme often referred to in definitions of learning disorders. Most definitions clearly state that learning disabilities are not the result of other conditions such as mental retardation, physical impairments such as poor eyesight or hearing, or cultural, social or environmental disadvantage (Lerner, 2001). Once again, this theme is present in both the DSM-IV and the L.D.A.C. definitions.

The final common element of learning disability definitions is the discrepancy between achievement and ability. According to Reynolds (1984-85) learning disabilities are characterized by "a major discrepancy between what you would expect academically of learning disabled children and the level at which they are actually achieving" (pg. 452). Achievement refers to the child's level of performance on academic tasks (Lerner, 2001). Achievement is measured by standardized achievement tests, such as the Wechsler Individual Achievement Test. The term ability refers to the child's potential to learn and is measured by an intelligence test, such as the Wechsler Intelligence Scale for Children-Third Edition. As stated by Gridley and Roid (1998) "it might be useful to think of an ability measure as giving us some sort of probability statement about how well a student might succeed. The achievement measure then reflects how that probability has been operationalized" (p.250).

When it comes to deciding which troubled students are eligible for special education services the ability–achievement discrepancy is the most important of the common elements of learning disability definitions. When the Education of all Handicapped Children Act came to be in 1975 in the United States, the definition of learning disability in Public Law 94-142 stated that a discrepancy between academic achievement and intellectual ability must be present in at least one of seven areas relating to ability to communicate and mathematical skill to receive special education for learning disabilities (Reynolds, 1984-85). When the act was renamed the Individual with Disabilities Education Act (I.D.E.A) in 1990 and the most recent updates were made in 1997, the discrepancy between achievement and ability remained a key component in the definition of learning disability (Meyer, 2000). According to Mercer and colleagues (1996) ninety-six percent of individual state definitions of learning disability specify that an ability-achievement discrepancy must be present for a child to be considered learning disabled and approximately ninety-eight percent of American schools rely on the concept of discrepancy to identify students.

With respect to learning disability policy, Canada differs from the United States. In Canada there is no overarching federal policy, such as the American Public Law (Saklofske & Janzen, 1990). While the Canadian Charter of Rights and Freedoms ensures that individuals cannot be discriminated against based on a mental or physical disability no federal policy demands that all learning disabled students have access to an education specifically suited to their special needs (Wiener & Siegel, 1992; Saklofske & Janzen, 1990). In Canada education is the jurisdiction of the provincial governments. The level of service and the processes used to determine access to special education services vary

widely from province to province (Klassen, 2002; Wiener & Siegel, 1992). However, some similarities do exist between provincial views of learning disabilities. The conceptual definitions employed by at least three of the provinces are modelled upon the Learning Disabilities Association of Canada's definition of learning disabilities (Klassen, 2002). In provincial definitions of learning disabilities adopted by the Ministries of Education in Alberta, Saskatchewan, Ontario, Nova Scotia, New Brunswick and Newfoundland the key component included average intelligence accompanied by academic difficulty (Klassen, 2002). British Columbia and Manitoba's definitions of learning disability made specific reference to an IQ-achievement discrepancy (Klassen, 2002). In Ontario, school boards receive funding partly based on the proportion of students with high needs enrolled. Guidelines for which students qualify for grants are stated in the Resource Manual for the Special Education Grant- Intensive Support Amount (ISA) (Ontario Ministry of Education, 2003-2004). According to the ISA assessment guidelines, a student must demonstrate an IQ score at the 25^{th} percentile or higher and one score on a standardized test of academic achievement, in the area of reading, oral language, written language, or mathematics, which falls at least two standard deviations below the IQ score in order to be considered learning disabled (Ontario Ministry of Education, 2003).

Both in Canada and the United States the achievement-ability discrepancy is widely used. The quality of education many children receive depends on whether they show a significant discrepancy between their school achievement and their potential to learn as quantified by an IQ score.

Calculating the Ability - Achievement Discrepancy

While the use of discrepancy formulas are very popular for determining access to special education services a great deal of debate surrounds their use. Some experts dislike the fact that the concept of discrepancy is based on the student's failure (Lerner, 2000). The student must fail or show much difficulty learning before becoming eligible for help. In most cases the learning disabled child does not receive special education until grade three or later (Lerner, 2000). This is closely linked to the second criticism of the use of discrepancy formulas; learning disabilities cannot be identified in very young children if discrepancy formulas are used (Lerner, 2000). The achievement portion of the discrepancy requires that the child be exposed to information that is traditionally presented in an academic setting. Very young children, who have very limited classroom experience, have no knowledge base that would allow them to complete an achievement test. Other criticisms of the ability-achievement discrepancy paradigm focus on the inclusion of intelligence in the formula. Some experts question if measures of achievement and intelligence really gauge different elements within the child (Lerner, 2000). Kavale and Forness (1985) warn that "intelligence represents a hypothetical construct and should not be perceived as an innate, fixed entity representing capacity" (pg.73).

Given the criticisms of the achievement-ability discrepancy it is still widely used. In a field that is better able to describe what a learning disability is not, rather than what characteristics do constitute the disorder, the discrepancy offers some major advantages. The quantitative characteristic of the discrepancy makes it very attractive. Those deciding which students are eligible for special education need only decide that a

student's achievement-ability discrepancy must be greater than ten standard score points, for example, to be considered for placement in special education. The discrepancy method allows for an efficient, objective process for placing students in special education programs (Kavale, 1995).

A great deal of debate surrounds the best way to determine if a significant discrepancy is present. Two very commonly used methods are the simple difference method and the predicted-achievement method.

Scoring the tests involves converting the raw achievement test scores and the ability test scores into a common unit of measure, most often the standard score (Kavale & Forness, 1995). Conventionally, this means that both measures have a mean of 100 and a standard deviation of 15 (Wilson & Cone, 1984). If the simple-difference method is used the presence of a discrepancy is determined simply by subtracting one score from the other (Kavale & Forness, 1995).

Little consensus exists regarding how big the difference must be before a significant discrepancy is said to be present. According to Wilson and Cone (1984), if an achievement score is 10 or more points below the IQ score generally a discrepancy is said to be present. Kamphaus (1993) reports that in most American states where Public Law 94-142 has been implemented a discrepancy of approximately one and a half standard deviations or between eighteen and twenty-two standard score points is used as the standard. In Ontario, the Ministry of Education requires a IQ-achievement discrepancy of two standard deviations or greater (Ministry of Education, 2003). To receive a diagnosis of learning disability using the standards put forth in the DSM-IV (APA, 1994)

the discrepancy between achievement and ability must be more than two standard deviations or 30 points.

The simple-difference method has a few advantages. It is simple. The calculations are easy. It is also easily explained to people without a background in statistics such as classroom teachers and parents (Payette, Clarizio, Phillips & Bennett, 1995).

There are also several drawbacks to the simple-difference method. This method does not take into account the correlation between IQ and achievement and this approach ignores the phenomena of regression towards the mean (Braden & Weiss, 1988). The simple-difference method assumes IQ scores and achievement scores are perfectly correlated. For example if a child has an IQ score of 115 their achievement score is also expected to be 115. In reality IQ and achievement are not perfectly correlated. In most cases the correlation is closer to 0.6 (Shepard, 1980). Because the IQ score and achievement score are not identical there will be regression toward the mean (Shepard, 1980). The phenomenon of regression toward the mean occurs when a dependent variable, such as academic achievement, is predicted from a highly correlated variable such as IQ. According to Thorndike (1963) "whenever the correlation between two measures is less than perfect the individual who falls well above average on one measure will be less superior on the other and those who fall well below average on the first measure will be less inferior on the second" (pg.11). That is, if an extreme score is obtained on the measure of IQ, the achievement score is likely to be less extreme (Wilson & Cone, 1984). The size of the second measure's shift toward the mean will depend on the correlation between the measures (Wilson & Cone, 1984). Regression towards the

mean implies that children with very high IQ scores will have less extreme achievement scores and children with very low IQs will have achievement scores closer to the mean (Cone & Wilson, 1981).

Without considering regression towards the mean, achievement standards for children with above average IQ scores are placed too high. A disproportionate number of children with high IQ scores are found to have a severe discrepancy and therefore are labelled as learning disabled. Conversely, children with below average IQs would be excluded from programs for learning disabled students in unacceptable numbers (Cone & Wilson, 1981).

The second method of finding discrepancies is referred to as the predicted achievement method or the regression discrepancy model. This approach takes into account regression of IQ on achievement (Kavale, Forness & Bender, 1987; Kavale & Forness, 1995). The problem of regression towards the mean is compensated for through the consideration of the correlation between IQ and achievement (Wilson & Cone, 1984). The use of regression "merely evens out the probabilities that a child of any intelligence level will be identified as having a severe discrepancy" (Kamphaus, 1993). Using various equations a 'predicted' achievement score is calculated based on the student's IQ score (Kavale & Forness, 1995). The scores are first converted from standard scores to *z* scores (Wechsler, 2001). The predicted achievement scores is then calculated with the following formula: $z_p = r_{xy} z_{ab}$, where r_{xy} is the correlation between the achievement and ability score, z_{ab} is the ability or IQ score and z_p is the predicted achievement (The Psychological Corporation, 2001).

The z-score for the predicted achievement is then converted to a standard score and the actual achievement score is subtracted from the predicted score (The Psychological Corporation, 2001). An advantage of the regression discrepancy model is that it takes into consideration the measurement error associated with intelligence and achievement and a standard error measurement for the discrepancy can be calculated (Evans, 1990).

Braden (1987) provided a very good illustration of what happens to LD identification rates across IQ levels when the simple and regression based methods for determining discrepancies are used. In his study Braden used 20 000 hypothetical students, 10 000 white and 10 000 black students. Using the information from the WISC-R standardization study he set the white student's mean IQ at 102.25 (SD = 14.08) and the black students' mean IQ to 86.42 (SD = 12.75). Given this information the number of white students and the number of black students will not be equal at different IQ intervals. Using the simple-difference method the odds of being identified as learning disabled changed across the IQ intervals. When the 20 000 hypothetical students were considered 1328 white students were found to be eligible for classes for the learning disabled whereas only 582 black students were found to meet the eligibility criteria. When the regression-based method was used the odds of being identified as learning disabled were constant across the various IQ intervals, 1020 white students and 952 black students were identified.

Pretext for the Current Study

According to Reynolds (1984-85) several key points must be considered when a discrepancy-based procedure is utilized to diagnose learning disabilities. The current study, as part of the Psychological Corporation's larger Canadian Standardization Project for the WIAT-II, addressed some of the points put forth by Reynolds (1984-1985). Reynolds' first recommendation is that the standardization samples for the tests whose scores are being compared be the same. Canadian data was not collected when the first edition of the WIAT was published. Professionals hoping to use the WISC-III and the WIAT to complete an assessment for learning disabilities would have had no other choice but to use the American WISC-III data as only American data was available for the WIAT. This situation is less than ideal in Canada as it has been shown that Canadian children perform differently than American children on the WISC-III (Wechsler, 1996). This problem has been alleviated with the collection of Canadian normative data for the WIAT-II. Once the Canadian norms are published clinicians will be able to compare their clients' performance on the WIAT-II to the performance of their Canadian counterparts and learning disability diagnosis will be done using only Canadian norms.

The second point put forth by Reynolds (1984-85) that the current study has addressed is that the correlation between the measures of aptitude and achievement should be based on an appropriate sample. Once again, if Canadian professionals used the first edition of the WIAT and the WISC-III for discrepancy analysis, they had to use correlations based on American normative data.

The Current Study and Hypotheses

The current study compared Canadian children's performance on the WISC-III to the norms provided in the WISC-III manual. It was hypothesised that the children in the current sample would score higher than the means reported in the manual, similar to the results found by the Canadian Standardization Project for the WISC-III. It was hypothesized that the scores from the current sample would be higher due to the Flynn effect (Flynn, 1984). Flynn (1984) has shown that as the norms for an IQ test get older, the IQ scores derived from those norms increase. Overall, Flynn (1984) reported that the normative performance gains 3 IQ points per decade. This is a very important consideration when diagnosing learning disabilities, especially as achievement scores are not subject to the Flynn effect (Truscott & Frank, 2001). The gains in IQ scores are strongest in measures of abstract problem solving ability, in other words, in measures of fluid intelligence (Rodgers, 1999; Cocodia, Kim, Shin, Kim, EE, Wee, & Howard, 2003). Gains have been found to be very small on measures of learned material, like those used in achievement tests. Flynn (1999) reported very small gains on WISC subtests such as Arithmetic, Information, and Vocabulary. Higher IQ scores do not translate into greater academic achievement. Flynn (1984) reported a decline in Scholastic Aptitude Test scores between 1963 and 1981 and Howard's (2001) survey of high-school teachers failed to show that teachers perceived increased student intelligence. Truscott and Frank (2001) concluded that "over the life of a test version, IQ-achievement discrepancies, the most salient LD criterion, are exaggerated...and more students would qualify for LD based on inflated severe discrepancies" (Truscott & Frank, 2001, pg.330).

The second objective of the current study was to compare the performance of the Canadian sample on the WIAT-II to the performance of their American counterparts. It was hypothesized that the Canadian sample would score significantly higher on some of the WIAT-II composites and subtests but, more specifically, would score lower on the Mathematics based composites and subtests, similar to the results found by Michalko and Saklofske (1996).

Finally, the current study compared the correlations between the WISC-III composites of VIQ, PIQ and FSIQ and the nine subtests of the WIAT-II found in the Canadian sample to those reported in the WIAT-II manual. A similar comparison was made between the WISC-III composites and the five composite scores yielded by the WIAT-II. It was hypothesized that the correlations from the current sample would not differ from the correlations reported in the WIAT-II manual.

METHOD

This study was completed as part of the Psychological Corporation's Canadian Standardization of the WIAT–II. More specifically, the data from the current study was part of the Canadian portion of the WISC- III / WIAT–II linking sample. As the Psychological Corporation was interested in information regarding parental education levels, this information was also gathered and was the focus of another student's thesis which was based on the same data set.

Participants

A total of 72 children participated in the study. Thirty-eight of the participants were in Grade 4 and thirty-four were in Grade 7. The mean age of the Grade 4's was 9 years and 8 months with a standard deviation of 3.5 months. The mean age of the Grade 7's was 12 years and 8 months with a standard deviation of 4 months. Of the Grade 4 students 20 were male and 18 were female. Of the Grade 7 students 13 were male and 21 were female. Students were chosen from Grades 4 and 7 as these were the age groups agreed upon with the Psychological Corporation.

All of the participants were enrolled in one of seven schools within the Rainbow District School Board in Sudbury, Ontario, Canada. As the researchers agreed to test approximately 80 children, schools were contacted one at a time until the predetermined number of participants was met. Only schools that offered programs in English were selected. Schools with French Immersion programs were not included. Upon approval of the school board, the principals from each of the schools were contacted by the researchers. Once they agreed to be part of the study a letter describing the study, a short

questionnaire and a consent letter were sent home with all of the Grade 4 and Grade 7 students in the school via the classroom teachers. The classroom teachers and, in some schools, the special education teacher and principal, collected the returned consent letters and questionnaires. Records were not kept of the number of consent letters that were not returned by parents. The letter and the questionnaire are presented in Appendix A. The questionnaire asked about health problems, such as poor vision or hearing, and previously diagnosed learning problems. Also, as the Psychological Corporation and a co-researcher were interested in the student's parents' socioeconomic status, the parent's highest level of education was also included on the questionnaire.

Participants were classified into one of four parental education levels by the second researcher, no high school diploma, high school diploma only, some university or college/technical school, and university degree. The second researcher wanted an equal number of participants from each parental education level. It was anticipated that children in the lowest parental education level would be the hardest to find, so, based on recommendations from the school board, specific schools were targeted based on the likelihood of finding children to fill this level. Participants were chosen from the returned consent forms based on which of the parental education levels needed to be filled. Early in the testing process all the children that returned a signed consent letter and fit the selection criteria completed the tests, whereas, towards the end of the testing process participants were chosen based on which cells were filled and which parental education levels still required participants. The third parental education level, some university or college, was the most popular and most easily filled. An effort was made to balance the number of males and females in each cell.

Only children whose first language was English were chosen to participate in the study. Children who were diagnosed by a doctor as having a hearing or visual impairment, neurological problems, developmental disabilities, attention deficit/hyperactivity disorder, or learning disabilities in reading, math, or writing were not included in the sample. Also, children who previously failed a grade were not included in the sample. These selection criteria were dictated by the Psychological Corporation. A separate study was conducted by the Psychological Corporation for the inclusion of these children in the WIAT - II standardization process.

The Instruments

The Wechsler Intelligence Scales for Children - Third Edition

The WISC-III is an individually administered intelligence test (Wechsler, 1991). It is used to assess the cognitive functioning of children between the ages of 6 years and 16 years and 11 months (Wechsler, 1991). The thirteen subtests of the WISC-III yield three composite scores. Information, Similarities, Arithmetic, Vocabulary, and Comprehension subtests combine to form the Verbal IQ composite score. Performance IQ is comprised by the sum of the scores on the Picture Completion, Coding, Picture Arrangement, Block Design, and Object Assembly subtests.

Four factor-based index scores can also be calculated (Wechsler, 1991). Information, Similarities, Vocabulary, and Comprehension make-up the first factor, Verbal Comprehension. Perceptual Organization is composed of Picture Completion, Picture Arrangement, Block Design, and Object Assembly scores. The third factor, Freedom from Distractibility, includes the scores from the Arithmetic and Digit Span

subtests. Coding and Symbol Search scores combine to form the final factor, Processing Speed (Wechsler, 1991). Mazes is a supplementary test, not otherwise used to calculate scores (Wechsler, 1991).

Once the WISC-III is administered the responses to the items of the individual subtests are scored and raw scores are obtained. The raw scores are then converted to scaled subtest scores (mean = 10 and standard deviation = 3). The scaled scores for the appropriate subtests are added to calculate the sum of scaled scores for the Verbal and Performance IQs and the four factor based index scores. The Verbal and Performance scores are added to calculate the Full Scale score. Using charts found in the WISC-III manual the scores are converted into IQ scores which have a mean of 100 and a standard deviation of 100 (Wechsler, 1991).

Administration of the WISC-III requires between fifty and eighty-five minutes.

The Wechsler Individual Achievement Test - Second Edition

The WIAT-II is an individually administered test used to assess the achievement level of individuals aged 4 through adulthood (The Psychological Corporation, 2001). The content of the tests encompasses material covered in pre-kindergarten classes through to college level material (The Psychological Corporation, 2001). A portion of the WIAT-II standardization sample was used to develop co-norms with the WISC-III, the WAIS-III and the WPPSI-R (The Psychological Corporation, 2001).

The WIAT-II consists of nine subtests that in turn comprise four composite scores. The Word Reading, Reading Comprehension and Pseudoword Decoding subtests comprise the Reading Composite. The Mathematics Composite score is made-up of the

scores from the Numerical Operations and Math Reasoning subtests. The Spelling and Written Expressions subtests combine to form the Written Language composite. The fourth WIAT-II composite is Oral Language. It is made up of the scores from the Listening Comprehension and Oral Expression subtests.

Once the administration of the test is completed raw scores for each subtest are calculated (The Psychological Corporation, 2001). Raw scores are then converted to standard scores (mean = 100 and standard deviation = 3) with the aid of charts provided within the WIAT-II manual. The subtest standard scores within a composite are added together. The sum is then converted to the composite standard score each of which has a mean of 100 and a standard deviation of 15 (The Psychological Corporation, 2001).

According to the WIAT-II manual administration of the entire test should take approximately ninety minutes for younger children (grades 1 through 6) and one and a half to two hours for older test takers (grades 7 through 16).

Procedure

All the participants completed the WISC-III and the WIAT-II. The tests were administered in counterbalanced order. That is half of the participants completed the WISC-III first and the other half completed the WIAT-II first. Two sessions were required for test administration. Whenever possible the tests were administered within twenty-four hours of each other. Testing was conducted by the author and one other graduate student in the Masters of Arts in Human Development program at Laurentian University. Both graduate students had been trained in psychological test administration. For each participant both of the measures were administered by the same graduate

student. The tests were administered in the schools attended by the participants during regular school hours. Participants took breaks for their regularly scheduled recesses and lunch breaks. The majority of the Grade 4 students required at least one break during the administration of each test. Many of the grade seven students were able to complete each test in a single sitting.

All of the subtests of the WISC-III were administered. Similarly, the WIAT-II was administered in its entirety. The tests were scored by the graduate students following the instructions provided in the WISC-III and WIAT-II manuals. When responses were not easily scored the graduate students discussed the problematic item until they agreed upon how they should be scored.

RESULTS

WISC-III and WIAT-II composite and subtest scores were calculated along with WISC-WIAT correlations. The WISC-III results are presented first, followed by the WIAT-II results and then the results regarding the correlations. Additional analyses were performed and include comparison of the current sample to the WISC-III Canadian norms, examination of Verbal-IQ – Performance IQ discrepancies found in the current sample, and, finally, an examination of WIAT-II scores across the schools sampled.

WISC-III Composites

The mean WISC-III IQ scores, Index scores, and standard deviations for the sample are reported in Table 1. The WISC-III IQ scores and Index scores from the current study were compared to the composite scores reported in the WISC-III manual. For all of the IQ scores the mean reported in the manual was 100 and the standard deviation was 15. The scores for the Grade 7's ranged from 97.47 for the Verbal Comprehension Index to 106.09 for the Processing Speed Index. For the Grade 4 students the scores ranged from 105.63 for the Freedom from Distractability Index to 99.87 for the Verbal IQ score. The standard deviations for both grades were smaller than the standard deviations reported in the manual. In order to compare the mean scores for each of the grades t-tests were computed. In order to avoid compounding of alpha error, alpha was set at the .01 level. The t-values are also reported in Table 1. No significant differences were found between the scores of the Canadian sample and the American norms for the IQ scores.

Table 1

Wechsler Intelligence Scale for Children - Third Edition Mean IQ Scores, Index Scores, Standard Deviations and t-values

	Grade 4 (n = 38)			Grade 7 (n=34)		
WISC-III IQ Scores	M	SD	t-test	M	SD	t-test
Verbal IQ	99.87	10.13	-.05	97.59	12.07	-.89
Performance IQ	102.05	11.55	.80	103.44	14.07	1.25
Full Scale IQ	100.76	8.88	.30	100.29	12.07	0.11
Verbal Comprehension	100.26	10.99	.10	97.62	11.55	-0.88
Perceptual Organization	102.61	12.05	1.01	103.15	12.68	1.16
Freedom from Distractibility	105.63	10.15	2.22	97.47	11.55	-0.93
Processing Speed	102.00	11.25	.78	106.09	15.17	2.19

Note. All scores were compared to American norms; mean = 100 and standard deviation = 15

WISC–III Subtests

The individual WISC-III subtests from the current study were also compared to the American norms. The mean scores for each of the subtests reported in the WISC-III manual were 10 and the standard deviations were all 3. The mean subtest scores and standard deviations for the current study are reported in Table 2. For the Grade 4 students the scores ranged from 11.61 on the Mazes subtest to 9.24 on the Vocabulary subtest. A high mean score of 10.97 on the Symbol Search subtest and low mean scores of 8.94 on the Information subtest was found for the Grade 7 students. In order to compare the means from the sample to the American norms t-tests were performed. Generally, the standard deviations for the Grade 4 students were smaller than the standard deviations reported in the WISC-III manual. The t-values are included in Table 2. The Grade 4 students were found to perform significantly higher on the Digit Span and Mazes subtests. The performance of the Grade 7 students did not differ significantly from the WISC-III manual on any of the subtests.

WIAT-II Composites

The mean WIAT-II composite scores and standard deviations for each grade are reported in Table 3. The mean from the manual for each composite is 100 and the standard deviation is 15. For the Grade 4 portion of the sample the WIAT-II composite scores ranged from 105.82 on the Oral Language composite to 94.74 on the Written Language composite. The Grade 7 students scored highest on the Oral Language composite, 104.88, and lowest on the Mathematics composite, 95.38. For the Grade 4's the standard deviations for 4 out of the 5 composites scores were much lower than the

Table 2

Wechsler Intelligence Scale for Children – Third Edition: Mean Subtest Scores, Standard Deviations, and t-values

	Grade 4 (n = 38)			Grade 7 (n=34)		
WISC-III Subtest Scores	M	SD	t-test	M	SD	t-test
Picture Completion	10.42	2.32	.82	10.56	2.62	1.02
Information	10.58	2.65	1.11	8.94	2.60	-1.94
Coding	9.95	2.81	-.10	10.85	3.66	1.48
Similarities	10.71	3.09	1.33	9.85	2.92	-.27
Picture Arrangement	11.11	4.25	1.94	9.88	3.56	-.21
Arithmetic	10.61	3.17	1.14	9.71	3.21	-.52
Block Design	10.29	3.23	.54	10.85	2.92	1.53
Vocabulary	9.24	2.51	-1.47	9.29	2.20	-1.32
Object Assembly	9.76	2.27	-.47	10.26	2.67	.47
Comprehension	9.42	2.45	-1.12	9.91	2.61	-.16
Symbol Search	10.39	2.59	.75	10.97	3.26	1.72
Digit Span	11.58	2.51	3.05*	9.18	2.21	-.35
Mazes	11.61	2.97	3.04*	10.79	3.29	1.40

Note. All scores were compared to American norms: mean = 10 and standard deviation = 3

* the sample mean and the manual mean differed significantly at $p < .01$

Table 3

Wechsler Individual Achievement Test - Second Edition: Mean Composite Scores, Standard Deviations and t-values

	Grade 4 (n = 38)			Grade 7 (n = 34)		
WIAT-II Composite Scores	M	SD	t-test	M	SD	t-test
Reading	99.66	11.23	-.13	97.41	9.04	-0.98
Mathematics	101.33	9.65	.41	95.38	12.06	-1.7
Written Language	94.74	15.99	-1.96	97.35	15.41	-0.95
Oral Language	105.82	7.86	2.33	104.88	11.33	1.81
Total	99.18	9.05	-.33	97.76	11.29	-0.83

Note. The scores were compared to American norms: mean =100 and standard deviation = 15
* the sample mean and the manual mean differed significantly at $p < .01$

standard deviations reported in the test manual. The same was found for the Grade 7 students; 4 of the 5 WIAT-II composites had standard deviations much smaller than 15. Once again in order to compare the sample scores to the manual scores, t-tests were conducted. The t-values are also reported in Table 3. Neither the Grade 4 nor Grade 7 students differed significantly from the mean composite scores as reported in the WIAT-II manual.

WIAT-II Subtests

Mean and standard deviations for the individual WIAT-II subtests are reported in Table 4. The scores ranged from 93.05 on the Written Expression subtest to 105.26 on the Oral Expression subtest. Both grades were found to have standard deviations much smaller than reported in the manual on most of the WIAT-II subtest scores. Table 4 also presents the t-values when the current sample was compared to the WIAT-II standardization sample. The Canadian Grade 4 students obtained significantly lower scores than the standardization sample on the Written Expression subtest.

For the Grade 7 students the WIAT-II subtest scores ranged from 91.44 on the Numerical Operations subtest to 107.21 on the Oral Expression subtest. The Canadian Grade 7 students performed significantly higher than the WIAT-II American standardization sample on the Oral Expression subtest. However, the Grade 7's performed significantly lower on the Numerical Operations subtest.

Table 4

Wechsler Individual Achievement Test – Second Edition: Mean Subtest Scores, Standard Deviations, and t-values

	Grade 4 (n = 38)			Grade 7 (n = 34)		
WIAT-II Subtest Scores	M	SD	t-test	M	SD	t-test
Word Reading	100.58	9.81	.22	96.09	9.81	-1.47
Reading Comprehension	101.32	6.98	.53	103.56	7.51	1.35
Pseudoword Decoding	101.21	13.31	.46	99.09	9.69	-.34
Numerical Operations	98.08	8.62	-.76	91.44	13.99	-3.11*
Math Reasoning	104.68	10.46	1.84	100.97	9.34	.36
Spelling	97.61	14.32	-.91	100.56	13.55	.20
Written Expression	93.05	15.72	-2.60*	95.38	17.78	-1.61
Listening Comprehension	106	8.68	2.39	102.32	12.19	.85
Oral Expression	105.26	10.91	2.06	107.21	10.48	2.69*

Note. The scores were compared to American means: mean =100 and standard deviation =15
* the sample mean and the manual mean differed significantly at $p < .01$

WISC-III IQ and WIAT-II Composite Correlations

The WISC-III/WIAT-II correlations are reported by age in the WIAT-II manual and not by grade. Because the mean age of the Grade 4 students was 9 years and 8 months, the correlations for the Grade 4's were compared to the correlations for 9 year olds as reported in Table K.13 (p. 355) of the WIAT-II manual. The correlations computed for the Grade 7 students were compared to the correlations reported in Table K.13 for 12 year olds (p. 358). Because the correlations reported in the WIAT-II manual were corrected for restriction of range of the WISC-III scores, all the correlations calculated using the data from the current sample were also corrected using Guilford and Fruchter's (1978) formula. For the Grade 4 portion of the sample, correlations between the WISC-III Verbal IQ, Performance IQ, and Full Scale IQ and the WIAT-II composites for both the current sample and the correlations reported in the WIAT-II manual are reported in Table 5. The correlations range from r = .64 for the correlation between Verbal IQ and Total Composite to r = -.01 for the Performance IQ-Reading Composite correlation.

For the Grade 7 portion of the sample, correlations between the WISC-III Verbal IQ, Performance IQ, and Full Scale IQ and the WIAT-II composites for both the current sample and the correlations reported in the WIAT-II manual are reported in Table 6. For the Grade 7 students the highest correlation was found between Verbal IQ and the Total Composite, r = .85, and the lowest correlation was found between the Performance IQ and Mathematics Composite, r = .39.

Table 5

Sample Correlations and Manual Correlations between the Wechsler Intelligence Scale for Children – Third Edition Verbal IQ, Performance IQ, and Full Scale IQ and the Wechsler Individual Achievement Test Composite Scores for Grade 4 Students

	WISC - III VIQ			WISC - III PIQ			WISC-III FSIQ		
WIAT - II Composites	Sample	Manual	z - test	Sample	Manual	z - test	Sample	Manual	z -test
Reading	.51	.65	-1.15	-.01	.27	-1.57	.29	.54	-1.69
Mathematics	.48	.59	-.87	.48	.43	.34	.55	.57	-.14
Written Language	.33	.50	-1.15	.08	.33	-1.44	.20	.47	-1.70
Oral Language	.36	.61	-1.79	.21	.28	-.43	.33	.51	-1.23
Total	.64	.71	-.72	.23	.35	-.71	.51	.61	-.83

Note: All correlations were corrected for variability of the WISC-III scores (Guilford & Fruchter, 1978)

Table 6

Sample Correlations and Manual Correlations between the Wechsler Intelligence Scale for Children – Third Edition Verbal IQ, Performance IQ, and Full Scale IQ and the Wechsler Individual Achievement Test Composite Scores for Grade 7 Students

	WISC - III VIQ			WISC - III PIQ			WISC-III FSIQ		
WIAT - II Composites	Sample	Manual	z - test	Sample	Manual	z - test	Sample	Manual	z -test
Reading	.73	.65	.83	.55	.46	.59	.29	.54	.99
Mathematics	.83	.71	1.50	.39	.60	-1.48	.55	.57	-.71
Written Language	.63	.58	.39	.52	.52	.04	.20	.47	.62
Oral Language	.73	.68	.53	.65	.39	1.84	.33	.51	1.48
Total	.85	.80	.79	.62	.57	.42	.51	.61	.83

Note: All correlations were corrected for variability of the WISC-III scores (Guilford & Fruchter, 1978)

In order to compare the correlations between the WISC-III IQ scores and the WIAT-II composite scores obtained from the current sample to the corresponding correlations reported in the WIAT-II manual, the correlations were converted to z-scores using Fisher's z score transformations (Ferguson, 1981). The *z*-values for the Grade 4's are also reported in Table 5 and the z-values for the Grade 7 students are also reported in Table 6. When the correlations between WISC-III IQ and WIAT-II composites for the Grade 4's from the current study were compared to the WIAT-II manual no significant differences were found. Likewise, no significant differences were found between the manual and sample correlations for the Grade 7 students.

WISC-III Composite-WIAT-II Subtest Correlations

Correlations between the WISC-III composite and WIAT-II subtests were computed for the current sample. The correlations for the Grade 4 students are presented in Table 7. Again the correlations were corrected for restriction of range. For the Grade 4 students the highest correlation was found between Verbal IQ and the Reading Comprehension subtest, r =.72, and the lowest correlation was found between Performance IQ and Word Reading, r = -.01. The correlations for the Grade 7 portion of the sample are reported in Table 8. For the Grade 7 students the correlations ranged from r = .88 between Verbal IQ and Math Reasoning and r = .22 between Performance IQ and Numerical Operations.

Once again the correlations from the current study were compared to the correlations reported in the WIAT-II manual. Again z-scores were computed using Fisher's transformation. The *z*-values for the Grade 4's are also presented in Table 7.

Table 7

Sample Correlations and Manual Correlations Between the Wechsler Intelligence Scale for Children – Third Edition Verbal IQ, Performance IQ, and Full Scale IQ and the Wechsler Individual Achievement Test Subtest Scores for Grade 4 Students

	WISC - III VIQ			WISC - III PIQ			WISC-III FSIQ		
WIAT - II Composites	Sample	Manual	z - test	Sample	Manual	z - test	Sample	Manual	z -test
Word Reading	.38	.62	-1.77	-.01	.27	-2.11	.16	.51	-2.22
Reading Comprehension	.72	.53	1.76	.34	.29	.27	.62	.46	1.23
Psuedoword Decoding	.35	.53	-1.25	-.11	.23	-1.88	.14	.44	-1.82
Numerical Operations	.28	.40	-.74	.26	.25	.03	.31	.37	-.38
Math Reasoning	.53	.68	-1.34	.54	.52	.14	.63	.67	-.42
Spelling	.28	.51	-1.53	.02	.31	-1.66	.16	.46	-1.86
Written Expression	.27	.41	-.85	.16	.29	-.75	.24	.39	-.91
Listening Comprehension	.57	.60	-.28	.19	.28	-.54	.43	.51	-.55
Oral Expression	-.08	.46	-3.16*	.04	.17	-.69	-.02	.37	-2.21

Note: All correlations were corrected for variability of the WISC-III scores (Guilford & Fruchter, 1978)
* the sample correlation and the manual correlation differed significantly at $p < .01$

Table 8

Sample Correlations and Manual Correlations Between the Wechsler Intelligence Scale for Children – Third Edition Verbal IQ, Performance IQ, and Full Scale IQ and the Wechsler Individual Achievement Test Subtest Scores for Grade 7 Students

	WISC - III VIQ			WISC - III PIQ			WISC-III FSIQ		
WIAT - II Composites	Sample	Manual	z - test	Sample	Manual	z - test	Sample	Manual	z -test
Word Reading	.73	.62	1.08	.55	.50	.38	.74	.63	1.06
Reading Comprehension	.45	.40	.29	.37	.46	-.56	.48	.48	.02
Psuedoword Decoding	.66	.56	.78	.33	.39	-.34	.59	.54	.35
Numerical Operations	.64	.65	-.07	.22	.50	-1.68	.47	.66	-1.47
Math Reasoning	.88	.67	2.92*	.58	.62	-.33	.80	.73	.93
Spelling	.67	.59	.70	.40	.43	-.19	.64	.58	.48
Written Expression	.38	.53	-.99	.43	.51	-.55	.47	.58	-.78
Listening Comprehension	.78	.78	.05	.62	.49	.95	.80	.72	.92
Oral Expression	.36	.37	-.09	.40	.22	1.00	.39	.34	.28

Note: All correlations were corrected for variability of the WISC-III scores (Guilford & Fruchter, 1978)
* the sample and the manual correlations differed significantly at $p < .01$

For the Grade 4's the correlation between Verbal IQ and Oral Expression was found to be significantly lower than the correlations reported in the WIAT-II manual.

The z-values for the Grade 7 students are included in Table 8. For the Grade 7 portion of the sample only the correlation between Verbal IQ and Math Reasoning was found to be significantly higher than the correlations reported in the manual.

Additional Analyses

WISC-III Canadian Norms

As the WISC–III scores from the current sample did not differ significantly from the American norms, the data from the sample was compared to the Canadian norms as reported in the WISC-III Canadian Supplement (Wechsler, 1996). The WISC-III protocols from the current study were re-scored according to the Canadian norms reported in the Canadian Supplement with the aid of the C-SAW (Psychological Corporation, 1995) computer program. The mean Full Scale IQ, Performance IQ, Verbal IQ, Verbal Comprehension Index, Perceptual Organization Index, Freedom from Distractibitility Index, and Processing Speed Index were then again compared to the Canadian norms. As with the American norms the Canadian norms have a mean of 100 and a standard deviation of 15. The means and standard deviations are reported in Table 9. The means for the Grade 4 students ranged from 103.95 on the Freedom from Distractibility Index to a mean of 95.21 for the Full Scale IQ. For the Grade 7 students the means ranged from a high of 103.18 on the Processing Speed Index to a mean of 96.47 on the Verbal Comprehension Index. In order to compare the means from the current sample to the means reported in the Canadian Supplement t-tests were conducted.

Table 9

Wechsler Intelligence Scale for Children – Third Edition Mean IQ Scores, Index Scores, Standard Deviations, and t-values Based On Canadian Norms

	Grade 4 (n = 38)			Grade 7 (n=34)		
WISC-III IQ Scores	M	SD	t-test	M	SD	t-test
Verbal IQ	97.24	10.71	-1.04	96.76	13.08	-1.17
Performance IQ	96.05	12.29	-1.45	99.50	14.57	-.18
Full Scale IQ	95.21	9.48	-1.83	97.47	13.21	-.91
Verbal Comprehension	96.82	11.44	-1.82	96.68	12.86	-1.20
Perceptual Organization	95.58	12.33	-1.62	98.91	13.33	-.39
Freedom from Distractibility	103.95	10.79	1.48	96.47	13.57	-1.26
Processing Speed	98.87	11.89	-.42	103.18	14.63	1.12

Note. All scores were compared to Canadian norms: mean = 100 and standard deviation = 15

The t-values are also reported in Table 9. No significant differences were found between the mean IQ scores and Index scores of the sample and the Canadian supplement.

The means for the individual WISC-III subtests were also computed using the norms reported in the Canadian Supplement. Once again, as with the American normative data the Canadian norms for the individual subtests have a mean of 10 and a standard deviation of 3. The subtest score means and standard deviations are reported in Table 10. For the Grade 4 students the scores ranged from a mean score of 11.26 on the Mazes subtest to a mean score of 8.37 on the Object Assembly subtest. In order to compare the sample means to the means reported in the Canadian Supplement (Wechsler, 1996) t-tests were performed. The t-values are also reported in Table 10. It was found that the Grade 4 students performed significantly lower then the Canadian norms on the Object Assembly and the Comprehension subtests. The scores for the Grade 7 students ranged from a high of 11.32 on the Mazes subtest to a mean score of 9.03 on the Digit Span subtest. The Grade 7 students did not differ significantly from the Canadian norms on any of the subtests.

Verbal IQ – Performance IQ Discrepancies

Further investigation of the data revealed that the Verbal IQ – Performance IQ discrepancies yielded some unusual values and additional analyses were merited. More statistically significant discrepancies were found than were expected based upon the American standardization sample. As the mean age of the Grade 4 students was 9 year and 8 months the values reported in Sattler for 9 year olds were used. The values reported by Sattler (2001) are based on the American WISC-III standardization sample. According

Table 10

Wechsler Intelligence Scale for Children – Third Edition Mean Subtest Scores and Standard Deviations Based On Canadian Norms

	Grade 4 (n = 38)			Grade 7 (n=34)		
WISC-III Subtest Scores	M	SD	t-test	M	SD	t-test
Picture Completion	9.47	2.33	-.98	9.56	2.62	-.79
Information	10.03	2.79	.05	9.21	3.44	-1.33
Coding	9.55	2.71	-.81	10.29	3.59	.48
Similarities	10.16	1.90	.31	9.76	2.63	-.43
Picture Arrangement	10.24	3.42	.40	9.88	3.23	-.21
Arithmetic	9.92	3.41	-.13	9.74	3.35	-.44
Block Design	9.00	3.22	-1.71	10.18	3.00	.31
Vocabulary	9.05	2.45	-1.74	9.29	2.20	-1.32
Object Assembly	8.37	2.41	-3.00*	9.65	2.64	-.63
Comprehension	8.50	2.36	-2.77*	9.53	3.00	-.82
Symbol Search	9.84	2.75	-.29	10.79	2.91	1.39
Digit Span	11.34	2.21	2.50	9.03	2.18	-1.82
Mazes	11.26	2.41	2.31	11.32	3.4	2.23

Note. All scores were compared to Canadian means: mean = 10 and standard deviation = 3

* the sample mean and the manual mean differed significantly at $p < .01$

to Sattler, Table A-2 (2001, p.741), in order for a Verbal IQ – Performance IQ discrepancy to be significant at an alpha level of .05 for the Grade 4 students the difference between the Verbal IQ score and the Performance IQ score must be greater than or equal to 11 points. When the Verbal IQ – Performance IQ discrepancies were calculated for the Grade 4 students it was found that 12 students, or 31.6% of the Grade 4 students, had significant discrepancies in which the Performance IQ was higher than the Verbal IQ score. According to Sattler (2001), 21.3% of the WISC-III standardization sample had discrepancies scores in which the Performance IQ score was 11 or more points higher than the Verbal IQ score. Within the current sample of Grade 4 students 10.5 % had a PIQ-VIQ discrepancy greater than or equal to 20 points compared to 8.5 percent of the standardization sample. For the Grade 4 students a difference of 24 points was the largest discrepancy found in which the Performance IQ was greater than the Verbal IQ. Of the standardization sample, 5.2% had a Performance IQ score 24 points or more greater than the Verbal IQ score, while only 1 Grade 4 student, or 2.6 % of the Grade 4 portion of the sample, had a discrepancy of 24 points.

As the mean age of the Grade 7 students was 12 years and 8 months the information presented in Sattler (2001) pertaining to 12 year olds was used. According to Sattler, Table A-2 (2001, p.741), for a Grade 7 student's discrepancy to be significant at an alpha level of .05 the scores must be separated by 12 or more points. According to Sattler,Table A - 5 (2001, p.746), 19.5 % of the standardization sample had a Performance IQ score that was 12 or more points higher than the Verbal IQ score. Eleven, or 32.4%, of the Grade 7s had PIQ scores 12 or more points higher than the VIQ scores. Only 8.5% of the standardization sample had PIQ-VIQ discrepancies greater than

or equal to 20 points, while 17.6 percent of the Grade 7 students had discrepancies of that size. The largest discrepancy found in the Grade 7 portion of the sample was 35 points. According to Sattler (2001), 2.4 % of the standardization sample had PIQ scores 35 points or more great than the VIQ score compared to 2.9 % of Grade 7 portion of the sample.

Discrepancies were also calculated when the Verbal IQ score was greater than the Performance IQ score. Once again, for the discrepancy to be statistically significant for the Grade 4 students the VIQ score had to be 11 or more points higher than the PIQ score. Nine of the Grade 4 students, or 23.7 % of the Grade 4 sample, were found to have a significant discrepancy. Of the WISC-III standardization sample 20.6% of the sample had a discrepancy greater than or equal to 11 points. According to Sattler, Table A-4 (2001, p.745), only 5.9 % of the standardization sample had Verbal IQ scores 20 or more points higher than the Performance IQ scores, while 13.1 % of the Grade 4 students from the current sample had discrepancies greater than or equal to 20 points. The largest discrepancy found in the Grade 4 portion of the sample when VIQ was greater than PIQ was 28 points. Only 1.4 % of the WISC-III standardization sample had a discrepancy of 28 points or more when the VIQ score was higher then the PIQ score. In the current sample 2.63% of the Grade 4 participants had a VIQ-PIQ discrepancy equal to 28 points.

Again to be statistically significant the discrepancies had to be greater than or equal to 12 points for the Grade 7 students. Only two Grade 7 students in the current sample were found to have significant discrepancies when Verbal IQ was greater than Performance IQ. According to Sattler (2001) 17.7% of the standardization sample had a VIQ score 12 or more points higher than the PIQ score, while only 5.9% of the Grade 7

students had similar discrepancies. The largest discrepancy in which the VIQ score was greater than the PIQ score for the Grade 7 students was 26 points. Of the standardization sample 2.6% had discrepancies greater than or equal to 26 points while 2.9% of the current sample had a discrepancy of 26 points.

Regardless of whether the Verbal IQ score is greater than the Performance IQ score or vice versa discrepancies greater than or equal to 20 points are important. If the PIQ score and VIQ score are distanced by 20 or more points it is advised that the Full Scale IQ not be reported, the child's skills are too disparate and the FSIQ would not offer a clear picture of the child's overall performance. In the current sample 16 of the 72 participants, or 22.22% of the sample, were found to have PIQ-VIQ discrepancies greater than or equal to 20 points. According to Wechsler (1991) only 12.3% of the standardization sample had discrepancies of that size.

WIAT Performance by School

As achievement scores are a direct measure of school learned information it was of interest to explore whether the students at the various school involved in the study differed in their WIAT scores. The mean WIAT composite scores and subtest scores for the various schools were compared for the Grade 4 and Grade 7 students through the use of one-way ANOVAs. Grade 4 students were sampled from five of the seven schools that participated in the study. One of the five schools was eliminated from the analysis as only three Grade 4 participants were from that particular school. The Grade 4 WIAT-II composite means, standard deviations and F statistics are reported in Table 11. The mean scores ranged from 88.50 on the Written Language composite for School #6 to 110.50 on

Table 11

Wechsler Individual Achievement Test – Second Edition Mean Composite Scores and Group Differences by Grade 4 Schools

	School #1 (n = 6)	School #2 (n =13)	School #5 (n =12)	School #6 (n = 4)	Group Differences
WIAT-II Composite Scores	M SD	M SD	M SD	M SD	F Statistic
Reading	104.33 (10.91)	95.65 (10.20)	100.33 (10.46)	94.50 (6.45)	F(3,31) = 1.34
Mathematics	96.33 (14.04)	100.46 (8.10)	101.17 (9.59)	102.50 (6.56)	F(3,31) = .44
Written Language	96.33 (18.63)	96.31 (12.55)	91.33 (16.66)	88.50 (15.29)	F(3,31) = .43
Oral Language	110.50 (4.85)	105.23 (9.38)	103.00 (7.50)	106.75 8.26	F(3,31) = 1.20
Total	100.50 (9.93)	97.92 (8.71)	98.00 (7.31)	96.75 (8.66)	F(3,31)=.19

the Oral Language composite for School #1. The Grade 4 students in the various schools did not differ significantly on any of the composite scores.

With regards to the Grade 7 students, two school had fewer students than there were groups to be compared, School #4 had 2 students as did School #7, so they were eliminated from the analysis. For the Grade 7 students the school means, standard deviations and F statistics are reported in Table 12. The composite means ranged from105.13 on the Oral Language Composite by School #6 to 93.00 on the Mathematics Composite also for School #6. However, the ANOVA revealed that the schools did not differ significantly on any of the WIAT-II composite scores.

The schools were also compared with regard to the WIAT-II subtest scores. The school subtest means, standard deviations, and F statistics for the Grade 4 students are reported in Table 13. For the Grade 4 students the mean subtest scores ranged from 85.75 on the Written Expression subtest for School #6 to 109.67 on the Listening Comprehension subtest achieved by School #1. The analysis of variance revealed that the Grade 4 classes in the various schools did not differ significantly on any of the WIAT-II subtests.

For the Grade 7 students the subtest scores ranged from 107.06 for School #6 on the Oral Expression Subtest to 87.31 on the Numerical Expression subtest also for School #6. The ANOVA revealed that the Grade 7 students from schools #3 and #6 differed only on the Reading Comprehension subtest. School #6 performed significantly better than School #3 on that particular subtest. The means, standard deviations, and the F statistics for the Grade 7 classes from the various schools are reported in Table 14.

Table 12

Wechsler Individual Achievement Test – Second Edition Mean Composite Scores and Group Differences by Grade 7 Schools

	School #3 (n = 14)	School #6 (n = 16)	Group Differences
WIAT-II Composite Scores	M (SD)	M (SD)	F Statistic
Reading	95.00 (19.44)	100.44 (7.91)	F(1,28) = 2.95
Mathematics	96.93 (7.73)	93.00 (14.73)	F(1,28) = .80
Written Language	93.36 (8.68)	102.13 (17.90)	F(1,28) = 2.78
Oral Language	104.57 (10.23)	105.13 (13.27)	F(1,28) = .02
Total	95.68 (8.24)	99.75 (13.20)	F(1,28) = .91

Table 13

Wechsler Individual Achievement Test – Second Edition Mean Subtest Scores and Group Differences by Grade 4 Schools

WIAT Subtest	School #1 M (SD)	School #2 M (SD)	School #5 M (SD)	School #6 M (SD)	Group Differences F statistic
Word Reading	106.50 (8.17)	96.08 (12.08)	103.25 (14.99)	91.75 (6.45)	F(3,31) = 1.83
Reading Comprehension	102.33 (6.77)	99.69 (7.06)	99.92 (5.57)	102.50 (6.56)	F(3,31) = .39
Pseudoword Decoding	106.17 (10.40)	96.08 (12.89)	104.58 (13.61)	94.75 (13.43)	F(3,31) = 1.58
Numerical Operations	92.33 (11.81)	99.54 (8.07)	97.58 (8.18)	99.25 (6.99)	F(3,31) = .99
Math Reasoning	101.50 (13.88)	102.54 (8.65)	105.33 (10.33)	106.75 (11.95)	F(3,31) = .35
Spelling	100.00 (14.97)	96.15 (10.69)	97.42 (16.35)	95.00 (12.25)	F(3,31) = .14
Written Expression	93.33 (19.41)	97.23 (13.13)	87.25 (15.02)	85.75 (16.05)	F(3,31) = 1.14
Listening Comprehension	109.67 (7.53)	103.77 (8.66)	104.42 (9.76)	104.75 (3.77)	F(3,31) = .70
Oral Expression	108.33 (10.35)	106.52 (10.70)	102.67 (12.63)	108.00 (10.80)	F(3,31) = .47

Table 14

Wechsler Individual Achievement Test – Second Edition Mean Subtest Scores and Group Differences by Grade 7 Schools

WIAT Subtest	School #3 (n=14) M SD	School #6 (n=16) M SD	Group Difference F Statistic
Word Reading	93.57 (9.77)	98.75 (9.96)	F(1,28) = 2.05
Reading Comprehension	100.86 (8.27)	106.19 (5.80)	F(1,28) = 4.26*
Pseudoword Decoding	97.50 (10.56)	101.75 (8.56)	F(1,28) = 1.48
Numerical Operations	95.57 (9.91)	87.31 (16.75)	F(1,28)= 2.60
Math Reasoning	100.14 (7.81)	100.44 (10.79)	F(1,28) = .01
Spelling	97.71 (12.57)	103.63 (14.19)	F(1,28) = 1.44
Written Expression	91.43 (14.60)	100.69 (17.84)	F(1,28) = 2.38
Listening Comprehension	102.21 (10.69)	102.69 (12.19)	F(1,28) = .01
Oral Expression	107.00 (9.47)	107.06 (11.81)	F(1,28) = .00

* schools differed significantly at $p < .05$

DISCUSSION

The purpose of the current study was to compare WISC-III and WIAT-II scores from a Canadian sample to the mean scores reported in the test manuals. The norms in the test manuals were based upon the scores of American participants. The current study also set out to examine correlations between the WISC-III composite scores and the WIAT-II subtests and composites. Once again the correlations between the WISC-III scores and the WIAT-II scores were compared to the correlations reported in the WIAT-II manual.

Summary of Results

WISC-III

The mean WISC-III standard scores for the VIQ, PIQ, FSIQ, and the four index scores: Verbal Comprehension, Perceptual Organization, Freedom from Distractibility, and Processing Speed, were compared to the means reported in the WISC-III manual. It was expected that the participants in the current sample would have higher mean scores than those reported in the manual. Scores were expected to more resemble the scores found by the WISC-III Canadian Study as reported in the WISC-III Canadian Supplement (Wechsler, 1996). The scores from the current study were also expected to be higher than the means reported in the manual due to the influence of the Flynn effect (Flynn, 1984). However, the WISC-III mean scores found in the current sample were not as high as hypothesized. When the composite scores and the index scores were examined neither the Grade 4 students or the Grade 7 students were found to differ significantly

from the norms reported in the WISC-III manual. An examination of the means show that for the Grade 4 students six of the seven scores were at or above the mean of 100 and only one fell below, suggesting a trend in the expected direction. For the Grade 7 students four of the WISC-III composite scores were above the mean and three were found to fall below the mean. The standard deviations for both grades were smaller than expected suggesting less variability in the scores from the current sample.

When the mean subtest scores were examined the Grade 4 students scored significantly higher on the Digit Span and Mazes subtests. The Grade 7 portion of the sample did not perform significantly higher or lower than the mean subtest scores reported in the WISC-III manual. Once again the Grade 4 students show a trend in the expected direction with nine of the thirteen subtest scores being at or above the mean of 10. However, inspection of the Grade 7's mean scores show only six scores at or above 10.

VIQ-PIQ discrepancies were also calculated for the sample. Far more children in the current sample had VIQ-PIQ discrepancies equal to or greater than the critical value of 20 points than were present in the WISC-III standardization sample. Many children from both grades had Performance IQ scores that were significantly greater than Verbal IQ scores.

As the WISC-III scores from the current sample did not differ from the American norms as hypothesized they were compared to the norms reported in the WISC-III Canadian Supplement (Wechsler, 1996). Statistical analysis revealed that the current sample did not differ significantly from the Canadian norms on any of the WISC-III composite or index scores. While not statistically significant, when scored using the

Canadian norms, the Grade 4 students attained scores lower than the mean of 100 on all but one of the composites. The same was true of the Grade 7's. With regards to the WISC-III subtests, the Grade 4 students were found to perform significantly lower than the Canadian norms on the Object Assembly and Comprehension subtests, while the Grade 7 students did not differ significantly on any of the WISC-III subtests. An examination of the means showed that the Grade 4 students scored lower than the mean of 10 on eight of the 13 subtests and the Grade 7 portion of the sample scored below the mean on nine of the subtests.

Overall, it would appear that the sample from the current study fell somewhere in between the Canadian norms and the American norms. The reason for this is not readily apparent; however, light may be shed on this issue through an examination of the sample used in the WISC-III Manual Canadian Supplement (Wechsler, 1996). Canada is a very large country with a very diverse population that differs between provinces and also within provinces. For the purposes of the Canadian study, Canada was divided into three geographic regions and participants were selected based on the proportion of school-aged children residing in each region (Wechsler, 1996). Sixteen percent of the sample came from the East Region consisting of the maritime provinces and Quebec. The West Region consisted of Manitoba, Saskatchewan, Alberta, British Columbia and, the Yukon and the Northwest Territories. Thirty-eight percent of the sample resided in the West Region. The final region, the Central region, consisted entirely of the province of Ontario and comprised 45.4% of the WISC-III Canadian sample (Wechsler, 1996). The WISC-III supplement states that children were chosen from both rural and urban communities; however, an examination of the map of testing sites and the list of

participating school boards shows far more urban than rural communities. Of the 23 testing sites in Ontario, only 4 were not in close proximity to a major metropolitan area (Toronto or Ottawa). The vast majority of the participating communities were situated in southern Ontario (Wechsler, 1996).

Along with language and ethnicity differences, northern and southern Ontario communities differ in other important ways that may directly impact a child's development. The unemployment rate is much higher in Sudbury than it is in Toronto, the major city in southern Ontario (Statistics Canada, 2001). While half of the Toronto labour force works in sectors such as sales, business and management a large portion of the Sudbury labour force works in blue-collar trades and in equipment operation occupations (Statistics Canada, 2001). Average earnings for a full-time worker who worked all year round was $50 516 in Toronto while in Sudbury it was only $43 424 (Statistics Canada, 2001). While the proportions of couple and lone-parent families are approximately equal, in Toronto the median family income for a lone-parent family is $32 920 while in Sudbury it is $26 880 (Statistics Canada, 2001). Smaller southern Ontario communities within from the WISC-III Canada sample also differ from Northern communities. Whitby, Waterloo, and Aurora are examples of smaller southern Ontario communities from the sample. The average earnings for full-time workers in these communities were $53 032, $52 982, and $66 112 respectively (Statistics Canada, 2001), much greater than in the Sudbury community. Also, the unemployment rate in all three communities was lower than in Sudbury. These statistics may suggest that parents raising children in the Sudbury area may not have the money to afford all the resources that their southern Ontario counterparts enjoy.

Parental education levels are related to child development and child intelligence (Bradley & Corwyn, 2002). Of the Sudbury population aged 20-34 only 16.6% had earned a university degree while more than double that, 36.4%, of the Torontonians had earned university degrees (Statistics Canada, 2001).

It has also been shown that cognitive stimulating experiences may positively affect a child's cognitive development (Guo & Harris, 2000). Field trips, a visit to a library or a museum, or attendance at a theatrical performance has been shown to mediate the effects of family income and intellectual development (Guo & Harris, 2000). While Sudbury has some fantastic resources, such as Science North, nothing can compare to the plethora of cultural and education resources, such as the Royal Ontario Museum, the Art Gallery of Ontario, Ontario Place and, the Metro Toronto Zoo, available to communities within a short drive of Toronto.

Overall, while the sample for the WISC-III Canadian study may have been carefully chosen to represent the Canadian population as a whole, Canada's population is very diverse and even regions with a single province may differ on a number of characteristics. A sizeable portion of the Canadian standardization sample came from communities in southern Ontario and the characteristics of these communities may not be representative of communities in other parts of the province, such as Northern Ontario. The discrepancy between the two populations may be in part responsible for the differences found in the WISC-III scores.

As the performance of the current sample did not differ significantly from either the American or Canadian norms, but fell in between the two, it may be advised that in a

population with characteristics similar to those found in the current sample, either the American or Canadian norms would be appropriate.

WIAT-II

The five composite scores yielded by the WIAT-II were computed for the current sample and compared to the means reported in the manual. It was hypothesized that the results of the current study would resemble those found by Michalko and Saklofske (1996). That is, it was expected that the performance of the Canadian children would equal or be higher than their American counterparts on all components of the WIAT except the Mathematics based composites and subtest scores. The Grade 4 students did not differ from the mean scores reported in the WIAT-II manual on any of the composites. However, the mean Oral Language score was higher than the manual mean and the Written Language scores was much lower than the norm. The other mean composite scores were very close to the means reported in the WIAT-II manual. While not significantly different from the means reported in the manual, the Grade 7 students performed lower than the manual mean on all but one of the composites. The mean Oral Language Composite score was higher than the mean reported in the manual. Also, for both grades, on all but one of the composite scores, the standard deviations from the current sample were much smaller than the standard deviations from the test manual, suggesting less variability in the composite scores.

The Grade 4 students scored significantly lower than the manual mean on the Written Expression subtest. While not statistically significant the Grade 4's did score higher than the mean reported in the manual on the Math Reasoning, Listening

Comprehension, and Oral Expression subtests. The mean scores on the remaining subtests were very close to the mean scores reported in the WIAT-II manual. The Grade 7 portion of the sample scored significantly lower on the Numerical Operations subtest. While not statistically significant, the Grade 7 students had a mean score higher than the mean reported in the WIAT-II manual on the Reading Comprehension and Oral Expression subtests. The Grade 7's also scored much lower, although not statistically different than the mean manual, on the Word Reading and Written Expression subtests. Once again the standard deviations for both grades were smaller than expected for most of the subtest scores.

With regard to the WIAT-II mean scores, the results of the current study were not exactly as hypothesized. While it was thought that the students in the current sample would score lower than the mean reported in the test manual on the Mathematics based composites and subtests this was not the case for the Grade 4 students. While the Grade 4 mean Mathematics composite score and the mean Numerical Operations subtest score were very close to the means reported in the manual, the Grade 4's did very well on the Math Reasoning subtest. However, the prediction of lower Mathematics scores did appear in the results of the Grade 7 students. The Numerical Operations subtest proved to be the weakness of the participants in the seventh grade.

The lower than expected WIAT-II scores may be related very closely to some findings made in the examination of the WISC-III data. As stated earlier, many students from both grades were found to have PIQ scores that were significantly higher than their Verbal IQ scores. As school performance is based primarily on verbal skills, this many help to explain the low WIAT-II scores in the current sample.

In 1997 the Ontario Ministry of Education introduced a new curriculum for elementary school students. The new curriculum was described as "rigorous and challenging" and "significantly more demanding then previous curricula" (Ministry of Education, 1997). When compared to the curriculum that it replaced, the new curriculum introduces many skills in earlier grades. The Grade 7 students started in the elementary school system with the older, less stringent curriculum. Perhaps when the new curriculum was introduced the Grade 7 students were expected to perform at a higher level without having the foundation of skills necessary to understand the new, more difficult mathematics.

Also, while The Ontario Curriculum, Grades 1-8: Mathematics (Ontario Ministry of Education, 1997) mentions that fundamental math skills be mastered using "paper-and-pencil skills" it is also noted in the Grade 7 Overall Expectations that a calculator may be used to "solve number questions that are beyond the proficiency expectations for operations using pencil and paper" (Ministry of Education, 1997, p. 14). Elsewhere in the curriculum document long division, operations with long lists of large numbers, and the calculation of square root are cited as examples of operations that students should be permitted to solve with the aid of a computer or calculator. While the WIAT-II allowed students to have scrap paper and a pencil for the Numerical Operations and Math Reasoning, aids such as calculators are not allowed. Perhaps the Grade 7 students have developed a reliance on calculators and cannot perform complex math problems by hand.

Both Grade 4 students and Grade 7 students scored much lower than expected on the Written Expression subtest. This particular subtest was administered towards the end of the WIAT-II. It was the experience of the researchers that the children were often

fatigued and growing bored with the test by this point. Even when offered a break, many of the participants were hesitant about completing the Written Expression exercises and some refused to complete parts of the subtest all together. All students who completed the WIAT-II during the standardization of the test received the subtests in the same order, therefore the placement of the subtest cannot account for the low scores of the current sample. However, this is an issue that should be investigated by the test's developers.

An examination of the curriculum currently taught in Ontario Elementary schools may also offer clues regarding the low Written Expression scores. The Ontario Curriculum: Language, Grades 1-8 (Ministry of Education, 1997) stresses that writing skills should be taught within the context of interesting, creative activities that are meaningful to the students. The curriculum document states "writing that is clear, correct, and precise is only part of our goal for students. We also want to give them the best possible opportunities for producing writing that is interesting and original and that reflects their capacity for independent critical thought" (Ministry of Education, 1997, p.8). Perhaps basic skills are being lost in an attempt to offer stimulating and engaging lessons. Topics such as sentence structure, punctuation, and grammar may not be very exciting but are essential for clear and concise written communication. While the curriculum seems to emphasize the learning of writing skills through creative writing projects, perhaps a solid foundation of basic skills is needed before innovative projects can be completed effectively.

WISC-III-WIAT-II Correlations

When the correlations between the WISC-III IQ scores and the WIAT-II composites were compared to the correlations reported in the WIAT-II manual, none of them were found to differ significantly. The correlations between the WISC-III IQ scores and the WIAT-II subtest scores were computed and very few were found to differ significantly from the correlations reported in the manual. Based on the information found here, separate correlations for Canadian children may not be needed when using the regression-based method to calculate discrepancies for the purpose of learning disability diagnosis. As very few of the Canadian correlations differed from the correlations reported in the WIAT-II manual, it would seem as though the relationship between the tests was not different in the Canadian sample.

Limitations

With funding for education being continually cut, many concerned parents of children with learning difficulties face long waits to have their children tested by the school board or high costs of assessment by a psychologist with a private practice. The consent letters for the study were left with the principal or resource teacher. Recognizing the value of the tests being administered, it is possible that some teachers and principals made an extra effort to ensure that certain troubled students returned their signed consent letters. In one instance it was discovered that some of the consent letters returned actually belonged to children in grades other than 4 and 7 even though the requirements of the study were explained to the principal. When questioned about how the students

received the forms the principal explained that those particular students were on very long waiting lists for assessments and she thought she might be able to sneak them in. For that reason the sample may have more than a representative number of lower performing children.

The test scores may also have been a little lower than expected due to inconsistent test settings in the various schools. As many of the schools did not have room to spare, the researchers had to take whatever space was offered and the testing conditions varied from school to school. Testing took place in vacant offices and classrooms and also in a school's kitchen, basement, and a storage room. Testing took place during the winter months and sometimes the more unconventional sites were chilly.

Overall, the WIAT-II scores were lower than predicted. This may be in part due to sampling bias. As mentioned in the Method Section, the data for this study was collected with a co-researcher. The second researcher was interested in the relationship between parental education and WISC-III and WIAT-II scores. It was expected that participants whose parents had the least amount of education would be hardest to find. Schools were chosen based on the likelihood of finding participants whose parents fell in the lowest level of education group. A significant portion of the sample, therefore, came from schools in disadvantaged neighbourhoods. One of the principals referred to the school as an "inner city school".

The situation of the schools within disadvantaged neighbourhoods may have affected the achievement scores. Ainsworth (2002) found that the characteristics of the neighbourhood in which a student resides serve as strong predictors of educational achievement. Using data from the national Education Longitudinal Study in the United

States, Ainsworth (2002) found that reading and mathematics test scores were strongly predicted by the prevalence of high-status residents in the students' neighbourhood. Similar results were found in Canada (Kohen, Brooks-Gunn, Leventhal, & Hertzman, 2002). Utilizing a combination of data from the Canadian census and the National Longitudinal Survey of Children and Youth, Kohen and associates (2002) found that even after controlling for family-level characteristics, such as household income, maternal education, and single female headship, students' competencies and neighbourhood characteristics were strongly related. It was found that neighbourhood affluence was associated with higher verbal ability scores in children (Kohen et al. 2002).

When the scores from the current study were analysed with regard to parental education levels the findings were not exactly as expected (Mullins, 2003). The participants were divided into four parental education levels, no high school diploma, high school diploma, some university or college, and a university degree. Only the WISC-III scores of students in the extreme groups, student's whose parents did not complete high school and student's whose parents had university degrees, differed significantly. When the WIAT-II composite and subtest scores were considered parental education level was found to have no effect on the scores (Mullins, 2003). This may be because parental education level is a less than perfect measure of socio-economic status. While some of the parents had high levels of education their children were still attending schools in disadvantaged neighbourhoods. Presumably, if a high level of education automatically translated into a better job these parents would be able to afford housing in a nicer neighbourhood, and, possibly more resources such as books and computers to aid the development of their children.

Overall Conclusions

Because of the small sample size and very small geographic area from which the sample was drawn, the results of this study cannot be generalized to the Canadian population. However, the study is a starting point for further research. It would be interesting to expand the sample to include schools from the entire Greater Sudbury Area. If the WISC scores remained lower than the scores reported in WISC-III Manual Canadian Supplement (The Psychological Corporation, 1996) further research would be warranted to explore the reasons for the lower scores of Northern Ontario children. Similarly, a larger more representative sample would be useful in the exploration of possible neighbourhood effects. Also, this study sheds some light on the importance of appropriate reference groups when choosing norms in which to compare a child's test score. While it is certainly not possible to create test norms for every geographic region of the country, clinicians should be aware of the possible differences between the populations in which they are working and the population on which the test was normed. Overall, the results of this study raise some very interesting questions that should be pursued through further research projects.

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Appendix A

Consent Letter and Questionnaire

Dear Parent(s):

We are graduate students in the Masters of Arts program in Human Development at Laurentian University supervised by Dr. Elizabeth Levin, Chair of the Psychology Department. We are required to complete a thesis project. Our study will explore the relationship between ability and achievement in school age children. The study is part of a larger project aimed at collecting Canadian data for a newly published achievement test, the Wechsler Individual Achievement Test - Second Edition (WIAT-II). Our research will explore the relationship between this new measure of achievement and a measure of ability, the Wechsler Intelligence Scale for Children - Third Edition (WISC-III). In the future the data we collect will be helpful in the identification of children with learning problems and will allow Canadian children to be compared to other Canadian children.

The project will explore how the relationships between the WIAT-II and the WISC-III differ across parental education levels. Also, it will compare the data we collect to existing American data to determine if Canadian and American children perform differently on these tests.

Each participant will complete the WIAT-II and the WISC-III. The questions on these tests are game-like activities and most children find them fun and entertaining. Each test will take between one and two hours. Some children will complete them in less time. The tests will be given on separate days.

The final decision regarding the participation of each child must be made by the child and the parent. You and your child are under no obligation to participate in this study and you have the right to withdraw at any time without consequences. The results of this study will not affect your child's grades. Personal information gathered as part of this study will remain private and confidential. Individual children's names will not be mentioned in the reporting of the results. This project has been approved by the Rainbow District School Board and the Ethics Committee at Laurentian University.

If you and your child wish to participate please complete the enclosed consent form and return it to the school AS SOON AS POSSIBLE. If you have any questions please contact either Peggy at 669-1269, Angela at 523-1558, or Dr. Levin at 675-1151 extension 4242.

A copy of the compete study results will be provided to the school upon completion of the study. A summary sheet will also be made available to the parents through the school office.

Sincerely,

Angela Mariga, BSc.(Hons.) Peggy Mullins, BSc.(Hons.) Elizabeth Levin, PhD.

I have consented for my child to participate in this study and I have received a copy of the consent form.

Parent/Guardian _____ _____
Name Signature

Child _____ _____
Name Signature

If you and your child give consent to participate in the study, please complete the following questionnaire.

Child's Date of Birth: ____/____/____ **Age**:____ _____ Boy or ____Girl
Month Day Year

Does your child speak and understand English? ____ Yes ____ No

Is English the first language your child learned? ____ Yes ____ No

Where was your child born? ____ Canada
____ Other Please Specify:_____

What is your child's ethnicity/family background?: (Please check one)

____ British (e.g., English, Scottish, Irish)
____ French
____ European (e.g., Italian, Ukrainian, Spanish)
____ Other Single (e.g., Chinese, Aboriginal, Vietnamese, Jewish, Filipino)
____ Multiple (i.e., any combination of single origin groups)

Are you a member of an Indian Band/First nation? ____ Yes ____ No

If yes, please specify:
____ North American Indian
____ Metis
____ Inuit

Parents' or Guardians' Education: (Check one in each column)

	Years Completed	Mother or Female Guardian	Father or Male Guardian
1.	Grades 9 – 12	_____	_____
2.	High School Diploma	_____	_____
3.	Some University/Technical	_____	_____
4.	University Degree	_____	_____

Parents' or Guardians' Employment:

	Mother or Female Guardian	Father or Male Guardian
Are you currently employed?	____ Yes ____ No	____ Yes ____No
If yes, specify	____ Full-time ____ Part-time	____ Full-time ____ Part-time
Job title (if employed)	_____	_____

Is your child receiving services or been previously diagnosed (at school or by a medical doctor) with any of the following? (Please check all that apply):

____ Hearing Loss (not including hearing aids)
____ Visual Impairment (not including glasses)
____ Mental Retardation/Developmental Disability
____ Psychological Condition (e.g., behavioural difficulties)
____ Placement in Special Education
____ Head Injury/Neurological problems
____ Attention Deficit/Hyperactivity Disorder (ADHD or ADD)
____ Cerebral Palsy
____ Learning Disability (LD) in:
    ____ Reading
    ____ Math
    ____ Writing

Thank-you for your co-operation!