Cognitive functioning in psychosocial subtypes of children with learning disabilities and comorbid psychiatric diagnoses.

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Cognitive Functioning in Psychosocial Subtypes of Children with Learning Disabilities and Comorbid Psychiatric Diagnoses

by

Timothy C. Johnston

A Thesis
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in Partial Fulfillment of the Requirements for the Degree of Master of Arts at the University of Windsor

Windsor, Ontario, Canada

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Abstract

The present study examined the relationship between psychosocial and cognitive functioning in a sample of 103 children ages 5 to 16 (74 males, 29 females) with known or suspected learning disorders and psychiatric disturbances. A cluster analysis of participants’ Personality Inventory for Children, Second Edition (Lachar & Gruber, 2001) adjustment scale scores revealed three psychosocial subtypes. Inter- and intra-subtype cognitive functioning patterns were identified through examination of participants’ Wechsler Intelligence Scale for Children, Third Edition (Wechsler, 1991) Verbal IQ-Performance IQ (VIQ-PIQ) discrepancy and index scores. Most notably, children categorized as psychosocially well-adjusted achieved higher scores than their psychosocially-impaired counterparts on the Processing Speed Index. Also, children categorized as suffering from internalized psychopathology demonstrated statistically non-significant VIQ>PIQ discrepancies and Verbal Comprehension Index score elevations. Overall, findings suggest the existence of a complex and multi-dimensional relationship between psychosocial and cognitive functioning in children with learning disabilities.
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Chapter I

Introduction

Overview of the Context and Goals of the Current Study

Today, more than half of the children requiring special needs services in America are designated as having a Learning Disability (LD; Torgesen, 1998). Clearly, research into the nature of LDs is important in the development of interventions to ensure that affected children receive adequate educational experiences. A plethora of research has been conducted on the cognitive and academic strengths and weaknesses of children with LD. However, until recently, little attention has been paid to the social, emotional, and behavioural (i.e., psychosocial) issues of affected children.

Over the last two decades, there has been a growing focus on the psychosocial development of children with LD (Bender & Wall, 1994; Cohen, 1986; Gadeyne, Ghesquière, & Onghena, 2004; Greenham, 1999; Pearl & Bay, 1999; Pickar, 1986; Porter & Rourke, 1985; Rourke, 1989; Rourke and Fuerst, 1991; Spafford & Grosser, 1993; Wong & Donahue, 2002). However, findings regarding the social, emotional and behavioural functioning of children with LD have been inconsistent and, at best, equivocal. While some researchers have found little evidence of psychosocial dysfunction (Connolly, 1969; Pickar & Tori, 1986; Silverman & Zigmond, 1983), others have found evidence of mild (Cohen, 1986; Gadeyne, Ghesquière, & Onghena, 2004; Greenham, 1999; Rourke & Fuerst, 1991) or major impairments (Gregory, Shanahan, & Walberg, 1986; Huntington & Bender, 1993; Rourke & Fuerst, 1991; Svetaz, Ireland, & Blum, 2000). These inconsistent findings could be due to many factors, including differences between studies in the selection of participants, measures used, and the
inherent heterogeneity that exists within the population of children with LD. In order to improve on the latter factor, population heterogeneity, studies have used subtyping techniques to uncover within-group differences in the psychosocial functioning of children with LD.

Rourke and his colleagues (Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997) have identified fairly stable psychosocial subtypes of children with LD, and have associated these subtypes with different cognitive assets and deficits (Fuerst, Fisk, and Rourke, 1990). The objective of the present study is to update and build on this work into the relationship between cognitive and psychosocial functioning, using more current measures and a broader sample of children with LD. Specifically, the present study seeks to (a) derive psychosocial subtypes of children with LD and (b) identify the specific cognitive strengths and weaknesses associated with these subtypes.

Structure of the Literature Review

The first topic to be discussed in the current study’s literature review is the definitional issues relating to LD. In particular, this section will focus on the absence of social skill deficits and the exclusionary criteria for primary emotional disturbance in many LD definitions. Next, the literature review will examine the existing research on the emotional, social, and behavioural development of children with LD. Methodological problems contributing to the inconsistent and equivocal findings in this research will then be reviewed. Following this review, the discussion will turn to the classification of children with LD. In particular, a statistical classification technique that produces subtypes of children with LD will be introduced. Next, the focus will turn to the use of
this classification technique in developing psychosocial subtypes of children with LD. Several studies attempting to identify psychosocial subtypes of children with LD will then be presented. Following this presentation, the discussion will focus on an important study in which psychosocial subtypes were found to differ on a summary measure of cognitive functioning. The limitations of this research will then be mentioned along with proposed methodological improvements to be implemented in the present study. Finally, the primary objectives and significance of the present study will be discussed, and the pertinent research questions and hypotheses presented.

LD Definitional Issues

The term “Learning Disabilities” was coined by Samuel Kirk in 1963 when he spoke at a conference entitled, “Exploration into Problems of the Perceptually Handicapped Child” (Torgesen, 1998). Prior to this conference, children who would now be designated as having an LD were instead classified under a diverse collection of terms, including brain injured, minimal brain dysfunction, Strauss Syndrome, dyslexia, and perceptual handicap (French, Ellsworth, & Amoruso, 1995; Morrison & Siegel, 1991). Kirk’s contribution was to amalgamate all these descriptors into the single term “Learning Disabilities”, in order to give affected children a more substantial political voice. For the first time, all children with LDs were united. Following Kirk’s speech, the conference attendees voted to establish the Association for Children with Learning Disabilities (ACLD).

Although the term “Learning Disability” has been used consistently since its debut in 1963, the definition of LD has changed considerably as research has advanced. In addition, with the creation of many organizations dedicated to advocating the needs of
children with LD, a number of definitions of the condition are presently available. Definitional inconsistencies are perhaps reflective of the fact that LD is not a single disorder; indeed, several definitions are most likely needed to adequately cover all affected children (Lerner, 2000).

The Learning Disability Association of Ontario (LDAO) defines LDs as:

A variety of disorders that affect the acquisition, retention, understanding, organization or use of verbal and/or non-verbal information. These disorders result from impairments in one or more psychological processes related to learning, in combination with otherwise average abilities essential for thinking and reasoning. Learning disabilities are specific not global impairments and as such are distinct from intellectual disabilities. (2005)

It is evident that this definition takes into account the numerous forms of LD. However, many other definitions contain stringent exclusionary criteria, such as the presence of a primary emotional disturbance (Fuerst, Fisk, & Rourke, 1989). In addition, definitions often fail to include the presence of social skill deficits (Torgesen, 1998). Unfortunately, the exclusion of primary emotional disturbance and the failure to include social skill deficits in many definitions of LD may in fact serve to divert public attention away from potentially co-occurring socio-emotional difficulties faced by children with LD. In the present study, the term LD will be used to describe children with learning problems and potential psychosocial difficulties.

Review of the Literature on the Psychosocial Functioning of Children with LD

In addition to cognitive and academic deficits, researchers have also found that children with LD frequently display various forms and severities of psychosocial
difficulties. Rourke and Fuerst (1996) define psychosocial processes as “those processes that are psychological in nature and that transpire primarily within the child, and those interpersonal processes that, although transpiring within the child, have their roots in both the child and the child’s social environment” (p. 277). Rourke’s definition suggests that psychosocial functioning can be construed in terms of the child’s emotional, social, and behavioural development.

Emotional Development of Children with LD

Self-concept and self-esteem. Self-concept and self-esteem are two of the most researched areas of psychosocial functioning in children with LD. Although many researchers use these two terms interchangeably, others insist that they represent slightly different constructs (Bryan, 1998). Cosden, Brown and Elliott (2002) define self-concept as “domain-specific self-perceptions” and self-esteem as an “overall sense of self-worth” (p. 34). Unfortunately, due to the frequent overlap of these two constructs in the literature, it is difficult to determine their differential relationships with LD. As a result, these two constructs will hereafter be considered jointly as “self-concept”.

Early research into the general self-concepts of children with LD focused on Erikson’s (1968) theory of social development. Erikson believed that, as the child grows older, he or she passes through discrete stages of social functioning. Successful resolution of each stage fosters the potential for satisfactory outcomes in subsequent stages. However, if the conflicts experienced within a stage are not adequately resolved, the child will have difficulty in navigating subsequent stages. Self-concept research focuses on Erikson’s fourth stage of social development, industry versus inferiority (Cook, 1979; Crump & Spicegood, 1982; Meyer, 1983; Pickar & Tori, 1986). In this
stage, the child attempts to accomplish tasks on his or her own. The competent and independent completion of such tasks encourages the healthy development of the child’s self-concept and self-esteem. However, if the child is persistently unable to accomplish his or her goals, his or her self-concept and self-esteem could suffer. In the case of the child with LD, the persistent inability to accomplish school-related tasks could result in the development of a sense of inferiority, accompanied by a poor self-concept.

There are three domains of self-concept that are frequently discussed in the literature: general, academic, and social. Research examining the general self-concept of children with LD has yielded mixed results; some researchers have identified affected children as having poor general self-concepts in comparison to their normally-achieving peers (Bender & Wall, 1994; Pickar, 1986; Spafford & Grosser, 1993), whereas other researchers have been unable to substantiate these findings (Gadeyne, Ghesquiere, & Onghena, 2004; Pearl & Bay, 1999; Vaughn, Elbaum, & Boardman, 2001). In a study by Durrant, Cunningham and Voelker (1990), it was found that only a behaviourally disordered subset of children with LD exhibited negative general self-concept in relation to their normal classmates.

Researchers have suggested that, due to the multidimensional nature of self-concept, it is necessary to look at specific domains within the construct in order to determine whether children with LD differ from their normally-achieving peers. Academic self-concept has consistently been shown to be lower in children with LD than in their normally-achieving peers (Greenham, 1999; Keogh, 1990; Pearl & Bay, 1999; Vaughn, Elbaum, & Boardman, 2001; Cosden, Brown, & Elliott, 2002). This finding seems logical in that children with LD experience repeated failure on school assignments,
tests, and exams, but not necessarily on non-academic tasks. Over time, these repeated failures engender in the child with LD a sense of inadequacy and low self-concept, although not necessarily in non-academic domains. In one study, researchers found that competence in a domain outside of the academic realm acted as a protective factor against the development of a poor general self-concept (Cosden, Brown, & Elliott, 2002). In addition, studies have also described children with LD as having poorer social self-concepts than children without LD. However, these findings are not uniform (Pearl & Bay, 1999), and, overall, children with LD generally appear to have average social self-concepts (Vaughn, Elbaum, & Boardman, 2001).

Briefly, certain researchers believe that self-concept is not a significant discriminator between LD and low achievement in children (Gadeyne, Ghesquiere, & Onghena, 2004). Gadeyne et al. found that children with LD could not be discriminated from their non-LD low-achieving peers on measures of self-concept; both groups displayed negative self-concepts. This finding suggests that negative self-concept may not be associated with LD, but rather with low achievement in general.

Bryan (1998) identified several potential explanations for the inconsistent research findings regarding self-concept in children with LD. These explanations include age differences in the children sampled, varying levels of academic achievement amongst children surveyed, biased proportions of SES and ethnic designations, and a diffuse selection of measures utilized.

Attributions and motivation. Attributions involve how the individual explains the outcomes of his or her actions (Bryan, 1998). An individual’s locus of control describes such attributions in terms of three dimensions: internal/external, stable/unstable, and
Psychosocial Subtypes of LD

global/specific. The first dimension, internal/external, describes whether the individual attributes an outcome to factors internal to the self (e.g., ability) or external to the self (e.g., luck or chance). The second dimension, stable/unstable, describes whether the individual’s attributions are either consistent or intermittent over time. Finally, the third dimension, global/specific, indicates whether the individual’s attributions are specific to certain situations or are applied across all situations.

Research into the locus of control of children with LD has yielded mixed results (Greenham, 1999). The most consistent findings involve the internal/external attribution dimension. In general, children with LD tend to attribute their successes to external factors, such as luck and the quality of the teacher’s instruction (French, Ellsworth, & Amoruso, 1995; Greenham, 1999; Pearl & Bay, 1999). Whenever children with LD succeed in an academic task, they do not believe that it is the result of their ability. However, the research literature is less clear on the attributions that children with LD make when they fail on a task. While some research has shown that affected children primarily attribute most of their failures to external factors (Bender & Wall, 1994; Manganello, 1992; Spafford & Grosser, 1993), other research suggests that children with LD attribute their failures to internal factors (Greenham, 1999; Pearl & Bay, 1999; Bryan, 1998). In the latter case, the child with LD sees his or her failure as due to his or her lack of ability or “smarts”. The research literature on the locus of control of children with LD is further clouded by the possibility of gender differences. Specifically, it has been demonstrated that girls with LD, to a greater extent than boys with LD, attribute their successes and failures to external factors (Ryckman & Peckham, 1986; Wehmeyer,
1993). It is therefore possible that gender moderates any relationship between locus of control and LD.

When children with LD consistently blame themselves for their academic failures, they may begin to lose the motivation, or drive, to succeed. Through repeated failure, affected children come to believe that, no matter how hard they try, they will be unable to succeed. This condition is often referred to as learned helplessness. Research has demonstrated that children with LD do indeed suffer from lower levels of motivation in relation to their normally achieving peers (Bender & Wall, 1994), and a higher incidence of learned helplessness has been reported (Cohen, 1986; French, Ellsworth, & Amoruso, 1995). However, this lack of motivation and heightened learned helplessness appear to apply primarily to the academic realm, where children with LD have the most difficulty. Pearl and Bay (1999) found that children with LD display no significant differences from their non-LD peers in social motivation, or the desire to involve themselves in social interactions.

Anxiety, depression, and suicide. Svetaz, Ireland, and Blum (2000) found that 25 percent of boys and 33 percent of girls with LD also suffer from severe emotional distress. Intuitively, it would seem that the academic troubles of children with LD would cause them to become anxious; they might worry about what other children in the class think of their ability, or about whether they will be able to succeed in life. Limited research has shown that children with LD do indeed display elevated levels of anxiety relative to their non-LD peers (Bender & Wall, 1994; Greenham, 1999; Pearl & Bay, 1999). However, this anxiety, although inflated, is usually not present at clinically
significant levels (Greenham, 1999). Apart from the results of a few studies, little is known as to the relationship between Anxiety and LD (Nieves, 1991; Bryan, 1998).

It also intuitively fits that children with LD who consistently fail in the classroom would develop depressive symptoms as a result of their feelings of inadequacy, inferiority, and lack of competence. As was the case with anxiety, limited research has shown that children with LD do display elevated levels of depression, relative to their normally-achieving peers (Greenham, 1999; Pearl & Bay, 1999; Wiener, 2002). The depressive symptoms, although inflated, are nevertheless usually not present at clinically significant levels (Greenham, 1999). In addition, it is interesting to note that when studies with poor designs are removed from consideration, children with LD no longer appear to suffer from higher levels of depression than do their non-LD peers (Greenham, 1999). Finally, disturbing findings have emerged suggesting that children with LD are at an increased risk for attempting suicide (Huntington & Bender, 1993; Svetaz, Ireland, & Blum, 2000).

In summary, research into the emotional development of children with LD has suggested that children with LD have lower levels of academic self-concept than do their non-LD peers. However, research into the general and social self-concepts of children with LD has produced mixed findings. In addition, research suggests that children with LD frequently attribute their successes to external factors, such as luck. Findings are mixed in terms of failure attributions amongst children with LD. Also, there is limited evidence suggesting that children with LD, as a group, suffer from more severe, albeit clinically insignificant, levels of anxiety and depression than their normally-achieving counterparts. Finally, there also exists limited evidence that children with LD are at an
increased risk for attempting suicide. In general, it appears that, as a group, children with 
LD are at a slightly greater risk for the development of emotional problems; however, the 
research literature is by no means consistent. Importantly, studies into the potential 
psychosocial dysfunction present in children with LD should not be limited to the 
emotional realm; the social functioning of children with LD is also worthy of 
investigation.

Social Development of Children with LD

Social competence. Warnes, Sheridan, Geske and Warnes (2005) define social 
competence as “the quality of an individual’s social interactions as perceived by those 
around him or her” (p.173). Social competence is a multidimensional construct, and, as 
such, is extremely difficult to operationalize (Rourke, 1989). Researchers have attempted 
to measure the construct using an assortment of instruments, including parent 
observations, teacher ratings, peer ratings, classroom observations, and behaviour 
checklists (Rourke, 1989). The inconsistent findings in the research literature regarding 
the association between social competence and LD are not surprising, given this diverse 
assortment of measurement instruments.

Once again, Erikson’s (1968) theory of social development can be drawn upon to 
understand how children with LD may be less socially competent than their non-LD 
peers. Erikson’s fourth stage, Industry versus Inferiority, is a crucial stage in that the 
child attempts to develop a sense of competence in his or her abilities. The repeated 
academic failures of a child with LD may cause him to begin to doubt his competence. It 
is possible that this low self-competence might extend into the social realm, if the same
underlying deficits in the child with LD that prevent him from achieving in school also inhibit him from engaging in effective social interactions with his peers.

Researchers have attempted to frame the social competence difficulties of children with LD using Dodge and colleague's (Coie & Dodge, 1983; Dodge, 1986; Dodge & Frame, 1982) information processing model. The five stages of Dodge's model are encoding cues, mental representation and interpretation, response search, response decision, and enactment. It is suggested that children with LD have the greatest deficits in the encoding social cues and response decision stages (Tur-Kaspa, 2002). In the encoding social cues stage of Dodge's information processing model, the individual perceives social cues in the environment. Research has shown that children with LD have considerable difficulty identifying nonverbal cues (e.g., facial expressions and posture), and have more difficulty interpreting emotions than their non-LD peers (Bryan, 1998; Tur-Kaspa, 2002). Interestingly, these deficits distinguish children with LD from their low achieving but non-LD counterparts (Bryan, 1998).

In the second stage of the social information processing model, mental representation and interpretation, the individual attempts to make sense of the social cues that he or she has just encoded. Researchers have identified an assortment of deficits in children with LD associated with this stage of Dodge's model. First, certain researchers have suggested that some children with LD have difficulties when engaging in role-playing and perspective-taking situations, relative to their non-LD peers (Pearl & Bay, 1999; Bryan, 1998). However, other role-playing studies have failed to confirm these findings, and, overall, results are equivocal (Pullis & Smith, 1981; Tur-Kaspa, 2002). Second, it has been suggested that children with LD have difficulty interpreting
moral situations. Bryan (1998) reported that children with LD between the ages of 14.3 and 18.5 years were equivalent in moral development to normally-achieving children between the ages of 10 and 14 years. In addition, the same researcher found that children with LD displayed a greater willingness to conform to peer pressure in an antisocial scenario and had less of a regard for social norms than did their non-LD peers.

Children with LD have also been found to perform poorly in the third stage of the social information processing model, \textit{response search}. In this stage, the individual searches for the most appropriate and optimal response for the social situation. In general, children with LD seem to exhibit difficulties on many social problem solving measures (Tur-Kaspa, 2002), particularly those involving hypothetical social situations (Bryan, 1998). Children with LD appear to struggle with both the quantity and quality of their strategies to resolve these hypothetical social situations (Bryan, 1998).

With regard to the fourth stage of the social information processing model, \textit{response decision}, research has shown that children with LD exhibit difficulties in choosing the most optimal responses to social situations (Bryan, 1998). Thus, where a social situation might require a nonverbal skill, a child with LD might instead decide to use a verbal skill. Certain researchers have speculated that this inappropriate social response decision might not result from a lack of social knowledge on the part of the child with LD, but instead from his or her inability to use the social knowledge spontaneously to fit the given situation (French, Ellsworth, & Amoruso, 1995; Greenham, 1999).

In the fifth and final stage of the social information processing model, \textit{enactment}, the individual actually engages in the social behaviour. Research has shown that children
with LD are, in general, less skilled in communicative competence than are their non-LD peers (Bryan, 1998). They have been shown to smile less and maintain less eye contact with others than is socially appropriate (Spafford & Grosser, 1993). In addition, children with LD appear to experience difficulties in situations in which they are required to deliver bad news to another person, and they are also less persuasive than their non-LD peers (Bryan, 1998). Finally, children with LD tend to agree more, disagree less, and argue less than their normally achieving counterparts (Bryan, 1998). In general, it appears that children with LD have difficulty regulating their social behaviours.

Social status. Rourke and Fuerst (1991) define social status as the extent to which the individual is accepted, rejected, or ignored by others. Overall, research has found that children with LD are less accepted, more rejected, and more neglected by their peers than are their non-LD counterparts (Gallico, Burns, & Grob, 1988; Greenham, 1999; Vaughn, Elbaum, & Boardman, 2001; Bryan, 1998; Tur-Kaspa, 2002). However, an examination of the pertinent literature also indicates that not all children with LD exhibit problems with peer status. In fact, approximately 40 to 70 percent of children with LD demonstrate average acceptance ratings by their peers (Greenham, 1999), and some children with LD are even more popular than their non-LD counterparts (Gallico, Burns, & Grob, 1988). The issue of peer status is further clouded by studies indicating that low peer status might be more attributable to low-achievement than to LD; that is, non-LD low-achieving children are sometimes indistinguishable from children with LD on peer status measures (Pearl & Bay, 1999).

Another dimension of peer status that has received some attention in the literature is the quality and quantity of the interactions the child with LD has with his or her non-
LD peers. Interestingly, Pearl and Bay (1999) suggest that, despite often having few friends, children with LD spend about the same amount of time interacting with peers as do their non-LD classmates. These researchers indicate that it is the quality, not the quantity, of the friendship interactions that differentiates children with LD from their non-LD peers. Within their friendship circles, and relative to those of purely non-LD children, children with LD (a) feel that their friends do not care as deeply for them, (b) spend less of their time with their friends engaging in mutually satisfactory activities, and (c) maintain more unresolved conflicts with their friends (Margalit & Al-Yagon, 2002).

Research has also shown that children with LD are more frequently ignored and rejected by their teachers (Rourke, 1989; Rourke & Fuerst, 1991; Pearl & Bay, 1999). The tendency for teachers to ignore and reject might result from the child with LD’s frequent classroom interruptions. Over time, teachers might not allow the child with LD to initiate interactions (such as clarifying instructions or stating opinions) because they view these occurrences as “interruptions” rather than as appropriate classroom behaviour. However, although teachers often reportedly ignore and reject children with LD, the frequency of student-teacher interactions are nevertheless inflated for children with LD (Rourke & Fuerst, 1991; Pearl & Bay, 1999). These frequent interactions are most likely negative and involuntary, such as the case of a teacher persistently instructing a child to “be quiet” or to “stop acting up”. In addition, there is evidence that parents of children with LD tend to punish and degrade their children to a greater extent than do the parents of non-LD children (Rourke, 1989).

In attempting to determine why exactly children with LD are less accepted and more rejected and neglected than their non-LD peers, it is necessary to look at the nature
of their interactions with others. Research has shown that children with LD tend to be more competitive and less considerate than their normally achieving peers (Gallico, Burns, & Grob, 1988). In addition, children with LD are characterized as being more egocentric in the statements that they make (Gallico, Burns, & Grob, 1988) and, in general, less pleasant or desirable (Rourke, 1989). These tendencies could lead others - including peers, teachers, and parents - to frequently dissociate themselves from children with LD.

In summary, research into the social development of children with LD suggests that they may have lower levels of social competence and social status than their normally-achieving peers. However, findings regarding the social competence of children with LD are largely inconsistent, perhaps due to the diversity of the measures used across studies. In terms of social status, children with LD often appear to be less accepted, more rejected, and more neglected by peers, teachers, and parents than their non-LD counterparts. In considering this evidence, it is important to note that (a) not all children experience low social status and (b) some studies have found that social status does not adequately differentiate between LD and low-achieving children. While social development is an important component of psychosocial functioning, it cannot be considered apart from behavioural development. Indeed, over time, negative social interactions may influence the behaviour of children with LD, or behavioural dysfunction may decrease the incidence of positive social interactions.

Behavioural Development of Children with LD

Delinquency. The research literature is mixed with regard to the relationship between delinquency and children with LD. While no study has found a direct causal
link between delinquency and LD, there is evidence that children with LD are particularly vulnerable to engaging in misconduct and disruptive acts (Bender & Wall, 1994; Pickar, 1986; Rourke & Fuerst, 1991; Spafford & Grosser, 1993; Svetaz, Ireland, & Blum, 2000). Indeed, parents and teachers are more likely to rate the behaviour of children with LD as disruptive, aggressive, delinquent, antisocial, hyperactive, and inattentive (Greenham, 1999). In addition, children with LD are more likely than non-LD children to be involved in social groups characterized as “deviant” rather than “prosocial” (Pearl, 2002). Finally, Sevatz, Ireland, and Blum (2000) found that 26 to 75 percent of juvenile offenders studied had what they described as “learning problems”.

Two theories are pertinent in attempting to explain the possible relationship between LD and delinquency: the school failure hypothesis, and the susceptibility theory. The school failure hypothesis suggests that children with LD experience failure to such an extent at school that they turn to deviant acts as a means of asserting their self-worth to both themselves and others. The susceptibility theory simply states that children with learning difficulties are predisposed to delinquent acts, and that protective factors (such as a warm and supportive family) are needed to prevent these acts. Pearl (2002) suggests another possible explanation for the delinquency that is sometimes found in children with LD: children with LD are more likely than non-LD children to join deviant social groups because of their desire to “fit in” and to be accepted. Once in these deviant social groups, their desire to be accepted might make them more agreeable to engaging in misconduct.

Although many researchers have found that there exists some type of relationship between delinquency and LD, there does exist a subgroup of researchers who have found no such relationship (Gadeyne, Ghesquiere, & Onghena, 2004; Greenham, 1999; Pickar
Rourke and Fuerst (1991) attribute the mixed results regarding the relationship between LD and delinquency to methodological inconsistencies between studies. Regardless, it is important to note that only a small subset of children with LD also engage in delinquent behaviour.

Attention-Deficit Hyperactivity Disorder (ADHD). It is widely believed that many children with LD also carry a comorbid condition of ADHD (French, Ellsworth, & Amoruso, 1995; Rourke & Fuerst, 1991). Research has shown that some children with LD exhibit increased impulsivity (Bender & Wall, 1994) as well as increased distractibility and off-task behaviour (Gadeyne, Ghesquiere, & Onghena, 2004; Rourke & Fuerst, 1991; Pearl & Bay, 1999; Bryan, 1998). These findings are unclear as to whether the reported impulsivity and distractibility are attributable to a comorbid ADHD condition or simply to pure LD. Further research is required to untangle the manifestations of the two disorders. However, this task will likely prove difficult; while ADHD and LD quite likely have differing etiologies, the two disorders seem to manifest similar symptomatology.

In an attempt to further understand the relationship between LD and ADHD, Wiener (2002) conducted a study looking at the risk of psychosocial dysfunction for children with pure LD, and for children with combined LD and ADHD. The results indicated that children with comorbid LD and ADHD were at increased risk for psychosocial dysfunction relative to children with a unitary LD diagnosis. This finding stresses the possible exacerbating effect of a comorbid condition of ADHD on the psychosocial dysfunction of children with LD.
In summary, research into the behavioural development of children with LD has focused on delinquency and comorbid ADHD conditions. Findings are mixed as to the relationship between LD and delinquency. Although no causal link has been found, many researchers suggest that children with LD are more vulnerable to misconduct and disruptive acts than their non-LD peers. However, it is important to note that many studies have failed to find a relationship between delinquency and LD. In addition, research has also focused on the co-occurrence of ADHD and LD in children. As a group, children with LD have been found to exhibit increased impulsivity, distractibility, and off-task behaviour. However, not all children with LD display behavioural dysfunction. Disentangling ADHD and LD might prove to be a difficult task, as the two conditions appear to have similar symptomatologies. Indeed, attempts to disentangle the various facets underlying behavioural (as well as emotional and social) development in children with LD are limited by methodological inconsistency across studies.

**LD Psychosocial Functioning Research: Methodological Issues**

The research on the psychosocial functioning of children with LD is by no means definitive. Rourke and Fuerst (1991) consider the research findings to be often trivial, contradictory, and not replicable. They attribute the equivocal findings to four primary methodological problems with the existing research. First, the mixed results in studies looking into the psychosocial functioning of children with LD might be explained by the variation in LD selection criteria between studies. That is, children classified as LD in one study might not have met the selection criteria for other studies. In addition, in many of the studies on the psychosocial functioning of children with LD, selection criteria are often left unclear or ambiguous (Nieves, 1991; Porter & Rourke, 1985). In summary,
studies with unclear or ambiguous selection criteria have made it difficult to compare studies and consolidate knowledge about the psychosocial functioning of children with LD.

A second limitation of research into the psychosocial functioning of children with LD is that measures of maladjustment vary by study. The multidimensional constructs under investigation (e.g., social competence, self-concept) are difficult to operationalize, and it is likely that many studies look at different dimensions of the same construct. As a result, findings regarding the same construct might be construed as contradictory, when in fact they merely demonstrate construct multidimensionality. In addition, many of the studies in the literature use only a single behavioural, cognitive, or perceptual measure in determining the psychosocial functioning of children with LD (Rourke, 1989). This univariate approach is seriously flawed, in that many psychosocial functioning variables are closely interrelated (Gadeyne, Ghesquiere, & Orghena, 2004). It is likely not possible to truly understand the psychosocial functioning of children with LD unless multiple variables are considered together.

A third consideration in explaining the discrepant findings regarding the psychosocial functioning of children with LD is developmental trajectory. Although many of the findings from the research literature appear contradictory, it could simply be that, as children with LD age, the nature of their psychosocial functioning changes. For instance, younger children with LD may not differ from their non-LD peers on measures of self-concept, whereas older children with LD may differ on these same measures. Unfortunately, longitudinal research on the psychosocial development of children with LD is quite scarce (Fuerst & Rourke, 1991).
The final, and most important, factor to consider when assessing the contradictory findings in the literature is that children with LD likely do not comprise a purely homogenous group. In addition to the heterogeneous cognitive strengths and weaknesses manifested by children with LD, there likely exist within-group variations on dimensions of psychosocial functioning. Unfortunately, most of the research literature does not recognize that children with LD likely comprise a very heterogeneous population in terms of their psychosocial functioning. Many studies utilize a contrasting-groups methodology, for which homogenous groups of children with LD are compared to similarly homogeneous groups of non-LD children (Rourke, 1989). The result of such a methodology is that the within-group differences of children with LD are ignored in order to focus on between-group differences. It is likely, upon examining the inconsistent findings of studies implementing the contrasting-groups approach, that there exist more within-group differences than between-group differences in psychosocial functioning in children with LD. In an attempt to further understand these within-group differences, Rourke and his colleagues (Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997) have focused on the development of psychosocial subtypes of children with LD.

In summary, there are four primary methodological issues that limit the consistency and usefulness of studies examining the psychosocial functioning of children with LD. First, selection criteria often vary between studies, so that different populations of children are included. Second, inconsistent measures of maladjustment are present in the research literature. Third, the research literature frequently fails to take into account developmental factors in psychosocial functioning research. Fourth, and most
importantly, researchers often fail to recognize that children with LD comprise a heterogeneous group. Clearly, a more appropriate methodological classification system is required in order to uncover within-group psychosocial functioning variations.

The Classification of Children with LD

All-or-Nothing Versus Ideographic Classification Systems

There exists great controversy over whether children with LD are best identified with all-or-nothing or ideographic classification systems (Rourke, 1989). In all-or-nothing classification systems, the individual is classified into one of two groups. The fourth edition of the Diagnostic and Statistical Manual of the American Psychiatric Association (DSM-IV) operates primarily as an all-or-nothing classification system. If the client satisfies a certain number of criteria for a disorder, he or she is considered to have the disorder; if the client meets fewer than the specified number of criteria, he or she is considered "normal". Applying the all-or-nothing classification system to the field of LD, children would either be classified into an LD group or a "normal" group; there would be no middle ground. Many of the studies reviewed previously on the psychosocial functioning of children with LD rely primarily on an all-or-nothing classification system to assign participants into one of two groups: "Children with LD" and "Children Without LD". As discussed in the previous section, this type of methodological design, although simplistic and convenient, does not adequately measure the within-group variation in the population of children with LD. In this respect, the use of an all-or-nothing classification system could contribute to the mixed research findings on the psychosocial functioning of children with LD.
Ideographic classification systems are conceptually very different from all-or-nothing classification systems. In ideographic systems, individuals are not classified into groups; rather, each individual is considered to be his or her own unique entity. Proponents of the ideographic system do not believe in diagnosing individuals with disorders. Instead, they stress the importance of considering the idiosyncrasies of each person. In the case of LD, the ideographic system implies that each child with LD displays unique patterns of strengths and weaknesses that must be addressed on an individual basis. However, research has shown that certain children with LD do indeed exhibit similar patterns of strengths and weaknesses (Rourke, 1989), thereby failing to support the ideographic system as a means of classification.

Cluster Analysis as a Method of Classification

A compromise between the all-or-nothing and ideographic classification systems is to classify children with LD into discrete subtypes. The creation of subtypes is accomplished through the development of an alternate taxonomy. Adams (1985) defines a taxonomy as a “systematic distinguishing, ordering, and naming of types within a subject field” (p. 19). Taxonomic research has a long history. For instance, Aristotle attempted to classify the various species of the animal kingdom into groups based on similarity. First, he divided animals into two primary groups; those that were red-blooded and those that were not red-blooded. He further divided these groups based on how offspring were created (e.g., live birth or egg).

Cluster Analysis (CA) is a modern multivariate statistical technique that replaces the rather subjective traditional methods of grouping individuals based on similarity. CA came into popularity after two biologists, Robert Sokal and Peter Sneath, published the
book *Principles of Numerical Taxonomy* in 1963. In this book, the two scientists used CA to classify organisms into groups, and then validated these clusters by comparing them on other measures to determine whether the groups represented separate species of organisms. Following the publication of *Principles of Numerical Taxonomy*, the use of CA in classification research became widespread across many scientific disciplines. In the late twentieth century, CA became even more popular with the development of computers capable of making many of the time-consuming CA calculations in a matter of seconds.

Cluster analysis involves the classification of individuals into groups (i.e., clusters) based on how similar they are to each other on the cluster variate, or collection of variables upon which they are classified. This cluster variate is determined entirely by the researcher prior to conducting the CA.

**Psychosocial Subtypes: The Personality Inventory for Children as a Cluster Variate**

The classification of children with LD into psychosocial subtypes requires the use of a suitable grouping measure. Rourke and colleagues (Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997) relied on the Personality Inventory for Children (PIC; Wirt, Lachar, Klinedinst, & Seat, 1977) in developing psychosocial subtypes of children with LD. The PIC is a tool designed to measure the behavioural, emotional, social and cognitive dimensions of a child’s psychosocial functioning. The measure was designed for use with children between the ages of 6 and 16. Usually, it is administered to a child’s primary caregiver (typically the mother). The PIC consists of 600 true or false items. There are three validity scales (Lie, Frequency, and Defensiveness), one screening
scale (Adjustment), and 12 clinical scales (Achievement, Intellectual Screening, Development, Somatic Concern, Depression, Family Relations, Delinquency, Withdrawal, Anxiety, Psychosis, Hyperactivity, Social Skills). The scores from these 16 scales are converted into standard $T$ scores and plotted visually as a psychosocial functioning profile. The PIC has been consistently validated as an excellent empirical classification tool for developing psychosocial subtypes of children with psychiatric diagnoses (e.g., Gdowski, Lachar, & Kline, 1985), and, in particular, LD (e.g., Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Porter & Rourke, 1985).

Shortly after its initial release, a revised edition of the PIC was published, known as the Personality Inventory for Children, Revised Format (PIC-R; Lachar, 1982). The PIC-R can be thought of as an abbreviated version of its predecessor, as it includes a selection of 280 items taken directly from the PIC. Notably, these 280 items still load onto the same set of 16 PIC validity, screening, and adjustment scales. For a heterogeneous clinical sample of 1,226 children, correlations between pairs of identically-labeled PIC and PIC-R clinical scales ranged from .96 to 1.0 and the mean correlation between these scales was .98 (Lachar, 1982). These high correlations suggest that the PIC and the PIC-R are likely very similar in terms of the underlying constructs that they measure. In light of this correspondence between the two measures, it is perhaps not surprising that the PIC-R, like the PIC, has received some validation as an appropriate classification tool in the derivation of psychosocial subtypes of children with LD (e.g., Saunders, Hall, Casey, & Strang, 2000).

The Personality Inventory for Children, Second Edition (PIC-II; Lachar & Gruber, 2001) is the most up-to-date version of the PIC, and features numerous structure-
based and content-based modifications over previous versions. The PIC-II is designed for children and adolescents between the ages of 5 and 19, thus extending the age range at the upper and lower bounds compared to previous versions. In addition, the PIC-II features a more representative normative sample of 2,306 parents of boys and girls in kindergarten through twelfth grade from urban, suburban, and rural areas, as well as from all major ethnic and SES groups. The measure consists of 275 true or false items that contribute to three validity scales (Inconsistency, Dissimulation, Defensiveness), nine adjustment scales (Cognitive Impairment, Impulsivity and Distractibility, Delinquency, Family Dysfunction, Reality Distortion, Somatic Concern, Psychological Discomfort, Social Withdrawal, Social Skill Deficits) and, for the first time, 21 adjustment subscales that allow for a more discrete examination of children’s psychosocial functioning. In addition, the PIC-II features a number of refinements with regards to individual item content. These refinements include (a) the revision of PIC-R items to eliminate their double-negative and maternally-biased wording and to increase their general clarity and (b) the creation of new items pertaining to more contemporary areas of interest in the assessment of children and adolescents such as eating disorders and substance abuse (Lachar & Gruber, 2001). Unlike previous versions of the PIC, most PIC-II items contribute to a single adjustment scale and do not load onto multiple adjustment scales. In all, item overlap between the PIC-R scales and the PIC-II scales has been found to range from 33 to 96 percent, with an average item overlap of 66 percent (Lachar & Gruber, 2001).

An important question concerns whether the adjustment scales of the PIC-II are functionally equivalent to the clinical scales from previous versions of the PIC. Lachar
and Gruber (2001) addressed this question through obtaining correlations between the PIC-II adjustment scale scores and the PIC-R clinical scale scores of 1,551 referred children; these correlations are presented in Table 1. The researchers defined correlations of .70 or greater as indicative of functional equivalence between scales. Lachar and Gruber found that the PIC-II adjustment scales were each functionally equivalent to one, two, or three PIC-R clinical scale(s). In addition, the researchers found that 11 of the 12 PIC-R clinical scales were each functionally equivalent to one, two, or three PIC-II adjustment scale(s). The remaining PIC-R clinical scale, Intellectual Screening, was not functionally equivalent to any of the PIC-II adjustment scales. Finally, correlations between functionally equivalent adjustment/clinical scales of the PIC-II and the PIC-R ranged from .71 to .99, with a mean correlation of .88. Taken together, Lachar and Gruber’s results suggest that the PIC-II and the PIC-R are likely measuring highly similar underlying constructs.

To date, the PIC-II has not yet been validated as a classification tool for developing psychosocial subtypes of children with LD. However, given (a) the substantial correlations between identically-labeled clinical scales of the PIC and PIC-R and (b) the general functional equivalence of the PIC-R’s clinical scales and the PIC-II’s adjustment scales, it seems likely that psychosocial subtypes of children with LD derived using the PIC-II would resemble those derived by other researchers using previous versions of the PIC.

Rourke’s “Windsor Taxonomic Research”

Rourke and colleagues (Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997)
Table 1

*Functional Correspondence of PIC-II Scores to PIC-R Scores*

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<th>SOM</th>
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<th>FAM</th>
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Table 1 (cont.)

*Functional Correspondence of PIC-II Scores to PIC-R Scores*

*Note.* Correlation of .70 or higher in bold to indicate evidence of adequate functional equivalence. N=1,551 referred children. Adapted from *Personality Inventory for Children, Second Edition (PIC-II) Standard Format and Behavioral Summary manual* (p. 134), by D. Lachar and C. P. Gruber, 2001, Los Angeles, CA: Western Psychological Services. *ACH:* Achievement; *IS:* Intellectual Screening; *DVL:* Development; *SOM:* Somatic Concern (PIC-R and PIC-II); *D:* Depression; *FAM:* Family Relations (PIC-R)/Family Dysfunction (PIC-II); *DLQ:* Delinquency (PIC-R and PIC-II); *WDL:* Withdrawal (PIC-R)/Social Withdrawal (PIC-II); *ANX:* Anxiety; *PSY:* Psychosis; *HPR:* Hyperactivity; *SSK:* Social Skills (PIC-R)/Social Skill Deficits (PIC-II); *COG:* Cognitive Impairment; *ADH:* Impulsivity and Distractibility; *RLT:* Reality Distortion; *DIS:* Psychological Discomfort.
have attempted to establish a reliable and valid psychosocial functioning classification system for children with LD. Psychosocial subtypes of children with LD have emerged as a result of this research. The progression of Rourke’s psychosocial studies, referred to as the “Windsor Taxonomic Research”, is briefly outlined below.

*Study one: Porter and Rourke (1985).* Porter and Rourke were interested in examining the psychosocial functioning of children with LD. They administered the PIC to the primary caregivers of 100 children with suspected LD between the ages of 6 and 15 who had been referred for neuropsychological assessment, in order to obtain information on interpersonal, behavioural, and emotional functioning. Children selected for this study were determined not to (a) suffer from emotional or cultural deprivation, (b) have any visual or hearing deficits, (c) have a language other than English as their primary language, (d) suffer from primary emotional disturbance or (e) have received psychiatric/psychological treatment in the past. In examining the results, the two researchers first looked at the mean PIC profile for the entire sample of children with LD. Notably, they found that all of the psychosocially-oriented clinical scales were within normal limits. These findings would suggest that children with LD, as a group, do not display any significant psychosocial dysfunction. However, considering all of the children with LD as a single group served to obscure within-group differences. In anticipation of such an effect, Porter and Rourke re-ran their analysis using Q-Factor Analysis in an attempt to classify the children with LD into subgroups. Q-Factor Analysis is a technique similar to CA, in that individuals are classified into groups (i.e., factors) based on similarity. In all, the researchers were able to classify 77 of the 100 children with LD into four groups. These four groups represented psychosocial subtypes of children with LD. The
researchers then calculated the mean PIC clinical scale scores for each of the four psychosocial subtypes.

Porter and Rourke (1985)'s Normal subtype consisted of 34 children, or 44 percent of those children classified. Children belonging to the Normal subtype exhibited minimal elevations on the PIC's psychosocially-oriented clinical scales. The researchers' Emotionally Disturbed (also termed Internalized Psychopathology) subtype consisted of 20 children, or 26 percent of those classified. Children belonging to the Emotionally Disturbed subtype exhibited marked (i.e., $T \geq 70$) elevations on the Psychosis, Depression, and Social Skills clinical scales of the PIC, and moderate (i.e., $T \geq 60$) elevations on the Anxiety and Withdrawal clinical scales. Porter and Rourke's Somatic Concern subtype consisted of 10 children, or 13 percent of those children classified. Members of this subtype demonstrated a marked elevation on the Somatic Concern clinical scale of the PIC. The researchers' Hyperactive (also termed Externalized Psychopathology) subtype consisted of 13 children, or 17 percent of those classified. Members of the Hyperactive subtype exhibited marked elevations on the Delinquency and Hyperactivity clinical scales of the PIC and a moderate elevation on the Family Relations clinical scale.

Notably, children comprising all four of Porter and Rourke (1985)'s psychosocial subtypes exhibited moderate to marked elevations on the cognitive-based scales of the PIC (i.e., the cognitive triad): Achievement, Intellectual Screening, and Development. The researchers claimed that these elevations on the cognitive triad, reflective of academic underachievement and cognitive impairment, were to be expected given the learning-disabled nature of their sample.
The general finding from the Porter and Rourke (1985) study was that the children with LD were a heterogeneous group in terms of their psychosocial functioning. Although many children with LD were classifiable into groups representing psychosocial dysfunction, it is important to note that approximately half of the sample displayed no clinically significant behavioural, emotional, or interpersonal difficulties.

**Study two: Fuerst, Fisk and Rourke (1989).** Fuerst, Fisk and Rourke attempted to replicate the findings of Porter and Rourke (1985) using a new sample of children with suspected LD and a more sophisticated set of statistical techniques. Unlike the study by Porter and Rourke, the researchers ensured that girls and boys were equally represented in their sample. In addition, the researchers used Cluster Analysis (CA), as well as Q-Factor Analysis, to classify the children with LD into psychosocial subtypes. In CA, individuals are each classified into one of the subtypes rather than multiple subtypes, allowing researchers to more easily classify individuals. In addition, CA allows for the creation of an unlimited number of psychosocial subtypes. These features of CA make it an attractive statistical technique, with certain qualities unmatched by Q-Factor Analysis.

Fuerst, Fisk and Rourke (1989) retained Porter and Rourke (1985)'s stringent sample selection criteria. In all, 132 children with suspected LD between the ages of 6 and 12 who had been referred for neuropsychological assessment were included in the study. Once again, the PIC was used to measure the children's social, emotional, and behavioural functioning. Through the use of CA, all 132 children were classified into one of three psychosocial subtypes. Upon calculating the mean PIC profiles for each of the three subtypes, it was apparent that they closely resembled those derived by Porter and Rourke (1985); the researchers labeled these three subtypes Normal, Emotionally...
Disturbed (also termed Internalized Psychopathology), and Hyperactive (also termed Externalized Psychopathology). Interestingly, Fuerst, Fisk and Rourke were unable to replicate the Somatic Concern subtype from Porter and Rourke’s study. In addition, the subtypes derived from Cluster Analysis and Q-Factor Analysis were remarkably similar, signaling their internal validity and robustness.

Study three: Fuerst, Fisk and Rourke (1990). Fuerst, Fisk and Rourke attempted to confirm the findings of Porter and Rourke (1985) and Fuerst, Fisk and Rourke (1989) using more sophisticated cluster analysis techniques and a different set of PIC clinical scales. The researchers used the same sample of 132 children with suspected LD between the ages of 6 and 12 from the Fuerst, Fisk and Rourke (1989) study. In all, six psychosocial subtypes were identified. Four subtypes were similar to those found by Porter and Rourke: Normal, Internalized Psychopathology, Externalized Psychopathology, and Somatic Concern. However, two of the subtypes derived were previously undiscovered: Mild Hyperactive and Mild Anxiety/Depression. Children belonging to the Mild Hyperactive subtype exhibited moderate elevations on the Hyperactive clinical scale of the PIC and moderate to marked elevations on the cognitive triad. Children belonging to the Mild Anxiety/Depression subtype demonstrated marked elevations on the Anxiety and Depression clinical scales and moderate elevations on the cognitive triad. In general, the Mild Anxiety/Depression subtype appeared to manifest itself as a less severe version of the Internalized Psychopathology subtype, and the Mild Hyperactivity subtype appeared to manifest itself as a less severe version of the Externalized Psychopathology subtype. One limitation of this study was that the small sample size resulted in the classification of only a small number of children into each
psychosocial subtype. It is possible that with a larger overall sample size, the researchers would have found additional subtypes representing smaller subpopulations of children with LD.

*Study four: Fuerst and Rourke (1993).* Fuerst and Rourke (1993) attempted to replicate the results of the Fuerst, Fisk, and Rourke (1990) study using a larger sample of 500 children with suspected LD between the ages of 6 and 12 who had been referred for neuropsychological assessment. In addition, unlike in previous studies by Rourke and colleagues, Fuerst and Rourke (1993) did not exclude children with comorbid psychiatric diagnoses or histories of psychiatric/psychological treatment. Procedurally, cluster analysis techniques were once again implemented in an effort to classify all of the children into psychosocial subtypes based on their PIC clinical scale scores. In all, six psychosocial subtypes were identified. Five of the six subtypes were virtually identical to those found in the previous study by Fuerst, Fisk and Rourke (1990): Normal, Mild Anxiety/Depression, Somatic Concern, Internalized Psychopathology, and Externalized Psychopathology. However, the Mild Hyperactivity subtype originally found by Fuerst, Fisk and Rourke (1990) was not replicated in this study. In addition, the sixth subtype found by Fuerst and Rourke (1993) was different than any of the other subtypes discovered in previous studies. The researchers labeled this previously undiscovered subtype Conduct Disordered, as the children in this subtype displayed a marked elevation on the Delinquency clinical scale of the PIC. Notably, members of this subtype also exhibited marked elevations on the cognitive triad.
General Findings of the Windsor Taxonomic Research

Rourke and his colleagues were able to identify a total of seven psychosocial subtypes of children with LD: Normal, Mild Anxiety/Depression, Mild Hyperactivity, Conduct Disordered, Somatic Concern, Internalized Psychopathology, and Externalized Psychopathology. Importantly, no one study has identified all seven psychosocial subtypes. It is questionable as to whether these subtypes overlap across samples, or whether they represent distinct subpopulations of children with LD. Fuerst and Rourke (1991) concluded that the Externalized Psychopathology subtype was the most reliable of the subtypes across studies. The Internalized Psychopathology and Normal subtypes were the second and third most reliable, respectively. The least reliable subtypes across studies were the Somatic Concern and Conduct Disordered subtypes.

Contemporary Taxonomic Research

In a related and more contemporary study, Saunders, Hall, Casey, and Strang (2000) cluster analyzed the PIC-R clinical scale scores of 323 children referred for neuropsychological assessment with known or suspected learning disorders and documented caregiver reports of emotional and/or behavioural dysfunction. Most notably, Saunders et al.’s investigation differed from studies by Rourke and colleagues in (a) its reliance on a more psychosocially-impaired sample and (b) its use of the PIC-R, rather than the PIC, as a measure of psychosocial functioning.

In all, Saunders et al. (2000)’s cluster analysis of the PIC-R resulted in the derivation of seven psychosocial subtypes of children with LD. The researchers reported that their Cognitive Deficit, Cognitive Internalized, and Cognitive Hyperactive subtypes correspond to Rourke and colleague’s Normal, Internalized Psychopathology, and Mild...
Hyperactive subtypes, respectively (Saunders et al., 2000). Notably, the remaining four subtypes found by Saunders et al. have not previously been derived by Rourke and colleagues. Saunders et al. labeled these four subtypes Normal (not to be confused with the identically-labeled subtype derived by Rourke and colleagues), Cognitive Social Skills Deficit, Combined Internalized/Externalized, and Cognitive Combined Internalized/Externalized.

The Normal subtype consisted of children who were likely only experiencing situation-specific and transient learning difficulties (in contrast to children from Rourke and colleagues' Normal subtype who exhibited moderate to marked elevations on the scales of the cognitive triad) and who were not exhibiting clinically significant psychosocial dysfunction. The Cognitive Social Skills Deficit subtype was comprised of children exhibiting cognitive and peer interaction difficulties (i.e., marked elevations on the cognitive triad and the Social Skills and Psychosis clinical scales of the PIC-R). The Combined Internalized/Externalized subtype consisted of children who were likely experiencing situation-specific and transient learning difficulties while at the same time demonstrating a wide range of internalizing and externalizing psychopathology (i.e., marked elevations on the Depression, Delinquency, Anxiety, Psychosis, Hyperactivity, and Social Skills clinical scales of the PIC-R). Finally, children belonging to the Cognitive Combined Internalized/Externalized subtype demonstrated significant levels of cognitive difficulty and both internalizing and externalizing psychopathology (i.e., marked elevations on all the clinical scales of the PIC-R except for Somatic Concern and Family Relations).
External Validation of Psychosocial Subtypes

In most of the previously mentioned studies, the psychosocial subtypes were validated using external variables (i.e., variables not utilized in the derivation of the subtypes). From a statistical standpoint, this is an essential step in the analysis of psychosocial subtypes. In CA, clusters (e.g., subtypes) are always found, regardless of the extent of the similarities or differences amongst individuals. To ensure that the clusters are meaningful (i.e., externally valid), they must differ significantly on measures not originally used in the CA. For example, Fuerst, Fisk, and Rourke (1990) externally validated their psychosocial subtypes of children with LD using a measure of cognitive functioning.

In summary, CA allows the researcher to classify children with LD into psychosocial subtypes that take into account the heterogeneous nature of the population. The scales of the PIC/PIC-R act as suitable grouping variables in the derivation of these psychosocial subtypes. Through cluster analyzing the scales of the PIC/PIC-R, Rourke and colleagues and Saunders et al. (2000) were able to identify 11 conceptually distinct psychosocial subtypes of children with LD across five studies. Table 2 lists the 11 conceptually distinct psychosocial subtypes and their representation across studies. Notably, no single study by these researchers identified all 11 psychosocial subtypes. In addition, Rourke and colleagues and Saunders et al. differed in terms of the labels they assigned to their psychosocial subtypes. Importantly, the most up-to-date version of the PIC, the PIC-II, has yet to be used in the derivation of psychosocial subtypes of children with LD. However, given the high degree of similarity between versions of the PIC, psychosocial subtypes derived using the PIC-II would likely resemble, at least in theory,
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<td>Externalized Psychopathology</td>
<td>Externalized Psychopathology</td>
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<td>5</td>
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<td>6</td>
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<td>Mild Hyperactive</td>
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<td>Cognitive Hyperactive</td>
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Table 2 (cont.)

*Eleven Distinct Psychosocial Subtypes and their Representation across Studies by Rourke and Colleagues and Saunders et al. (2000)*

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<td>Mild Anxiety/Depression</td>
<td>Mild Anxiety/Depression</td>
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<td>Conduct Disordered</td>
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<td>Cognitive Social Skill Deficit</td>
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<td>Cognitive Combined Internalized/Externalized</td>
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<td>11</td>
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<td>Combined Internalized/Externalized</td>
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those derived using the PIC/PIC-R. Regardless of the version of the PIC used to classify children with LD into psychosocial subtypes, these subtypes must be externally validated to ensure that they differ meaningfully from one another. In one of the five aforementioned studies, Fuerst, Fisk and Rourke (1990) sought to externally validate their psychosocial subtypes using a measure of cognitive functioning. These findings are discussed below.

The Relationship between Psychosocial and Cognitive Functioning in Children with LD

External validation in CA allows the researcher to uncover important relationships between clusters (e.g., subtypes) and other variables. Fuerst, Fisk and Rourke (1990) uncovered an important relationship when they compared psychosocial subtypes of children with LD on a measure of cognitive functioning: the Verbal IQ – Performance IQ discrepancy score of the Wechsler Intelligence Scale for Children (WISC; Wechsler, 1949).

Prior to their analysis, Fuerst, Fisk and Rourke (1990) classified their sample into three groups. The first group, “VIQ<PIQ”, consisted of children with Performance IQ scores at least 10 points higher than their Verbal IQ scores. The second group, “VIQ>PIQ”, consisted of children with Verbal IQ scores at least 10 points higher than their Performance IQ scores. Finally, the third group, “VIQ=PIQ”, consisted of children with Verbal and Performance IQ scores within 10 points of each other. The groups were selected so that each had an equal number of boys and girls (n=22) and an equal number of younger (six to eight years old) and older (9 to 12 years old) children (n=22).

Once they had selected their sample, Fuerst, Fisk and Rourke (1990) conducted a CA to derive six psychosocial subtypes: Normal, Mild Anxiety/Depression, Mild
Hyperactivity, Somatic Concern, Internalized Psychopathology, and Externalized Psychopathology. The researchers then attempted to externally validate their subtypes by looking for differences in the frequencies of each of the three VIQ-PIQ groups between psychosocial subtypes. Within the Normal, Mild Anxiety/Depression, and Somatic Concern subtypes, children in the VIQ>PIQ group were under-represented relative to children in the VIQ<PIQ and VIQ=PIQ groups. All three cognitive VIQ-PIQ groups were equally represented in the Mild Hyperactivity psychosocial subtype. Overall, these results indicated that children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction were less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. Within the Internalized Psychopathology and Externalized Psychopathology subtypes, children in the VIQ>PIQ group were over-represented relative to children in the VIQ=PIQ and VIQ<PIQ groups. These latter results indicated that children with LD belonging to subtypes characterized by severe psychosocial dysfunction were more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. Fuerst, Fisk and Rourke (1990) concluded that there was a significant relationship between psychosocial functioning and cognitive functioning in children with LD.

Psychosocial and Cognitive Functioning Research: Limitations

Although Fuerst, Fisk and Rourke (1990) contributed significantly to the research base on the relationship between cognitive and psychosocial functioning, there exist several significant problems relating to their methodology.

Outdated measures. A significant limitation of the Fuerst, Fisk and Rourke (1990) study is that it used outdated measures of cognitive and psychosocial functioning.
Specifically, the researchers used the original version of the WISC (Wechsler, 1949) to measure cognitive functioning, and the original version of the PIC (Wirt, Lachar, Klinedinst, & Seat, 1977) to measure psychosocial functioning. The age of these measures presents a problem in that there is no guarantee that inferences drawn from studies using these measures will apply to the modern population. The current study will improve on the work of Fuerst, Fisk, and Rourke (1990) by using relatively current measures of cognitive and psychosocial functioning, the WISC-III (Wechsler, 1991) and the PIC-II (Lachar & Gruber, 2001). Importantly, both the WISC-III and PIC-II feature more representative standardized samples. It is also significant to note that the current study will be the first to use the PIC-II to derive psychosocial subtypes of children with LD.

Outdated and unrepresentative sample. The current study will improve on Fuerst, Fisk, and Rourke’s (1990) sample of children with LD. These researchers collected their data in the 1970s and 1980s. As a result, the data obtained from their sample might not adequately represent current children with LD. The present study will use archival data representing a more recent sample of children with LD, collected between 2003 and 2005.

In addition, Fuerst, Fisk, and Rourke (1990) excluded from their sample children who were suffering from primary emotional disturbance or who had received previous psychological/psychiatric treatment. Selecting such a sample of children with “pure” LD might have improved the internal validity of the study, but only at the expense of its external validity. It is quite possible that a number of children with LD have comorbid diagnoses of emotional disturbance, or have been treated for psychological problems in
In a study where only children with "pure" LD are investigated, significant results cannot be applied to the subpopulation of children with LD who have comorbid psychological conditions. The current study attempts to increase the external validity of the Fuerst, Fisk, and Rourke study by including in its sample children with comorbid psychiatric diagnoses.

The nature of the measure of cognitive functioning. Fuerst, Fisk and Rourke (1990) themselves conceded that their VIQ-PIQ discrepancy measure was perhaps not discrete enough to identify specific relationships between cognitive and psychosocial functioning in children with LD. Indeed, a summary measure such as VIQ-PIQ discrepancy score ignores the multidimensional nature of the construct of intelligence. It is possible that a child will display more variation within the VIQ and PIQ scales than between the two scales. Unfortunately, the VIQ-PIQ discrepancy score is generally insensitive to such within-scale variation.

The current study seeks to improve on Fuerst, Fisk, and Rourke's (1990) study by utilizing more discrete measures of cognitive functioning. In so doing, specific and meaningful relationships can be derived between the cognitive and psychosocial functioning of children with LD. WISC-III index scores will complement the VIQ-PIQ discrepancy score in measuring cognitive functioning. Although certain researchers have advised against the use of WISC-III index scores to diagnose LD (Kush, 1996; Riccio, Cohen, Hall, & Ross, 1997), general support exists for the use of this type of measure to develop hypotheses as to an individual's cognitive strengths and weaknesses (Hale, Fiorello, Kavanagh, Hoeppner, & Gaither, 2001).
Generally, children with LD do not appear to exhibit a consistent pattern of cognitive performance (Sattler, 1988). The difficulty with uncovering a specific pattern of WISC-III Index score deficits amongst children with LD is that such a pattern likely does not exist; instead, it is probable that different subtypes of children with LD will exhibit unique patterns of cognitive functioning. The current study will investigate whether cognitive functioning patterns do in fact differ across psychosocial subtypes of children with LD.

In summary, Fuerst, Fisk and Rourke (1990) investigated the relationship between cognitive and psychosocial functioning in children with LD. They externally validated six psychosocial subtypes using a measure of cognitive functioning: the WISC-III Verbal IQ (VIQ) – Performance IQ (PIQ) discrepancy score. The results indicated that children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction were less likely to display a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. In addition, children with LD belonging to subtypes characterized by severe psychosocial dysfunction were more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. The present study seeks to improve on several methodological limitations associated with Fuerst, Fisk and Rourke’s (1990) research. First, more current measures of cognitive and psychosocial functioning will be used. Second, the data collected will represent a more recent sample of children with LD and will not exclude children with comorbid psychiatric diagnoses. Third, the present study will use the WISC-III index scores and the VIQ-PIQ discrepancy score to allow for a more discrete measurement of cognitive functioning. These methodological improvements will allow the present study to achieve its primary objective of
significantly contributing to research on the relationship between cognitive and psychosocial functioning in children with LD.

Objectives and Significance of the Current Study

The primary objective of the current study is to replicate and refine Fuerst, Fisk, and Rourke's (1990) investigation into the relationship between cognitive functioning and psychosocial functioning in children with LD. Specifically, the current study will seek to determine whether psychosocial subtypes of children with LD exhibit differential patterns of cognitive strengths and weaknesses. Indeed, certain patterns of cognitive strengths and weaknesses may be more highly associated with severe forms of psychosocial dysfunction in children with LD. In identifying these crucial relationships, the current study will contribute to research on possible early interventions for children with LD who suffer from severe psychopathology.

Research Questions and Hypotheses of the Current Study

Two primary research questions are considered in the current study. First, what are the psychosocial subtypes of children with LD? Although 11 conceptually distinct psychosocial subtypes were identified by Rourke and colleagues (Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Saunders et al., 2000; Tsatsanis, Fuerst & Rourke, 1997) and Saunders et al. (2000), these subtypes were all derived using the PIC/PIC-R. The current study will use the PIC-II to derive psychosocial subtypes, so subtypes identified may differ from those found in previous studies. However, given the similarity between previous versions of the PIC and the PIC-II, it is anticipated that psychosocial subtypes identified in the current study will resemble those found in studies using the PIC/PIC-R.
Second, what are the cognitive strengths and weaknesses of the psychosocial subtypes of children with LD, as determined by the WISC-III (a) VIQ-PIQ discrepancy score, and (b) index scores? This research question is exploratory in terms of the use of the WISC-III index scores as indicators of cognitive functioning, and confirmatory in terms of the VIQ-PIQ discrepancy. In accordance with the findings of Fuerst, Fisk, and Rourke (1990), it is expected that (a) children with LD belonging to subtypes characterized by severe psychosocial dysfunction will be more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern and (b) children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction will be less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. Although exploratory in nature, the examination of WISC-III index scores may reveal discrete patterns of cognitive strengths and weaknesses amongst psychosocial subtypes of children with LD.
Chapter II

Method

Participants

This study drew from an archival sample of 103 children ages 5 to 16 (mean age = 122.05 months; $SD=1.28$ months; 74 males, 29 females) with known or suspected learning or information processing disorders referred to the Windsor Regional Children’s Centre (RCC) in Windsor, Ontario, Canada for neuropsychological assessment between the years of 2003 and 2005. Notably, the RCC’s referral policy stipulates that, typically, only children receiving treatment for extensive psychological and/or behavioural disturbances are eligible for neuropsychological assessment. As a result, it can be assumed that most of the children in the archival sample had comorbid LD and psychiatric diagnoses. In accordance with several of Fuerst, Fisk, and Rourke’s (1990) selection criteria, participants in the present study did not (a) suffer from emotional or cultural deprivation, (b) have any visual or hearing deficits or (c) have a language other than English as their primary language. However, in contrast to Fuerst, Fisk, and Rourke (1990), children with primary emotional disturbance and children who had received treatment for psychological or psychiatric disorders in the past were included in the present study. Participants were primarily Caucasian and from upper-lower to lower-middle class socioeconomic backgrounds. The sample consisted of 87 right-handers and 15 left-handers.
Measures


The WISC-III standardization sample consists of 2,200 children between the ages of 6 and 16, and represents a range of geographic regions, ethnicities, and socioeconomic statuses. The WISC-III has three main composite scales: the Verbal IQ, Performance IQ, and Full Scale IQ summary score. The internal reliabilities of these scales are .95, .91, and .96, respectively. The composite scales have means of 100 and standard deviations of 15.

The WISC-III includes four index scores, each comprised of several subtests. The Verbal Comprehension Index (comprised of the Information, Similarities, Vocabulary, and Comprehension subtests) measures verbal concept formation, cultural knowledge and opportunities, as well as academic achievement orientation. The Perceptual Organization Index (comprised of the Picture Completion, Picture Arrangement, Block Design, and Object Assembly subtests) measures perceptual organization, nonverbal reasoning ability, spatial ability, and alertness to detail. The Freedom from Distractibility Index (consisting of the Arithmetic and Digit Span subtests) measures attention, short-term auditory memory, numerical ability, and self-monitoring skills. Finally, the Processing Speed Index (consisting of the Coding and Symbol Search subtests) measures speed of mental processing, attention, concentration, visual-motor coordination, and short-term visual memory.

The current study relied on Verbal and Performance IQ to derive VIQ-PIQ discrepancy scores representative of cognitive functioning. In addition, cognitive
strengths and weaknesses were also measured through the use of the four index scores of the WISC-III.

*Personality Inventory for Children, Second Edition (PIC-II; Lachar & Gruber, 2001)*

In the current study, psychosocial subtypes of children with LD were derived using the nine adjustment scales of the PIC-II: Cognitive Impairment (COG; alpha=.87, test-retest=.94, 39 items), Impulsivity and Distractibility (ADH; alpha=.92, test-retest=.88, 27 items), Delinquency (DLQ; alpha=.95, test-retest=.90, 47 items), Family Dysfunction (FAM; alpha=.87, test-retest=.90, 25 items), Reality Distortion (RLT; alpha=.89, test-retest=.92, 29 items), Somatic Concern (SOM; alpha=.84, test-retest=.91, 28 items), Psychological Discomfort (DIS; alpha=.90, test-retest=.90, 39 items), Social Withdrawal (WDL; alpha=.81, test-retest=.89, 19 items), and Social Skill Deficits (SSK; alpha=.91, test-retest=.92, 28 items). Adjustment scale standard scores range from $T=40$ to $T=90$, with $T$-scores greater than 59 indicating clinically interpretable elevations.

*Procedure*

After clearance from the University of Windsor and RCC ethics committees was received, archival data were collected from the RCC for each of the children with LD retroactively selected for this study. The archival data collection procedure involved recording each child’s (a) demographic information, (b) WISC Full Scale IQ, VIQ, PIQ, and index scores and (c) PIC-II adjustment scale, adjustment subscale, and validity scale scores.
Chapter III

Results

Overview of Analyses

The present study examined the relationship between psychosocial functioning and cognitive ability in children with LD. A two-part analysis was conducted in order to achieve this goal. Part One involved deriving psychosocial subtypes of children with LD through the use of cluster analysis techniques. In Part Two, derived psychosocial subtypes were externally validated using a series of cognitive ability measures. The first phase of Part Two involved a WISC-III Verbal IQ (VIQ)-Performance IQ (PIQ) discrepancy score comparison for each subtype using the chi-square goodness-of-fit statistic. The second phase of Part Two featured an examination of between-subtype and within-subtype variation in WISC-III index score performance; mean-based index score comparisons were conducted using profile analysis, and frequency-based comparisons were conducted using the chi-square goodness-of-fit statistic.

Part One: Derivation of Psychosocial Subtypes using Cluster Analysis

The first research question in the present study, concerning the identification of psychosocial subtypes of children with LD, was addressed through the use of cluster analysis (CA). Cluster analysis is a multivariate technique that places individuals into groups (i.e., clusters) based on their similarity to each other on a set of variables and is designed to minimize within-cluster variance while at the same time maximizing between-cluster variance. The clusters derived from the CA can be thought of as subtypes of the sample under investigation. Variables entered into the CA in the present study were the nine adjustment scales of the PIC-II. It was anticipated that the CA would
support the current study’s first hypothesis that derived psychosocial subtypes would resemble those found in studies using previous versions of the PIC.

Initial Data Screening

Invalid PIC-II profiles. Prior to conducting the CA, the original data were screened for the presence of invalid PIC-II profiles. The three validity scales of the PIC-II – Inconsistent (INC), Fake Bad (FB), and Defensiveness (DEF) – were examined for each child to determine PIC-II adjustment scale and subscale profile interpretability. Elevated INC scale scores (i.e., $T > 69$) indicate the possibility that caregiver PIC-II responses were made without attention to, or comprehension of, item content (Lachar & Gruber, 2001). In order to ensure consistency of caregiver responses in the current study, six cases with INC scale scores ranging from 72 to 87 were removed from further analysis.

Elevated FB scale scores (i.e., $T > 59$) often indicate caregiver exaggeration of problems or malingered symptoms (Lachar & Gruber, 2001). However, children with severe forms of psychopathology can also display FB scale score elevations (Lachar & Gruber, 2001). In all, 35 out of the 103 children examined in the present study had elevated FB scale scores. The decision was made not to remove these children from further analysis, as doing so would have potentially excluded children with severe forms of psychopathology and would also have reduced the present study’s sample size by approximately one third.

Finally, elevated DEF scale scores (i.e., $T > 59$) are indicative of caregiver problem denial, and are quite rare in referred populations (Lachar & Gruber, 2001). The authors of the PIC-II assert that DEF-elevated profiles with no clinically interpretable
adjustment scale scores (i.e., $T > 59$) should be treated with caution, but that DEF-elevated profiles with clinically interpretable adjustment scale scores should be more seriously considered (Lachar & Gruber, 2001). Examination of the PIC-II profiles for the six children in the present study with DEF scale score elevations revealed the presence of at least one clinically interpretable adjustment scale score for each child. Given this latter finding, as well as the statistical difficulties associated with the removal of additional children from an already relatively small sample, it was decided that all six cases with elevated DEF scores would remain in the analysis.

*Outlier removal.* Many standard statistical assumptions (e.g., univariate normality, homogeneity of variance) need not be satisfied when conducting a CA. However, as with numerous other statistical techniques (e.g., MANOVA), CA is generally sensitive to the presence of multivariate outliers. Although leverage and Mahalanobis' distance statistics did not reveal any such outliers, preliminary cluster analyses of the data did reveal two cases that consistently formed their own group (i.e., cluster) across a range of cluster solutions. The present study's small sample size made it difficult to determine whether these two cases were indeed outliers, or whether they represented an under-sampled group from the population under investigation. When the two cases were temporarily removed and the same preliminary cluster analyses were repeated, solutions with larger and more balanced cluster sizes were obtained. In order to optimize the sizes of derived clusters (in light of the present study's relatively small sample size) the decision was made to drop the two potential outliers from subsequent analyses.
Descriptive Statistics

In all, eight cases were removed from the original sample of 103 children as a result of initial data cleaning (six invalid PIC-II profiles and two potential outliers), resulting in an adjusted sample size of 95 children. PIC-II adjustment scale means and standard deviations for the revised total sample \((N=95)\) are displayed in Table 3. In addition, PIC-II validity scale, adjustment scale, and adjustment subscale means and standard deviations for the revised total sample are presented together in Appendix A.

Cluster Analysis Procedure

PIC-II adjustment scale data for the revised sample were cluster analyzed to derive psychosocial subtypes of children with LD. Notably, there is no single procedure for conducting a CA; many possible methods exist for separating individuals into clusters. The clustering procedure utilized depends largely on the nature of the data and the goals of the analysis. Two frequently used clustering procedures in CA include agglomerative hierarchical clustering and \(k\)-means iterative partitioning. In agglomerative hierarchical clustering, each individual, or case, begins as its own cluster. Through a step-by-step process, these clusters are linked together based on similarity until all the cases are included in a single cluster. Through relying on graphical output or “rules of thumb”, the researcher determines what stage of the hierarchical process includes the optimal number of clusters. An advantage of this clustering method is that it provides an excellent estimation of the number of clusters in a cluster solution. However, a disadvantage of this method is that once clusters are merged together they cannot be broken apart.

In \(k\)-means iterative partitioning, cluster “seeds”, or initial cluster centers, are
Table 3

PIC-II Adjustment Scale Descriptive Statistics for the Four Derived Clusters and Total Sample

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<td>Cluster 2: (n=27; 28%)</td>
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<td>Cluster 3: (n=26; 27%)</td>
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<td></td>
<td>SD</td>
</tr>
<tr>
<td>Cluster 4: (n=35; 37%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
</tr>
</tbody>
</table>
Table 3 (cont.)

**PIC-II Adjustment Scale Descriptive Statistics for the Four Derived Clusters and Total Sample**

<table>
<thead>
<tr>
<th>Group</th>
<th>COG</th>
<th>ADH</th>
<th>DLQ</th>
<th>FAM</th>
<th>RLT</th>
<th>SOM</th>
<th>DIS</th>
<th>WDL</th>
<th>SSK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Sample (N=95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>M</strong></td>
<td>69.62</td>
<td>65.38</td>
<td>62.83</td>
<td>55.55</td>
<td>67.15</td>
<td>54.92</td>
<td>67.43</td>
<td>55.93</td>
<td>69.18</td>
</tr>
</tbody>
</table>

**Note.** Bold type refers to a clinically significant elevation on the relevant adjustment scale as defined by the PIC-II manual.

*Cluster 1:* Internalized Psychopathology; *Cluster 2:* Internalized/Externalized Psychopathology, Severe; *Cluster 3:* Internalized/Externalized Psychopathology, Mild; *Cluster 4:* Normal. **COG:** Cognitive Impairment; **ADH:** Impulsivity and Distractibility; **DLQ:** Delinquency; **FAM:** Family Dysfunction; **RLT:** Reality Distortion; **SOM:** Somatic Concern; **DIS:** Psychological Discomfort; **WDL:** Social Withdrawal; **SSK:** Social Skill Deficits.

*Percentages of children assigned to the four clusters sum to 99 rather than 100 due to rounding error.*
determined randomly or by the researcher for all predefined clusters. Once these seeds have been selected, each individual, or case, is then assigned to the cluster with the closest cluster seed. The cluster seeds, or centres, are then re-calculated for the newly formed clusters. At this point, certain cases may now be closer to the cluster seed of a different cluster than to the cluster seed of their own cluster. These cases are re-assigned to the cluster with the closest cluster seed. Once these re-assignments are made, the cluster seeds are once again re-calculated. This procedure is repeated until case re-assignments are no longer necessary. The most significant advantage of the iterative partitioning clustering method is that individuals can be re-assigned to different clusters if they are no longer optimally located in their present cluster.

The present study used a two-stage clustering algorithm that capitalized on the strengths of the two aforementioned clustering procedures. First, an agglomerative hierarchical clustering method known as group average linkage (GAL) was utilized to facilitate the derivation of a range of possible cluster solutions. Group average linkage involves finding the minimum average distance between pairs of cases in different clusters. In other words, the researcher is looking for the average distance between all the cases in one cluster and all the cases in another cluster. At each step of the clustering process, the pair of clusters with the shortest average distance is combined. Group average linkage is considered robust and “competitive” in its ability to adequately replicate known population cluster structures (Everitt, Landau, & Leese, 2001). In particular, GAL is less prone, as compared to other agglomerative hierarchical clustering methods (e.g., Ward’s method), to the erroneous formation of equally-sized clusters when
corresponding groups from the population under investigation vary in size (Everitt et al., 2001).

When using an agglomerative hierarchical clustering method such as GAL, the researcher must choose a measure of similarity to determine which individuals belong together in a given cluster. Correlational measures (e.g., Pearson's $r$) are used when the researcher wishes to examine differences in patterns of cluster performance on the variables included in the CA. Distance measures (e.g., Euclidean distance) are used when the researcher is interested in differences in the magnitudes, rather than the patterns, of cluster performance on the variables included in the CA. However, certain distance measures appear to take into account both pattern and magnitude of cluster performance. One such measure, squared Euclidean distance, has been found to preserve the shape, elevation, and scatter of cluster data (Morris & Fletcher, 1988). Consequently, in the present study, differences in both pattern and magnitude of psychosocial functioning between clusters were investigated using squared Euclidean distance.

The second part of the two-step clustering procedure involved the use of a $k$-means iterative partitioning method to determine the specific cluster membership of children in the sample. Following the initial GAL hierarchical CA, cluster means for each of the adjustment scales were entered as initial cluster centres for the $k$-means CA. The purpose of implementing a $k$-means CA was to correct for any mis-assigned cases from the GAL hierarchical CA.

In CA, there is no definitive procedure for determining the optimal number of clusters to retain (i.e., the optimal cluster solution). All procedures for identifying the number of clusters are heuristics; they are simply “rules of thumb” that are not

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guaranteed to consistently yield the correct results. Consequently, in selecting an optimal cluster solution, it is prudent to rely on at least two or three different heuristics (Everitt et al., 2001). In the present study, an optimal cluster solution was selected through examination of the GAL agglomeration schedule and dendrogram, visual inspection of PIC-II mean cluster profiles, and, in particular, assessment of cluster internal reliability using alternative clustering methods. The agglomeration schedule and dendrogram were used to examine the similarity between pairs of clusters joined at each step of the GAL agglomerative hierarchical clustering procedure; here, the optimal solution was defined as the number of clusters present prior to the fusion of two dissimilar clusters. Visual inspection of PIC-II cluster profiles involved looking for unique profiles in terms of pattern and/or magnitude of adjustment scale scores; here, the optimal solution was defined as the one with the most clinical interpretability and relevance.

The third heuristic used to select the optimal number of clusters in the present study was to investigate the internal reliability of potential cluster solutions. Typically, the internal reliability of derived clusters in CA is determined through either (a) replicating a cluster solution on a different sample from the same population using the same clustering method, or (b) replicating a cluster solution on the same sample using different clustering methods. The present study’s sample size was too small to split in half for the purposes of replication. Thus, in determining the optimal cluster solution, two-stage GAL/k-means solutions were replicated using six other agglomerative hierarchical methods, each combined with k-means iterative partitioning: within-groups linkage, nearest neighbor, furthest neighbor, centroid clustering, median clustering, and Ward’s method. A GAL/k-means cluster solution was considered reliable and stable if
structurally similar clusters were derived through replication with alternative two-stage methods.

In the present study, GAL/k-means and other two-stage methods’ cluster memberships were compared using Goodman and Kruskal’s tau (τ), a measure of association for nominal data with possible values ranging from .00 (no association) to 1.00 (perfect association). Specifically, Goodman and Kruskal’s tau was used to determine the extent to which individual cases retained similar cluster memberships across pairs of solutions derived from differing two-stage clustering methods. In addition, GAL/k-means and other two-stage methods’ cluster solution profiles were compared graphically to determine the extent of overlap in mean PIC-II adjustment scale scores.

Cluster Analysis Findings

Combined agglomeration schedule and dendrogram data for the GAL/k-means hierarchical analysis suggested the presence of an optimal three to six cluster solution. Taking this information into account, additional visual inspection of cluster PIC-II profiles for clinical relevance/interpretability and cluster replications (see below) using other two-stage clustering methods resulted in the selection of an optimal four-cluster GAL/k-means solution. PIC-II adjustment scale means and standard deviations for each of the four GAL/k-means clusters are listed in Table 3, and adjustment scale means are graphically displayed for each of the four clusters in Figures 1 to 3. In addition, PIC-II validity scale, adjustment scale, and adjustment subscale means and standard deviations for the four derived clusters are presented together in Appendix A.
Figure 1. Mean PIC-II adjustment scale profile for the Internalized Psychopathology subtype (Cluster 1; \( n=7 \)).
Figure 2. Mean PIC-II adjustment scale profiles for the Severe (Cluster 2; \( n=27 \)) and Mild (Cluster 3; \( n=26 \)) forms of the Internalized/Externalized Psychopathology subtype.
Figure 3. Mean PIC-II adjustment scale profile for the Normal subtype (Cluster 4; \( n=35 \)).
Goodman and Kruskal’s tau ($\tau$) was significant ($p<.001$) for all six replications of the four-cluster GAL/$k$-means solution. This result indicated that there was a significant level of association between the clusters derived using the GAL/$k$-means method and the clusters derived using the six other two-stage clustering methods. Goodman and Kruskal’s tau coefficients for all six replications of the four-cluster GAL/$k$-means solution are displayed in Table 4. Notably, the GAL/$k$-means four-cluster solution was most successfully replicated using the Centroid Clustering/$k$-means iterative partitioning (CC/$k$-means) two-stage method, $\tau = .972$, $p<.001$. A frequency-based cross-tabulation (see Table 5) comparing the two nominal cluster membership variables for the GAL/$k$-means and CC/$k$-means four-cluster solutions revealed that only two cases out of the total sample of 95 were assigned to differing clusters as a function of clustering method. In addition, visual comparisons of the two solutions’ mean PIC-II adjustment scale score cluster profiles (see Figures 4 to 6) suggest perfect to near perfect correspondence between GAL/$k$-means and CC/$k$-means clusters. These replication findings, taken together, support the stability and reliability of the four GAL/$k$-means clusters in terms of their composition (i.e., the specific cases assigned to each cluster) and mean PIC-II adjustment scale scores.

Labels were assigned to derived GAL/$k$-means clusters for descriptive purposes. Cluster 1 ($n=7$) represented a psychosocial subtype of children exhibiting cognitive difficulties and a wide range of internalizing psychopathology (“Internalized Psychopathology” subtype; Figure 1). Clusters 2 ($n=27$) and 3 ($n=26$) together represented a single psychosocial subtype of children exhibiting cognitive difficulties in
Table 4

Goodman and Kruskal's Tau Coefficients for the Six Replications of the Group Average Linkage (GAL)/k-means Four Cluster Solution

<table>
<thead>
<tr>
<th>Replication Method</th>
<th>WGL/k-means</th>
<th>NN/k-means</th>
<th>FN/k-means</th>
<th>CC/k-means</th>
<th>MC/k-means</th>
<th>WM/k-means</th>
</tr>
</thead>
<tbody>
<tr>
<td>GAL/k-means</td>
<td>.564*</td>
<td>.623*</td>
<td>.517*</td>
<td>.924*</td>
<td>.816*</td>
<td>.456*</td>
</tr>
</tbody>
</table>

Note. GAL/k-means: Group Average Linkage/k-means; WGL/k-means: Within-Groups Linkage/k-means; NN/k-means: Nearest Neighbor/k-means; FN/k-means: Furthest Neighbor/k-means; CC/k-means: Centroid Clustering/k-means; MC/k-means: Median Clustering/k-means; WM/k-means: Ward’s Method/k-means.

* p < .001.
Table 5

Cross-Tabulation Comparing Frequency of Cluster Membership for the Group Average Linkage (GAL)/ k-means and Centroid Clustering (CC)/ k-means Four Cluster Solutions

<table>
<thead>
<tr>
<th>GAL/k-means Solution</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cluster 1: Internalized Psychopathology (n=7)</td>
<td></td>
<td>7</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cluster 2: Internalized/Externalized Psychopathology: Severe (n=27)</td>
<td>0</td>
<td></td>
<td>27</td>
<td>0</td>
</tr>
<tr>
<td>Cluster 3: Internalized/Externalized Psychopathology: Mild (n=26)</td>
<td>0</td>
<td>1</td>
<td>25</td>
<td>0</td>
</tr>
<tr>
<td>Cluster 4: Normal (N=35)</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>34</td>
</tr>
</tbody>
</table>

Note. GAL/k-means: Group Average Linkage/k-means; CC/k-means: Centroid Clustering/k-means.
Figure 4. Mean PIC-II adjustment scale profile for Cluster 1: Group Average Linkage (GAL) $k$-means versus Centroid Clustering (CC) $k$-means.
Figure 5. Mean PIC-II adjustment scale profiles for Clusters 2 and 3: Group Average Linkage (GAL) $k$-means versus Centroid Clustering (CC) $k$-means.
Figure 6. Mean PIC-II adjustment scale profile for Cluster 4: Group Average Linkage (GAL)/ k-means versus Centroid Clustering (CC)/ k-means.
addition to Severe and Mild forms of internalizing and externalizing psychopathology, respectively ("Internalized/Externalized Psychopathology" subtype; Figure 2). These latter two clusters, although both clinically interpretable and relevant, were considered two forms of the same psychosocial subtype because they exhibited virtually identical types of psychopathology and differed mainly in terms of symptom severity. Finally, Cluster 4 ($n=35$) represented a psychosocial subtype of children with mild cognitive difficulties but no clinically interpretable instances of psychosocial dysfunction ("Normal" subtype; Figure 3).

Thus, the present study’s CA ultimately revealed three psychosocial subtypes of children with LD: Normal ($n=35$), Internalized/Externalized Psychopathology ($n=53$), and Internalized Psychopathology ($n=7$). The CA findings offer partial support for the present study’s first hypothesis; specifically, the three derived psychosocial subtypes are conceptually similar to three of the eleven distinct subtypes identified by Rourke and colleagues and Saunders et al. (2000). The present study’s Normal subtype is conceptually similar to the subtype labeled Normal by Rourke and colleagues and Cognitive Deficit by Saunders et al. In addition, the present study’s Internalized/Externalized Psychopathology subtype is conceptually similar to the subtype labeled Cognitive Combined Internalized/Externalized by Saunders et al. Finally, the present study’s Internalized Psychopathology subtype is conceptually similar to the subtype labeled Internalized Psychopathology by Rourke and colleagues and Cognitive Internalized by Saunders et al.
Part Two: Cognitive Strengths and Weaknesses of the Psychosocial Subtypes

The present study's second research question concerned the specific cognitive strengths and weaknesses of the previously derived psychosocial subtypes of children with LD. These strengths and weaknesses were examined through increasingly specific measures of cognitive functioning: WISC-III Verbal IQ (VIQ) – Performance IQ (PIQ) Discrepancy, and WISC-III index performance. The increasing specificity of these measures encouraged a multi-level view of the cognitive strengths and weaknesses of the psychosocial subtypes. The VIQ-PIQ discrepancy phase of the analysis was designed to address the present study's second hypothesis that (a) children with LD belonging to subtypes characterized by severe psychosocial dysfunction would be more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern and (b) children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction would be less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. The index score phase of the analysis, consisting of two procedural steps (i.e. means-based followed by frequency-based comparisons of index score performance for each subtype), was exploratory in nature, and, as such, did not seek to address any specific hypotheses.

Initial Data Screening

Outlier windsorization. Participants' WISC-III PIQ, VIQ, and index scores were temporarily standardized in order to search for univariate outliers. For the present analysis, outliers were defined as data points greater or equal to three standard deviations above or below the mean. One participant's Freedom from Distractibility Index (FDI) standardized score of 3.48 was well above the established outlier cut-off. Given the current study's relatively small sample size, the decision was made to windsorize, rather
than remove, the problematic FDI score. Windsorization involves replacing an outlier data point with the value of the next largest acceptable data point plus one. The advantage of windsorization is that an outlier data point’s influence on a variable can be reduced without having to removing it from the analysis. The problematic FDI score of 140 was windsorized to 116 (the value of the next largest data point plus one).

**Descriptive Statistics**

Wechsler Intelligence Scale for Children – Third Edition Full Scale IQ (FSIQ), PIQ, VIQ, Verbal Comprehension Index (VCI), Perceptual Organization Index (POI), FDI, and Processing Speed Index (PSI) means and standard deviations were calculated for each psychosocial subtype and for the total sample (see Table 6). Notably, of the 95 children in the previous cluster analysis, 73 had available PIQ, VCI, POI, and FDI data, 72 had available VIQ and FSIQ data, and 70 had available PSI data.

**VIQ-PIQ Discrepancy Phase: Procedure**

The VIQ-PIQ discrepancy phase closely followed the methodology of Fuerst, Fisk, and Rourke (1990). First, the sample was divided into three groups (independent of psychosocial subtype). The VIQ>PIQ group had VIQ scores at least 10 points greater than their PIQ scores. The VIQ<PIQ group had PIQ scores at least 10 points greater than their VIQ scores. Finally, the VIQ=PIQ group had VIQ and PIQ scores that were within 9 points of each other. The second step of the VIQ-PIQ discrepancy phase of the analysis was to determine VIQ-PIQ group frequency for each of the psychosocial subtypes. Following these frequency calculations, three one-way chi-square goodness-of-fit tests were conducted to determine whether any of the three VIQ-PIQ groups were over or under-represented (in terms of frequency) in each psychosocial subtype. That is, for each
Table 6

*WISC-III Composite and Index Score Descriptive Statistics for the Three Psychosocial Subtypes*

<table>
<thead>
<tr>
<th>Group</th>
<th>FSIQ</th>
<th>VIQ</th>
<th>PIQ</th>
<th>VCI</th>
<th>POI</th>
<th>FDI</th>
<th>PSI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internalized Psychopathology (n=7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>83.57</td>
<td>92.29</td>
<td>78.29</td>
<td>95.86</td>
<td>80.71</td>
<td>77.43</td>
<td>83.50</td>
</tr>
<tr>
<td>SD</td>
<td>15.85</td>
<td>15.07</td>
<td>17.08</td>
<td>16.63</td>
<td>18.18</td>
<td>13.18</td>
<td>19.20</td>
</tr>
<tr>
<td>Internalized/Externalized Psychopathology (n=53)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>82.18</td>
<td>83.92</td>
<td>84.28</td>
<td>84.49</td>
<td>86.79</td>
<td>81.49</td>
<td>83.03</td>
</tr>
<tr>
<td>SD</td>
<td>13.95</td>
<td>14.97</td>
<td>15.67</td>
<td>13.41</td>
<td>15.72</td>
<td>15.01</td>
<td>13.84</td>
</tr>
<tr>
<td>Normal (n=35)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>86.30</td>
<td>88.04</td>
<td>87.59</td>
<td>88.37</td>
<td>87.63</td>
<td>85.56</td>
<td>93.85</td>
</tr>
<tr>
<td>SD</td>
<td>16.82</td>
<td>17.59</td>
<td>18.28</td>
<td>17.45</td>
<td>18.46</td>
<td>16.26</td>
<td>19.77</td>
</tr>
<tr>
<td>Total Sample (N=95)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>83.86</td>
<td>86.28</td>
<td>84.93</td>
<td>87.01</td>
<td>86.52</td>
<td>82.60</td>
<td>87.24</td>
</tr>
<tr>
<td>SD</td>
<td>15.17</td>
<td>16.03</td>
<td>16.79</td>
<td>15.48</td>
<td>16.88</td>
<td>15.34</td>
<td>17.37</td>
</tr>
</tbody>
</table>

*Note.* *FSIQ*: Full Scale IQ; *VIQ*: Verbal IQ; *PIQ*: Performance IQ; *VCI*: Verbal Comprehension Index; *POI*: Perceptual Organization Index; *FDI*: Freedom from Distractibility Index; *PSI*: Processing Speed Index.
psychosocial subtype, a one-way chi-square goodness-of-fit test was conducted to evaluate whether a particular VIQ-PIQ group was more or less prevalent. This procedure was carried out to determine whether children in each subtype exhibited a predominant set of cognitive strengths and weaknesses. For the three chi-square analyses, a Bonferroni correction was implemented to control for Type 1 error; the p-value required for statistical significance was established at \(0.05/3 = 0.017\).

**VIQ-PIQ Discrepancy Phase: Findings**

Verbal IQ>Performance IQ, VIQ=PIQ, and VIQ<PIQ frequencies for each of the three psychosocial subtypes and for the total sample are provided in Table 7. In addition, these frequencies are presented as proportions of total subtype membership in Figure 7. The three chi-square goodness-of-fit tests comparing VIQ>PIQ, VIQ=PIQ, and VIQ<PIQ group frequencies for each psychosocial subtype did not produce significant results, indicating the absence of a statistically significant relationship between psychosocial subtype and VIQ-PIQ discrepancy. However, visual inspection of VIQ-PIQ group composition percentages for the Internalized Psychopathology subtype (see Figure 7) indicated a statistically non-significant trend towards proportionally more VIQ>PIQ than VIQ=PIQ or VIQ<PIQ members. The substantial discrepancy between mean VIQ and PIQ scores for the Internalized Psychopathology subtype (see Table 6) offers further support for the aforementioned trend.

Statistically, the VIQ-PIQ discrepancy analysis did not support the present study’s second hypothesis that (a) children with LD belonging to subtypes characterized by severe psychosocial dysfunction would be more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern and (b) children with LD belonging to subtypes

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Table 7

_Frequencies of WISC-III Verbal IQ (VIQ) > Performance IQ (PIQ), VIQ=PIQ, and VIQ<PIQ Group Membership for the Three Psychosocial Subtypes and the Overall Sample_

<table>
<thead>
<tr>
<th>Group</th>
<th>VIQ&gt;PIQ</th>
<th>VIQ=PIQ</th>
<th>VIQ&lt;PIQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internalized Psychopathology</td>
<td>4</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Internalized/Externalized Psychopathology</td>
<td>10</td>
<td>18</td>
<td>10</td>
</tr>
<tr>
<td>Normal</td>
<td>7</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>Overall Sample</td>
<td>21</td>
<td>34</td>
<td>17</td>
</tr>
</tbody>
</table>

_Note. VIQ: Verbal IQ; PIQ: Performance IQ._
Psychosocial Subtypes of LD 75

Figure 7. WISC-III Verbal IQ (VIQ)>Performance IQ (PIQ), VIQ=PIQ, and VIQ<PIQ group percentages for the three psychosocial subtypes.
characterized by mild or no psychosocial dysfunction would be less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. However, descriptively, the portion of the second hypothesis pertaining to children with LD belonging to subtypes characterized by severe psychosocial dysfunction was partially supported by a trend towards better VIQ than PIQ performance for the Internalized Psychopathology subtype.

Index Score Phase: Procedure

Mean-based index score analysis. The first procedural step of the index score phase involved conducting a profile analysis (PA) to determine between-subtype and within-subtype patterns of mean index score variability. Profile analysis is a combined univariate and multivariate technique designed to compare two or more groups on a set (i.e., profile) of repeated-measure dependent variables. In the current study, PA groups consisted of the three psychosocial subtypes, and the repeated measures were the four indexes of the WISC-III. Prior to conducting the PA, the relevant statistical assumptions (concerning sample size, missing data, multivariate normality, absence of outliers, homogeneity of variance-covariance matrices, linearity, and absence of multicollinearity and singularity) were evaluated and consequently deemed to have been met.

In general, PA tests whether different groups' profiles across a range of repeated-measures are parallel (i.e., test of parallelism), equally elevated (i.e., test of elevation), and flat (i.e., test of flatness). The univariate test of elevation involves determining the presence or absence of a between-groups main effect; a significant between-groups main effect suggests that one or more groups differ in elevation on the averaged set of repeated measure variables. The multivariate test of flatness involves determining the presence or absence of a within-subjects main effect; a significant within-subjects main effect
suggests the absence of a flat profile when group scores are averaged together within each repeated measure. Univariate ANOVAs and/or post-hoc comparisons can be run to further investigate significant between-group or within-subject main effects. Finally, the multivariate test of parallelism involves determining the presence or absence of a between-groups/within-subjects interaction; a significant interaction suggests that group profile patterns vary across the repeated measures (i.e., the group profile patterns are not parallel). Simple effects or interaction contrasts, followed by post-hoc comparisons if necessary, can be run to further investigate the nature of a between-groups/within-subjects interaction.

*Frequency-based index score analysis.* The second procedural step of the index score phase involved determining the frequency of specific index score strengths and weaknesses for each subtype. First, for each of the four WISC-III indexes, children’s percentile rankings, relative to each other (*not* relative to the WISC-III standardization sample) were calculated. Second, for each of the WISC-III indexes, participants were split into one of three groups (independent of psychosocial subtype) representing varying levels of ability based on their percentile rankings. The Low group included individuals with index scores at or below the 33rd percentile. The Average group included participants with index scores greater than the 33rd percentile and less than or equal to the 66th percentile. The High group included individuals with index scores greater than the 66th percentile.

Third, for each of the four indexes within each subtype, the frequencies of Low, Average, and High group membership were calculated. These frequency calculations determined how many children did poorly, average, or well on each index score within
each psychosocial subtype. Finally, within the three psychosocial subtypes, one-way chi-square goodness-of-fit tests were conducted for the four WISC-III indexes, comparing Low, Average, and High group frequencies. This procedure was carried out to determine which cognitive abilities were more frequently strengths or weaknesses for each psychosocial subtype. In order to control for Type 1 error, a Bonferroni correction was implemented for the four chi-square goodness-of-fit tests conducted within each psychosocial subtype; the alpha required for statistical significance for each “family” of four chi-square goodness-of-fit analyses was established at .05/4 = .0125.

Index Score Phase: Findings

Mean-based index score analysis. WISC-III mean index score profiles for the three psychosocial subtypes are presented in Figure 8. The profile analysis (PA) revealed a statistically significant index score within-subjects main effect, Hotelling’s Trace = .326, $F(3,65)=7.060, p<.001, \eta^2=.246$. However, any further exploration of this main effect was precluded by the presence of a statistically significant psychosocial subtype/index score interaction, Wilks’ Lambda = .824, $F(6,130) = 2.204, p=.047, \eta^2=.092$. This finding suggested that the three psychosocial subtype mean index score profiles were not parallel. A simple effects analysis was run to further investigate the nature of the relationship between psychosocial subtype and index. This analysis involved conducting four one-way between-groups ANOVAs, one for each WISC-III index; Tabachnick and Fidell (1996) recommend this procedure over one-way within-subjects ANOVAs when profile flatness and parallelism cannot be assumed. A Bonferroni correction was implemented to control for Type 1 error; the $p$-value required for statistical significance
Figure 8. WISC-III index score mean profiles for the three psychosocial subtypes.
was established at .05/4 = .0125. Notably, none of the one-way between-groups ANOVA main effects reached statistical significance.

In an effort to increase the power of the PA so that the significant interaction could be interpreted, the decision was made to repeat the simple effects analyses without a Bonferroni correction (i.e., returning the per-comparison alpha level required for statistical significance to .05). The repeated simple effects analyses revealed that the psychosocial subtypes differed significantly in terms of their performances on the PSI, \( F(2,67)=3.404, p=.039, \eta^2=.092 \). Follow-up pairwise comparisons revealed that the Normal subtype scored significantly higher on the PSI than did the Internalized/Externalized Psychopathology subtype, \( t(62)=2.546, p=.013 \). Interestingly, the Internalized Psychopathology subtype, although comparable in PSI performance to the Internalized/Externalized Psychopathology subtype, did not score significantly lower than the Normal subtype on the PSI (see Figure 8). However, the weighted average mean PSI score of the Internalized Psychopathology and Internalized/Externalized Psychopathology subtypes was found to be significantly lower than the mean PSI score of the Normal subtype, \( t(68)=2.628, p=.011 \). Additional pairwise comparisons of index performance for each subtype revealed that the Internalized/Externalized Psychopathology subtype performed significantly better on the VCI than on the FDI, \( t(36)=2.459, p=.019 \), and that the Normal subtype performed better on the PSI than on the FDI, \( t(26)=2.230, p=.035 \).

Finally, two statistically non-significant trends (see Figure 8) involving the Internalized Psychopathology subtype are worthy of mention. Firstly, the Internalized Psychopathology subtype appeared to receive a higher mean score on the VCI than the
other two psychosocial subtypes. Secondly, the Internalized Psychopathology subtype also appeared to receive a higher mean score on the VCI than on the other three indexes.

Frequency-based index score analysis. Frequencies of Low, Average and High index performance for each psychosocial subtype and the total sample are provided in Table 8; these frequencies are also presented as proportions of total subtype membership in Figure 9. The twelve one-way chi-square goodness-of-fit tests comparing frequencies of Low, Average, and High index performers for each psychosocial subtype did not produce any statistically significant results at \( \alpha = .0125 \). However, when the chi-square analyses were repeated without controlling for Type 1 error (i.e., when the per-comparison alpha level was set at .05), a significant difference was found between the expected and observed frequencies of Low, Average, and High PSI performance for the Normal subtype, \( \chi^2(2) = 6.222, p = .045 \). Specifically, it appeared that members of the Normal subtype were more often High than Average or Low PSI performers (see Table 8 and Figure 9). In addition, two statistically non-significant trends deserve particular mention. As depicted in Figure 9, members of the Internalized Psychopathology subtype appeared to (a) exhibit a greater proportion of High than Average or Low performances on the VCI and (b) demonstrate a lesser proportion of High than Average or Low performances on the FDI.
Table 8

*Frequencies of High, Average and Low WISC-III Index Performance for the Three Psychosocial Subtypes and the Overall Sample*

<table>
<thead>
<tr>
<th>Group</th>
<th>WISC-III Index</th>
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<tr>
<td></td>
<td>VCI</td>
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<tr>
<td>Internalized Psychopathology</td>
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<tr>
<td>High</td>
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<td>Average</td>
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<td>Low</td>
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<td>Internalized/Externalized Psychopathology</td>
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<tr>
<td>Low</td>
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<tr>
<td>High</td>
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<tr>
<td>Average</td>
<td>10</td>
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<tr>
<td>Average</td>
<td>26</td>
</tr>
<tr>
<td>Low</td>
<td>24</td>
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*Note.* VCI: Verbal Comprehension Index; POI: Perceptual Organization Index; FDI: Freedom from Distractibility Index; PSI: Processing Speed Index.
Figure 9. Percentages of High, Average and Low performance on the four indexes of the WISC-III for the three psychosocial subtypes.
Chapter IV

Discussion

Review of Primary Objective, Research Questions, and Hypotheses

The primary objective of the present study was to replicate and refine Fuerst, Fisk, and Rourke's (1990) investigation into the relationship between cognitive functioning and psychosocial functioning in children with LD. Two research questions were formulated to achieve this primary objective. The first research question involved determining the psychosocial subtypes of children with LD. To address this question, a cluster analysis (CA) was conducted on the nine adjustment scales of the PIC-II. The present study's first hypothesis was that psychosocial subtypes derived using the PIC-II would resemble those identified in studies using previous versions of the PIC. The second research question of the present study involved determining the cognitive strengths and weaknesses of the derived psychosocial subtypes of children with LD. In order to address this question, the WISC-III Verbal IQ (VIQ) – Performance IQ (PIQ) discrepancies and index performances of the derived psychosocial subtypes were examined. The VIQ-PIQ analysis pertained to the present study's second hypothesis that (a) children with LD belonging to subtypes characterized by severe psychosocial dysfunction would be more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern and (b) children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction would be less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. The index score analysis was unique to the present study and therefore exploratory in nature. Findings relating to the present study's two hypotheses and exploratory analysis are discussed below.
Replication of the Psychosocial Subtypes Reported in Previous Studies

General Findings

Findings offer partial support for the first hypothesis of the present study. In all, three reliable psychosocial subtypes of children with LD were derived that resemble three of the 11 distinct subtypes identified by Rourke and colleagues and Saunders et al. (2000). The three psychosocial subtypes derived in the present study include a subtype suffering from cognitive difficulties but no clinically significant psychosocial dysfunction ("Normal"; \( n = 35; \) 37 percent of children), a subtype suffering from cognitive difficulties and a range of internalizing psychopathology ("Internalized Psychopathology"; \( n = 7; \) seven percent of children) and a subtype suffering from cognitive difficulties and a range of internalizing and externalizing psychopathology ("Internalized/Externalized Psychopathology"; \( n = 53; \) 56 percent of children). Notably, the latter subtype consisted of Mild (\( n = 26; \) 27 percent of children) and Severe (\( n = 27; \) 28 percent of children) groups of children with similar patterns of PIC-II mean adjustment scale elevations but differing symptom severities (individual percentages of children assigned to the Mild and Severe groups appear to sum to 55 rather than 56 due to rounding error).

Clinical Descriptions of the Derived Psychosocial Subtypes

The most salient characteristics for each psychosocial subtype derived in the present study are described below. These characteristics are based on the types of difficulties reported by caregivers of children demonstrating similar PIC-II adjustment scale and subscale elevations from the PIC-II standardization sample. The complete set of PIC-II adjustment scale and subscale means and standard deviations for the three derived psychosocial subtypes are provided in Appendix A.
Children belonging to the Internalized Psychopathology subtype were typically described by their caregivers as suffering from severe developmental problems, in addition to problematic academic achievement and potential adaptive behaviour difficulties. Likely as a result of these developmental problems, caregivers described their children as being dependent to a certain extent on others, having deficient communication skills, and feeling that they are different from those around them. Caregivers also described their children as displaying poor social skills and engaging in bizarre behaviours. Given these problematic behaviours, it is not surprising that these children were reported as experiencing unrewarding interactions with others. Likely as a consequence of these unrewarding interactions, children in this subtype were described by caregivers as isolating themselves socially and frequently engaging in solitary activities. Caregiver responses also indicated that these children tended to express their psychological stress in the form of physical complaints. Emotionally, children in this subtype were described by caregivers as exhibiting inappropriate affect, crying frequently, worrying about small things, displaying signs of depression, suffering from sleep disturbance, and sometimes experiencing suicidal thoughts.

Children in the Severe group of the Internalized/Externalized Psychopathology subtype were reported by caregivers to suffer from severe intellectual and language deficits, along with academic achievement difficulties. In addition, caregivers also reported these children as exhibiting poorly modulated emotion, a wide range of externalizing and under-controlled problem behaviours, and as engaging in disobedient acts that included property destruction. Children in the Severe group were also reported to insult and tease other children, show little concern for others, and to be in frequent...
conflict with family members. As was the case with the Internalized Psychopathology subtype, children in the Severe group were reported by their caregivers to exhibit bizarre behaviours, cry frequently, worry about small things, and to show signs of depression. In addition, these children were also described as expressing their psychological stress through physical complaints, although to a lesser extent than children belonging to the Internalized Psychopathology subtype. Notably, these children were reported to exhibit a mild level of internal preoccupation and oversensitivity to external stimulation. Although caregivers indicated that children in this subtype experienced similar social difficulties to children in the Internalized Psychopathology subtype (i.e., unrewarding relations with classmates and poor social skills), these children only exhibited a mild tendency to engage in social withdrawal.

In general, children belonging to the Mild group of the Internalized/Externalized Psychopathology subtype typically suffered from milder versions of the cognitive and psychosocial difficulties experienced by the Severe group. These children were reported to be suffering from below average academic performance and possible adaptive behaviour and intellectual difficulties. These children were also described by their caregivers as overactive, argumentative, disruptive of others, disobedient, and in conflict with family members. Caregivers indicated that their children were sometimes irritable and sad, and that they sometimes worried about things. In addition, children in the Mild group were reported as often being excluded by peers and as not having many friends. However, unlike the Severe group, caregivers did not describe their children as engaging in clinically significant amounts of social withdrawal. In addition, unlike the Severe
group, the Mild group was not reported to express their psychological stress in the form of physical complaints.

Finally, children belonging to the Normal psychosocial subtype were reported by their caregivers to be suffering from poor academic achievement and possible intellectual difficulties. However, these children were not reported to be suffering from any clinically significant forms of psychosocial dysfunction; that is, for these children, the non-cognitive adjustment scales and subscales of the PIC-II were within normal limits.

*Comparison of Derived Psychosocial Subtypes to those Reported in the Research Literature*

The Normal and Internalized Psychopathology subtypes derived in the present study are similar to two identically labeled subtypes discovered by Rourke and colleagues using samples of children with suspected learning difficulties referred for neuropsychological assessment (e.g., Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997). In the present study, 37 percent of children were classified into the Normal subtype. In general, the proportion of children assigned to the Normal subtype in the present study falls between the lower limit of 14 percent of children (Fuerst, Fisk, & Rourke, 1990) and the upper limit of 56 percent of children (Fuerst, Fisk & Rourke, 1989) reported by Rourke and colleagues for the same subtype. The variable size of the Normal subtype across studies by Rourke and colleagues is likely due, at least in part, to sample differences in diversity of psychosocial functioning and the sophistication of the statistical methods used to classify children into subtypes.
Importantly, the Internalized Psychopathology subtype derived in the present study is considerably smaller than similar subtypes derived by Rourke and colleagues (e.g., Fuerst, Fisk & Rourke, 1989; 1990; Porter & Rourke, 1985). Specifically, seven percent of children were assigned to the Internalized Psychopathology subtype in the present study, whereas a lower limit of 14 percent (Fuerst & Rourke, 1993) and an upper limit of 26 percent (Porter & Rourke, 1985) of children were assigned to the Internalized Psychopathology subtype in studies by Rourke and colleagues. Importantly, this discrepancy does not imply a scarcity of children suffering from internalizing forms of psychopathology in the present study. In fact, a greater proportion of children in the present study exhibited internalizing forms of psychopathology than did children in the aforementioned studies by Rourke and colleagues (e.g., Fuerst, Fisk, & Rourke, 1989, 1990; Fuerst & Rourke, 1993; Fuerst & Rourke, 1995; Porter & Rourke, 1985; Tsatsanis, Fuerst & Rourke, 1997). However, children exhibiting internalizing psychopathology in the present study also frequently suffered from additional externalizing forms of psychopathology, whereas children exhibiting internalizing psychopathology in the aforementioned studies by Rourke and colleagues did not.

The Normal and Internalized Psychopathology subtypes derived in the present study also correspond, respectively, to the Cognitive Deficit and Cognitive Internalized subtypes derived by Saunders et al. (2000) using a sample of children referred for neuropsychological assessment with known or suspected LD and documented caregiver reports of emotional and/or behavioural dysfunction. The proportions of children assigned to Saunders et al.’s Cognitive Deficit subtype and the present study’s Normal subtype are slightly discrepant (24 percent versus 37 percent, respectively), possibly due
to differences in the diversity of psychosocial functioning displayed by the two samples. In contrast, the proportions of children assigned to Saunders et al.’s Cognitive Internalized subtype and the present study’s Internalized Psychopathology subtype do not appear to differ considerably (11 percent versus seven percent, respectively).

The Internalized/Externalized Psychopathology subtype derived in the present study is conceptually similar to Saunders et al. (2000)’s Cognitive Combined Internalized/Externalized subtype. Notably, Saunders et al. are the only other researchers to have previously derived this psychosocial subtype. Both the Saunders et al. study and the present investigation differed from most of the previous studies by Rourke and colleagues in terms of their deliberate inclusion of children with comorbid psychiatric diagnoses and histories of psychiatric treatment. Indeed, Saunders et al.’s and the present study’s less stringent selection criteria allowed for the inclusion of children exhibiting extreme levels of psychopathology who would have been excluded from most of the studies by Rourke and colleagues. Consequently, it is not surprising that a group of children with LD exhibiting both internalizing and externalizing psychopathology were found in the present investigation and in the study by Saunders et al. but not in previous studies by Rourke and colleagues. Importantly, the presence of an Internalized/Externalized Psychopathology subtype in both the present investigation and the study by Saunders et al. strengthens the argument that a number of children with LD do indeed suffer from comorbid combined internalizing and externalizing psychopathology.

Despite the similarities between the two studies, there appears to be a substantial difference in the proportion of children assigned to the present study’s Internalized/Externalized Psychopathology subtype (56 percent) versus the proportion of children...
assigned to Saunders et al. (2000)’s Cognitive Combined Internalized/Externalized subtype (seven percent). This difference could represent a “cohort effect” whereby the population of children with LD assessed in both the Saunders et al. investigation and the present study has, over time, become more psychosocially impaired. A possible explanation for this cohort effect is the existence of increasingly stringent referral policies at organizations such as the Windsor Regional Children’s Centre stipulating that only the most dysfunctional of children are eligible for neuropsychological assessment.

Diversity in Patterns of Psychosocial Functioning

Notably, the present study’s sample did not exhibit as many patterns of psychosocial functioning as did samples from related studies (e.g., Fuerst, Fisk & Rourke, 1990; Fuerst & Rourke, 1993; Porter & Rourke, 1985; Saunders et al., 2000). Of the three subtypes derived in the present study, both subtypes suffering from psychosocial impairment (i.e., the Internalized Psychopathology and Internalized/Externalized Psychopathology subtypes) exhibited numerous elevations on the PIC-II adjustment scales and subscales. At the other end of the spectrum, one subtype (i.e., the Normal subtype) demonstrated an absence of psychosocial dysfunction altogether. Notably, none of the derived subtypes in the present study suffered from less pervasive forms of psychosocial impairment (i.e., a limited number of psychosocially-oriented PIC-II adjustment scale and subscale elevations). In contrast, Rourke and colleagues reported several psychosocial subtypes with only a limited number of psychosocially-oriented PIC clinical scale elevations: Mild Anxiety, Conduct Disorder, Somatic Concern, and Mild Hyperactivity (e.g., Fuerst, Fisk & Rourke, 1990; Fuerst & Rourke, 1993). In addition, Saunders et al. (2000) identified two psychosocial subtypes with only a limited number of

Three factors in particular may have contributed to the limited number of patterns of psychosocial functioning identified in the present study. First, the relatively small sample size of the present study (N=103) might serve to explain the limited number of psychosocial subtypes derived. Intuitively, it makes sense that a large sample would be required to identify subtypes of children representing low-frequency LD subpopulations. In the preliminary analyses of the present study, two children were removed who displayed patterns of PIC-II scores that differed markedly from those of the rest of the sample. It is possible that these two children represented a psychosocial subtype found at a very low frequency in the LD population. An increased sample size might have resulted in a greater number of children representing this theoretical low-frequency LD subpopulation. Indeed, studies by Rourke and colleagues with larger sample sizes have generally identified a more diverse range of psychosocial subtypes (e.g., Fuerst, Fisk, & Rourke, 1990; Fuerst and Rourke, 1993) than studies by the same researchers with smaller sample sizes (e.g., Porter & Rourke, 1985; Fuerst, Fisk, & Rourke, 1989).

Second, the limited number of psychosocial subtypes derived in the present study versus in previous investigations could reflect measurement differences. Rourke and colleagues and Saunders et al. (2000) relied on the PIC/PIC-R to derive psychosocial subtypes of children with LD, whereas the present study relied on the more up-to-date PIC-II. Notably, many of the adjustment scales of the PIC-II do not share a one-to-one correspondence with the clinical scales of the PIC/PIC-R; rather, it is often the case that individual adjustment scales are highly correlated with more than one clinical scale.
instance, the Psychological Discomfort adjustment scale is highly correlated with the Depression, Anxiety, and Psychosis clinical scales. Given the tendency for certain adjustment scales to be highly correlated with more than one clinical scale, it might be anticipated that children exhibiting particular patterns of adjustment scale elevations on the PIC-II would exhibit more diverse patterns of clinical scale elevations on the PIC/PIC-R. For example, children exhibiting a single elevation on the Psychological Discomfort adjustment scale of the PIC-II might be expected to demonstrate any one of six possible patterns of elevations on the Depression, Anxiety, and Psychosis clinical scales of the PIC/PIC-R. In addition, the PIC/PIC-R features 12 clinical scales, whereas the PIC-II features only 9 adjustment scales. Consequently, it is possible that some of the variation in children's psychosocial functioning as measured by the 12 clinical scales of the PIC/PIC-R may be lost when relying instead on the nine scales of the PIC-II.

Third, characteristics specific to the present study's sample likely influenced the number of derived psychosocial subtypes. Children undergoing neuropsychological assessment at the Windsor Regional Children's Centre (RCC) frequently suffer from internalizing and externalizing forms of psychopathology requiring their concurrent enrolment in preadolescent/adolescent outpatient programs and milieu/day programs. Notably, children exhibiting less extreme forms of psychosocial dysfunction (i.e., children exhibiting a limited number of psychosocially-oriented adjustment scale and subscale elevations on the PIC-II) are generally ineligible for referral to the RCC for neuropsychological testing. These population characteristics serve to explain why none of the derived subtypes in the present study displayed a limited number of elevations on
the psychosocially-oriented scales of the PIC-II and why two of the three subtypes exhibited extensive elevations on these same scales and subscales.

Notably, the large proportion of children from the present study's sample displaying only cognitive impairments (i.e., the Normal subtype) appears to contradict the RCC's policy of admitting mainly those children exhibiting psychological and behavioural disturbances. However, a considerable amount of time can pass between time of referral and actual neuropsychological assessment at the RCC. During this period of time, children may have received a substantial amount of treatment for their internalizing and externalizing problems. Children who are members of the Normal subtype in the present study may have exhibited internalizing and externalizing psychopathology at the times of their referrals, but may have been treated successfully for their psychosocial difficulties during the period prior to neuropsychological assessment. Alternatively, the large number of children reported to display normal psychosocial functioning in the present study may be attributable to particular parental response sets rather than to the absence of psychosocial dysfunction per se. For instance, research has demonstrated that parents often rate their children's pathology as most extensive on first report, and that these ratings tend to decrease on subsequent reports, independent of whether any treatment has occurred (e.g., Conners, Goyette, Southwick, Lees, & Andrulonis, 1976; Glow, Glow, & Rump, 1982). Applied to the present study, this research suggests that parents may have exhibited a general tendency to rate their children's psychopathology more severely at the time of initial referral to the RCC than at the time of neuropsychological assessment when they completed the PIC-II.
Summary and Implications

The research literature suggests that a sizeable portion of children with LD exhibit low self-esteem, depression, poor social skills, social withdrawal, inattention/hyperactivity, and delinquency (e.g., Bender & Wall, 1994; Greenham, 1999; Svetaz, Ireland, & Blum, 2000). Indeed, these documented psychosocial difficulties are largely corroborated by the substantial number of children in the present study exhibiting impairment in the social, emotional, and behavioural realms. In addition, children in the present study evidencing psychosocial impairment were typically found to be suffering from multiple psychosocial difficulties rather than one psychosocial difficulty in particular. These multiple psychosocial difficulties included a wide range of internalizing psychopathology, or, more commonly, a wide range of combined internalizing and externalizing psychopathology.

The psychosocial subtype findings for the present study have implications regarding the planning of appropriate remedial efforts for children with LD. Children with LD belonging to the Normal subtype would most likely benefit from direct academic remediation for their learning difficulties, without the need for any additional clinical intervention. Indeed, school-based academic remediation is already widely accessible for this group of children. However, the results of the present study suggest that, for many children with LD, academic remediation is not sufficient. Specifically, children with LD belonging to the Internalized Psychopathology and Internalized/Externalized Psychopathology subtypes would likely benefit from additional socio-emotional interventions. Children with LD experiencing internalizing difficulties in the absence of externalizing difficulties would likely benefit from social skills training, as
well as therapy targeting depression and other forms of psychological distress. In addition to these types of interventions, children with LD experiencing combined internalizing and externalizing psychosocial difficulties might also respond well to individual behavioural interventions targeting acting-out behaviours, and, potentially, family and parent counseling.

The Relationship between Psychosocial Subtype Membership and VIQ-PIQ Pattern

General Findings

Minimal support was found for the second hypothesis of the present study. The three derived psychosocial subtypes did not differ significantly in terms of VIQ-PIQ performance; that is, the three subtypes included statistically proportional numbers of children with VIQ>PIQ, VIQ=PIQ, and VIQ<PIQ. Despite these statistically non-significant findings, it should be noted that over half (57 percent) of children in the Internalized Psychopathology subtype had VIQ scores ten or more points greater than their PIQ scores. In addition, the mean VIQ score for children in the Internalized Psychopathology subtype was 14 points (almost a full standard deviation) higher than the mean PIQ score for these same children. Notably, the small size of the Internalized Psychopathology subtype (n=7) might have reduced the likelihood of finding a statistically significant VIQ>PIQ discrepancy. The VIQ>PIQ trend for the Internalized Psychopathology subtype, although not statistically significant, is worthy of further investigation as it suggests that children with LD suffering from extensive internalizing psychopathology may have better-developed psycholinguistic than visual-spatial-perceptual abilities.
Related Findings from Previous Studies

Fuerst, Fisk and Rourke (1990) were also unable to find a statistically significant VIQ>PIQ discrepancy for their Internalized Psychopathology subtype (n=26). However, these researchers noted that there was a trend approaching statistical significance for children in the Internalized Psychopathology subtype to demonstrate superior VIQ over PIQ performance (approximately 45 percent of children belonging to the subtype demonstrated this VIQ>PIQ trend). This trend corresponds to the non-statistically significant trend found for the Internalized Psychopathology subtype in the present study.

The findings from a study by Fuerst and Rourke (1993) also indirectly support the present investigation’s non-statistically significant VIQ>PIQ discrepancy trend for the Internalized Psychopathology subtype. Drawing upon a sample of 500 children with suspected LD referred for neuropsychological assessment, these researchers derived six psychosocial subtypes and compared these subtypes on three measures of academic achievement - reading, spelling, and arithmetic performance. Fuerst and Rourke (1993) found that children in the Internalized Psychopathology subtype exhibited the largest reading > arithmetic discrepancy. In interpreting these findings, it is important to note that reading tasks typically involve psycholinguistic abilities similar to those measured by the VIQ, whereas arithmetic tasks typically involve more visual-spatial-perceptual abilities similar to those measured by the PIQ. Thus, these researchers’ findings indirectly suggest that children with LD belonging to the Internalized Psychopathology subtype may be better developed in their VIQ-related cognitive abilities than their PIQ-related cognitive abilities.
The aforementioned VIQ-PIQ-related findings of Fuerst et al. (1990), Fuerst and Rourke (1993), and the present study for the Internalized Psychopathology subtype suggest that children belonging to this subtype may suffer from Rourke’s (1989) theoretical Non-verbal Learning Disability (NLD). Briefly, as is the case for the Internalized Psychopathology subtype, children with NLD typically do not display externalizing forms of psychopathology but instead exhibit poor social perception, engage in frequent social withdrawal, and suffer from excessive depression and/or anxiety (Rourke, 1989). Most relevant to the present discussion, children with NLD appear to display similar patterns of cognitive functioning to children belonging to the Internalized Psychopathology subtype. Specifically, children with NLD perform better on tasks measuring receptive language and verbal memory abilities than on tasks measuring visual-spatial-organizational abilities (Rourke, 1989). In addition, these children tend to exhibit better word reading skills than arithmetic skills (Rourke, 1989). Thus, the cognitive characteristics of Rourke’s NLD syndrome appear to offer some support for the VIQ>PIQ trend demonstrated by the Internalized Psychopathology subtype in the present study.

The present study’s VIQ-PIQ findings suggest that no relationship exists between psychosocial and cognitive functioning for children with LD belonging to the Normal subtype. As such, Fuerst et al. (1990)’s finding that the Normal subtype is comprised of significantly fewer VIQ>PIQ than VIQ=PIQ or VIQ<PIQ members is not supported by the present study. The two studies’ discrepant findings may be attributed to their varying sampling procedures and design characteristics. Fuerst et al. (1990) pre-selected equal numbers of children with VIQ>PIQ, VIQ=PIQ, and VIQ<PIQ discrepancy patterns from
a larger sample of children with learning difficulties for inclusion in psychosocial subtype derivation, whereas the present study did not control for VIQ-PIQ discrepancy (i.e., in the present study, VIQ-PIQ group sizes for the total sample were not equal). Arguably, the unaltered VIQ-PIQ groups for the overall sample in the present study are more representative of the general population of children with LD than the artificially equalized VIQ-PIQ groups for the overall sample in the study by Fuerst et al. (1990). It follows that, of the two studies, the present investigation’s VIQ-PIQ group frequencies for the Normal subtype are potentially more representative of the VIQ-PIQ group frequencies for the general subpopulation of children with LD who do not exhibit psychosocial dysfunction.

Verbal IQ-Performance IQ performance for the Internalized/Externalized Psychopathology subtype remains uninvestigated in the research literature. Given its many PIC-II adjustment scale and subscale elevations, one might expect the Internalized/Externalized Psychopathology subtype to exhibit the same VIQ>PIQ discrepancy as was displayed by Fuerst et al. (1990)’s severe psychopathology subtypes (i.e., the Internalized Psychopathology and Externalized Psychopathology subtypes). However, no such VIQ>PIQ discrepancy was found for the Internalized/Externalized Psychopathology subtype in the present study. Thus, the VIQ-PIQ analysis findings for the present study suggest that, for children with LD exhibiting such an extensive range of psychopathology, little relationship exists between psychosocial and cognitive functioning.
Summary and Implications

The statistically equivalent proportions of children belonging to the VIQ>PIQ, VIQ=PIQ and VIQ<PIQ groups for each of the present study’s three psychosocial subtypes challenges Fuerst et al. (1990)’s assertion that (a) children with LD belonging to subtypes characterized by severe psychosocial dysfunction are more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern and (b) children with LD belonging to subtypes characterized by mild or no psychosocial dysfunction are less likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern.

Nevertheless, based on the statistically non-significant VIQ>PIQ trend found in the present study for the Internalized Psychopathology subtype, it is possible that children with LD suffering from severe forms of internalizing psychopathology are more likely to show a VIQ>PIQ pattern than either a VIQ=PIQ or VIQ<PIQ pattern. However, further research is required relying on larger samples to determine whether a statistically significant VIQ>PIQ pattern does indeed exist for the Internalized Psychopathology subtype. Contingent on future empirical validation, elucidation of this relationship between psychosocial and cognitive functioning may facilitate the development of more effective clinical and academic interventions for children presenting with both severe internalizing psychopathology and LD.

Exploratory Analyses: Psychosocial Subtype Index-Based Cognitive Strengths and Weaknesses

Exploratory Analyses Findings

In the aforementioned analysis, VIQ-PIQ discrepancy may not have represented a discrete enough measure of cognitive functioning. In order to address this possibility,
Psychosocial Subtypes of LD

psychosocial subtype WISC-III index scores were examined to allow for a more fine-tuned analysis of cognitive ability. Within-subtype and between-subtype comparisons were conducted for these four indexes. Results were generally non-significant when alpha was adjusted downward to control for Type 1 error. However, the implementation of a per-comparison alpha rate of .05 that did not control for Type 1 error resulted in a number of significant findings. These results should be interpreted cautiously, as it is possible that one or more outcomes is/are due to chance alone. These findings, as well as a number of statistically non-significant trends, are discussed below.

The Normal subtype achieved a significantly higher mean score on the Processing Speed Index (PSI) than did the combined Internalized Psychopathology and Internalized/Externalized Psychopathology subtypes. In other words, processing speed appeared to be a strength for children with learning difficulties exhibiting no psychosocial dysfunction relative to children with learning difficulties exhibiting severe forms of psychosocial dysfunction. Interestingly, this relationship between cognitive and psychosocial functioning is likely not unique to children with LD. For instance, Riccio et al. (1997) reported that, for a sample taken from a heterogeneous child population, poor PSI performances on the WISC-III were correlated with conduct problems as well as depression. Indeed, regardless of whether or not a child has an LD, PSI task completion time is likely negatively influenced by the slow motor movement associated with depression, the indecisive behavior reflective of poor self-confidence, and/or the meticulous behavior associated with a variety of anxiety disorders. Also, independent of the presence or absence of an LD, externalizing behaviors such as hyperactivity and distractibility likely serve to impede children's attention to detail on the tasks of the PSI.
In addition, the Normal subtype received significantly higher scores on the PSI than on the Freedom from Distractibility Index (FDI). This latter finding is inconsistent with previous studies asserting that children with “pure” forms of LD often exhibit personal weaknesses on both the FDI and the PSI (i.e., the SCAD pattern; Kaufman, 1994; Prifitera & Dersh, 1993). In the present study, the Normal subtype (representing a group of children exhibiting “pure” forms of LD) appeared to display the short-term verbal memory deficits but not the processing speed deficits identified by previous researchers as common characteristics of children with LD. Notably, Mayes, Calhoun, and Crowell (1998) discovered a similar FDI deficit pattern to that exhibited by the Normal subtype in the present study. Specifically, these researchers investigated FSIQ–index discrepancy patterns for a sample of 66 children with LD, and found that, relative to FSIQ, children with LD tended to perform more poorly on the FDI than on the other three Indexes of the WISC-III. Interestingly, the researchers also reported that this substantial FSIQ-FDI discrepancy pattern held for children with a wide range of learning difficulties (e.g., reading comprehension, numerical operations, and written expression difficulties).

The Internalized/Externalized Psychopathology subtype achieved significantly higher scores on the Verbal Comprehension Index (VCI) than on the FDI. However, Table 5 indicates that mean index scores for the Internalized/Externalized Psychopathology subtype are all within approximately five points of each other; it is likely that this subtype’s large size relative to the other two subtypes might have resulted in the VCI>FDI index score differential reaching statistical significance.
Although there were no statistically significant findings regarding the Internalized Psychopathology subtype’s index score performance, several statistically non-significant trends in the data were apparent that may have reached statistical significance had the subtype’s size been larger. First, the subtype’s mean VCI score appeared to be considerably higher than the other two subtypes’ mean VCI scores. This trend suggests that children belonging to the Internalized Psychopathology subtype may be better developed in verbal concept formation than children belonging to the other two subtypes derived in the present study. In addition, the Internalized Psychopathology subtype appeared to score higher on the VCI than on the other three indexes of the WISC-III, particularly the FDI. This trend suggests that the Internalized Psychopathology subtype’s verbal concept formation ability may be better developed than its non-verbal reasoning, short-term auditory memory, and speed of mental processing abilities. Interestingly, the large differential between the Internalized Psychopathology subtype’s mean VCI and FDI scores demonstrates how VIQ (calculated through the combination of the VCI and the FDI) and VIQ-PIQ discrepancy are likely misleading measures of verbal ability for this subtype.

Summary and Implications

Index score analysis results were generally statistically non-significant when alpha was adjusted downward to control for Type 1 error. However, several mean-based and frequency-based comparisons reached statistical significance when a per-comparison alpha rate was implemented that did not control for Type 1 error. Importantly, it is likely that the present study’s small sample size served to lower experimental power and thereby obscure important inter- and intra- subtype index score differences.
Two findings in particular from the index score analysis may warrant further exploration in future research studies. First, children with LD who did not suffer from psychosocial dysfunction were found to score significantly higher (when no attempt was made to control for Type 1 error) on the PSI than, on average, children with LD suffering from severe forms of psychopathology. Although it is possible that the lower scores on the PSI for children exhibiting psychosocial dysfunction reflect cognitive impairment secondary to LD, it is also possible that the PSI scores of these children were depressed by cognitive/behavioral sequelae of the psychosocial problems (e.g., motor slowing, distraction, poor motivation), or that other variables are moderating the relationship between LD and psychosocial dysfunction.

Second, children suffering from severe and extensive internalizing psychopathology demonstrated a statistically non-significant trend towards higher scores on the VCI than on the other three indexes of the WISC-III. While lower scores on the POI, FDI, and PSI could reflect cognitive impairments secondary to LD that predispose affected children to the development of severe internalizing psychopathology, these lower scores could also represent the dampening effects of internalizing symptomatology on particular aspects of cognition, or, as mentioned above, the effects of one or more moderating variables. A better understanding of the relationship between severe psychosocial dysfunction and cognitive functioning in children with LD would aid in the interpretation of findings from the present study's index score analysis and would also facilitate the implementation of appropriate and effective academic and clinical interventions.
Study Limitations

A number of factors limiting the findings of the present study are worthy of mention. First, the present study’s relatively small sample size may have resulted in an under-representation of low-frequency psychosocial subtypes of children with LD; larger and more representative psychosocial subtypes may have been derived with a larger sample size. In addition, of the psychosocial subtypes derived in the present study, the Internalized Psychopathology subtype was particularly small (n=7). The small size of this group likely interfered with the detection of statistically significant differences; conspicuous descriptive trends in the data for the Internalized Psychopathology subtype might have reached statistical significance had the subtype’s size been larger. In summary, a larger overall sample size, as well as a larger Internalized Psychopathology subtype, would likely have resulted in the derivation of a greater number of statistically significant findings in the present study.

A second limitation of the present study, given its archival and therefore retrospective nature, is that its findings do not specify the direction of the proposed relationship between cognitive ability and severe psychosocial dysfunction. It is possible that poor psychosocial functioning might slow the development of children’s cognitive abilities. Indeed, displays of psychosocial dysfunction at school, including depression, social isolation, and hyperactivity might interfere with the development of important cognitive abilities. However, it is also likely that, in many circumstances, children’s under-developed cognitive abilities may act as catalysts for the development of psychosocial functioning difficulties. Children who are unable to effectively complete schoolwork or participate competently in class as a result of under-developed cognitive
abilities may, over time, begin to experience low self-esteem and depression, or may lose
the motivation to learn and begin to exhibit disruptive behaviour. In addition, it is also
possible that the relationship between psychosocial functioning and cognitive ability is
bi-directional and/or mediated/moderated by one or more other variables.

Sample characteristics may limit the extendibility of the present study’s findings
to the general population of children with LD. Firstly, the children used in the present
study were all referred for neuropsychological assessment to address known or suspected
learning or information processing disorders. It is questionable whether these children
were representative of the general population of children with LD. In addition, data in
the present study were collected from an organization that usually only services children
with internalizing and externalizing problems in addition to learning difficulties. In all
likelihood, these children would be expected to have a greater number of comorbid
psychiatric conditions than the typical child with LD. At the other extreme, Rourke and
colleagues conducted most of their studies using strict exclusionary criteria that restricted
their samples to children with “pure” LD who had no history of psychiatric diagnosis or
treatment. Thus, the present study’s and Rourke and colleagues’ samples feature children
functioning at extremes on the mental health spectrum and therefore these samples may
not be fully representative of the general population of children with LD.

Age and gender characteristics of the sample may also have influenced the results
of the present study. The present study included a sample of children between five and
16 years of age. Potentially, the number of psychosocial subtypes derived and the
severity of these subtypes’ psychopathology may have varied with age. Age differences
in the psychosocial functioning of children with LD have been investigated by a number
of researchers. While certain studies have found that severity of psychosocial functioning in children with LD increases with age (McGee, Williams, Share, Anderson, & Silva, 1986; Rourke, 1989; Strang, 1981), other more recent studies have found no such relationship between age and the psychosocial functioning of children with LD (Fuerst & Rourke, 1993; Tsatsanis, Fuerst, & Rourke, 1997). Regardless, samples with large un-partitioned age ranges are common in studies investigating the psychosocial functioning of children with LD (e.g., Fuerst, Fisk, & Rourke, 1989; Saunders et al., 2000). In addition, the cognitive functioning of psychosocial subtypes in the present study might have been influenced by age. In a similar study investigating the relationship between children with LD’s psychosocial and cognitive functioning, Fuerst et al. (1990) controlled for age by including an equal number of younger (six to eight years old) and older (nine to 12 years old) children in each of their VIQ-PIQ discrepancy groups. Unfortunately, the present study’s relatively small sample size precluded the equal assignment of younger and older children to VIQ-PIQ discrepancy groups.

Disproportionate gender representation could also have impacted the derivation of psychosocial subtypes of children with LD in the present investigation. Specifically, the present study featured approximately two and a half times as many boys as girls. As a result, psychosocial data for the boys were likely more influential on subtype formation than were psychosocial data for the girls; in other words, the derived psychosocial subtypes were likely more representative of boys with LD than girls with LD. In addition, the cognitive functioning of psychosocial subtypes in the present study might have been influenced by gender. Fuerst, Fisk, and Rourke (1990) controlled for gender in their investigation into the relationship between children with LD’s psychosocial and
cognitive functioning by evenly assigning males and females to VIQ-PIQ discrepancy groups. Unfortunately, again, the present study's small sample size made it difficult to ensure that VIQ-PIQ discrepancy groups were evenly split in terms of gender.

A final limitation of the present study is that psychosocial functioning was defined in terms of a single self-report questionnaire (i.e., the PIC-II). Reliance on this single measure of psychosocial functioning introduces the possibility of method variance confounding the formation of psychosocial subtypes. In addition, it is possible that the PIC-II adjustment scale scores utilized in the derivation of psychosocial subtypes of children with LD did not adequately operationalize the broad construct of psychosocial functioning. Finally, as a questionnaire administered to caregivers, PIC-II responses are subjective and not necessarily representative of children's actual emotional, social, and behavioural difficulties.

**Future Research**

The present study is the first to use the PIC-II to derive psychosocial subtypes of children with LD. As such, these PIC-II psychosocial subtypes (especially the relatively unique Internalized/Externalized Psychopathology subtype) need to be replicated in order to establish their consistency both within and between various subpopulations of children with LD.

In addition, any study attempting to replicate the findings of the present investigation should sample a larger number of children with LD. A larger sample size would likely prove advantageous in a number of ways. Firstly, it would facilitate the use of a cross-validation (i.e., split sample) procedure to better assess the internal reliability of derived psychosocial subtypes. Secondly, a larger sample size would also increase
experimental power and, consequently, the likelihood of statistically significant findings. A study with greater experimental power would be especially beneficial insofar as it would allow for a more comprehensive investigation of the cognitive strengths and weaknesses associated with low-frequency psychosocial subtypes of children with LD, such as the Internalized Psychopathology subtype derived in the present study.

Future studies might attempt to explore the direction of the relationship between cognitive ability and severe psychosocial dysfunction in children with LD. As mentioned previously, particular cognitive impairments may lead to the development of psychosocial difficulties in children with LD, or, alternatively, symptoms of psychosocial dysfunction may serve to depress cognitive abilities. In order to better understand the relationship between cognitive ability and severe psychosocial dysfunction, researchers may wish to conduct longitudinal studies whereby children with LD are monitored from an early age to test whether particular patterns of cognitive functioning are predictive of future psychopathology. Alternatively, cross-sectional studies could also be conducted whereby separate groups of children with LD are assessed at different ages to determine whether the incidence of severe psychosocial dysfunction increases over time for those children exhibiting particular patterns of cognitive functioning. Researchers implementing these longitudinal and cross-sectional designs might also consider controlling for other variables that could be moderating the relationship between cognitive ability and severe psychosocial dysfunction.

Future studies might also attempt to derive psychosocial subtypes for several discrete age groups of children with LD using the PIC-II and compare these subtypes using various measures of cognitive ability. This analysis would test whether age
influences the relationship between psychosocial and cognitive functioning in children with LD. Additionally, in order to evaluate the effects of gender on the relationship between psychosocial and cognitive functioning in children with LD, future investigations might attempt to derive separate psychosocial subtypes for boys and girls and compare these subtypes using various measures of cognitive ability.

In the present study, only the PIC-II adjustment scale scores were cluster analyzed in order to derive psychosocial subtypes of children with LD. Although mean adjustment subscale scores were calculated for the three psychosocial subtypes, these scores were not utilized in the formation of the subtypes. PIC-II adjustment subscales are beneficial in that they offer a more discrete description of psychosocial functioning, and differentiate between the specific types of psychosocial difficulties contributing to adjustment scale elevations. As such, future studies might attempt to derive more fine-tuned psychosocial subtypes of children with LD using the PIC-II adjustment subscale scores.

The present study utilized the WISC-III VIQ-PIQ discrepancy and index scores as measures of cognitive ability. The index score analysis was unique to the present study in that it allowed for a more discrete examination of the cognitive strengths and weaknesses associated with the various psychosocial subtypes of children with LD. However, an even more discrete examination of subtype cognitive functioning might have been accomplished through the use of the WISC-III subtest scores. Unfortunately, the present study's small sample size prevented the inclusion of any additional cognitive measures. Future studies with larger sample sizes could include WISC-III subtest scores in order to allow for an extremely fine-tuned analysis of the cognitive strengths and
weaknesses of the psychosocial subtypes of children with LD. In addition, a newer version of the WISC is now readily available (i.e., WISC-IV; Wechsler, 2003). Notably, this newer version of the WISC has not yet been used to examine the cognitive functioning of psychosocial subtypes of children with LD. Therefore, future research might aim to examine the WISC-IV index and subtest score performances of psychosocial subtypes of children with LD derived using the PIC-II.

The psychosocial subtypes derived in the present study were validated using measures of cognitive functioning. However, these psychosocial subtypes could also have been validated using measures of academic achievement. Fuerst and Rourke (1993) derived a set of psychosocial subtypes using the original PIC and compared these subtypes on measures of reading, spelling, and arithmetic. The researchers were able to identify specific associations between psychosocial subtype membership and academic achievement. Future studies might seek to compare psychosocial subtypes derived using the PIC-II on measures of academic achievement similar to those featured by Fuerst and Rourke (1993).

Once a stable number of psychosocial subtypes of children with LD has been identified using the PIC-II, future research might attempt to address the question of whether these subtypes extend to other clinical populations of children. Ralston, Fuerst, and Rourke (2003) cluster analyzed the PIC-R to derive psychosocial subtypes of children with below average IQ. These researchers then compared the resulting subtypes to those of children with LD previously derived by Rourke and colleagues, and found a high level of correspondence. In another study by Butler, Rourke, Fuerst, and Fisk (1997), psychosocial subtypes of children with closed-head injuries were derived using
the original PIC and, when these subtypes were compared to subtypes of children with LD previously derived by Rourke and colleagues, a considerable amount of overlap was noted. Importantly, these instances of overlap between LD and non-LD clinical populations may not hold with PIC-II-derived psychosocial subtypes. Future studies might seek to compare updated PIC-II-derived psychosocial subtypes of children from the LD population to PIC-II-derived psychosocial subtypes of children from non-LD populations.

**General Summary and Conclusions**

The present investigation contributes significantly to the research literature as the first study to use the PIC-II to derive psychosocial subtypes of children with LD. In all, three psychosocial subtypes of children with LD were derived using the PIC-II; two of these subtypes are conceptually similar to subtypes of children with LD found by both Rourke and colleagues and Saunders et al. (2000), whereas the third subtype is unique to only the present investigation and to the study by Saunders et al. The internal reliability of the three psychosocial subtypes, as evidenced by their replicability across clustering methods, provides support for the use of the PIC-II as a measure of psychosocial functioning in children with LD. Interestingly, the patterns of psychosocial functioning observed in the present study were not as diverse as those found by other researchers (e.g., Fuerst, Fisk, & Rourke, 1990; Fuerst & Rourke, 1993; Saunders, 2000). The restricted number of psychosocial functioning patterns may be explained by such factors as the present study’s relatively small sample size and unique sample characteristics. Future research might attempt to collect larger amounts of data from a variety of
organizations in order to increase the likelihood of capturing the complete range of psychosocial functioning exhibited by children with LD.

In addition, the present investigation builds upon previous research by addressing the possibility of a more complex relationship between psychosocial and cognitive functioning in children with LD. When VIQ-PIQ discrepancy was used in the present study to examine the cognitive functioning of the psychosocial subtypes, only one of the three subtypes displayed a trend towards a particular VIQ-PIQ performance pattern, and, notably, this trend was not statistically significant. However, in the present study's index score analysis, a number of statistically significant and non-significant patterns of cognitive functioning were discovered for the psychosocial subtypes. Thus, it appears that the VIQ-PIQ discrepancy might be overly simplistic and therefore less appropriate than index score performance when it comes to identifying the rather discrete cognitive strengths and weaknesses exhibited by psychosocial subtypes of children with LD.

Notably, further research is necessary in order to substantiate the findings from the present study's index score analysis, as many of these findings do not take into consideration the potential for Type 1 error.

In accordance with previous studies, the findings of the present investigation suggest that children with LD are a heterogeneous population in terms of their psychosocial and cognitive functioning. However, school-based interventions for children with LD often focus primarily on the remediation of cognitive, rather than psychosocial, difficulties. It is likely that the resource constraints commonly faced by school boards prevent most children with LD from ever receiving the treatment that they require for their psychosocial difficulties. Nevertheless, over time, this failure on the part
of school boards to address children’s psychosocial difficulties may prove extremely costly, as untreated instances of psychosocial dysfunction may exacerbate academic failure and the need for prolonged and extensive academic remediation.

From a long-term perspective, a more resource-friendly option for school boards might be to provide early socio-emotional intervention opportunities to children with LD who suffer from severe psychosocial dysfunction. Depending on the nature of the psychosocial dysfunction, early socio-emotional interventions may include social skills training, individual therapy targeting self-esteem, depression, and anxiety, or even parent counseling. Further research is necessary in order to ensure that these early socio-emotional interventions are maximally effective in reducing the incidence of psychopathology in children with LD.
References


Appendix A

PIC-II Scale and Subscale Descriptive Statistics for the Four Derived Clusters and Total Sample

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<td>(N=95)</td>
<td>65.38</td>
<td>66.34</td>
<td>55.17</td>
<td>62.83</td>
<td>53.44</td>
<td>62.52</td>
</tr>
</tbody>
</table>

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Appendix A (cont.)

PIC-II Scale and Subscale Descriptive Statistics for the Four Derived Clusters and Total Sample

<table>
<thead>
<tr>
<th>Group(^a)</th>
<th>PIC-II Scale</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>FAM</td>
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<tr>
<td>Cluster 1: ((n=7; 7%)) Internalized Psychopathology</td>
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</tr>
<tr>
<td>(M)</td>
<td>51.00</td>
</tr>
<tr>
<td>(SD)</td>
<td>8.64</td>
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<tr>
<td>Cluster 2: ((n=27; 28%)) Internalized/Externalized Psychopathology: Severe</td>
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</tr>
<tr>
<td>(M)</td>
<td><strong>60.89</strong></td>
</tr>
<tr>
<td>(SD)</td>
<td>11.70</td>
</tr>
<tr>
<td>Cluster 3: ((n=26; 27%)) Internalized/Externalized Psychopathology: Mild</td>
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</tr>
<tr>
<td>(M)</td>
<td><strong>60.92</strong></td>
</tr>
<tr>
<td>(SD)</td>
<td>11.80</td>
</tr>
<tr>
<td>Cluster 4: ((n=35; 37%)) Normal</td>
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</tr>
<tr>
<td>(M)</td>
<td>48.34</td>
</tr>
<tr>
<td>(SD)</td>
<td>6.69</td>
</tr>
<tr>
<td>Total Sample ((N=95))</td>
<td></td>
</tr>
<tr>
<td>(M)</td>
<td>55.55</td>
</tr>
<tr>
<td>(SD)</td>
<td>11.53</td>
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Appendix A (cont.)

PIC-II Scale and Subscale Descriptive Statistics for the Four Derived Clusters and Total Sample

<table>
<thead>
<tr>
<th>Groupa</th>
<th>SOM</th>
<th>SOM1</th>
<th>SOM2</th>
<th>DIS</th>
<th>DIS1</th>
<th>DIS2</th>
<th>DIS3</th>
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<tbody>
<tr>
<td>Cluster 1: (n=7; 7%) Internalized Psychopathology</td>
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<td></td>
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<td></td>
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</tr>
<tr>
<td>M</td>
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<td>80.14</td>
<td>67.43</td>
<td>80.71</td>
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<tr>
<td>SD</td>
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<td>13.01</td>
<td>7.49</td>
<td>17.43</td>
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<tr>
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<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>M</td>
<td>60.44</td>
<td>61.93</td>
<td>55.37</td>
<td>80.44</td>
<td>72.41</td>
<td>79.63</td>
<td>67.89</td>
</tr>
<tr>
<td>SD</td>
<td>8.59</td>
<td>10.55</td>
<td>8.29</td>
<td>9.25</td>
<td>12.02</td>
<td>9.47</td>
<td>14.11</td>
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<tr>
<td>Cluster 3: (n=26; 27%) Internalized/Externalized Psychopathology: Mild</td>
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<tr>
<td>M</td>
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<td>9.06</td>
<td>10.13</td>
<td>10.28</td>
<td>11.69</td>
</tr>
<tr>
<td>Cluster 4: (n=35; 37%) Normal</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>48.66</td>
<td>49.14</td>
<td>48.49</td>
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<td>51.57</td>
<td>56.80</td>
<td>52.89</td>
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<td>7.65</td>
<td>9.45</td>
<td>9.39</td>
<td>10.33</td>
<td>12.83</td>
</tr>
<tr>
<td>Total Sample (N=95)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>M</td>
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<td>51.71</td>
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<td>61.58</td>
<td>67.85</td>
<td>59.48</td>
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Appendix A (cont.)

PIC-II Scale and Subscale Descriptive Statistics for the Four Derived Clusters and Total Sample

<table>
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<th>PIC-II Scale</th>
<th>WDL</th>
<th>WDL1</th>
<th>WDL2</th>
<th>SSK</th>
<th>SSK1</th>
<th>SSK2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cluster 1:</strong> (n=7; 7%) Internalized Psychopathology</td>
<td>70.14</td>
<td>59.43</td>
<td>79.43</td>
<td>80.71</td>
<td>68.00</td>
<td>82.71</td>
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<tr>
<td><strong>Cluster 2:</strong> (n=27; 28%) Internalized/Externalized Psychopathology: Severe</td>
<td>60.11</td>
<td>53.48</td>
<td>66.74</td>
<td>82.33</td>
<td>68.85</td>
<td>86.56</td>
</tr>
<tr>
<td><strong>Cluster 3:</strong> (n=26; 27%) Internalized/Externalized Psychopathology: Mild</td>
<td>54.42</td>
<td>50.73</td>
<td>58.27</td>
<td>67.38</td>
<td>61.62</td>
<td>69.27</td>
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<tr>
<td><strong>Cluster 4:</strong> (n=35; 37%) Normal</td>
<td>50.97</td>
<td>50.51</td>
<td>50.23</td>
<td>58.06</td>
<td>59.11</td>
<td>53.74</td>
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<tr>
<td><strong>Total Sample</strong> (N=95)</td>
<td>55.93</td>
<td>52.07</td>
<td>59.27</td>
<td>69.18</td>
<td>63.22</td>
<td>69.45</td>
</tr>
</tbody>
</table>

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Appendix A (cont.)

PIC-II Scale and Subscale Descriptive Statistics for the Four Derived Clusters and Total Sample

*Note.* Bold type refers to a clinically significant elevation on the relevant scale or subscale as defined by the PIC-II manual. *INC:* Inconsistency; *FB:* Dissimulation; *DEF:* Defensiveness; *COG:* Cognitive Impairment; *COG1:* Inadequate Abilities; *COG2:* Poor Achievement; *COG3:* Developmental Delay; *ADH:* Impulsivity and Distractibility; *ADH1:* Disruptive Behavior; *ADH2:* Fearlessness; *DLQ:* Delinquency; *DLQ1:* Antisocial Behavior; *DLQ2:* Dyscontrol; *DLQ3:* Noncompliance; *FAM:* Family Dysfunction; *FAM1:* Conflict Amongst Members; *FAM2:* Parent Maladjustment; *RLT:* Reality Distortion; *RLT1:* Developmental Deviation; *RLT2:* Hallucinations and Delusions; *SOM:* Somatic Concern; *SOM1:* Psychosomatic Preoccupation; *SOM2:* Muscular Tension and Anxiety; *DIS:* Psychological Discomfort; *DIS1:* Fear and Worry; *DIS2:* Depression; *DIS3:* Sleep Disturbance/Preoccupation With Death; *WDL:* Social Withdrawal; *WDL1:* Social Introversion; *WDL2:* Isolation; *SSK:* Social Skill Deficits; *SSK1:* Limited Peer Status; *SSK2:* Conflict with Peers.

*Percentages of children assigned to the four clusters sum to 99 rather than 100 due to rounding error.*
Appendix B

University of Windsor Research Ethics Board and Windsor Regional Hospital Research

Ethics Board Clearance Forms
This is to inform you that the University of Windsor Research Ethics Board (REB), which is organized and operated according to the *Tri-Council Policy Statement* and the University of Windsor *Guidelines for Research Involving Human Subjects*, has reviewed your project and the outstanding issues are listed above. Once these issues have been addressed, a clearance letter will be sent to you.

A Progress Report and/or Final Report is due by the dates noted above. The REB may ask for monitoring information at some time during the project’s approval period.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the REB. Minor change(s) in ongoing studies will be considered when submitted on the Request to Revise form.

Investigators must also report promptly to the REB:
- a) changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
- b) all adverse and unexpected experiences or events that are both serious and unexpected;
- c) new information that may adversely affect the safety of the subjects or the conduct of the study.

Forms for submissions, notifications, or changes are available on the REB website: www.uwindsor.ca/reb.

We wish you every success in your research.

Maureen Muldoon, Ph.D.
Chair, Research Ethics Board

cc: Dr. Sylvia Voelker, Psychology
    Linda Bunn, Research Ethics Coordinator

This is an official document. Please retain the original in your files.
Today's Date: January 23, 2006
Principal Investigator: Mr. Timothy Johnston
Department/School: Psychology
REB Number: 05-177
Research Project Title: Cognitive functioning in psychosocial subtypes of children with learning disabilities and comorbid psychiatric diagnoses
Clearance Date: January 23, 2006
Project End Date: April 30, 2006

This is to inform you that the University of Windsor Research Ethics Board (REB), which is organized and operated according to the *Tri-Council Policy Statement* and the University of Windsor *Guidelines for Research Involving Human Subjects*, has granted approval to your research project on the date noted above. This approval is valid only until the Project End Date.

A Progress Report or Final Report is due by the date noted above. The REB may ask for monitoring information at some time during the project’s approval period.

During the course of the research, no deviations from, or changes to, the protocol or consent form may be initiated without prior written approval from the REB. Minor change(s) in ongoing studies will be considered when submitted on the Request to Revise form.

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We wish you every success in your research.

Maureen Muldoon, Ph.D.
Chair, Research Ethics Board

cc: Dr. Sylvia Voelker, Psychology
    Linda Bunn, Research Ethics Coordinator

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Maureen Muldoon, Ph.D.
Chair, Research Ethics Board

cc: Dr. Sylvia Voelker, Psychology
Linda Bunn, Research Ethics Coordinator

This is an official document. Please retain the original in your files.
Windsor Regional Hospital  
Research Ethics Board  
1995 Lens Avenue  
Windsor, Ontario N8W 1L9  

REB REVIEW FORM  

Meeting Review Date: October 27, 2005  

Project Title: Cognitive Functioning in Psychosocial Subtypes of Children with Learning Disabilities and Comorbid Psychiatric Diagnoses  

Principal Investigator: Dr. Cory Saunders, Windsor Regional Children's Centre  
Student Researcher: Tim Johnston  
Faculty Advisor: Dr. Sylvia Voelker, University of Windsor  

REB File Reference: 05-070  

SUBMISSIONS REVIEWED:  

TYPE OF APPROVAL:  
[ X ] Category A: Approved * Please note suggestion below.*  
[ ] Category B: Approval - with some concerns addressed - Board Comments attached  
[ ] Category C: Decision deferred. More information/revisions required - Comments attached  
[ ] Category D: Not Approved  

This Research Ethics Board carries out its functions in a manner consistent with ICH Good Clinical Practice Guidelines, applicable regulations and the Tri-Council Policy Statement for Ethical Conduct of Research Involving Humans. A quorum was present and only Research Ethics Board members who are independent of the investigator(s) conducting the study participated in decisions relating to this research.  

Please notify this board when your study is complete and submit a summary of the conduct of the study. This approval is for one year, expiring on October 26, 2006. Any changes in protocol must be submitted to the Research Ethics Board for approval.  

The Research Ethics Board suggests that either a separate consent form be used for permission of subsequent use of data for research or that a boxed section be put in the current consent form that asks "May we use your data in future for research purposes?" with a yes or no check off/initial portion beside this question.  

Anil Dhari, MBBS, FRCP  
Chair, Windsor Regional Hospital  
Research Ethics Board  

Date Nov. 11/05  

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Vita Auctoris

Name: Timothy Compton Johnston

Place of Birth: Toronto, Ontario

Year of Birth: 1980


Queen’s University, Kingston, ON 1999-2004 B.Sc., B.A.(Hons.), B. Ed.

University of Windsor, Windsor, ON 2004-2006 M.A.
(called enrolled in the Ph.D. program)