CHAPTER 1: INTRODUCTION TO THE BACKGROUND, AIMS AND ORGANISATION OF THE THESIS

1. Introduction

Chapter 1 will provide an introduction to the background, aims, and organisation of the current thesis. This will include a brief overview of the project that will be elaborated on in Chapters 2 and 3. The current project will include 3 studies and the aims for each study will be presented. A brief outline of each chapter will then be provided.

1.1 Background

There has been considerable debate over the construct validity of the AD/HD and ODD symptoms (see Burns, Walsh, & Gomez, 2003; refer Appendix A for the DSM-IV-TR AD/HD and ODD criteria). To date, previous EFA and CFA studies investigating the internal validity of the DSM-IV AD/HD symptoms alone and with the DSM-IV ODD and CD symptoms provide support for separate AD/HD dimensions of IN and H/I and a single ODD dimension (e.g., Bauermeister, 1992; Baumgaertel, Wolraich, & Dietrich, 1995; Pelham Jnr., Gnagy, Greenslade, & Milich, 1992; Weiler, Bellinger, Marmor, Rancier, & Waber, 1999; Wolraich, Feurer, Hannah, Baumgaertel, & Pinnock, 1998). A major limitation of previous EFA and CFA studies is that they are based on single source ratings (i.e., parent or teacher) and do not take measurement error (i.e., source effects) into account.

Recent CFA MT-MS studies have addressed the presence of source effects by using multiple sources (i.e., teachers and parents) to rate childhood behaviour (Burns & Walsh, 2002; Burns, Walsh et al., 2003; Gomez, Burns, Walsh, & De Moura, 2003; Gomez, Burns, Walsh, & Hafetz, 2005; Keogh, 2002; Smith, 2003; Tallent, 2003). Overall, these studies provide low trait variance for the AD/HD and ODD dimensions,

with some support for the convergent validity of teacher-rated IN and parent-rated H/I (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003). However, in the majority of CFA MT-MS studies source variance is greater than trait variance. The large source effects found in recent MT-MS studies may be explained by cross-situational differences (e.g., AD/HD and ODD behaviours are compared in the home and school settings). To date, no studies have examined the internal validity of the AD/HD and ODD symptoms in a single setting (e.g., home). Such research would address the cross-situational debate and provide a better understanding of the nature adequately addressed in previous studies.

Given that recent CFA MT-MS studies have found that the AD/HD and ODD dimensions contain more source than trait variance, the relationships between the IN, H/I, and ODD dimensions with each other and with other dimensions (i.e., academic and behavioural problems) is unclear. Therefore, it is unknown if the measures are capturing trait, source, or error variance. The separation of trait from source effects is important for understanding the relationships between the AD/HD and ODD dimensions with other dimensions. There are currently no known studies that have examined the relationship between the trait dimensions of IN, H/I, and ODD with each other and with other trait dimensions using mother and father ratings.

1.2 Aims of the current project

It is the aim of the current project to examine the construct validity of the AD/HD and ODD dimensions in a single setting (i.e., home) based on mother and father ratings. The current project includes three studies that are derived from the same data set. Study 1 will use CFA to examine the internal validity of the AD/HD and ODD symptoms, separately for mother and father ratings. Study 2 will use the MT-MS approach to

examine the internal validity of the AD/HD and ODD dimensions based on combined mother and father ratings using the best fit model identified in Study 1 (i.e., postulated model). The AD/HD and ODD dimensions will be tested at the matrix and symptom parcel levels. Study 3 will examine the relationships between the IN, H/I, and ODD trait dimensions with each other and with other trait dimensions including academic performance, prosocial behaviour, peer problems, and emotional problems. The MT-MS approach will be used based on combined mother and father ratings.

1.3 Organisation of the chapters in the thesis

Following this chapter, Chapter 2 of this thesis will provide a brief overview of AD/HD and ODD. Given that the focus on the current thesis is on the construct validity of the AD/HD and ODD symptoms and not the actual disorders, only a brief overview of AD/HD and ODD will be provided. Chapter 2 will include historical changes in the DSM conceptualisation of the AD/HD and ODD symptoms, prevalence, sex differences, developmental progression, and comorbidity. Diagnostic criteria, assessment, and causes and theories of AD/HD and ODD will also be briefly outlined.

Chapter 3 is separated into two parts. Part 1 will discuss different frameworks for diagnostic validation and then Part 2 will present previous research that has examined the internal and external validity of the AD/HD and ODD symptoms. This chapter will present EFA, CFA, and MT-MS studies in detailed tabular form and an overview of each table will be covered briefly in the text. Chapter 3 will also address findings from past research and limitations will be discussed for the EFA, CFA, and MT-MS methods. For the MT-MS approach, findings will be reported at the matrix and individual levels.

Chapter 4 will present the aims, method, results, and a brief discussion of Study 1, which will examine the factor structure of the DSM-IV AD/HD and ODD symptoms and

symptom parcels based on a single source (i.e., mother or father) using the CFA approach. A 1-factor, a 2-factor, and a 3-factor model of AD/HD and a single factor model of ODD will be tested to determine best fit. The AD/HD model that shows the best data fit based on the single source data will be used as the postulated model in Study 2.

Chapter 5 will include the aims, method, results, and a brief discussion of Study 2, which will examine the construct validity of the AD/HD and ODD symptom parcels using the MT-MS approach based on combined mother and father ratings. The data will be analysed at the matrix and symptom parcel level. At the matrix level, the MT-MS approach will be used to compare a postulated model (e.g., Model 1) with more restrictive models (e.g., Models 2, 3, and 4). At the symptom parcel level, the MT-MS approach will also be used to determine the amount of trait, source, and error variance in the IN, H/I, and ODD dimensions.

Chapter 6 will include the aims, method, results, and a brief discussion of Study 3, which will examine the relationships between the IN, H/I, and ODD trait dimensions with each other and with other trait dimensions including academic performance, prosocial behaviour, peer problems, and emotional problems. The MT-MS approach will be used and only trait correlations will be reported once source and error variance have been removed.

Given that the procedure was similar for each study, only a brief description of the procedure will be provided for Studies 2 and 3 (Chapters 5 and 6) as a detailed discussion will have already been provided in Chapter 4 for Study 1. Furthermore, any measures used in Studies 2 and 3 that were also used in Study 1, will only be briefly described as they would have received a detailed discussion in Chapter 4 for Study 1.

CHAPTER 2: AD/HD AND ODD: HISTORICAL ANALYSIS AND OVERVIEW

1. Introduction

Attention-Deficit/Hyperactivity Disorder (AD/HD), Oppositional Defiant Disorder (ODD), and Conduct Disorder (CD) are recognised in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) as three of the most common behaviour disorders in primary school children (American Psychiatric Association [APA], 1994). Classified by the DSM-IV as disorders that usually are first diagnosed in infancy, childhood, and adolescence, AD/HD, ODD, and CD are listed as Attention-Deficit and Disruptive Behaviour Disorders (1994).

Chapter 2 is divided into 2 sections and provides a brief overview of AD/HD and ODD. Part 1 examines the historical changes in the DSM conceptualisation of AD/HD and ODD. It will be demonstrated that the conceptualisation of the childhood disorders have been through various changes since the introduction of Hyperkinetic Reactive Disorder in the DSM-II (APA,1968). Although ODD was introduced into the DSM at a later stage, it also has been through several changes. Part 1 also includes the current DSM organisation of the AD/HD and ODD symptoms. Part 2 will provide an overview of AD/HD and ODD including prevalence, sex differences, developmental progression, comorbidity, diagnostic criteria, and assessment. The causes and theories of AD/HD and ODD will also be presented separately, as presented in several authoritive texts on childhood behaviour disorders (e.g.; Barkley, 1998; Mash & Barkley, 1998).

2. Part 1: Historical Changes in the Conceptualisation and Diagnosis of AD/HD and ODD

2.1 Historical and Current Conceptualisation of AD/HD

The DSM organisation of the AD/HD symptoms has gone through many changes since the symptoms of the disorder were highlighted at the beginning of the twentieth century (see Still, 1902). The childhood behaviour disorders were first presented with the introduction of the hyperactive disorder (labelled as Hyperkinetic Reaction Disorder; APA, 1968). In the DSM-II, overactivity was recognised as a core feature and poor attention was considered secondary. However, the DSM included minimal details for reliable clinical diagnosis and only generalised descriptions of behaviour (Achenbach & Edelbrock, 1978; Barkley, 1998).

Based on studies by Douglas and colleagues (Douglas & Peters, 1979), the DSM-III (APA, 1980) listed three separate categories of symptoms: inattention (5 symptoms), impulsivity (5 symptoms), and hyperactivity (4 symptoms), using the label of Attention Deficit Disorder with Hyperactivity (ADD/H). If only the DSM-III inattention and impulsivity were present, the diagnosis of Attention Deficit Disorder Without Hyperactivity (ADD/WO) was provided (APA, 1980). The DSM-III ADD/H classification was considered a major improvement over the DSM-II and was noteworthy for several reasons. First, greater emphasis was placed on inattention and impulsivity as major features. Second, subtypes were created according to the presence or absence of hyperactivity, although these subtypes were based on little empirical research (Barkley, 1990).

During the 1980s with the introduction of the DSM-III, there was considerable debate whether the classification of AD/HD has helped to distinguish it from other disorders (Barkley, 1990). In particular, it was difficult to distinguish AD/HD from

ODD/CD due to the overlapping characteristics of these disorders (Prior & Sanson, 1980; Quay, 1979). Prior and Sanson (1986) suggested that specificity should occur to validate the child behaviour disorders in the areas of aetiology, symptomology, course, and treatment outcomes and prognosis.

To date, support has been provided for differentiation between AD/HD and ODD based on factor analysis studies (to be presented in Chapter 3) and studies that have reported unique patterns concerning etiology, prognosis, treatment, and outcomes. For instance, whereas AD/HD has been shown to be more closely associated with lower IQ, academic performance, and lower parent psychopathology (Lahey, Piacentini et al., 1988; McGee, Williams, & Silva, 1984; Schachar, 1991; Werry, Reeves, & Elkind, 1987), CD/ODD has been shown to be more closely associated with maternal rejection, poor parental supervision (Loeber, Brinthaupt, & Green, 1990), and parental alcohol abuse (Reeves, Werry, Elkind, & Zametkin, 1987; Stewart, deBlois, & Cummings, 1980). Further comorbidity studies have also provided unique patterns for AD/HD and those with or without co-existing ODD/CD.

Jensen, Martin, and Cantwell (1997) reported children with comorbid AD/HD and ODD/CD are characterised by differences in clinical and biological characteristics, and clinical course and treatment outcomes for children with AD/HD only. Clinical characteristics of comorbid AD/HD and ODD include earlier age of onset, higher prevalence among males, and a decreased chance for eventual remission than children with AD/HD only. Biological characteristics indicate that AD/HD and CD/ODD are characterised by lower IQs, increased learning difficulties, and evidence of neuropsychological deficits. Furthermore, Jensen et al. (1997) reported poorer outcomes for children with AD/HD and ODD/CD and treatment that addresses both inattention and disruptive/aggressive behaviour is more effective. These findings appear to provide

support for separate AD/HD and ODD disorders consistent with other studies that have investigated the diagnostic discrimination between the two entities (Jensen et al., 2001; Kuhne, Schachar, & Tannock, 1997; Livingston, Dykman, & Ackerman, 1990). This issue will be addressed further in Chapter 3.

The introduction of the DSM-III-R led to further revision of the organisation of AD/HD symptoms. The revisions included a single symptom list of 14 inattention, hyperactivity, and impulsivity symptoms replacing the three separate lists, and ADD was renamed Attention-deficit Hyperactivity Disorder (ADHD; APA, 1987). A feature of the DSM-III-R was the addition of a new category, Undifferentiated Attention Deficit Disorder (UADD). This sparked controversy as the conceptualisation of the sub-type was vague and the DSM-III subtype of ADD/WO was effectively eliminated from DSM-III-R.

Based on factor analysis studies (DuPaul, 1991) and major field trials (Frick et al., 1994; Lahey et al., 1994), the DSM-IV reorganised the AD/HD symptoms into separate categories of inattention and hyperactivity/impulsivity (see Appendix A for a full list of symptoms). Although the AD/HD diagnostic label was retained, unique to the DSM-IV criteria was a requirement that the AD/HD symptoms must be present across multiple settings (e.g., home and school; APA, 1994). The DSM-IV also recognised three AD/HD subtypes including AD/HD Predominantly Inattentive Type (AD/HD – IN), AD/HD Predominantly Hyperactive/Impulsive Type (AD/HD – H/I), and AD/HD Combined Type (AD/HD – C; APA, 1994). The DSM-IV ADHD-C and ADHD-IN subtypes were intended to be comparable to previous DSM subtypes of ADD/H and ADD/WO, respectively. With the introduction of the DSM-IV-TR, there were no changes to the organisation of the AD/HD symptoms (APA, 2000). Therefore, the current study will refer to the DSM-IV AD/HD symptoms.

2.2 Historical and Current Conceptualisation of ODD

Oppositional Disorder was first introduced into the DSM-III categorised as a Disorder Usually First Evident in Infancy, Childhood, or Adolescence (APA, 1980). It was characterised by persistent disobedient, negativistic, and provocative opposition to authority figures (APA, 1980). According to the DSM-III, a child needed at least two out of five symptoms to meet the diagnostic criteria for Oppositional Disorder (APA, 1980). It was not until DSM-III-R that it was renamed Oppositional Defiant Disorder (ODD) and was grouped with AD/HD and CD under the heading of Disruptive Behaviour Disorders (APA, 1987). From DSM-III to DSM-III-R, the total number of ODD symptoms also increased from five to nine symptoms. Furthermore, the diagnostic criteria in DSM-III-R became more stringent than previous DSM editions with the number of symptoms required to meet the ODD criteria increasing from two to five symptoms (APA, 1980; APA, 1994).

From DSM-III-R to DSM-IV, further changes were made to the DSM organisation of the ODD symptoms. Several primary ODD symptoms were deleted from the list that was provided in DSM-III-R including swearing and the use of abusive language (APA, 1980; APA, 1994). Furthermore, it was now required that four out of eight symptoms were required to meet the diagnostic criteria for ODD (see Appendix A for a full list of symptoms), as supported in the DSM-IV field trials (Lahey, Applegate, Barkley et al., 1994). Children who exhibited fewer than 4 ODD symptoms were eligible to receive a diagnosis of Disruptive Behaviour Disorder Not Otherwise Specified (APA, 1994). With the introduction of the DSM-IV-TR the organisation of the ODD symptoms remained unchanged. As was the case with AD/HD, the current study will refer to the DSM-IV ODD symptoms.

3. Part 2: Overview of AD/HD and ODD

3.1 AD/HD

AD/HD is one of the most common childhood disorders characterised by inattention and hyperactivity/impulsivity (APA, 1994). Hyperactivity/impulsivity is characterised by excessive behaviour, squirming, difficulty remaining seated, inappropriate noise/vocalisation, and difficulty waiting (APA, 1994). In contrast, inattention is characterised by careless mistakes, difficulty organising tasks and activities, being easily distracted, and difficulty sustaining attention (APA, 1994). A more detailed account of AD/HD will be provided in the following overview of the disorder.

3.1.1 Prevalence and Sex Differences of AD/HD

The DSM-IV estimates the prevalence of AD/HD in school-age children as between 3% and 5% (APA, 1994). However, previous studies using teacher and predominantly mother ratings to rate the AD/HD symptoms tend to report higher prevalence rates that range from approximately 3% to 18% (August, Braswell, & Thuras, 1998; DuPaul et al., 1997; DuPaul et al., 1998; Gadow, Sprafkin, & Nolan, 2001; Gomez, Harvey, Quick, Scharer, & Harris, 1999; Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001; Nolan, Gadow, & Sprafkin, 2001; Wolraich et al., 1998; Wolraich, Hannah, Pinnock, Baumgaertel, & Brown, 1996). There is large variation in the prevalence rates of AD/HD based on the nature of the sample (i.e., clinical versus community) and method of assessment (i.e., different rating sales). For instance, the DSM-IV reports prevalence of AD/HD is higher in clinical samples compared to community samples (APA, 1994). Prevalence rates for AD/HD symptoms in community samples include 2.8% (n = 7,231; August et al., 1998), 7.5% (n = 3,597; Graetz et al., 2001), 11.4% (n = 8,258; Wolraich et al., 1996), 15.8% (n=3,006; Nolan et al., 2001), and 17.8% (n = 4,323; Wolraich et al., 1998). However, these rates may be inflated as they are based on a single

rater (i.e., parent or teacher). In accordance with the DSM-IV criteria, it would be expected the prevalence rates would be lower when multiple raters (i.e., parents and teachers) are used to rate AD/HD behaviours in two settings (i.e., home and school).

Recent data that capture the cross-situational nature of the DSM-IV criteria (e.g., symptoms must be present in multiple settings) may be more accurate. On the basis of parent-teacher agreement, Gomez et al. (1999) reported that AD/HD prevalence was 2.4% in an Australian primary school sample (n = 1,275). They also found that AD/HD - IN was the most prevalent subtype (1.6%), followed by AD/HD - C (0.6%) and AD/HD – H/I (0.2%). This is consistent with previous findings based on a single rater (i.e., parent or teacher) that report AD/HD – IN is more prevalent than AD/HD – C and AD/HD – H/I (Baumgaertel et al., 1995; Graetz et al., 2001; Morgan, Hynd, Riccio, & Hall, 1996; Nolan et al., 2001; Wolraich et al., 1996).

Based on the DSM-IV AD/HD diagnostic criteria, there is a higher prevalence of AD/HD symptoms in boys compared to girls, with male-to-female ratios ranging from 4:1 to 9:1 (APA, 1994). Past studies report lower male-to-female ratios ranging from 1:1 to 5.3:1 in community samples (Carlson, Tamm, & Gaub, 1997; DuPaul et al., 1997; DuPaul et al., 1998; Gadow et al., 2001; Graetz et al., 2001; Rohde et al., 1999), compared to male-to-female ratios ranging from 6:1 to 9:1 in clinical samples (Ross & Ross, 1982). As previously discussed, these findings are based on a single rater (i.e., parent or teacher). When parent-teacher agreement was required for an AD/HD diagnosis, Gomez et al. (1999) reported a sex ratio in a community sample of 5.3 to 1 in favour of boys.

In summary, prevalence rates for AD/HD may be as high as 17.8% depending on the sampled population, assessment measures, and procedures used by the researcher. According to subtype, AD/HD – IN is more prevalent than AD/HD – C, and AD/HD –

H/I has the lowest prevalence rate. However, many past studies are based on a single rater (i.e., parent or teacher). Recent findings based on parent-teacher agreement show that the prevalence is considerably lower when the AD/HD diagnostic criteria require the symptoms to be present in multiple situations (e.g., home and school) as specified in the DSM-IV (APA, 1994). Finally, a higher rate of AD/HD symptoms is found in boys compared to girls.

3.1.2 Developmental Progression of AD/HD

AD/HD is a disorder that has an age of onset that occurs early in childhood and is stable over time persisting into adulthood. Although the DSM-IV specifies that the AD/HD symptoms must be present before the age of 7 years to meet the diagnostic criteria (APA, 1994), evidence suggests that the onset of AD/HD typically occurs at 3 to 4 years (Barkley, DuPaul, & McMurray, 1990; Loeber, Green, Lahey, Christ, & Frick, 1992). Although the features of AD/HD are typically present during the adolescent period and persist through to adulthood (Klein & Mannuzza, 1991), younger children demonstrate higher levels of AD/HD symptoms (DuPaul et al., 1997).

It is estimated that between 30% to 80% of children diagnosed as hyperactive will have persisting features of AD/HD into adolescence and 65% into adulthood (Barkley, 1996). Follow-up studies indicate that antisocial behaviour (i.e., theft and shoplifting) and substance use are also high among those adolescents and adults diagnosed with AD/HD as children, particularly when CD was also present at a younger age (Barkley, Fischer, Edelbrock, & Smallish, 1990; Gittelman, Mannuzza, Shenker, & Bonagura, 1985; Mannuzza, Klein, Abikoff, & Moulton, 2004).

3.1.3 Comorbidity of AD/HD

AD/HD is highly associated with a range of comorbid conditions, which include other disruptive behaviour disorders (i.e., ODD and CD), learning disorders, anxiety and mood disorders, and language and communication disorders (Barkley, 1990). In particular, AD/HD has a high comorbidity with other disruptive behaviour disorders. For instance, Pelham Jnr. and Evans (1992) reported that 55% of children with AD/HD exhibited comorbid ODD or CD.

Previous research has shown an association between AD/HD – C subtype with anxiety and depression (Eiraldi, Power, & Nezu, 1997; Morgan et al., 1996), CD and ODD (Eiraldi et al., 1997; Gaub & Carlson, 1997; McBurnett et al., 1999), academic impairment (Gaub & Carlson, 1997; Lahey, Applegate, McBurnett et al., 1994; Morgan et al., 1996), peer rejection (Lahey, Applegate, McBurnett et al., 1994), and social impairment (Gaub & Carlson, 1997). Similarly, AD/HD – IN is associated with academic impairment (Baumgaertel et al., 1995; McBurnett et al., 1999; Morgan et al., 1996; Wolraich et al., 1996), anxiety and depression (Eiraldi et al., 1997; Morgan et al., 1996), and social impairment (Gaub & Carlson, 1997). Finally, AD/HD – H/I is associated with CD and ODD (Eiraldi et al., 1997; Gaub & Carlson, 1997; McBurnett et al., 1999), peer problems, and social impairment (Gaub & Carlson, 1997).

3.1.4 Causes of AD/HD

Although a specific cause of AD/HD is unknown, it is most likely caused by multiple factors (Barkley, 1990). Both genetic and neurological factors have been suggested in the aetiology of AD/HD. Several associated conditions that may provide a pathway to AD/HD include very low birth weight, fetal alcohol syndrome, fragile X syndrome, and a genetically transmitted thyroid disorder (Cantwell, 1996a). However,

these conditions are only present in a small percentage of the diagnosed AD/HD cases (Barkley, 1990). Early writings on AD/HD proposed that the disorder was caused by brain damage resulting from trauma, brain infections, or other post-natal injuries or complications (Barkley, 1991). For instance, Rutter (1977) argued for the existence of "brain damage syndromes" described as the underlying factors in the etiology of hyperkinetic disorders (e.g., AD/HD).

Although most children with AD/HD do not show a history of brain damage, neurological factors have been implicated in the aetiology of AD/HD. Tannock (1998) reported localised abnormalities in several brain regions including the prefrontal cortex, basal ganglia, and corpus callosum. There is also evidence to indicate a strong genetic predisposition to AD/HD and other mental disorders. Previous studies have found that there is a higher rate of conduct problems, hyperactivity, depression, and alcoholism among biological relatives of children with AD/HD (Barkley, 1991). Twin and adoption studies have also have provided evidence for the role of genetics in the development of AD/HD (Gillis, Gilger, Pennington, & DeFries, 1992; Goodman & Stevenson, 1989; Hays, Bennett, McStephen, Rooney, & Levy, 2004; Hudziak, Derks, Althoff, Rettew, & Boomsma, 2005; Todd et al., 2001).

There has also been considerable debate over the impact of parenting styles on the aetiology of AD/HD. Although it is believed that negative parent-child relationships and family dysfunction do not cause AD/HD, these factors have been identified in families of children with the disorder (Stormshak, Bierman, McMahon, & Lengua, 2000).

3.1.5 Theories of AD/HD

Several theories have been proposed to explain AD/HD, but as stated above the actual cause remains unknown (Barkley, 1997; Sergeant, Oosterlaan, & van der Meere,

1999). The major AD/HD theories to be discussed in this section include the defective regulation of behaviour (Still, 1902), minimal brain dysfunction (Wender, 1971), information processing theory (Sergeant et al., 1999), regulatory control of cognitive processing and motor control (Douglas, 1972, 1983, 1988; Douglas & Peters, 1979), a dysfunctional behavioural inhibition system (Quay, 1988a, 1988b), and deficits in executive functioning (Barkley, 1994, 1997).

Initially, several theories were proposed that described cognitive and behavioural deficits similar to those seen in children with AD/HD including defective moral control (Still, 1902) and minimal brain dysfunction (Wender, 1971). Originally, Still (1902) reported that problem behaviour in young children was caused by poor volitional inhibition and defective moral regulation of behaviour. Central to the theory was the important role of poor inhibition, poor sustained attention, and hyperactivity. Similar to Still (1902), Wender (1971) identified six deficit areas in children with minimal brain dysfunction. These areas included motor behaviour, learning difficulties, impulse control, attentional and perceptual cognitive functioning, interpersonal relations, and emotions. Concurrently with Wender's research, Douglas (1972; 1983; 1988; Douglas & Peters, 1979) outlined deficits in the regulatory control of cognitive processing and motor control for children with AD/HD.

According to Douglas (1972; 1983; 1988; Douglas & Peters, 1979), children with AD/HD have problematic regulatory control when environmental or task demands are increased, which affects cognitive performance. Douglas (1983) identified deficits in four areas of functioning: (1) poor investment and maintenance of effort, (2) deficiency in modulation of arousal to meet situational demands, (3) strong inclination to seek immediate reinforcement, and (4) difficulties in impulse control. Subsequently, Douglas (1988) argued that the four deficient areas were caused by a central impairment in self-

regulation that led to difficulties with organisation, planning, metacognition, self-monitoring, and self-correction.

Instead, Sergeant et al. (1999) have proposed the cognitive-energetic model of AD/HD. According to the model, there are information processing difficulties that cause the disorder (Sergeant et al., 1999). The motor output stage of information processing is dependent on effort, which is affected by the demands of the task and cognitive load. AD/HD occurs when there is a lack of allocation of cognitive and energetic resources. However, it is argued that the cognitive-energetic model does not sufficiently explain the various cognitive deficits associated with AD/HD (Barkley, 1999b).

Based on Gray's (1970) reinforcement sensitivity theory (RST), Quay (1988a; 1988b) proposed that children with AD/HD are affected by dysfunctional regulation between the Behavioural Inhibition System (BIS) and the Behavioural Activation System (BAS), as they work in opposition to one another. The two brain systems differ in their sensitivity to punishment and reward. Impulsivity, as characterised by AD/HD, arises from diminished activity in the BIS leading to low sensitivity to punishment contingencies regardless of the presence or absence of reward cues (Quay, 1988a, 1988b, 1997). There has also been support for an underlying mechanism highlighting poor self-control as a major cause of AD/HD.

According to Barkley (1994; 1997), AD/HD is caused by an inhibitory deficit caused by executive function problems. There are four distinct executive function domains: (1) working memory, (2) self-regulation of affect/motivation/arousal, (3) internalisation of speech including rule-governed behaviour and problem-solving, and (4) reconstitution which includes understanding, analysis, and integration of behaviour. These four domains are separately related to motor control including behaviour performance (Barkley, 1997). In summary, several AD/HD theories have been proposed

including defective regulation of behaviour, minimal brain dysfunction, information processing theory, regulatory control of cognitive processing and motor control, dysfunctional behavioural inhibition system, and deficits in executive functioning.

3.1.6 Diagnostic Criteria for AD/HD

There are 18 AD/HD symptoms presented in the DSM-IV organisation of AD/HD (refer Appendix A). These include 6 hyperactivity symptoms such as "often fidgets with hands or feet or squirms in seat" and "often talks excessively", and 3 impulsivity symptoms such as "often interrupts or intrudes on others" (APA, 1994, p. 84). Furthermore, there are 9 inattention symptoms including "often has difficulty sustaining attention in tasks or play activities" and "often does not seem to listen when spoken to directly" (APA, p. 84). The DSM-IV criteria for AD/HD – IN are met when 6 or more inattention symptoms and fewer than six hyperactivity/impulsivity symptoms are present. In contrast, DSM-IV AD/HD – H/I is diagnosed when 6 or more hyperactivity/impulsivity symptoms and fewer than 6 inattention symptoms are diagnosed. The DSM-IV criteria for AD/HD – C are met when 6 or more inattention symptoms and 6 or more hyperactivity/impulsivity symptoms are present (APA, 1994). In the case where there are prominent AD/HD symptoms but the criteria are not met, a diagnosis of AD/HD Not Otherwise Specified is provided (APA, 1994).

3.1.7 Assessment of AD/HD

A multimethod approach that incorporates structured interviews and rating scales should be used in the assessment of AD/HD, reflecting the complexity of the disorder and its developmental nature (Barkley, 1990). Parent and teacher rating scales provide important information from informers that may have many years of experience with the

child across diverse settings and situations (Barkley, 1998). There are several broad-band checklists (e.g., rating scales) that are commonly used in the assessment of child behaviour disorders and have good psychometric properties. These checklists include the Child Behaviour Checklist (CBCL; Achenbach & Edelbrock, 1983), the Teacher Report Form (TRF; Achenbach & Edelbrock, 1986), the Conners Teacher Rating Scale-Revised (CTRS-R; Goyotte, Conners, & Ulrich, 1978), and the Eyberg Child Behaviour Inventory (ECBI; Eyberg, 1980; Eyberg & Ross, 1978; Robinson, Eyberg, & Ross, 1980). These measures are dimensional and are not keyed to the DSM-IV AD/HD symptoms, therefore a diagnosis of AD/HD cannot be made based on the results of the scales (Frauenglass & Routh, 1999).

As outlined by the American Academy of Child and Adolescent Psychiatry (AACAP, 1997), assessment should also include a structured interview with the parents, as it may be difficult to confirm the diagnosis of AD/HD based only on an interview with the child or adolescent. Interviews can also be conducted with other caregivers and teachers. The interview has a dual purpose: to gather background information and provide diagnostic information (Anastopoulos & Shelton, 2001). The most commonly used standardised interviews for the assessment of AD/HD reflect the DSM-IV diagnostic criteria and allow for an AD/HD diagnosis to be made (Frauenglass & Routh, 1999). Several commonly used structured interviews include the Diagnostic Interview for Children and Adolescents (DICA; Boyle et al., 1993; Herjanic & Reich, 1982; Reich & Welner, 1988) with parent, child (6-12 years old), and adolescent (13-17 years old) versions, and the Diagnostic Interview Schedule for Children that has parent (DISC-P) and child (DISC-C) versions (P. Fischer et al., 1991; Schwab-Stone et al., 1993; Shaffer et al., 1993).

A school-related assessment is also recommended to obtain reports of behaviour, learning, school attendance, and grades and test scores (AACAP,1997). This can help to identify any behavioural or developmental problems that may not have been evident in the home setting (Barkley, 1998). Finally, it is recommended that a complete medical history and physical examination be conducted within 12 months prior to the assessment (AACAP,1997). Barkley (1990) outlined several reasons for a medical examination. First, a differential diagnosis of AD/HD should be considered and any medical conditions ruled out. For instance, hearing or vision problems, or any other health problems may be affecting behaviour. Second, any co-existing medical conditions should be investigated that may require medical management. Third, whether any physical conditions are present should be determined that may impact on the use of medications for treatment (i.e., high blood pressure).

3.1.8 Treatment of AD/HD

The most common approaches to the treatment of AD/HD include medical interventions or psychosocial interventions (i.e., cognitive-behavioural treatment). The use of intensive treatment programs that include group work and social skills components also appear to be beneficial for children with AD/HD. Generally, it is recommended that a multi-faceted treatment approach that combines both psychosocial and medical interventions (Abikoff & Klein, 1992; Cantwell, 1996a) and takes comorbidity into account (Pelham Jnr. & Fabiano, 2001) be used.

Psychostimulant medication, including methylphenidate (Ritalin), dexamphetamine (Dexedrine), and pemoline (Cylert), is the most commonly used pharmacological treatment for AD/HD (Abikoff & Klein, 1992). Pharmacological interventions focus on the behavioural deficits associated with AD/HD and have been

shown to be effective for approximately 70% of children (Cantwell, 1996a). For instance, methylphenidate (MPH) has been shown to be effective in both low and high doses (Kolko, Bukstein, & Barron, 1999) and for comorbid conditions (Hinshaw, Henker, Whalen, Erhardt, & Dunnington, 1989). Generally, these studies have shown considerable variation in children's response to AD/HD medication. Therefore, it is recommended that different AD/HD subtypes, physical characteristics of the child, environment of the child (e.g., school or home), and different comorbid conditions should be considered in the choice of medication (Barkley, 1998). As recommended by the AACAP (1997), a combination of medical and psychosocial intervention should be used to treat AD/HD.

Psychosocial interventions that have been found to be effective for children with AD/HD focus on the child, parents, and the school (Cantwell, 1996a). Parent training is an essential component that uses contingency management techniques in order to reduce disruptive behaviour in the home setting and increase the self-confidence of the parent and reduce family stress (Anastopoulos & Farley, 2003; Barkley, 1999a, 2000). In contrast, school-based interventions are developed to address classroom behaviour through behavioural management strategies in the school environment (DuPaul & Stoner, 1994). For instance, rewards, incentives, and time out are some strategies used in the classroom situation to control disruptive behaviour. Finally, child focused interventions use individual therapy (e.g., cognitive behavioural therapy) to address deficits in social skills, on-task behaviour, and other associated conditions such as depression or anxiety (Cantwell, 1996a).

There have also been promising outcomes for intensive behavioural programs that foster social skills training in a group setting for children with AD/HD. For instance, Pelham Jnr. and Hoza (1996) implemented an intensive 8-week Summer Treatment

Program (STP) which includes daily training in social skills and learning cooperation through group tasks. Although no randomised trials have been conducted on the STP, positive outcomes include a low dropout rate, 96% of the parents rated an improvement in their childrens' behaviour, and an overall improvement in the child's psychosocial functioning.

3.2 ODD

ODD is characterised by a pattern of hostile, negativistic, and defiant behaviour, whereas CD is characterised by the violation of the basic rights of others or social norms or rules, through behaviours that include destruction of property, theft, and truancy (APA, 1994). Furthermore, the oppositional behaviour must be more frequent than that typically observed based on a developmental or age-appropriate level (APA, 1994). Due to shared characteristics between ODD and CD, many studies do not distinguish between the two disorders. Therefore, the current overview of ODD will also include CD studies that are particularly relevant for ODD.

3.2.1 Prevalence and Sex Differences with Regard to ODD

Although the DSM-IV estimates that the prevalence of ODD is approximately 2% to 16%, these rates vary according to the sampled population and the method of assessment (APA, 1994). Previous studies have reported prevalence rates in community samples of 2.7% (Costello et al., 1996), 5.7% (Rey, 1993), and 8.1% (Fergusson, Horwood, & Lynskey, 1993). In clinical samples, reported cases are as high as 17% (Pelham Jnr. & Evans, 1992) and 17.4% (Garland et al., 2001).

The prevalence of ODD varies according to sex and rates tend to fluctuate according to the developmental period. Fergusson et al. (1993) found ODD was more

prevalent in young boys than girls (8.6% and 7.5%, respectively). Lahey et al. (2000) found in an adolescent sample no sex differences for ODD, but boys did exhibit more aggressive behaviour (e.g., violence against others). These findings support the DSM-IV classification of ODD that states the prevalence to be higher for boys compared to girls in the pre-puberty period, whereas prevalence is approximately equivalent after puberty. However, males are viewed as being more confrontational with persisting symptoms (APA, 1994).

3.2.2 Developmental Progression of ODD

Typically, ODD is more prevalent in younger than older children and emerges during preschool years (APA, 1994; Lahey et al., 2000; Lavigne et al., 2001), whereas CD is more prevalent at an older age (Lahey et al., 2000). It is argued that ODD is a precursor to CD, indicating a developmental progression linking the two disorders (Barkley, 1999a; Biederman et al., 1996; Frick et al., 1993; Lahey & Loeber, 1994; Lahey et al., 2000; Loeber, Keenan, Lahey, Green, & Thomas, 1993; Loeber, Lahey, & Thomas, 1991).

Although most youths with CD have a previous history of ODD, not all cases of ODD develop to CD (Loeber et al., 1991). Lahey and Loeber (1994) found oppositional behaviours (i.e., temper tantrums and blaming others) occur early then proceed to intermediate CD (i.e., bullying, fighting, and hurting animals) followed by a advanced CD (i.e., stealing, engaging in forced sex, and truancy). Further studies indicate that CD can be a precursor for antisocial personality disorder (APD) or even criminal behaviour (Burke, Loeber, & Lahey, 2003; Lahey & Loeber, 1994; Mitchell & Rosa, 1981). Furthermore, there is an increased likelihood that ODD will develop into AD/HD at a later stage (Lavigne et al., 2001).

3.2.3 Comorbidity of ODD

Previous studies indicate the ODD and CD occur frequently with AD/HD (August, Realmuto, Joyce, & Hektner, 1999; Biederman et al., 1996). In a 4-year follow-up study of 140 children with AD/HD, it was found that 65% of children had ODD and 22% had CD (Biederman et al., 1996). Further studies investigating AD/HD subtypes have found that high comorbidity occurs between ODD and the AD/HD – C and AD/HD – H/I subtypes (Eiraldi et al., 1997; Gaub & Carlson, 1997; Teegarden & Burns, 1999). Other comorbid conditions such as anxiety and depression are also commonly found with ODD (Bird, Gould, & Staghezza, 1993; Greene et al., 2002). Bird et al. (1993) reported that for children in the general population meeting criteria for ODD, comorbid anxiety disorders were as high as 53%, and depressive disorders 17.6%. Children with ODD and CD also demonstrate deficits in several other areas of functioning including academic performance and social functioning (Frick, Kamphaus, Lahey, & Loeber, 1991; Ledingham, 1999). Although Frick et al. (1991) found an association between CD and academic impairment, when the co-occurrence between AD/HD and CD was controlled for, only AD/HD was associated with academic impairment.

3.2.4 Causes of ODD

To date, no evidence has been presented that indicates a unique etiology of ODD (Rey, 1993). However, it is believed that ODD is caused by an interaction of parent, family, environmental, and child characteristics (Sanson & Prior, 1999). Negative parenting and family interactions have been implicated in the onset of ODD. Stormshak et al. (2000) found that low levels of warm involvement were characteristic of both children who demonstrated high levels of oppositional behaviour and their parents.

Research has also found that aggressive children's perceptions of their parents' parenting styles may lead to the development of hostile cognitions and aggressive behaviour (Gomez & Francis, 1995; Gomez & Gomez, 2000, 2002; Gomez, Gomez, DeMello, & Tallent, 2001). Temperament is most salient as negative emotionality has been found to be a predictor of ODD (Sanson & Prior, 1999). More specifically, poor self-regulation, low manageability, and impulsivity appear to be precursors of externalising behaviours (i.e., ODD). In summary, ODD is caused by an interaction between parent, family, environmental, and child characteristics. These include negative parenting and family interactions.

3.2.5 Theories of ODD

Several models of ODD have been proposed highlighting poor parenting practices and maladaptive family patterns in families of children with the disorder. Proposed theories include the coercive family process theory (Patterson, 1976, 1982), attachment theory (Greenberg, Speltz, & DeKlyen, 1993; Greenberg, Speltz, DeKlyen, & Endriga, 1991), genotype-environment correlations (Scarr, 1989, 1992), and Barkley's (1999a) four factor model.

The coercive family process theory links parenting styles to aggression in children. Patterson (1976, 1982) argued that maladaptive interaction patterns arise due to negative reinforcement, which shapes the way parents and children behave. This reciprocal interaction is the coercive trap that escalates patterns of maladaptive interactions between families of children with ODD and CD.

According to attachment theory (Greenberg et al., 1993; Greenberg et al., 1991), the early development of ODD is based on the child's concepts of both self and others that enable the child to regulate their negative feelings. Parenting styles that are

inconsistent or lack warmth in responding to the child are believed to lead to insecure attachment. Hence, the child develops expectations of negative feelings in close relationships and is not provided with supportive models for handling negative emotions.

Scarr (1989, 1992) has applied the theory of genotype-environment correlations to ODD and CD. Based on Plomin, DeFries, and Loehlin's (1977) original theory, genotypes-environment correlations refer to a simple correlation between genotype and environment. Scarr (1992) has proposed three specific types of genotype-environment correlations including passive, evocative, and active. Passive effects involve both genes and environment shared by parents and children. For instance, parents may pass on genes relating to difficult temperament to their children, and the parents' difficult temperament may be exhibited as negative parenting that is also correlated with the child's difficult temperament (Neiderhiser et al., 2004). Evocative effects refer to the responses received by others that are related to particular child characteristics (Scarr, 1992). This may involve parents responding to a child's difficult temperament with negative parenting. Active effects occur when a child actively selects environments that are correlated with his or her genetically determined characteristics (Scarr, 1992). This may involve a child selecting peers who have similar characteristics. Overall, the model is supported by research investigating the relationship between child, parental, and family characteristics of ODD (Carlson, Tamm, & Hogan, 1999).

Based on similar principles to the genotype-environment correlation theory, Barkley (1999a) proposed a four-factor model of oppositional behaviour. Factor 1 includes impaired child and family management practices, which is present in most families that have a child with ODD. Factor 2 recognises that adolescents have certain temperaments and cognition that are susceptible to non-compliance and coercive-aggressive behaviour, whereas Factor 3 suggests that defiance can increase as a result of

temperamental and cognitive characteristics in the parents. Factor 4 suggests that the contextual events surrounding the family may increase the risk of ODD, including both the external and internal environment that may not contribute to the child's behaviour but may influence the parent's management skills.

As stated, several theories of ODD have been proposed including the coercive family process theory, attachment theory, genotype-environment correlations, and a four-factor model. These theories suggest that family dysfunction and poor parenting practices are key components in the development of oppositional behaviour.

3.2.6 Diagnostic Criteria and Assessment of ODD

As outlined in the DSM-IV, there are 8 ODD symptoms (refer Appendix A). To meet the diagnostic criteria for ODD, at least four out of eight symptoms must be present for at least 6 months and the symptoms must occur more frequently than is typically observed in individuals of a comparable age and developmental level (APA, 1994). A comprehensive assessment that includes a full medical, school, family and developmental history, and a range of broad band measures (e.g., Conners' Rating Scales; Goyette et al., 1978) should be administered. As specified by Anastopoulos and Shelton (2001), the interviews should be conducted with parents and other caregivers, and can also be administered to children, adolescents and teachers.

3.2.7 Treatment of ODD

Psychosocial interventions that are parent, child, and school-focused are the preferred treatment for ODD. However, it is important to consider the resources of the family and child to ensure the necessary support is available to administer the intervention effectively (Frauenglass & Routh, 1999). Parent training and skill

management are particularly effective in treating oppositional behaviour and conduct problems. For instance, Parent-Child Interaction Therapy (PCIT) has been shown to be effective in treating younger children with ODD (Brinkmeyer & Eyberg, 2003). The goal of PCIT is to improve the relationship between parent and child and develop the behaviour management skills of the parent/s.

3.3 Summary of AD/HD and ODD Issues

AD/HD and ODD are recognised by the DSM-IV as two of the most common childhood behaviour disorders in primary school children (APA, 1994). The DSM-IV estimates the prevalence of AD/HD in school-age children to be between 3% and 5%, however, research indicates that prevalence rates may be as high as 17.8%. Although the DSM-IV does not state which AD/HD subtype is the most common, research suggests that AD/HD – IN is the most common subtype. For ODD, prevalence has been reported as high as 16%. Generally, prevalence rates for AD/HD and ODD differ based on the sampled population, assessment measures and procedures, and the diagnostic criteria used by the researcher.

Overall, evidence supports a higher male-to-female prevalence ratio with estimations as high as 5.3:1 for AD/HD and 3.1:1 for ODD. However, ODD prevalence is approximately equivalent between boys and girls after puberty. As previously stated, the sex ratios for AD/HD and ODD tend to vary according to the sample population.

Follow-up studies suggest that AD/HD is not just a childhood disorder. It continues into adulthood and causes impairment in the areas of cognitive, family, and psychosocial functioning for up to 65% of sufferers. Children with ODD are more likely to develop AD/HD at a later stage and it has been suggested that ODD is a precursor to CD indicating a developmental progression linking the two disorders.

AD/HD is also associated with a range of comorbid conditions including other disruptive behavior disorders (i.e., ODD and CD), learning disorders, anxiety and mood disorders, and language and communication disorders. Children with AD/HD have also demonstrated impairments in associated features such as emotional, behavioural, social, academic, and peer relations. ODD shows high comorbidity with AD/HD and anxiety and mood disorders, and is associated with academic and social impairments.

Although the actual cause of AD/HD is unknown, it is believed that the disorder may be caused by multiple factors including very low birth weight, fetal alcohol syndrome, fragile X syndrome, and a genetically transmitted thyroid disorder. Several theories have also been posited to provide a greater understanding of AD/HD, and these focus on different components of the disorder including inhibition, information processing and regulatory control. Several theories have been proposed to explain ODD including coercive family process theory, attachment theory, and genotype-environment correlations, as it is believed that ODD is caused by an interaction of parent, family, environmental, and child characteristics.

Children with AD/HD are assessed using a multimethod approach that includes interviews and rating scales based on multiple sources (i.e., parents and teachers) to reflect the cross-situational approach of DSM-IV. Both pharmacological (e.g., MPH) and psychosocial interventions (i.e., parent skills training or behavioural management training) can be used in the effective treatment of children with AD/HD and/or non-compliant behaviour. A similar assessment process is administered for ODD and the preferred treatment includes psychosocial interventions that are parent, child, and school-focused.

Chapter 2 has demonstrated that AD/HD and ODD have gone through several changes in the DSM conceptualisation of the childhood disorders. Furthermore, as

outlined in this chapter there is a high rate of comorbidity between AD/HD, ODD, and CD. This has led to debate over the validity of the diagnostic categories for childhood disorders (Waldman, Lilienfeld, & Lahey, 1995) and the organisation of the AD/HD, ODD and CD symptoms. This will be addressed in the following chapter.

CHAPTER 3: INTERNAL AND EXTERNAL VALIDITY OF THE AD/HD AND ODD SYMPTOMS

1. Introduction

Chapter 3 will be separated into 3 parts. Part 1 outlines a framework for diagnostic validation based on the internal and external validity of the AD/HD and ODD symptoms. In this section only models of diagnostic validation will be addressed, as validity studies will be addressed in Part 2. Exploratory factor analysis (EFA), confirmatory factor analysis (CFA), and multitrait-multisource (MT-MS) studies have previously been used to examine the internal validity of the AD/HD and ODD symptoms. Part 1 will also discuss the EFA, CFA, and MT-MS approaches. Part 2 will present studies that have examined the factor structure (i.e., internal validity) of the AD/HD and ODD symptoms and how the structures of these constructs relate to the DSM organisation. The factor structure of the AD/HD symptoms will be examined alone and together with the ODD symptoms, based on EFA and CFA methods. Part 2 will also examine the construct validity of the AD/HD and ODD symptoms based on previous MT-MS studies. The MT-MS method is a sophisticated technique and has also been used in the investigation of the construct validity of the ADHD and ODD symptoms, which takes source effects into consideration. CFA MT-MS findings will be provided at the matrix and individual level. Previous CFA MT-MS studies have reported results at the individual level as well as the symptom parcel level (i.e., group of symptoms). To avoid confusion Part 2 will not distinguish between these studies and use the term individual level to refer to both types of analyses. Limitations of previous EFA, CFA, and MT-MS studies will also be addressed. Part 3 will then examine the external validity of the AD/HD and ODD symptoms by investigating the relationship between the IN, H/I, and

ODD trait dimensions with other trait dimensions (i.e., academic impairment and behavioural problems).

2. Part 1: A Framework for the Validation of Childhood Psychological Disorders and the Implications for the Validation of AD/HD and ODD

2.1 Models of Diagnostic Validation

Diagnostic validation has been an important process in testing the DSM organisation of the AD/HD and ODD symptoms. A particular classification system model is deemed useful when the diagnostic categories demonstrate both internal and external validity (Cantwell, 1996b). To date, several models of diagnostic validation have been proposed (Cantwell, 1975; Klerman, 1986; Morey, 1991; Robins & Guze, 1970). Robins and Guze (1970) illustrated a model for the validation of psychiatric disorders that comprised various stages including clinical description, laboratory studies, exclusion criteria, outcome studies, and familial and aggression studies.

The first stage of the Robin and Guze (1970) model involves the establishment of internal validity using EFA or CFA methods to determine a cluster of symptoms for each disorder. In relation to AD/HD and ODD, internal validity (i.e., independence of factors) would be established by showing that the IN, H/I, and ODD symptoms load significantly on their respective factors when the symptoms are analysed together using factor analysis techniques (i.e., CFA or EFA). The second stage of the diagnostic validation procedure involves the establishment of external validity. This involves showing that there is meaningful differentiation between dimensions. In relation to AD/HD and ODD, external validity is demonstrated when the disorders or symptoms relating to AD/HD and ODD differ in ways other than the criteria that define them (i.e., behavioural characteristics and/or treatment response).

In an expanded version by Cantwell (1975; 1996b), a 6-stage model was proposed to validate childhood psychiatric disorders that addresses the establishment of internal and external validity. The six stages include (1) clinical description, (2) physical and neurological factors, (3) laboratory studies, (4) family studies, (5) natural history studies, and (6) treatment studies (Cantwell, 1975). The internal validity is established by describing childhood disorders based on their core clinical symptoms and common associated features. This involves determining whether a specific disorder or group of symptoms bundle together to form a homogenous diagnostic category using cluster or factor analysis techniques (Cantwell, 1975). In contrast, external validity is established according to whether a specific disorder or group of symptoms varies in ways other than the diagnostic criteria that define them. Cantwell (1975) argued that the disorder or group of symptoms must vary according to prevalence, incidence, morbidity risk, life expectancy rates, and demographic details. Differences in psychosocial factors such as stress and early childhood experiences (e.g., physical or sexual abuse) also increase external validity (Cantwell, 1975).

As discussed by Cantwell (1996b), there are two different methods generally used in the establishment of external validation. The first method involves the relationship of the AD/HD or ODD symptoms with other constructs that are not part of the diagnostic criteria (e.g., academic problems). Support for the external validity of the AD/HD or ODD symptoms would be provided if the other construct showed a specific correlation with AD/HD or ODD, but not other constructs defining other disorders. Hence, the external correlate (e.g., academic problems) would be specific to constructs of the disorder and not other constructs defining other disorders. The second approach involves comparing one group of individuals with AD/HD or ODD and another group with other disorders using measures that do not define their clinical status. For instance, external

validity is established if individuals with AD/HD can be shown to have academic difficulties, whereas individuals with anxiety and depression do not demonstrate similar problems.

2.2 EFA, CFA, and MT-MS Methods as used in the Validation of the AD/HD and ODD Symptoms

In the diagnostic validation of AD/HD and ODD, EFA and CFA methods have been used to establish the factor structure of the disorders. In this section a brief overview will be provided of the different methods used in the investigation of the factor structure of ADHD and ODD symptoms.

The aim of EFA is to define the underlying structure among a set of correlations. The EFA method analyses the structure of relationships among a number of variables and identifies a set of common underlying dimensions (Hair Jnr., Anderson, Tatham, & Black, 1995), thus reducing a large number of variables to a smaller number of factors (Tabachnick & Fidell, 1996). The EFA method is commonly used in the initial stages of research when the association between observed and latent variables is undetermined (Byrne, 1998). In contrast to EFA, it is appropriate to use CFA when there is an understanding of the underlying latent variable structure (Byrne, 1998). Driven by theory or empirical research, a model is postulated based on the relations between the observed and underlying factors (Byrne, 1998). The postulated model is then statistically tested for its goodness of fit to the sample data.

Derived from the multitrait-multimethod (MT-MM) design, the MT-MS approach is a more sophisticated measure in the validation process. As proposed by Campbell and Fiske (1959), the MT-MM design involves the measure of multiple traits (i.e., IN and H/I) with multiple methods of testing (i.e., clinical interview and behaviour rating scale).

The MT-MM procedure allows for the testing of convergent and discriminant validity of latent traits and discriminant validity of the latent methods. Furthermore, the procedure also provides the amount of trait, source, and error variance for each manifest variable (Eid, Lischetzke, Nussbeck, & Trierweiler, 2003; Lance, Noble, & Scullen, 2002). There are presently two major CFA approaches to model MT-MM data including the correlated trait-correlated method (CT-CM) approach and the correlated uniqueness (CU) approach. However, the CU approach does have some limitations and is not considered the preferred approach (Eid et al., 2003; Lance et al., 2002). For instance, if there is correlation between the methods and the sources, this is problematic as the CU approach assumes that the methods and sources are orthogonal (e.g., no correlation exists between the two factors; Eid et al., 2003). However, previous findings show artificially inflated correlations between the factors, thus amplifying the construct validity (Gomez et al., 2003). It is recommended that the CT-CM approach should be used as it allows the methods and sources to correlate with each other (Eid et al., 2003; Lance et al., 2002). The MT-MM approach is referred to as the multitrait-multisource (MT-MS) design to reflect the use of multiple sources (i.e., parent and teacher) with a single method (i.e., rating scale; Gomez et al., 2003).

The MT-MS model assesses the convergent and discriminant validity at the matrix and individual levels. At the matrix level, the procedure involves a comparison of the hypothesised model with a series of more restrictive (i.e., nested) models. According to Byrne (1998), a more precise measure of trait and source variance is ascertained by an assessment of the individual parameters. This involves the evaluation of the individual parameters of the postulated model (e.g., the amount of trait, source and error variance in each symptom, the correlation between the traits and the correlation between sources). To demonstrate convergent validity at the individual level, the magnitude of the trait

loadings should be greater than the source loadings and higher trait variance indicates stronger convergent validity (Gomez et al., 2003; Gomez et al., 2005). Discriminant validity is supported by low correlation between both traits (i.e., IN and H/I) and sources (i.e., parent and teacher).

2.3 Summary of the Validation of the AD/HD and ODD Symptoms

Models of diagnostic validation have been useful in providing researchers with a framework for examining the construct validity of the AD/HD and ODD symptoms. A particular classification system model is deemed useful when the diagnostic categories demonstrate both internal and external validity. In relation to AD/HD and ODD, internal validity would be established by showing that the IN, H/I, and ODD symptoms load significantly on their respective factors when the symptoms are analysed together using factor analysis techniques. In contrast, external validity involves showing that there is meaningful differentiation between dimensions. For AD/HD and ODD, external validity is demonstrated when the disorders or symptoms relating to AD/HD and ODD differ in ways other than the criteria that define them (e.g., peer problems). In the diagnostic validation of AD/HD and ODD, EFA and CFA have been used to establish the factor structure of the disorders. In contrast, the MT-MS method is a more sophisticated technique, which takes source effects into consideration. In the following section previous EFA, CFA, and MT-MS studies that have examined the internal and external validity of the AD/HD and ODD symptoms will be presented.

3. Part 2: An Examination of the Internal Validity of the AD/HD and ODD Dimensions based on EFA, CFA, and MT-MS Studies using Mother and Father Ratings

To date, there have been numerous studies examining both the internal and external validity of AD/HD and ODD. These studies have employed factor analysis to validate both disorders and will be evaluated further in this section. However, it will be argued that these studies are problematic in several ways. In particular, previous studies have not adequately addressed the cross-situational nature of AD/HD. Although recent CFA MT-MS studies have compared teacher and parent ratings of the AD/HD and ODD symptoms, to date no studies have compared mother and father ratings. Hence, two sources (i.e., mother and father) would be rating childhood behaviour in the same situation (i.e., home) rather than at home and school (i.e., parent and teacher). To date, there are no recent CFA MT-MS studies that have examined the factor structure (i.e., internal validity) of the AD/HD and ODD symptoms based on father ratings. This section will present EFA, CFA, and MT-MS studies that have investigated the factor structure of the AD/HD and ODD symptoms based on teacher and parent ratings. These studies have investigated the AD/HD symptoms alone and together with the ODD and CD symptoms.

3.1 EFA Studies Examining the Internal Validity of the AD/HD and ODD Symptoms

3.1.1 EFA Studies Examining the Factor Structure of the AD/HD Symptoms Alone

Table 1 shows EFA studies that have examined the factor structure of the AD/HD symptoms alone using parent and teacher ratings. These scales are derived from DSM-III, DSM-III-R, and DSM-IV AD/HD symptoms. There are also three studies included which are based on self-report (Quarto, 1997; Rohde et al., 2001) and clinician (Lahey,

Pelham Jnr. et al., 1988) ratings. Table 1 shows support for the 2-factor model of AD/HD including separate IN and H/I dimensions (Bauermeister, 1992; Bauermeister et al., 1995; Brito, 1995; DuPaul et al., 1997; DuPaul et al., 1998; Healy et al., 1993; Holland, Gimpel, & Merrell, 1998; Hudziak et al., 1998; Lahey, Pelham Jnr. et al., 1988; McBurnett, Pfiffner, & Frick, 2001; Rohde et al., 2001; Sherman, Iacono, & McGue, 1997; Yang, Schaller, & Parker, 2000). These studies were all based on non-referred samples. Only DuPaul (1991) and Quarto (1997) reported slightly different findings rather than support for separate IN and H/I dimensions. DuPaul reported 2 separate AD/HD factors of IN and IMP with HYP loading onto both factors. Quarto reported 3 factors including cognitive inefficiency, H/I, and positive impression. However, the self-report scale used in this study was based on the DSM-IV AD/HD symptoms and other items not listed in the DSM-IV (e.g., social desirability). Support for the 2-factor model of AD/HD was also found in a single clinical sample (Lahey, Pelham Jnr. et al., 1988).

Table 1 also demonstrates the high association between the IN and H/I dimensions. Previous EFA studies examining the AD/HD symptoms alone have reported moderate to high correlations of .45 to .94 between IN and H/I (Brito, 1995; DuPaul et al., 1997; DuPaul et al., 1998; Holland et al., 1998; Hudziak et al., 1998; Rohde et al., 2001). In summary, community and clinical EFA studies investigating the factor structure of the AD/HD symptoms alone show support for separate AD/HD dimensions of IN and H/I based on teacher and parent ratings.

Table 1

EFA Studies of AD/HD Symptoms

Study	Sample *N* = *n* of boys/girls Age range Country	Rating Scale Rater	Extraction Method and Loading	Extracted factors	Pearson's correlations between factors
Bauermeister et al. (1992)	Epidemiological survey of 614 children Sex ratio not reported 4 to 16 years Puerto Rico	Teacher Rating Scale including DSM-III-R AD/HD items derived from the Teacher Report Form (TRF) and the School Behaviour Inventory – Revised (SBI-R) Teachers	Principal component analysis (PCA) with varimax rotation Loading not reported	2-factor model: 1. Inattention-distractibility 2. H/I	Not reported
Bauermeister et al. (1995)	248 children and adolescents from the San Juan metropolitan area	A Spanish translation of the Diagnostic Interview Schedule for Children (DISC – 2.1) (including DSM-III-R AD/HD	PCA with varimax rotation >.40	2-factor model: 1. IN 2. H/I	Not reported

	125 boys 123 girls 9 to 17 years Puerto Rico	symptoms) Teachers and parents (father/mother not specified)			
Brito et al. (1995)	2,082 public school children 782 males 1,300 females Age range not stated (mean age of 11.2 years) Brazil	Teacher scale based on DSM-III-R AD/HD items (Portuguese version) Teachers (females)	PCA with varimax rotations >.40	2-factor model: 1. IN 2. H/I	Not reported
DuPaul (1991)	Elementary school children Sample 1: 653 students 315 boys 338 girls Sample 2: 564 students	ADHD Rating Scale (including DSM-III-R AD/HD items) Parents (95% mother ratings and 5% unspecified) and teachers	PCA with varimax rotation >.49	2-factor model: 1. Inattention-hyperactivity 2. Impulsivity-hyperactivity	Not reported

	279 boys 285 girls 6 to 12 years United States				
DuPaul et al. (1997)	4,009 children from 31 U.S. school districts 2,054 boys 1,934 girls (21 unspecified) Kindergarten to Grade 12 United States	ADHD Rating Scale – IV (school version) Teachers	Principal axis factoring (PAF) with oblique rotation $\geq$ .30	2-factor model: 1. IN 2. H/I	.70
DuPaul et al. (1998)	4,666 children from 22 U.S. school districts 4131 female 524 male (11 unspecified)	ADHD Rating Scale – IV (home version) 4071 mothers, 494 fathers, 39 guardians, 36 grandparents, and 26 unspecified	PAF with oblique rotation >.40	2-factor model: 1. IN 2. H/I	.68

	4 to 20 years United States				
Healey et al. (1993)	85 non-referred school children (primarily Black and Hispanic) 43 girls 42 boys 6 to 12 years United States	Revised Conners Teacher Questionnaire (CTQ) Experimental questionnaire of DSM-III ADH and DSM-III-R AD/HD items Teachers	PCA with varimax rotation $\geq$ .58	2-factor model: 1. IN 2. H/I	Not reported
Holland et al. (1998)	1006 children and adolescents Kindergarten to Grade 12 (age range not specified) 508 males 496 females United States	ADHD Symptoms Rating Scale (ADHD-SRS) Teachers and parents (father/mother not specified)	PCA with orthogonal and oblique rotations > .30	2-factor model: 1. IN 2. H/I	.69

Hudziak et al. (1998)	Sample of female adolescent twin pairs and their parents 2,126 female pairs 13 and 19 years United States	Telephone interview version of the Diagnostic Interview for Children and Adolescents (DICA) – Revised – Parent Version Parents (mother/father not specified)	PCA with oblique promax rotation Loading not reported	2-factor model: 1. IN 2. H/I	.51
Lahey et al. (1988)	Sample 1: 667 non-referred elementary school children Sex not reported Kindergarten to Grade 5 (age not reported) United States Sample 2: 86 referred children to an outpatient clinic	Swanson, Nolan, and Pelham Scale (SNAP) Checklist (includes DSM-III symptoms) Clinician ratings of a list of 20 descriptors of AD/HD including items from DSM-III (13 items) and DSM-III-R (2 items)	PCA with varimax rotations > .40	2-factor model: 1. Motor Hyperactivity-Impulsivity 2. Inattention-Disorganisation	Not reported

	Sex not reported 6 to 13 years United States	Clinicians (referred sample only) and teachers (for both samples)			
McBurnett et al. (2001)	692 children referred to an AD/HD clinic 543 boys 149 girls 3 to 18 years United States	Swanson, Nolan, and Pelham Scale (SNAP-R) Checklist (includes 17 DSM-IV symptoms) Teachers and parents (mother/father not specified)	PCA with oblique rotation Loading not reported	2-factor model: 1. IN 2. H/I	Not reported
Quarto (1997)	867 students attending public and parochial elementary (n=16), middle (n=10), and high schools (n=7) 421 males 446 females 8 to 18 years	ADHD Self-Report Rating Scale (ADHD SRRS) based on DSM-IV symptoms and items based on research literature Students (self-report)	PCA with varimax rotation $\geq$ .38	3-factor model: 1. Cognitive Inefficiency (CI) 2. H/I 3. Positive Impression (PI)	*r* (CI – H/I) =.53 *r* (CI – PI) = -.29 *r* (H/I – PI) = -.31

	United States				
Rohde et al. (2001)	1,013 students 496 boys 517 girls 12 to 14 years Brazil	18 DSM-IV AD/HD symptoms Students (self-report)	PCA with varimax and promax rotations $\geq$ .40	2-factor model: 1. IN 2. H/I	.45
Sherman et al. (1997)	576 twin boys participating in the Minnesotta Twin Family Study (MTFS) 11 and 12 years United States	MTFS Teacher Rating Form (TRF) (includes DSM-III and DSM-III-R AD/HD items) Diagnostic Interview for Children and Adolescents – Revised, Parent Version (DICA – R) Teachers and mothers	PCA with varimax rotation $\geq$ .40	2-factor model: 1. IN 2. H/I	Not reported

Yang et al. (2000)	Elementary school 231 boys 223 girls 6 to 12 years Taiwan	20-item ADHD checklist including DSM-III-R, DSM-IV, and ICD-10 symptoms 121 classroom teachers	PCA with Varimax rotation > .55	2-factor model: 1. IN 2. H/I	Not reported

NOTE: AD/HD = Attention-Deficit/Hyperactivity Disorder; IN = inattention; H/I = hyperactivity/impulsivity; PCA = principal component analysis; PAF = principal axis factoring.

3.1.2 EFA Studies Examining the Factor Structure of the AD/HD, ODD, and CD Symptoms

Table 2 shows EFA studies that have examined the factor structure of the DSM-III, DSM-III-R, and DSM-IV AD/HD, ODD, and CD symptoms together. As shown in Table 2, previous AD/HD and ODD studies based on community samples show support for the 2-factor model of AD/HD (i.e., IN and H/I) and separate dimensions of ODD and CD or ODD/CD (Bauermeister, 1992; Baumgaertel et al., 1995; Pelham Jnr., Gnagy et al., 1992; Weiler et al., 1999; Wolraich et al., 1998). These results are all derived from teacher ratings, with the exception of the study by Weiler et al. (1999) that included mother and teacher ratings.

Table 2 also shows EFA studies investigating the factor structure of the DSM-III-R and DSM-IV AD/HD, ODD, and CD symptoms in clinical and special education samples based on teacher and parent ratings. These studies have reported mixed results. Bauermeister (1992) provided support for separate IN, H/I, ODD, and CD dimensions in an elementary school sample, whereas he provided support for separate factors of AD/HD and ODD in a preschool sample in the same study. Further studies have reported contrasting models to the 2-factor model of AD/HD and 1-factor model of ODD (Bauermeister, 1992; Burns & Patterson, 1991; Pelham Jnr. & Evans, 1992; Wolraich et al., 1996). For instance, Burns and Patterson (1991) showed support for a single factor model of AD/HD, and Pelham and Evans (1992) reported separate ODD and covert CD dimensions, with several CD symptoms loading onto the ODD dimension. However, these studies incorporated DSM-III and DSM-III-R AD/HD and ODD symptoms. Wolraich et al. (1996) included the DSM-IV AD/HD and ODD symptoms and provided support for separate IN, H/I, ODD/CD, and stealing/truancy dimensions.

Based on correlations between AD/HD and ODD factors, Table 2 shows only a single study provided values. In a preschool sample, Bauermeister (1992) reported a correlation of .56 between ODD and attention deficit-hyperactivity. In a school sample, correlations of .57 between H/I and inattention/distractibility (ID), .56 between H/I and ODD, and .42 between ID and ODD were reported derived from DSM-III-R AD/HD and ODD symptoms (Bauermeister, 1992).

Overall, EFA studies of referred and non-referred samples investigating the factor structure of the DSM-IV AD/HD, ODD, and CD symptoms together show support for separate IN, H/I, ODD, and CD (or ODD/CD) dimensions. Although there was some support for a single AD/HD dimension, this was only provided by studies incorporating the DSM-III AD/H and DSM-III-R ADHD symptoms. These results were all based on parent and teacher ratings.

Table 2

EFA Studies of AD/HD, ODD, and CD Symptoms

Study	Sample *N* = *n* of boys/girls Age range Country	Rating Scale/Rater	Extraction Method and Loading	Extracted factors	Pearson's correlations between factors
Bauermeister (1992)	665 preschool children and 680 school children referred or identified as in need for psychological service <u>Preschool sample</u>: 365 boys 300 girls 4 and 5 years <u>School sample</u>: 355 boys 325 girls	Experimental scale including the DSM-III-R AD/HD and ODD symptoms Teachers	PCA followed by varimax and oblique rotations <u>≥</u> .40	<u>Preschool sample</u> 2-factor model: 1. Attention-deficit hyperactivity (ADH) 2. ODD <u>School sample</u> 3-factor model: 1. H/I 2. IN/distractibility (ID) 3. ODD	<u>Preschool sample</u> .56 <u>School sample</u> *r* (H/I – ID) =.57 *r* (H/I – OD) =.56 *r* (ID – OD) =.42

	6 to 13 years Puerto Rico				
Baumgaertel et al. (1995)	1,077 elementary school students from 5 rural and 5 urban public schools sex ratio not reported 5 to 12 years Germany	Teacher questionnaire including DSM-III, DSM-III-R, and DSM-IV AD/HD, ODD, and CD items 44 classroom teachers	PCA with varimax rotation $\geq$ .45	4-factor model: 1. IN 2. H/I 3. ODD 4. CD	Not reported
Burns & Patterson (1991)	Study 1: 1,526 children and adolescents from 5 pediatric clinics in 4 states 53% male 47% female 2 and 17 years Study 2: 1,003 children and	Eyberg Child Behaviour Inventory (ECBI) (items reflect DSM-III-R AD/HD, CD, and ODD symptoms) Study 1: Ratings completed by 91% of mothers, 7% of fathers, and 3% of other relatives or foster parents	PCA with varimax rotation Loading not reported	3-factor model: 1. ODD 2. CD 3. Attentional difficulties	Not reported

	adolescents from an urban school district 52% male 48% female 6 to 18 years United States	Study 2: Ratings completed by 80% of mothers, 15% of fathers, and 5% by other relatives or foster parents			
Pelham Jnr & Evans (1992)	364 boys attending part-time or full-time special education classes 5 to 19 years United States	Disruptive Behaviour Disorders (DBD) Rating Scale (based on DSM-III-R symptoms) Teachers	PCA with Varimax rotation $\geq$ .40	4-factor model: 1. IN 2. Impulsivity/overactivity 3. Covert CD 4. ODD and several CD symptoms (i.e., including often lies, initiates physical fights, and is physically cruel to people)	Not reported
Pelham Jnr. et al. (1992)	931 male students	Disruptive Behaviour Disorders (DBD) Rating Scale (includes	PCA with varimax rotations	3-factor model: 1. ODD	Not reported

	5 to 14 years North America (United States and Canada)	DSM-III-R AD/HD, ODD, and CD items) Teachers	$\geq$ .40	2. IN 3. Impulsivity/overactivity	
Weiler et al. (1999)	Referred sample: 124 children 86 boys and 38 girls 6 to 12 years Community sample: 225 children 110 boys and 115 girls 7 to 11 years United States	Diagnostic Rating Scale (DRS) including DSM-IV AD/HD symptoms, ODD symptoms, 7 of the 15 CD symptoms, and 7 questionnaires to screen for depression and anxiety Mothers and teachers	PCA with promax rotations $\geq$ .60	4-factor model: 1. Inattention 2. Hyperactivity 3. ODD/CD 4. Anxiety/depression	Not reported
Wolraich et al. (1998)	Longitudinal study of Year 1: 6,591 elementary school children Year 2: 4,226 school children	Vanderbilt AD/HD Diagnostic Teacher Rating Scale (VADTRS) including DSM-IV AD/HD symptoms, a screen for	PCA with orthogonal and oblique rotations $\geq$ .40	4-factor model: 1. IN 2. H/I 3. ODD/CD	Not reported

	Sex ratio not reported 6 to 12 years United States	other behaviour disorders, and anxiety and depression Teachers		4. Anxiety/depression	
Wolraich et al. (1996)	8,258 school children from 16 elementary school including regular and special classes 4,102 males 3,836 females Kindergarten to Grade 5 United States	Modified questionnaire including DSM-III-R and DSM-IV AD/HD and ODD items and 6 of the 13 CD items 398 teachers	PCA with varimax rotation >.45	5-factor model: 1. ODD/CD 2. IN 3. H/I 4. Anxiety/depression 5. Stealing/truancy	Not reported

NOTE: AD/HD = Attention-Deficit/Hyperactivity Disorder; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour; CD = conduct behaviour; PCA = principal component analysis.

3.1.3 Limitations of EFA Studies Examining the Factor Structure of the AD/HD and ODD Symptoms

In previous EFA studies, the factor structure of the parent and teacher ratings of the AD/HD, ODD, and CD symptoms has been primarily determined by principal component analysis (Baumgaertel et al., 1995; DuPaul, 1991; Wolraich et al., 1996), which generally employs orthogonal rotations. It is an assumption that when orthogonal rotations are employed, the constructs under investigation are conceptually unrelated (e.g., IN and H/I). This is problematic as findings suggest that the IN and H/I dimensions are conceptually related (Beiser, Dion, & Gotowiec, 2000; Burns, Walsh et al., 2003; Burns et al., 1997b; DuPaul et al., 1997; DuPaul et al., 1998; Gomez et al., 2003; Gomez et al., 1999; Holland et al., 1998). This issue will be further addressed later on in this chapter.

3.2 CFA Studies Examining the Internal Validity of the AD/HD and ODD Symptoms

3.2.1 CFA Studies Examining the Factor Structure of the AD/HD Symptoms Alone

Table 3 shows CFA studies that have examined the factor structure of the DSM-III, DSM-III-R, and DSM-IV AD/HD symptoms alone as rated by parents and teachers. As presented in Table 3, recent CFA studies investigating the DSM-IV AD/HD symptoms support a 2-factor model of AD/HD including separate IN and H/I dimensions (Beiser et al., 2000; DuPaul et al., 1997; DuPaul et al., 1998; Gomez et al., 2003; Gomez et al., 1999). Although the 3-factor model of AD/HD (i.e., separate IN, HYP, and IMP dimensions) has generally shown a slightly better fit than the 2-factor model (Gomez et al., 1999; Pillow, Pelham Jnr., Hoza, Molina, & Stultz, 1998), due to the high correlations between the HYP and IMP dimensions (e.g., correlations between .57 and .94) the 2-factor model has been considered more appropriate. Smith (2003) also reported support

for the 2-factor model of AD/HD in an unpublished CFA study of Australian elementary school children.

As also shown in Table 3, moderate to high correlations have also been reported for the IN and H/I dimensions based on community samples. CFA studies examining the factor structure of the AD/HD symptoms alone have provided correlations between IN and H/I ranging from .57 to .94 (Beiser et al., 2000; DuPaul et al., 1997; DuPaul et al., 1998; Gomez et al., 2003; Gomez et al., 1999).

To date, Pillow et al. (1998) is the only CFA study that has investigated the factor structure of the AD/HD symptoms alone in a clinical sample (Pillow et al., 1998). Although Pillow et al. provided support for separate dimensions of IN, HYP, and IMP, these results were derived from the DSM-III ADD and DSM-III-R ADHD symptoms. In contrast, Tallent (2003) provided support for separate dimensions of IN and H/I based on the DSM-IV AD/HD symptoms in an unpublished CFA study based on a clinical sample. Surprisingly, the correlation between IN and H/I was lower than those reported for community samples (i.e., mother = .31 and teacher = .29).

In summary, CFA studies investigating the factor structure of the DSM-IV AD/HD symptoms alone provide support for separate dimensions of IN and HYP in clinical and community samples. These findings are based on parent and teacher ratings. Although several studies investigating the AD/HD symptoms have found the 3-factor model to be a slightly better fit to the data than the 2-factor model, the 2-factor model is considered a more appropriate solution due to the high correlation between the HYP and IMP dimensions. However, due to the high rate of comorbidity between the childhood behaviour disorders (e.g., AD/HD with ODD and CD), it is argued that the organisation of the AD/HD symptoms should be assessed with the other childhood behaviour disorders considered (Pillow et al., 1998).

Table 3

CFA Studies of AD/HD Symptoms

Study	Sample *N* = *n* of boys/girls Age range Country	Rating scale/rater	Fit index		Extraction method	Models supported	Pearson's correlations between factors
Beiser et al. (2000)	1,555 Native and 489 non-Native elementary school children 52% female 48% male Grades 2 and 4 (age range not stated) North America	Teacher Interview Form (TIF), Child's Assessment by a Parent (CAP), and the Student's Observation of Self (SOS) 1,118 parents (70% biological mother), teachers, and children	1-factor model (non-Natives): <u>Parent ratings</u> LRχ^2 = 106.8 AGFI = .67 CFI = .76 RMSR = .17 <u>Child ratings</u> LRχ^2 = 52.4 AGFI = .91 CFI = .89 RMSR = .07	<u>Teacher ratings</u> LRχ^2 = 378.9 AGFI = .52 CFI = .77 RMSR = .21	Maximum likelihood estimation	2-factor model – correlated: 1. Attention-deficit (AD) 2. H/I	*Non-Native*: <u>Parent ratings</u> .89 <u>Teacher ratings</u> .75 *Native*: <u>Parent ratings</u> .87 <u>Teacher ratings</u> .68

2-factor model (non-Natives):

Parent ratings	Teacher ratings
LRχ^2 = 85.5	LRχ^2 = 142.9
AGFI = .74	AGFI = .81
CFI = .82	CFI = .93
RMSR = .15	RMSR = .12
ΔX^2 = 21.3	ΔX^2 = 236.0
Child ratings	
LRχ^2 = 49.5	
AGFI = .91	
CFI = .89	
RMSR = .06	
ΔX^2 = 2.5	

2-factor model – correlated (non-Natives):

Parent ratings	Teacher ratings
LRχ^2 = 64.2	LRχ^2 = 52.7

AGFI = .79	AGFI = .92
CFI = .88	CFI = .99
RMSR = .13	RMSR = .06
$\Delta\chi^2 = 21.3$	$\Delta\chi^2 = 90.2$

1-factor model (Natives):

Parent ratings	Teacher ratings
$LR\chi^2 = 81.1$	$LR\chi^2 = 778.1$
AGFI = .81	AGFI = .41
CFI = .90	CFI = .71
RMSR = .11	RMSR = .23

Child ratings

$LR\chi^2 = 58$

AGFI = .96

CFI = .92

RMSR = .05

2-factor model (Natives):

Parent ratings	Teacher ratings
LRχ^2 = 250.5	LRχ^2 = 71.2
AGFI = .80	AGFI = .83
CFI = .92	CFI = .92
RMSR = .12	RMSR = .10
ΔX^2 = 9.9	ΔX^2 = 537.6

Child ratings

LRχ^2 = 58.1

AGFI = .96

CFI = .92

RMSR = .05

$\Delta\chi^2$ = .01

2-factor model – correlated (Natives):

Parent ratings	Teacher ratings
LRχ^2 = 64.7	LRχ^2 = 121
AGFI = .85	AGFI = .90

			CFI = .92 CFI = .97 RMSR = .10 RMSR = .08 $\Delta\chi^2$ = 6.5 $\Delta\chi^2$ = 129.5			
DuPaul et al. (1997)	4,009 children from 31 U.S. school districts 2,054 boys 1,934 girls 21 unspecified Kindergarten to grade 12 United States	ADHD Rating Scale – IV (school version) Teachers	1-factor: χ^2 = significant (actual value not reported) RMSEA = approximately .05 (actual value not reported) 2-factor: χ^2 = significant (actual value not reported) RMSEA = approximately .05 (actual value not reported) $\Delta\chi^2$ = 191 CVI = .24	Maximum likelihood estimation	2-factor model: 1. IN 2. H/I	.94
DuPaul et al. (1998)	4,666 children from 22 U.S. school	ADHD Rating Scale – IV (Home	1-factor: χ^2 = significant (actual value not	Maximum likelihood	2-factor model: 1. IN	.92

	districts 4131 female 524 male 11 unspecified 4 to 20 years United States	version) 4071 mothers, 494 fathers, 39 guardians, 36 grandparents, and 26 unspecified	reported) RMSEA = below .05 (actual value not reported) CVI = 1.05 2-factor: χ^2 = significant (actual value not reported) RMSEA = below .05 (actual value not reported) $\Delta\chi^2$ = 178 CVI = .42		estimation	2. H/I	
Gomez et al. (1999)	1275 primary school children 608 boys 668 girls 5 to 11 years	DSM-IV AD/HD Rating Scale Parents (father/mother not specified)	1-factor model: <u>Parent ratings</u> χ^2 = 2084.17* GFI = .77 AGFI = .71 RMSR = .05	 <u>Teacher ratings</u> χ^2 = 5166.54* GFI = .52 AGFI = .39 RMSR = .06	Maximum likelihood estimation Weighted least squares	2-factor model: 1. IN 2. H/I	2-factor model: <u>Parent ratings</u> .75 <u>Teacher ratings</u> .68

Australia	2-factor model: Parent ratings Teacher ratings χ^2 = 1057.80* χ^2 = 1841.93* GFI = .90 GFI = .84 AGFI = .88 AGFI = .80 RMSR = .04 RMSR = .04 3-factor model: Parent ratings Teacher ratings χ^2 = 861.11* χ^2 = 1189.19* GFI = .93 GFI = .90 AGFI = .91 AGFI = .88 RMSR = .03 RMSR = .04 1-factor versus 2-factor model $\Delta\chi^2$ = 1026.37* $\Delta\chi^2$ = 3324.61* 1-factor versus 3-factor model $\Delta\chi^2$ = 1223.06* $\Delta\chi^2$ = 3977.35*	estimation	3-factor model: Parent ratings *r* (IN – HYP) =.77 *r* (IN – IMP) =.64 *r* (HYP– IMP) =.84 Teacher ratings *r* (IN + HYP) =.73 *r* (IN + IMP) =.57 *r* (HYP– IMP) =.86

			2-factor versus 3-factor model $\Delta\chi^2 = 196.69^*$ $\Delta\chi^2 = 652.74^*$				
Gomez et al. (2003)	Study 1: 1,475 Australian elementary school children 733 boys 742 girls mean age 8.28 (age range not stated) Australia Study 2: 285 Brazilian children	Study 1: DSM-IV AD/HD Rating Scale Study 2: CADBI 2.3 – parent and teacher version Study 1: 95% mothers and remaining 5% not specified Study 2: 77% mothers, 15%	*Study 1* <u>Parent ratings</u> 1-factor: S-B$\chi^2 = 1707^*$ RCFI = .77 RRMSEA = .089 2-factor: S-B$\chi^2 = 870^*$ RCFI = .89 RRMSEA =.061 2-factor > 1-factor* *Study 2* <u>Parent ratings</u>	<u>Teacher ratings</u> S-B$\chi^2 = 1925^*$ RCFI = .67 RRMSEA = .109 S-B$\chi^2 = 703^*$ RCFI = .89 RRMSEA = .063 <u>Teacher ratings</u>	Robust maximum likelihood estimation	2-factor model: 1. IN 2. H/I	*Parents* <u>Australian sample</u> .76 <u>Brazilian sample</u> .73 *Teachers* <u>Australian sample</u> .69 <u>Brazilian sample</u> .67

		fathers, and 8%	1-factor:			
	Grades 1 to 4 (age	others	S-Bχ^2 = 436*	S-Bχ^2 = 467*		
	range not stated)		RCFI = .83	RCFI = .71		
			RRMSEA =.089	RRMSEA = .134		
	Brazil					
			2-factor:			
			S-Bχ^2 = 239*	S-Bχ^2 = 181*		
			RCFI = .94	RCFI = .92		
			RRMSEA =.053	RRMSEA = .070		
			2-factor > 1-factor*			
Pillow et al.	282 clinically	Disruptive	1-factor model:	Weighted	3-factor model:	Not reported
(1998)	referred boys	Behaviour	χ^2 = 168.96	least squares	1. IN	
		Disorders (DBD)	TLI = .85	estimation	2. HYP	
	5 to 15 years	Rating Scale	CFI = .88		3. IMP	
		(includes DSM-III-	RMSEA = .120			
	United States	R ADHD, ODD,				
		and CD symptoms)				

		Swanson, Nolan, and Pelham Scale (SNAP) (includes DSM-III symptoms) Teachers and parents (father/mother not specified)	2-factor model: χ^2 = 103.15 TLI = .92 CFI = .94 RMSEA = .085 $\Delta\chi^2$ = 65.81 3-factor model: χ^2 = 89.21 TLI = .93 CFI = .95 RMSEA = .080 $\Delta\chi^2$ = 13.94				
Smith (2003)	308 Australian secondary school sample 132 boys	AD/HD Behaviour Rating Scale A single item rating academic	<u>Adolescent</u> 1-factor: S-Bχ^2 = 391.86 CFI = .83 RMSEA = .06	2-factor: S-Bχ^2 = 281.97 CFI = .89 RMSEA = .06	Maximum likelihood estimation	*Parent and teacher* 2-factor model: 1. IN 2. H/I	<u>2-factor</u> *Adolescent* .79 *Parent* .73

176 girls	performance	3-factor:		Adolescent	Teacher
12 to 18 years	Adolescents (self-	S-Bχ^2 = 240.06	RMSEA = .05	3-factor model:	.73
Australia	report), teachers,	CFI = .91		1. IN	
	and parents (87%	Parent		2. HYP	3-factor
	mothers, 11%	1-factor:	2-factor:	3. IMP	*Adolescent*
	fathers, 2% other)	S-Bχ^2 = 834.90	S-Bχ^2 = 379.85		*r* (IN – HYP) = .80
		CFI = .77	CFI = .89		*r* (IN – IMP) = .65
		RMSEA = .13	RMSEA = .08		*r*(IMP – HYP) =.77
		3-factor:			
		S-Bχ^2 = 280.20	RMSEA = .06		*Parent*
		CFI = .92			*r* (IN – HYP) = .75
		Teacher			*r* (IN – IMP) = .61
		1-factor:	2-factor:		*r*(IMP – HYP) =.81
		S-Bχ^2 = 890.10	S-Bχ^2 = 363.71		
		CFI = .74	CFI = .86		*Teacher*
		RMSEA = .18	RMSEA = .13		*r* (IN – HYP) = .78
		3-factor:			*r* (IN – IMP) = .54
		S-Bχ^2 = 272.58	RMSEA = .12		*r*(IMP – HYP) =.80

			CFI = .89 <u>Difference between models</u> 2-factor > 1-factor* 3-factor > 2-factor, 1-factor				
Tallent (2003)	220 AD/HD participants 191 males 29 females 6 to 13 years Australia	DSM-IV AD/HD Rating Scale Teachers and parents (father/mother not specified)	1-factor model: <u>Parent ratings</u> χ^2 = 845.85* GFI = .593 AGFI = .485 RMSR = .089 2-factor model: <u>Parent ratings</u> χ^2 = 428.85* GFI = .908 AGFI = .757 RMSR = .058 3-factor model:	<u>Teacher ratings</u> χ^2 = 1278.41* GFI = .425 AGFI = .272 RMSR = .126 <u>Teacher ratings</u> χ^2 = 467.83* GFI = .776 AGFI = .715 RMSR = .056	Maximum likelihood estimation	2-factor model: 1. IN 2. H/I	2-factor model: <u>Parent ratings</u> .31 <u>Teacher ratings</u> .29 3-factor model: <u>Parent ratings</u> *r* (IN – HYP)=.36 *r* (IN – IMP)=.19 *r* (HYP – IMP)=.71 <u>Teacher ratings</u> *r* (IN – HYP)=.43 *r* (IN – IMP)=.21

Parent ratings	Teacher ratings	*r* (HYP – IMP)=.84
χ^2 = 355.23*	χ^2 = 338.47*	
GFI = .851	GFI = .843	
AGFI = .807	AGFI = .797	
RMSR = .052	RMSR = .041	
1-factor versus 2-factor model		
$\Delta\chi^2$ = 406.89	$\Delta\chi^2$ = 810.58	
1-factor versus 3-factor model		
$\Delta\chi^2$ = 490.62	$\Delta\chi^2$ = 939.94	
2-factor versus 3-factor model		
$\Delta\chi^2$ = 83.73	$\Delta\chi^2$ = 129.36	

NOTE: * = p <.001; AD/HD = Attention-Deficit/Hyperactivity Disorder; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity; LRχ^2 = log likelihood χ^2; AGFI = adjusted goodness-of-fit index; CFI = comparative fit index; RMSR = root mean square residual; χ^2 = Likelihood Ratio Test statistic; CVI = cross-validation index; RMSEA = root mean squared error of approximation; GFI = goodness-of-fit index; S-Bχ^2 = Satorra-Bentler scaled chi-square statistic; RCFI = robust comparative fit index; RRMSEA = robust root mean squared error of approximation; TLI = Tucker-Lewis index; Δ = change.

3.2.2 CFA Studies Examining the Factor Structure of the AD/HD, ODD, and CD Symptoms

Table 4 shows CFA studies that have examined the factor structure of the DSM-III, DSM-III-R, and DSM-IV AD/HD, ODD, and CD symptoms together, based on parent and teacher ratings. As presented in Table 4, based on community samples, recent CFA studies investigating the AD/HD, ODD, and CD symptoms provide support for a 2-factor model of AD/HD (i.e., IN and H/I) and separate dimensions of ODD and CD (Burns & Walsh, 2002; Burns, Walsh, Owen, & Snell, 1997a; Burns et al., 1997b; Gomez et al., 2005; Molina, Smith, & Pelham, 2001). In an unpublished Australian study, Keogh (2002) also provided support for separate IN, H/I, and ODD dimensions. In contrast, based on DSM-III and DSM-III-R symptoms, Fergusson and colleagues provided support for a single Attention Deficit dimension (Fergusson, Horwood, & Lloyd, 1991; Fergusson, Horwood, & Lynskey, 1994) and separate CD dimensions including overt CD and covert CD (Fergusson et al., 1994). Previous CFA studies have also demonstrated a close association between the AD/HD and ODD dimensions. As shown in Table 4, correlations ranged between .61 and .86 for IN and H/I, .58 and .77 for IN and ODD, and .64 and .87 for H/I and ODD (Burns et al., 1997a; Burns et al., 1997b; Gomez et al., 2005; Molina et al., 2001).

Recent CFA studies investigating the factor structure of the AD/HD, ODD, and CD symptoms together in clinical samples have also provided support for the 2-factor model of AD/HD (i.e., IN and H/I) and separate dimensions of ODD and CD (Boe, 1997; Burns, Boe, Walsh, Sommers-Flanagan, & Teegarden, 2001; Molina et al., 2001). Only Pillow et al. (1998) provided support for a 2-factor model of AD/HD and an ODD factor in which the IMP symptoms were allowed to cross-load onto the ODD dimension. However, Pillow's et al. study was based on DSM-III and DSM-III-R ADHD and ODD

symptoms. Table 4 also shows that high correlations have been found between the IN, H/I, and ODD dimensions for clinical samples ranging between .59 and .82 (Burns et al., 2001; Pillow et al., 1998). Overall, CFA studies examining the factor structure of the AD/HD, ODD, and CD symptoms together in community and clinical samples have found support for distinct factors of IN, H/I, and ODD.

Table 4

CFA Studies of AD/HD, ODD, and CD Symptoms

Study	Sample *N* = *n* of boys/girls Age range Country	Rating scale/rater	Fit index	Extraction method	Model supported and factor loading	Pearson's correlations between factors
Boe (1997)	396 children from a pediatrics/family practice 209 boys 187 girls 3 to 17 years United States	Child and Adolescent Disruptive Behaviour Inventory (CADBI) – Parent Version (DSM-IV) Parents (91.4% mother, 4.5% father, and 4% other)	1-factor model: S-Bχ^2 = 1550.50* GFI = .585 CFI = .740 RCFI = .732 SRMR = .091 2-factor model: S-Bχ^2 = 1118.03* GFI = .681 CFI = .825 RCFI = .820	Maximum likelihood estimation with robust estimation	3-factor model: 1. ODD 2. IN 3. H/I	Not reported

			SRMR = .079 3-factor model: S-Bχ^2 = 633.66* GFI = .852 CFI = .918 RCFI = .918 SRMR = .051 2-factor < 1-factor S-Bχ^2 = 432.47* 3-factor < 2-factor S-Bχ^2 = 484.37* 3-factor < 1-factor S-Bχ^2 = 516.84*			
Burns et al. (1997a)	Study 1: 1,445 children in the Pullman School District	Study 1: CADBI – Teacher Rating Scale One (TRS1)	Study 1: 4-factor model: CFI = .924 RCFI = .865	Robust maximum likelihood estimation	4-factor model: 1. IN 2. H/I 3. CD	<u>Study 1:</u> *r* (IN – H/I)=.74 *r* (IN – ODD)=.64 *r* (IN – CD)=.39

722 boys	(DSM-III-R	GFI = .867	4. ODD	*r* (H/I – ODD)=.69
723 girls	symptoms)	SRMR = .048		*r* (H/I – CD)=.44
				r (ODD – CD) =.71
5 to 14 years	Study 2:	Models 1, 2, and 3 not reported		
	CADBI – Teacher			<u>Study 2:</u>
United States	Rating Scale Two	4-factor < 1, 2, 3-factor*		*r* (IN – H/I)=.78
	(TRS2)			*r* (IN – ODD)=.66
Study 2:	(DSM-IV	Study 2:		*r* (IN – CD)=.53
1,711 children in the	symptoms)	4-factor model:		*r* (H/I – ODD)=.80
Clarkson School		CFI = .934		*r* (H/I – CD)=.63
District	Teachers	RCFI = .929		*r* (ODD – CD) =.81
		GFI = .871		
862 boys		SRMR = .044		
849 girls				
		Models 1, 2, and 3 not reported		
4 to 15 years				
		4-factor < 1, 2, 3-factor*		
United States				

Burns et al. (1997b)	4,019 children Sample1: 2,061 children 2 to 10 years Sample 2: 1,958 children 11 to 19 years 2,145 boys 1,874 girls United States	CADBI – Parent Rating Scale (PRS) Parents including 82.43% mothers, 13.26% fathers, 4.30% grandparents, other relatives, or foster parents	4-factor model: <u>2 to 10 years</u> GFI = .947 CFI = .943 RCFI = .947 SRMR = .042 RMSEA = .055 <u>11 to 19 years</u> GFI = .941 CFI = .945 RCFI = .935 SRMR = .043 RMSEA = .059 Models 1, 2, and 3 not reported 4-factor < 3-, 2-, 1-factor models	Robust maximum likelihood estimation	4-factor model: 1. IN 2. H/I 3. ODD 4. Overt conduct disorder (CD)	<u>Ages 2 to 10</u> *r* (IN – H/I)=.86 *r* (IN – ODD)=.66 *r* (IN – CD)=.46 *r* (H/I – ODD)=.72 *r* (H/I – CD)=.60 *r* (ODD – CD) =.62 <u>Ages 11 to 19</u> *r* (IN – H/I)=.76 *r* (IN – ODD)=.70 *r* (IN – CD)=.52 *r* (H/I – ODD)=.72 *r* (H/I – CD)=.71 *r* (ODD – CD) =.68

Burns et al. (2001)	Outpatient pediatric clinics on 742 children (380 boys and 362 girls) not in treatment and 91 children (64 boys and 27 girls) in treatment for AD/HD 3 to 16 years United States	CADBI-Parent Rating Scale Version 1a (includes DSM-IV symptoms) Mothers	<u>Children not in treatment</u> 1-factor: S-Bχ^2 = 2955* CFI = .72 RCFI = .70 SRMR = .089 RMSEA = .126 3-factor (A): S-Bχ^2 = 1293* CFI = .90 RCFI = .89 SRMR = .057 RMSEA = .077 ΔS-Bχ^2 =965*	2-factor: S-Bχ^2 = 2258* CFI = .80 RCFI = .78 SRMR = .078 RMSEA = .108 ΔS-Bχ^2 =697* 3-factor (B; with cross loadings): S-Bχ^2 = 1257* CFI = .90 RCFI = .89 SRMR = .055 RMSEA = .076 ΔS-Bχ^2 =36*	Robust maximum likelihood estimation	3-factor model: 1. IN 2. H/I 3. ODD	*r* (IN – H/I)=.68 *r* (IN – ODD)=.68 *r* (H/I – ODD)=.72

4-factor:	
S-Bχ^2 = 1190*	SRMR = .055
CFI = .91	RMSEA = .073
RCFI = .90	ΔS-Bχ^2 =103*
<u>Children in treatment</u>	
1-factor:	2-factor:
S-Bχ^2 = 634*	S-Bχ^2 = 530*
CFI = .64	CFI = .73
RCFI = .74	RCFI = .82
SRMR = .107	SRMR = .096
RMSEA = .144	RMSEA = .126
	ΔS-Bχ^2 =104*
3-factor (A):	3-factor (B):
S-Bχ^2 = 435*	S-Bχ^2 = 431*
CFI = .81	CFI = .81
RCFI = .89	RCFI = .89

			SRMR = .085 RMSEA = .106 ΔS-Bχ² =95* 4-factor: S-Bχ² = 433* CFI = .81 RCFI = .89	SRMR = .084 RMSEA = .106 ΔS-Bχ² =4 SRMR = .085 RMSEA = .106 ΔS-Bχ² =2			
Burns & Walsh (2002)	2-year longitudinal study of 752 children 372 girls 380 boys Kindergarten to 7th Grade United States	Sutter-Eyberg Student Behaviour Inventory (SESBI) CADBI-TS (includes DSM-III-R AD/HD, CD and ODD symptoms) Teachers	<u>Time 1</u> 1-factor: S-Bχ² = 1665 CFI = .68 RCFI = .56 RMSEA = .216 3-factor: S-Bχ² = 507	2-factor: S-Bχ² = 1036 CFI = .82 RCFI = .74 RMSEA = .166 ΔS-Bχ² =629 3-factor (w/ error): S-Bχ² = 347	Robust maximum likelihood estimation	3-factor model: 1. IN 2. H/I 3 ODD	Not reported

CFI = .91	CFI = .95
RCFI = .89	RCFI = .93
RMSEA = .114	RMSEA = .092
ΔS-Bχ^2 =529	ΔS-Bχ^2 =160
<u>Time 2</u>	
1-factor:	2-factor:
S-Bχ^2 = 1734	S-Bχ^2 = 1084
CFI = .68	CFI = .81
RCFI = .56	RCFI = .73
RMSEA = .222	RMSEA = .174
	ΔS-Bχ^2 =650
3-factor:	3-factor (w/ error):
S-Bχ^2 = 546	S-Bχ^2 = 387
CFI = .91	CFI = .94
RCFI = .88	RCFI = .92
RMSEA = .122	RMSEA = .057
ΔS-Bχ^2 =538	S-Bχ^2 =159

			Time 3 1-factor: 2-factor: S-Bχ^2 = 1627 S-Bχ^2 = 994 CFI = .66 CFI = .84 RCFI = .65 RCFI = .81 RMSEA = .193 RMSEA = .134 ΔS-Bχ^2 =633 3-factor: 3-factor (w/ error): S-Bχ^2 = 573 S-Bχ^2 = 433 CFI = .91 CFI = .93 RCFI = .90 RCFI = .93 RMSEA = .102 RMSEA = .087 ΔS-Bχ^2 =421 ΔS-Bχ^2 =140		
Fergusson et al. (1991)	A birth cohort of 1,265 children 635 males	Questionnaire of CD and AD/HD items (broadly conformed to	M1: 1-factor (no method effect) χ^2 = 225.58 AGFI = .71	Maximum likelihood estimation	2-factor model: .87 1. Attention deficit 2. CD

	630 females New Zealand	DSM-III symptoms) Children's Self-Report Psychiatric Rating Scale Children, mothers, and teachers	M2: 2-factor (no method effect) $\chi^2 = 225.50$ AGFI = .64 M3: 1-factor (method effect) $\chi^2 = 26.28$ AGFI = .93 $\Delta X^2 = 199.3$* M4: 2-factor (method effect) $\chi^2 = 1.93$ AGFI = .99 $\Delta\chi^2 = 223.6$*				
Fergusson et al. (1994)	739 adolescents sex ratio not reported	Revised Problem Behaviour Checklist (based on DSM-III-R)	<u>Single factor</u>: $LR\chi^2 = 71.7$* AGFI = .90	<u>ODD + CD</u>: $LR\chi^2 = 47.5$ AGFI = .92	Maximum likelihood estimation	4-factor model: 1.ODD 2. Overt CD 3. Covert CD 4. AD/HD	*r* (AD/HD – ODD) = .88 *r* (AD/HD – overt CD) = .68

	15 years New Zealand	Diagnostic Interview Schedule for Children (DICA) Children and parents (mother/father unspecified)	<u>Overt + covert CD</u>: LRχ^2 = 27.0* AGFI = .96 <u>4-factor</u>: LRχ^2 = 9.4 AGFI = .98	<u>3-factor</u>: LRχ^2 = 5.7 AGFI = .98			*r* (AD/HD – covert CD) = .68 *r* (ODD – overt CD) = .70 *r* (ODD – covert CD) = .75 *r* (overt CD – covert CD) = .75
Gomez et al. (2005)	917 Malaysian elementary school children 424 boys 493 girls Mean age: Boys 8.87 years	A Malay version of the Disruptive Behaviour Questionnaire (DBQ) Teachers and parents (mother/father not	<u>Parent</u> 1-factor: S-Bχ^2 = 1890* CFI = .79 RMSEA = .076 SRMR = .066 3-factor: S-Bχ^2 = 905*	2-factor: S-Bχ^2 = 1229* CFI = .88 RMSEA = .058 SRMR = .052 4-factor: S-Bχ^2 = 837*	Maximum likelihood estimation M-Plus's robust weighted least squares estimation	3-factor model: 1. IN 2. H/I 3. ODD	<u>Parent</u> *r* (IN – H/I) =.66 *r* (IN – ODD) =.58 *r* (H/I – ODD) =.64 *Teacher* *r* (IN – H/I) =.70 *r* (IN – ODD) =.61 *r* (H/I – ODD) =.78

Girls 9.02 years	specified)	CFI = .92	CFI = .93	(WLSM)
Malaysia		RMSEA = .047	RMSEA = .045	
		SRMR = .043	SRMR = .040	
		<u>Teacher</u>		
		1-factor:	2-factor:	
		S-Bχ^2 = 3340*	S-Bχ^2 = 2502*	
		CFI = .76	CFI = .82	
		RMSEA = .116	RMSEA = .099	
		SRMR = .082	SRMR = .073	
		3-factor:	4-factor:	
		S-Bχ^2 = 1239*	S-Bχ^2 = 1183*	
		CFI = .92	CFI = .93	
		RMSEA = .066	RMSEA = .064	
		SRMR = .046	SRMR = .044	
		<u>Difference between models</u>		
		3-factor > 1-factor, 2-factor*		

			4-factor > 3-factor *				
Keogh (2002)	213 Australian elementary school children 104 boys 109 girls 5 to 12 years Australia	Disruptive Behaviour Questionnaire (DBQ) A single item rating academic performance Teachers and parents (mother/father not specified)	<u>Parent</u> Model 1: χ^2 = 2184.75* NFI = .70 RMSEA = .16 SRMR = .09 GFI = .60 Model 2b: χ^2 = 1466* NFI = .80 RMSEA = .11 SRMR = .08 GFI = .74 Model 3b: χ^2 = 946.82*	Model 2a: χ^2 = 1432.43* NFI = .80 RMSEA = .16 SRMR = .09 GFI = .74 Model 3a: χ^2 = 985.80* NFI = .86 RMSEA = .08 SRMR = .06 GFI = .82 Model 3c: χ^2 = 1118.29*	Maximum likelihood estimation	3-factor model (Model 3a): 1. IN 2. H/I 3. ODD	3-factor model (Model 3a): <u>Parent</u> *r* (IN – H/I) =.74 *r* (IN – ODD) =.60 *r* (H/I – ODD) =.74 <u>Teacher</u> *r* (IN – H/I) =.61 *r* (IN – ODD) =.58 *r* (H/I – ODD) =.73

NFI = .87	NFI = .85
RMSEA = .08	RMSEA = .09
SRMR = .06	SRMR = .07
GFI = .85	GFI = .82
Model 4:	
χ^2 = 875.71*	RMSEA = .07
NFI = .88	SRMR = .05
GFI = .87	
Teacher	
Model 1:	Model 2a:
χ^2 = 2093.21*	χ^2 = 1684.51*
NFI = .61	NFI = .68
RMSEA = .23	RMSEA = .20
SRMR = .11	SRMR = .10
GFI = .44	GFI = .49
Model 2b:	Model 3a:
χ^2 = 1465.80*	χ^2 = 1078.10*

NFI = .73	NFI = .80
RMSEA = .16	RMSEA = .12
SRMR = .09	SRMR = .08
GFI = .59	GFI = .71
Model 3b:	Model 3c:
χ^2 = 1050.73*	χ^2 = 1335.11*
NFI = .80	NFI = .75
RMSEA = .11	RMSEA = .15
SRMR = .07	SRMR = .08
GFI = .72	GFI = .63
Model 4:	
χ^2 = 929.17*	RMSEA = .10
NFI = .83	SRMR = .07
GFI = .74	
Parent and teacher:	
Difference between models	

			Models 3a, 3b, 4>Model 1* Model 4>Models 3a, 3b* Model 3b>Model 3a*				
Molina et al. (2001)	Study 1: 247 middle school students 56% male 44% female 11 to 16 years United States Study 2: 224 adolescents	Study 1: Questionnaire adapted from the DSM-IV AD/HD and ODD symptom list Objective measures of achievement and rule-breaking Self-report of delinquent behaviour	Study 1: 1-factor: S-Bχ^2 = 1107.70* CFI = .77 SRMR = .08 3-factor: S-Bχ^2 = 614.20* CFI = .91 SRMR = .06 Study 2: 1-factor: S-Bχ^2 = 691.05* CFI = .67	2-factor: S-Bχ^2 = 840.19* CFI = .84 SRMR = .07 2-factor: S-Bχ^2 = 590.40* CFI = .75	Robust maximum likelihood estimation	3-factor model: 1. IN 2. H/I 3. Defiant behaviour	Study 1: *r* (IN – H/I)=.85 *r* (IN – ODD)=.77 *r* (H/I – ODD)=.87 Study 2: *r* (IN – H/I)=.77 *r* (IN – ODD)=.75 *r* (H/I – ODD)=.87

(132 with AD/HD and 92 without AD/HD)	Teachers and children or adolescents	SRMR = .09 3-factor:	SRMR = .09
		S-Bχ^2 = 437.65*	
sex ratio not stated	Study 2:	CFI = .88	
	Disruptive	SRMR = .07	
13 to 18 years	Behaviour		
	Disorders (DBD)		
United States	Rating Scale		
	Diagnostic Interview Schedule for Children (DISC), Version 2.3		
	Mothers, teachers and adolescents		

Pillow et al. (1998)	282 clinically referred boys 5 to 15 years United States	Disruptive Behaviour Disorders (DBD) Rating Scale (includes DSM-III-R ADHD, ODD, and CD symptoms) Swanson, Nolan, and Pelham Scale (SNAP) (includes DSM-III symptoms) Teachers and parents (father/mother not specified)	Model 2B (1 second-order and 5 first-order factors): $\chi^2 = 382.79$* TLI = .96 CFI = .96 RMSEA = .076 Model 2A (2 second-order and 5 first-order factors): $\chi^2 = 332.59$* TLI = .96 CFI = .97 RMSEA = .067 $\Delta X^2 = 50.20$* Model 2D (2 second-order and 4 pure first-order factors): $\chi^2 = 368.22$*	Weighted least squares estimation	Model 2C: 1. IN 2. H/I 3. CD 4. ODD (IMP items crossload onto the ODD factor)	*r* (IN – HYP)=.59 *r* (IN – IMP)=.61 *r* (HYP – IMP)=.82 ODD and CD correlations not reported

	TLI = .96 CFI = .96 RMSEA = .073
	Model 2C (2 second-order and 4 mixed first-order factors): χ^2 = 298.42* TLI = .97 CFI = .97 RMSEA = .062 $\Delta\chi^2$ = 69.80*

NOTE:* = *p* <.001; AD/HD = Attention-Deficit/Hyperactivity Disorder; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity; ODD = oppositional behaviour; CD = conduct behaviour; S-Bχ^2 = Satorra-Bentler scaled chi-square statistic; GFI = goodness-of-fit index; CFI = comparative fit index; RCFI = robust comparative fit index; SRMR = standardised root mean square residual; RMSEA = root mean squared error of approximation; χ^2 = Likelihood Ratio Test statistic; AGFI = adjusted goodness-of-fit index; LRχ^2 = log likelihood χ^2; NFI = normed fit index; TLI = Tucker-Lewis index; Δ = change.

3.2.3 Limitations of the CFA Studies Examining the Factor Structure of the AD/HD and ODD Symptoms

As was the case for the EFA studies, there were moderate to high correlations between the dimensions in the CFA studies. For community samples, correlations between the AD/HD and ODD dimensions range from .64 to .87. In contrast, correlations between the AD/HD and ODD dimensions in clinical samples were slightly lower ranging from .42 to .82. In particular, there was a strong relationship between HYP and IMP, and to a lesser degree H/I and ODD.

Several possible reasons have been suggested for the high correlation between the AD/HD and ODD dimensions. Burns and Walsh (2002) argue that the strong relation could be explained by the three constructs sharing common risk factors. Alternatively, it is possible that some of the AD/HD and ODD symptoms could have weak discriminant validity (i.e., a symptom that correlates with its own cluster at the same level as its correlates with the other cluster). A final possibility is that the use of rating scales that base their findings on a single informant could inflate the correlations between the AD/HD and ODD dimensions. Because previous EFA and CFA studies have been based on ratings from a single source (i.e., parent or teacher), this may lead to strong source effects in the AD/HD and ODD dimensions. Therefore, it is suggested that the organisation of the AD/HD and ODD symptoms should be examined using multiple raters (i.e., parents and teachers) to address problems of measurement error (i.e., source variance).

3.3 CFA MT-MS Studies Examining the Construct Validity of the AD/HD and ODD Symptoms

3.3.1 Trait, Source, and Error Variance in the AD/HD and ODD Symptoms

At present, there is considerable debate over the construct validity (e.g., convergent and discriminant validity) of the DSM-IV classification of AD/HD and ODD, as previous research using parent and teacher rating scales has not taken measurement error (e.g., source effects) into consideration (see Burns, Walsh, & Gomez, 2003). Source effect refers to systematic variance in the obtained score that is specific to a particular source such as the parent or teacher (Rowe & Kandel, 1997). Traditionally, source effects are usually considered as a form of bias associated with characteristics of the rater (Fiske, 1987). Such characteristics include response bias, halo effects, and projection bias (see Greenbaum, Dedrick, Prange, & Friedman, 1994). Source effect is independent from trait effect, which is the systematic variance due to the construct being assessed (Rowe & Kandel, 1997). It is suggested that the MT-MS procedure could address problems associated with source effects.

As previously outlined, past EFA and CFA studies investigating the construct validity of the AD/HD and ODD symptoms have based their findings on single source ratings (i.e., parent or teacher). Such studies are susceptible to measurement error (i.e., source effects). This does not enable the distinction to be drawn between source and trait effects for the IN, H/I, and ODD dimensions, which can distort the relationship between these constructs (Crystal, Ostrander, & Chen, 2001). For instance, previous EFA and CFA studies investigating the factor structure of the AD/HD and ODD dimensions have reported high correlations between the IN, H/I, and ODD constructs (e.g., as shown in Table 4, correlations between .61 and .86 for IN and H/I, .58 and .77 for IN and ODD,

and .64 and .87 for H/I and ODD). However, the use of a single source makes it impossible to determine if the high association between constructs is due to trait or source effects. Therefore, it is argued that source variance represents a measurement artifact (i.e., form of bias) that needs to be removed from rating scales to ascertain the true relationship between constructs (Fiske, 1987; Greenbaum et al., 1994). Given the extensive use of parent and teacher rating scales in AD/HD research, the MT-MS approach allows for a greater understanding of current research findings by providing the amount of trait, source, and error variance in AD/HD measures for parent and teacher ratings.

3.3.2 A Review of CFA MT-MS Studies Examining the Construct Validity of the AD/HD and ODD Symptoms

To date, there has been limited research into the amount of variance in the AD/HD and ODD dimensions due to trait, source, and error effects (Burns & Walsh, 2002; Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003; Tallent, 2003). As seen in Table 5, recent CFA MT-MS studies have provided support for the construct validity of the AD/HD and ODD dimensions in community and clinical samples at the matrix level. Of the five studies presented in Table 5, each study provides support for the convergent and discriminant validity of traits (i.e., IN, H/I, and ODD) and discriminant validity of sources (i.e., parent and teacher) at the matrix level.

Table 5

Construct Validity of Traits and Discriminant Validity of Sources

Study	Sample *N* = *n* of boys/girls Age range Country	Rating Scale/Rater	Traits	Support for convergent validity of traits	Support for discriminant validity of traits	Sources	Support for discriminant validity of sources
Gomez et al. (2003)	1475 Australian elementary school children	*Australian* DSM-IV AD/HD Rating Scale	Australian IN H/I	 Yes Yes	 Yes Yes	 Mother Teacher	 Yes Yes
	733 boys 742 girls	95% mothers and remaining 5% not specified	Brazilian IN H/I	 Yes Yes	 Yes Yes	 Mother Teacher	 Yes Yes
	285 Brazilian elementary school children 136 boys	Brazilian A Portuguese version of the Child and Adolescent Disruptive					

	149 girls 5 to 11 years Australia and Brazil	Behaviour Inventory 2.3 (CADBI 2.3) 77% mothers, 15% fathers, and 8% others					
Gomez et al. (2005)	917 Malaysian elementary school children 424 boys 493 girls Mean age: Boys 8.87 years Girls 9.02 years Malaysia	A Malay version of the Disruptive Behaviour Questionnaire (DBQ) Teachers and parents (mother/father not specified)	IN H/I ODD	Yes Yes Yes	Yes Yes Yes	Parent Teacher	Yes Yes
Keogh (2002)	213 Australian elementary school	Disruptive Behaviour Questionnaire (DBQ)	IN H/I	Yes Yes	Yes Yes	Parent Teacher	Yes Yes

	children 104 boys 109 girls 5 to 12 years Australia	A single item rating academic performance Teachers and parents (mother/father not specified)	ODD	Yes	Yes		
Smith (2003)	308 Australian secondary school sample 132 boys 176 girls 12 to 18 years Australia	AD/HD Behaviour Rating Scale A single item rating academic performance Adolescents (self-report), teachers, and parents (87% mothers, 11% fathers, 2% other)	IN H/I	Yes Yes	Yes Yes	Mother Teacher Adolescent	Yes Yes Yes

Tallent	220 AD/HD	DSM-IV AD/HD	IN	Yes	Yes	Parent	Yes
(2003)	participants	Rating Scale	H/I	Yes	Yes	Teacher	Yes
	191 males 29 females 6 to 13 years Australia	Teachers and parents (mother/father not specified)					

NOTE: IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour.

As indicated by the published and unpublished CFA MT-MS studies presented in Table 6 (e.g., 5 AD/HD studies and 3 ODD studies), the overall average of trait, source, and error variance according to parent, teacher, and adolescent ratings show limited support for the convergent validity of the IN, H/I, and ODD dimensions at the individual level. For the five reviewed studies for AD/HD and three reviewed ODD studies, the overall average of trait, source, and error variance was 23%, 57%, and 20% for IN, 21%, 54%, and 26% for H/I, and 36%, 50%, 24% for ODD, respectively. Overall, for the IN, H/I, and ODD dimensions, source variance dominated trait variance.

Although there was minimal support for the overall convergent validity of the AD/HD and ODD dimensions at the individual level, there was support for convergent validity of teacher-rated ODD based on the average variance across the five reviewed MT-MS studies (i.e., 48% trait, 47% source, and 24% error variance). To a lesser degree, there was partial support for the convergent validity of parent-rated IN (i.e., 31% trait versus 47% source) and teacher-rated H/I (i.e., 35% trait versus 45% source) based on significant trait variance, but source variance was greater than trait variance. Overall, one teacher-rated (Keogh, 2002) and three parent-rated (Gomez et al., 2003; Gomez et al., 2005; Smith, 2003) studies showed support for the convergent validity of the IN dimension as indicated by strong trait variance. For the H/I dimension, four teacher-rated studies (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003) and one parent-rated study (Keogh, 2002) showed support for convergent validity. Finally, one teacher-rated (Gomez et al., 2005) and one parent-rated (Keogh, 2002) study showed support for convergent validity of the ODD dimension. Overall, there was support for strong trait variance in parent-rated IN and teacher-rated H/I.

To date, there has only been a single unpublished MT-MS CFA study based on a clinical sample. Tallent (2003) provided support for the convergent and discriminant

validity of traits, and convergent validity of sources at the matrix level. At the individual level, support was provided for the convergent validity of teacher-rated H/I (i.e., 30% trait, 19% source, and 51% error variance) and parent-rated IN (i.e., 29% trait, 9% source, and 62% error variance). This was consistent with findings from other CFA MT-MS studies that have provided support for strong trait variance in parent-rated IN and teacher-rated H/I (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003). However, overall there was a substantially large amount of error variance for the IN and H/I dimensions (Tallent, 2003).

Table 6

Trait, Source, and Error Variance in AD/HD – IN, AD/HD - H/I, and ODD Traits for Community Samples

Study	Source	IN			Support	H/I			Support	ODD			Support
		Trait	Source	Error	For CV	Trait	Source	Error	For CV	Trait	Source	Error	For CV
Burns et al.	Time 1												
(2003)	Teacher	22%	70%	8%	No	58%	42%	0%	Yes	-	-	-	-
	Parent	46%	48%	6%	Yes	1%	99%	0%	No	-	-	-	-
	Time 2												
	Teacher	20%	73%	7%	No	32%	45%	23%	No	-	-	-	-
	Parent	33%	52%	16%	No	1%	79%	21%	No	-	-	-	-
Gomez et al.	Australian												
(2003)	Teacher	10%	58%	33%	No	28%	37%	35%	No	-	-	-	-
	Parent	21%	38%	41%	No	0%	50%	49%	No	-	-	-	-
	Brazilian												
	Teacher	9%	68%	22%	No	40%	23%	37%	Yes	-	-	-	-
	Parent	29%	29%	42%	Yes	1%	50%	50%	No	-	-	-	-
Gomez et al.	Teacher	6%	84%	10%	No	41%	46%	13%	Yes	55%	33%	12%	Yes
(2005)	Parent	34%	40%	26%	No	2%	50%	48%	No	2%	72%	27%	No

Keogh	Teacher	44%	49%	7%	Yes	3%	76%	24%	No	41%*	60%*	36%*	No
(2002)	Parent	9%	75%	24%	No	38%	38%	24%	Yes	45%	34%	21%	Yes
Smith (2003)	Teacher	12%	71%	18%	No	41%	43%	15%	Yes	-	-	-	-
	Parent	46%	37%	16%	Yes	5%	86%	10%	No	-	-	-	-
	Adolescent	6%	67%	28%	No	19%	44%	37%	No	-	-	-	-
Total:	Teacher	18%	68%	15%	1	35%	45%	21%	4	48%	47%	24%	1
Mean (S.D.)	Parent	31%	46%	24%	3	7%	65%	29%	1	24%	53%	24%	1
	Adolescent	6%	67%	28%	0	19%	44%	37%	0	-	-	-	-
	Overall	23%	57%	20%	4	21%	54%	26%	5	36%	50%	24%	2

Note: * = total variance totals 137%, which indicates the figures have been incorrectly stated by the researcher; CV = construct validity; S.D. = standard deviation; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

As seen in Table 7, several published and unpublished CFA MT-MS studies reported significant correlations between the IN, H/I, and ODD dimensions providing minimal support for the discriminant validity of traits at the individual level (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003). In contrast, Tallent (2003) and Gomez et al. (2003) reported low correlations between IN and H/I indicating discriminant validity of traits at the individual level. As discussed further in Chapter 3, each study presented in Table 7 showed low to moderate correlations between parent and teacher (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003; Tallent, 2003), indicating support for the discriminant validity of sources. However, discriminant validity was not supported for teacher-adolescent ratings as demonstrated by high correlation between the two sources (Smith, 2003).

Table 7

Discriminant Validity of the IN, H/I, and ODD Traits and Parent and Teacher Sources at the Symptom Parcel Level

Study	Sample	Correlation of Traits:			Correlation of sources:		
		IN – H/I	IN – ODD	H/I – ODD	Parent – Teacher	Teacher - Adolescent	Parent – Adolescent
Gomez et al. (2003)	Australian	-.04	-	-	.52*	-	-
	Brazilian	.34*	-	-	.32*		
Gomez et al. (2005)	Malaysian						
	Parcel 1	.32*	.27*	.71*	.06	-	-
	Parcel 2	.24*	.20*	.74*	.11	-	-
Tallent[1] (2003)	Australian	-.09	-	-	.43*	-	-
Keogh (2002)	Australian	.53*	.43*	.62*	.01	-	-
Smith (2003)	Australian	.44*	-	-	.51*	.72*	.37*

Note: * = $p<.001$; [1] = clinical sample; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour.

In summary, at the matrix level, support is provided for the convergent and discriminant validity of traits and the discriminant validity of sources. At the individual level, support is provided for the convergent validity of parent-rated IN and teacher-rated H/I. Finally, minimal support is provided for the discriminant validity of traits based on the high correlations between the IN, H/I, and ODD dimensions. In contrast, support is provided for the discriminant validity of sources between parents and teachers.

3.3.3 Implications of CFA MT-MS Studies Examining the Construct Validity of the AD/HD and ODD Symptoms

It has been argued that the dominance of source effects over trait effects for parent and teacher ratings might be due to cross-situational differences in ratings of childhood behaviour (Achenbach, McConaughy, & Howell, 1987; Rowe & Kandel, 1997). In a meta-analysis study of 119 studies, Achenbach et al. (1987) reported a mean correlation between similar sources (i.e., mother and father) of .50 and a mean correlation of different sources of .28 (i.e., parent and teacher) in the rating of childhood behaviour. It was suggested that the correlation between different sources was low when the child's behaviour was rated in two different situations (i.e., home and school) as the different raters have a unique view of the child's behaviour that varies from the home to school environment (Achenbach et al., 1987). Rowe and Kandel (1997) examined childhood externalising (i.e., aggressive and undercontrolled) and internalising (i.e., inhibited and overcontrolled) behaviours based on two sources (i.e., mother and father) in the same situation (i.e., home). For the externalising behaviours, trait variance was greater than source variance, but the source variance was greater than the trait variance for internalising behaviours.

Further CFA MT-MS studies have reported stronger source variance than trait variance for childhood depression and anxiety (Cole, 1990; Cole, Truglio, & Peeke, 1997) and adult antisocial personality and behaviour (Windle & Dumenci, 1999). Fergusson and Horwood (1989) also reported strong source variance for mother ratings of conduct problems, whereas teacher ratings of conduct problems showed strong trait variance. In contrast, three CFA MT-MS studies showed strong trait variance compared to source variance for substance use in college students (Stacy, Widaman, Hays, & DiMatteo, 1985; Tildesley, Hops, Ary, & Andrews, 1995) and competence in adults with mental retardation (Widaman, Stacy, & Borthwick-Duffy, 1993).

As outlined in Table 6, previous CFA MT-MS studies show that the IN, H/I, and ODD dimensions contain substantially more source variance than trait variance (with the exception of parent-rated IN and teacher-rated H/I). These findings suggest that the relationships between AD/HD and ODD constructs are distorted with the inclusion of source effects as they reflect the bias of the rater and not the systematic variance that generalises across sources (Bagozzi & Youjae, 1990; Kenny & Kashy, 1992). To reduce the bias and understand the true relations between constructs, it becomes necessary to separate source variance from trait variance. An alternative view of source effects suggests it reflects real differences in childhood behaviour that is specific to each source (Dishion, Burraston, & Li, 2002). Instead of reflecting a rater bias, source effect may capture an accurate perception of the child's different behaviour for mother and father. It is argued that source effects represent meaningful variance that should not be excluded from an investigation of childhood behaviour (Dishion et al., 2002; Dishion & Patterson, 1999; Lance et al., 2002). Therefore, it needs to be established if source effects contain mostly accuracy or bias, which leads to several possibilities as outlined by Burns and Haynes (in press), as discussed next.

First, strong source effects may contain source specific bias. This outcome does not provide an accurate representation of the relationship between IN, H/I, and ODD as the relationship is contaminated with measurement error. Alternatively, the strong source effects may represent an accurate and contrasting view of the child's behaviour as held by different sources. A third possibility is that strong source effects are a mixture of both outcomes including bias and accuracy with a need to establish which form is considered more important (Burns & Haynes, in press). In the first published CFA MT-MS study to address the accuracy versus bias issue, Burns, Walsh, et al. (2003) examined the construct validity of the IN and H/I dimensions across a 3-month interval based on parent and teacher ratings. They found that the IN and H/I dimensions contained mostly source variance in conjunction with strong convergent and moderately strong discriminant validity of the sources across time. These results indicate that the strong source effects evident in the AD/HD rating scale should be viewed as accuracy rather than bias (i.e., most of the source effects represent the situational specificity of the child's behaviour rather than a form of bias associated with the characteristics of the rater).

4. Part 3: An Examination of the External Validity of the AD/HD and ODD Symptoms

To date, there has been limited research on the relationship of the IN, H/I, and ODD dimensions with other trait dimensions. Previous studies have reported an association between IN and academic impairment (Lahey, Applegate, McBurnett et al., 1994; Molina et al., 2001), visual search errors (Healy et al., 1993), higher depression scores, and lower Full Scale IQ scores (Willcutt, Pennington, Chhabildas, Friedman, & Alexander, 1999). Further studies have also reported an association between H/I and academic impairment (DuPaul, 1991), commission errors on a Continuous Performance Test (Healy et al., 1993), global ratings of impairment (Lahey, Applegate, McBurnett et

al., 1994), and ODD and CD (Willcutt et al., 1999). Finally, ODD has been associated with low grade point average and delinquency (Molina et al., 2001). As discussed in the previous section, these findings may be limited as they are based on a single rater (i.e., parent or teacher) and may include measurement error (i.e., source effects).

The separation of trait from source effects is important in order to understand the relationships that the AD/HD and ODD dimensions have with each other and with other dimensions (i.e., academic performance, emotional problems, peer problems, and prosocial behaviour). For instance, although previous EFA and CFA studies suggest there is a strong association between academic problems and IN, these results are derived from a single source and it is unknown if the reported correlations reflect trait variance, source variance, unexplained variance (i.e., error variance), or a combination of the three forms of variance (Burns & Haynes, in press). Therefore, to ascertain the true association between IN, H/I, and ODD with other trait dimensions, it is recommended that the MT-MS method be used to separate trait variance from source variance.

Table 8 also shows recent published and unpublished CFA MT-MS studies that have examined the relationship between H/I, IN and ODD with academic performance, peer problems, emotional problems, prosocial behaviour, conduct problems, and global functioning based on parent and teacher ratings (Gomez et al., 2003; Keogh, 2002; Smith, 2003). These CFA MT-MS studies showed IN was significantly and negatively correlated with academic performance (Gomez et al., 2003; Keogh, 2002; Smith, 2003) and prosocial behaviour (Keogh, 2002; Smith, 2003). To a lesser degree, H/I and ODD showed a significant and negative correlation with academic performance (Keogh, 2002), and ODD was significantly and positively correlated with emotional problems and peer problems (Keogh, 2002). Finally, IN and H/I were significantly and negatively correlated with global functioning (Smith, 2003). However, these findings are

problematic as the measures of IN, H/I, and ODD capture source effects rather than trait effects. Before an understanding of the relations between AD/HD and ODD with other constructs can be achieved, it is important to ascertain the true nature of source effects (i.e., accuracy versus bias).

In summary, the majority of research investigating the relationships the AD/HD and ODD dimensions have with each other and with other dimensions has been based on ratings from a single source, which may lead to measurement error. Recent CFA MT-MS studies demonstrated there is a relationship between IN, H/I, and ODD, with academic impairment, prosocial behaviour, conduct problems, peer and emotional problems, and global functioning. However, these findings are problematic as measures are capturing mostly source effects rather than trait effects. At present, the true nature of source effects is not well understood.

Table 8

Summary of External Validity Studies for the AD/HD and ODD Symptoms

	Sample *N* = *n* of boys/girls Age range Country	Variables	Measures/raters	Analysis	Significant findings
DuPaul (1991)	55 elementary school children 26 boys 29 girls 6 to 12 years United States	Inattention-hyperactivity Impulsivity-hyperactivity Classroom behaviour Academic achievement	ADHD Rating Scale (including DSM-III-R AD/HD items) Abbreviated Conners Teacher Rating Scale (ACTRS) Direct observation of off-task frequency, percentage of work completed, percent correct of work completed, and academic efficiency score (AES)	Pearson product-moment correlation	Parent-completed inattention-hyperactivity scores were negatively associated with work completion percentage and academic efficiency Teacher-completed inattention-hyperactivity scores were negatively associated with academic efficiency and

			Comprehensive Test of Basic Skills (CTB) Teachers, research assistants, and children		standardised achievement test scores Both parent- and teacher-completed scores of H/I were less strongly associated with criterion measures
Gomez et al. (2003)	285 Brazilian elementary school children 136 boys 149 girls 5 to 11 years Brazil	IN H/I Academic problems	Study 1: DSM-IV AD/HD Rating Scale Study 2: CADBI 2.3 – parent and teacher version Teacher: quality of homework, classroom work, reading, arithmetic, and writing Parent: quality of homework, reading, arithmetic, and writing	MT-MS analysis	IN was positively correlated with academic problems

Healy et al. (1993)	85 non-referred school children (primarily Black and Hispanic) 43 girls 42 boys 6 to 12 years United States	IN H/I Cognition	Revised Conners Teacher Questionnaire (CTQ) Experimental questionnaire of DSM-III ADH and DSM-III-R AD/HD items Matching Familiar Figures Test (MFF) Target Detection Test (TDT) Continuous Performance Test (CPT) Child	Stepwise Regression	H/I related to commission errors (CPT false alarm errors) IN related to attention and visual search (MFF errors)
Keogh (2002)	213 elementary school children 104 boys 109 girls 5 to 12 years Australia	IN H/I ODD Academic performance Emotional and peer	Disruptive Behaviour Questionnaire (DBQ) Single question regarding academic performance Strengths and Difficulties Questionnaire (SDQ)	Multitrait-multisource (MT-MS) trait correlations	IN, H/I, and ODD were negatively correlated with academic performance (correlation between IN and academic performance much higher than the correlations between academic performance and H/I and

		problems	Teachers and parents (mother/father not specified)		ODD)
		Prosocial problems			IN was negatively correlated with prosocial behaviour
		CD			ODD was positively correlated with emotional problems and peer problems
Lahey et al. (1994)	380 clinically-referred youths	H/I	Children's Global Assessment Scale	Multiple Regression	H/I associated with global ratings of impairment
	80 girls	IN	Homework Problem Checklist (adapted version)		
	300 boys	Global impairment		Spearman-Brown rank correlations	IN associated with academic impairment
	4 to 17 years		Academic Performance Rating Scale (adapted version)		
	United States	Academic performance	Teacher Ratings of Social Impairment		

			Teacher and parent (mother/father not specified)		
Molina et al. (2001)	Study 1: 247 middle school students 56% male 44% female 11 to 16 years United States Study 2: 224 adolescents (132 with AD/HD and 92 without AD/HD) sex ratio not stated 13 to 18 years United States	IN H/I Study 1: Achievement and rule-breaking behaviour Delinquent behaviour Study 2: Delinquency Full Scale IQ	Study 1: Questionnaire adapted from DSM-IV AD/HD and ODD symptom list Teacher records of school-rule violations tallied on a student card Final report card grade point average (GPA) was made available Self-report questionnaire of delinquent behaviour Teachers, children, and parent (mother/father not specified) Study 2:	Correlation coefficients t-tests Multiple Analysis of Variance (MANOVA)	Study 1: Lower GPA was more strongly associated with IN than H/I Lower GPA was more strongly associated with ODD than with H/I Study 2: Lower GPA was more strongly associated with IN than H/I Delinquency was more

		(FSIQ) Achievement	AD/HD and ODD symptoms measured using the Disruptive Behaviour Disorders (DBD) Rating Scale Delinquency measured using the Diagnostic Interview for Children (DISC) Version 2.3 or 3.0 Vocabulary and Block Design subtests of the Wechsler Intelligence Scale for Children – III (WISC-III) or Wechsler Adult Intelligence Scale (WAIS-R) Wechsler Individual Achievement Test (WIAT) Grade Point Average (GPA)		associated with ODD than IN and H/I
Smith (2003)	308 Australian secondary	IN	Mother ratings and children AD/HD Behaviour Rating Scale	MT-MS trait	Conduct problems

school sample 132 boys 176 girls 12 to 18 years Australia	H/I Academic performance Conduct problems Prosocial behaviour Global functioning	A single item rating academic performance Adolescent (self-report), teacher and parent ratings (87% mothers, 11% fathers, 2% other)	correlations	showed a significant and positive correlation with IN and H/I IN showed a negative correlation with prosocial behaviour, academic performance, and global functioning H/I showed a negative correlation with global functioning Academic performance and global functioning were more strongly related to IN than H/I

Willcutt et al. (1999)	Clinically referred sample of 105 children and adolescents with AD/HD (93 boys and 12 girls) and 95 children and adolescents without AD/HD (46 boys and 49 girls) 8 to 18 years United States	IN H/I ODD Cognitive ability Depression Comorbid psychaitric disorders	Full IQ Scale Scores on the Wechsler Intelligence Scale For Children (WISC) or the Wechsler Adult Intelligence Scale DSM-III-R Diagnostic Interview for Children and Adolescents – Parent Version (DICA – P) DICA – Children Version Children's Depression Inventory (CDI) DSM-IV version of the Swanson, Nolan, and Pelham Checklist (SNAP – IV) Teachers, children, and parents (although exact number not stated, 13 fathers were used)	Spearman-Brown rank correlation Multiple regression	H/I associated with ODD and CD IN associated with higher depression scores IN associated with lower FSIQ scores

NOTE: AD/HD = Attention-Deficit/Hyperactivity Disorder; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour; MT-MS = multitrait-multisource

5. Conclusion

To date, previous EFA and CFA studies investigating the factor structure of the DSM-IV AD/HD symptoms alone and with the DSM-IV ODD and CD symptoms provide support for separate AD/HD dimensions of IN and H/I and a single ODD dimension. Although there has been limited support provided for a 1-factor model of AD/HD, such studies have incorporated the DSM-III ADH and DSM-III-R ADHD symptoms. These studies also provide support for variations on the 1-factor ODD model, which include allowing IMP items to load onto the ODD dimension. A major limitation of previous EFA and CFA studies is that they are based on single source ratings (i.e., parent or teacher) and do not take measurement error (i.e., source effects) into account.

Recent CFA MT-MS studies have addressed the presence of source effects by comparing teacher and parent ratings of childhood behaviour. Overall, such studies provide support for the convergent validity of teacher-rated IN and parent-rated H/I. However, in the majority of CFA MT-MS studies source variance is greater than trait variance. Therefore, it needs to be established if source effects reflect mostly accuracy or bias. Although recent CFA MT-MS findings are based on multiple sources (i.e., parent and teacher), AD/HD and ODD behaviours are compared in different settings (i.e., home and school). To date, no studies have examined the factor structure of the AD/HD and ODD symptoms for father and mother ratings. Such research would address the cross-situational debate and indicate if source effects are due to mostly bias or accuracy.

Furthermore, since recent CFA MT-MS studies have found more source than trait variance in the AD/HD and ODD symptoms based on parent and teacher ratings, this questions the relationship of the IN, H/I, and ODD dimensions with other academic and behavioural problems. Previous studies have reported an association between IN and academic impairment, visual search errors, higher depression scores, and lower IQ

scores. Further studies have also reported an association between H/I and academic impairment, commission errors on a continuous performance task, global ratings of impairment, and ODD and CD. Finally, ODD has been associated with low grade point average and delinquency. However, these studies have also been based on single source ratings. Therefore, it is unknown if the measures are capturing trait, source, or error variance. The separation of trait from source effects is important for understanding the relationship between the AD/HD and ODD dimensions with other dimensions.

Recent CFA MT-MS studies have examined the relationships that the AD/HD and ODD trait dimensions have with each other and with other trait dimensions. These studies showed that IN was significantly and negatively correlated with academic performance and prosocial behaviour. To a lesser degree, H/I and ODD showed a significant and negative correlation with academic performance, and ODD was significantly and positively correlated with emotional problems and peer problems. Finally, IN and H/I were significantly and negatively correlated with global functioning. However, recent CFA MT-MS findings are problematic as measures have captured mostly source effects in the AD/HD and ODD dimensions with other trait dimensions. To date, the nature of source effects has not been determined and it is unknown if the relationship between AD/HD and ODD with other dimensions reflect mostly bias or accuracy. Therefore, the true trait relationship between the AD/HD and ODD dimensions with academic performance, peer problems, emotional problems, and prosocial behaviour is not known. There are currently no known studies that have examined the relationship between the trait dimensions of IN, H/I, and ODD with other trait dimensions using mother and father ratings. These issues will be addressed in the current study.

CHAPTER 4: STUDY 1 OF THE CURRENT THESIS – AIMS, HYPOTHESES, METHODOLOGY, RESULTS AND A BRIEF DISCUSSION

1. Introduction

Chapter 4 provides the background, hypothesis, methodology, and a brief discussion for Study 1, which involves an examination of the factor structure of the AD/HD and ODD symptoms and symptom parcels based on a single source (i.e., mother or father). Part 1 will outline the aims and hypotheses for Study 1and will include the different AD/HD and ODD models to be tested. Part 2 will present the methodology for Study 1 and will include demographic details of the families involved in the research project. Part 3 will include the results of Study 1. First, an investigation of the factor structure of the AD/HD and ODD symptoms will be undertaken, followed by an examination of the AD/HD and ODD symptom parcels, which will be discussed in greater detail later in this chapter. A discussion of the CFA procedure will also be included in Part 3. Part 4 will include a brief discussion of Study 1.

2.Part 1: Aims and hypotheses of Study 1

As outlined in Chapter 3, previous CFA (Burns et al., 2001; Burns et al., 1997b; DuPaul et al., 1997; DuPaul et al., 1998; Gomez et al., 1999; Molina et al., 2001; Pillow et al., 1998) and EFA (Bauermeister, 1992; Baumgaertel et al., 1995; Pelham Jnr., Gnagy et al., 1992; Weiler et al., 1999; Wolraich et al., 1998) studies have consistently supported the 2-factor model of AD/HD (i.e., IN and H/I) and the 1-factor model of ODD as proposed by the DSM-IV. However, this issue not been adequately resolved as discussed in Chapter 3. These studies are based on parent and teacher ratings, and have not addressed the cross-situational issue or provided an adequate understanding of the true nature of source effects in the AD/HD and ODD dimensions.

Study 1 will examine the factor structure of the DSM-IV AD/HD and ODD symptoms based on a single source to establish which model is the most appropriate fit to the data. Due to the small sample size, which could lead to convergence problems with the data, the AD/HD and ODD symptoms will be analysed separately. For the AD/HD symptoms, 3 separate models will be compared including the 1-factor, 2-factor, and 3-factor models of AD/HD. Figure 1 shows AD/HD Model 1, involving the AD/HD symptoms loading onto a single factor. Figure 2 shows AD/HD Model 2, involving the AD/HD symptoms loading onto 2 separate factors IN and H/I. Figure 3 shows AD/HD Model 3, involving the AD/HD symptoms loading onto 3 separate factors including IN, HYP, and IMP.

The combined H/I dimension used in the 2-factor model is not only based on support from past EFA studies, but also on high correlations between HYP and IMP compared to IN and IMP or IN and HYP reported in previous studies (Gomez et al., 1999; Pillow et al., 1998; Tallent, 2003). For instance, Gomez et al. (1999) reported high correlations for HYP and IMP (r=.84 and .86) compared to IN and HYP (r=.77 and .73) and IN and IMP (r=.64 and .57) for parent and teacher ratings, respectively (see Table 3 in Chapter 3). In recent MT-MS studies, only Smith (2003) has reported higher correlations between IN and HYP (r=.80) compared to HYP and IMP (r=.77), but this was only the case for adolescent (self-report) ratings. Both respective parent and teacher ratings provided higher correlations for hyperactivity and impulsivity (r=.81 and .80) compared to inattention and hyperactivity (r=.75 and .78; refer Table 3 of Chapter 3). Therefore, due to a lack of empirical support for 2-factor AD/HD models that involve combined IN and HYP or IN and IMP dimensions, they were not included in the current study.

For the ODD symptoms, only the 1-factor model will be examined as supported by previous research (Boe, 1997; Burns et al., 2001; Burns & Walsh, 2002; Burns et al., 1997a; Burns et al., 1997b; Fergusson et al., 1994; Molina et al., 2001; Pillow et al., 1998). No other ODD models were included in Study 1 as no empirical support has been provided. Figure 4 shows the ODD Model 1, involving the ODD symptoms loading onto a single factor. The single sources include mother and father.

Based on previous findings employing parent and teacher ratings, it is expected that AD/HD Model 1 will show a poor fit (Beiser et al., 2000; Gomez et al., 2003; Gomez et al., 1999; Pillow et al., 1998). In contrast, it is expected that AD/HD Models 2 and 3 will show a good fit, with Model 2 considered more appropriate due to a high correlation between the HYP and IMP dimensions (Gomez et al., 2003; Gomez et al., 1999). To date, no single source CFA studies have investigated the factor structure of the AD/HD and ODD symptoms based on father ratings.

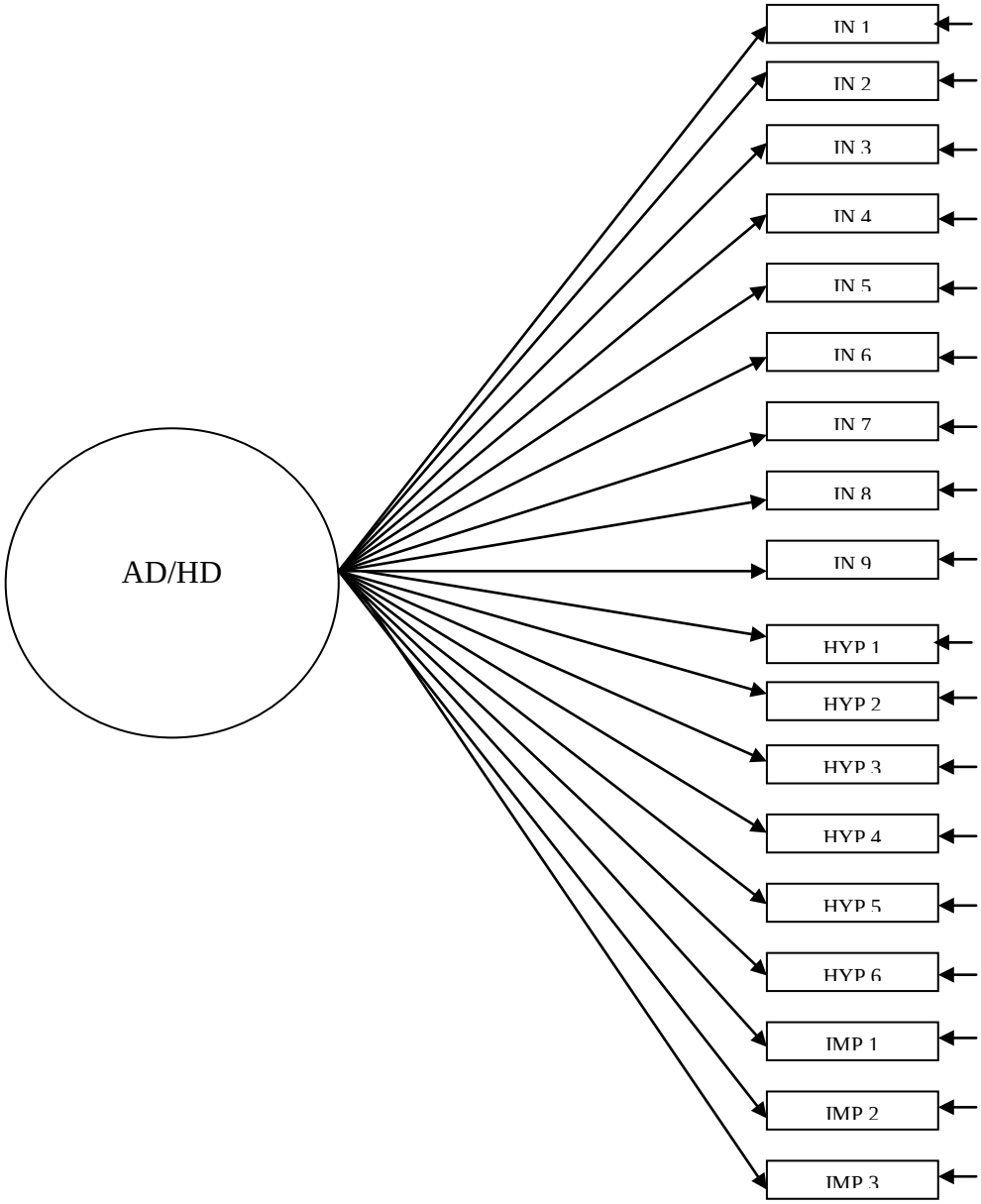

Figure 1: AD/HD Model 1 – A schematic representation of the single factor model comprising 9 IN, 6 HYP, and 3 IMP symptoms loading onto a single AD/HD factor. *Note:* IN = inattention, HYP = hyperactivity, IMP = impulsivity, AD/HD = Attention-Deficit/Hyperactivity Disorder.

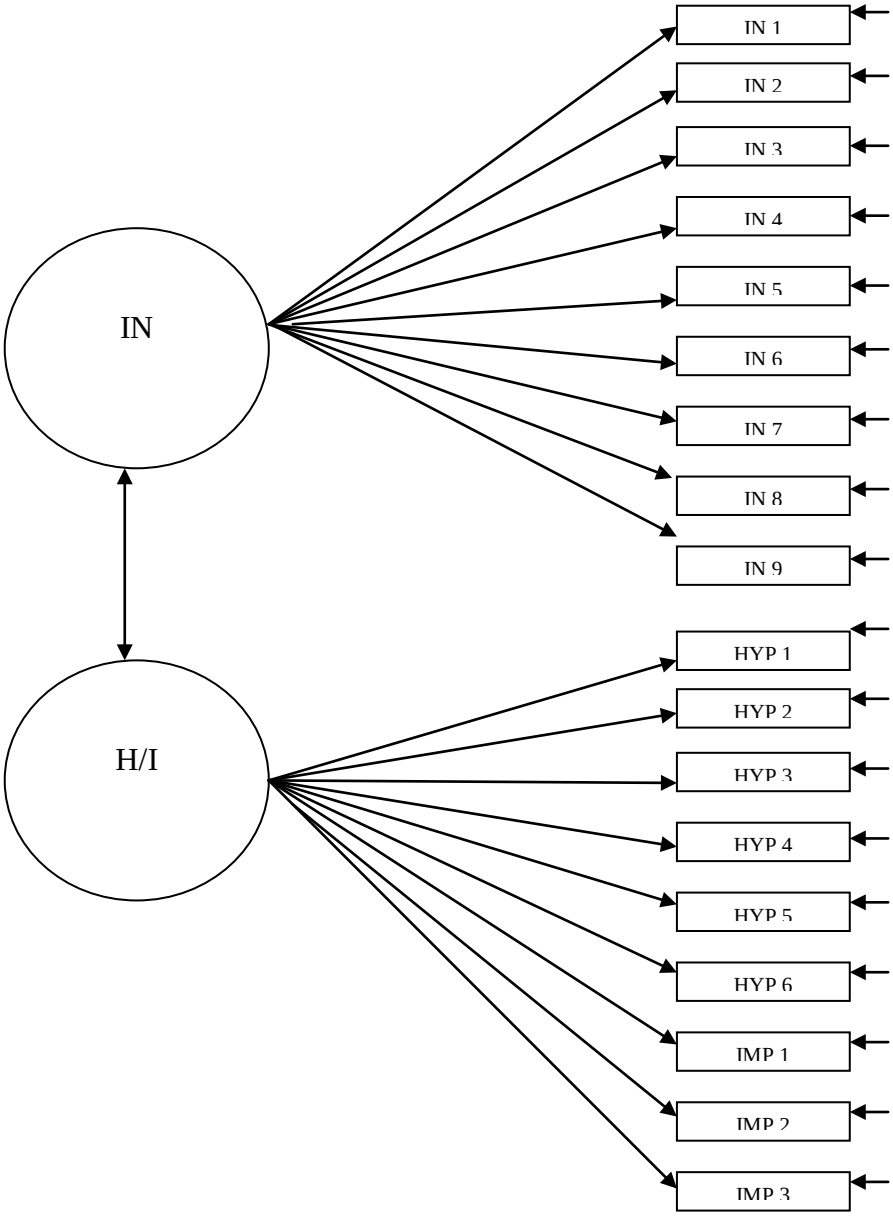

Figure 2: AD/HD Model 2 – A schematic representation of the 2-factor model consisting of AD/HD (9 IN and 9 H/I symptoms).

Note: IN = inattention, H/I = hyperactivity/impulsivity, HYP = hyperactivity, IMP = impulsivity.

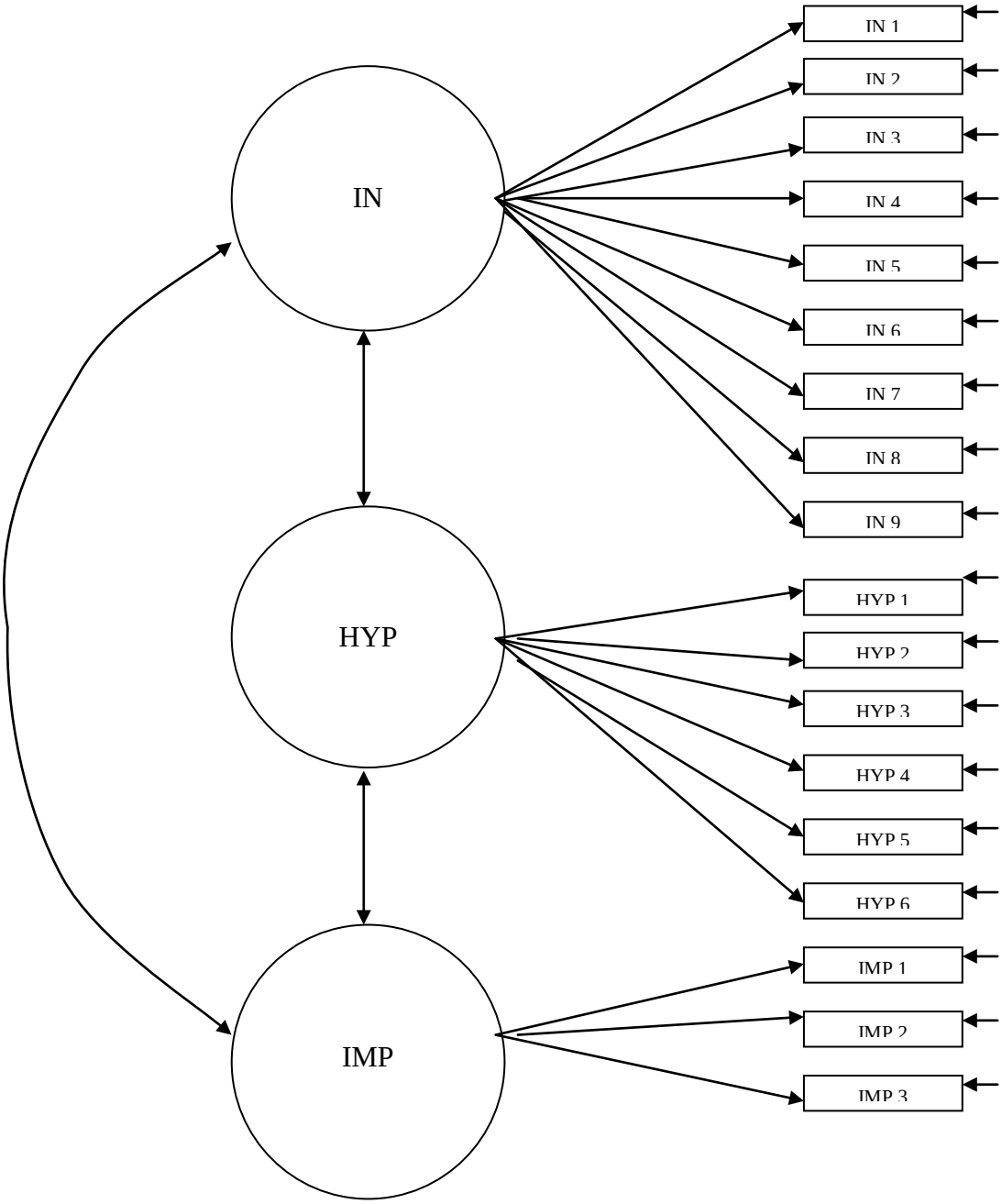

Figure 3: AD/HD Model 3 – A schematic representation of the 3 -factor model of AD/HD consisting of an IN factor (9 IN symptoms), a HYP factor (6 HYP symptoms), and an IMP factor (3 IMP symptoms).

Note: IN = inattention, HYP = hyperactivity, IMP = impulsivity.

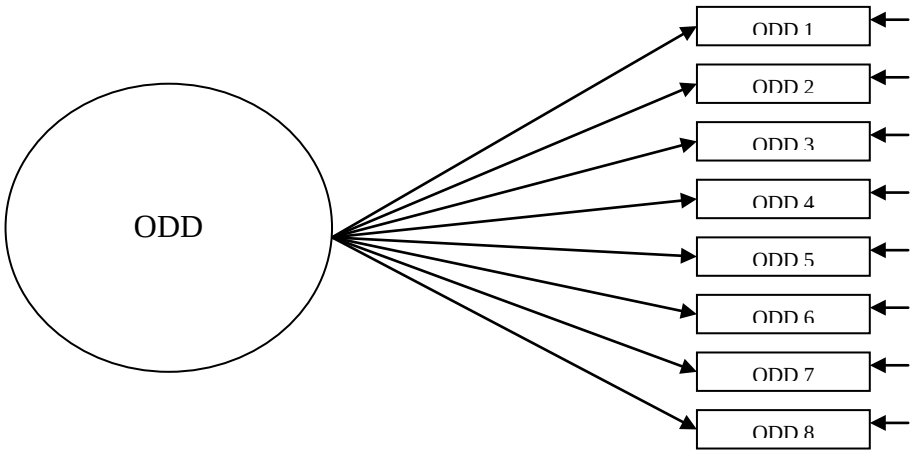

Figure 4: ODD Model 1 – A schematic representation of the single factor model comprising 8 ODD symptoms loading onto a single ODD factor.

Note: ODD = oppositional behaviour.

Study 1 will also examine the factor structure (i.e., internal validity) of the DSM-IV AD/HD and ODD symptom parcels based on mother and father ratings to establish which model is the most appropriate fit. Due to the small sample size in the current study, the AD/HD and ODD symptom parcels will be grouped together as has been the case in recent CFA MT-MS studies (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005). The parcels are created by bundling symptoms together to produce a mean score for several items that provide a measure of the same construct.

There are several advantages for examining the data at the symptom parcel level rather than at the individual symptom level. First, problems associated with the small sample size are minimised and the creation of symptom parcels reduces the amount of skewness and kurtosis. This procedure creates a closer approximate of a normal distribution for the kurtosis and skewness values, therefore dealing with the lack of multivariate normality (West, Finch, & Curran, 1995). Second, it is suggested that the use of parcels will reduce the amount of error variance, which improves the amount of source and trait variance (Gomez et al., 2003). Third, previous findings indicate that the MT-MS analysis at the parcel level is a closer approximation of the total IN and H/I dimensions used to understand AD/HD (Gomez et al., 2003). This is due to total scores of the IN, H/I, and ODD dimensions being used in research on AD/HD and ODD rather than individual item scores (Gomez et al., 2005). Fourth, item parcels are considered to produce estimates that are more stable in small samples (e.g., 200) as they require the estimation of fewer parameters in the measurement model (West et al., 1995). For the AD/HD and ODD symptom parcels, 3 separate models including 1-factor, 2-factor, and 3-factor models will be compared.

Figure 5 shows Parcels Model 1, involving the AD/HD and ODD symptom parcels loading onto a single factor (i.e., 1-factor AD/HD and ODD model). Figure 6

shows Parcels Model 2, involving the AD/HD and ODD symptom parcels loading onto 2 separate factors (i.e., 2-factor AD/HD and ODD model). Figure 7 shows Parcels Model 3, involving the AD/HD symptom parcels loading onto 2 separate factors including IN and H/I, and the ODD symptom parcels loading onto a separate ODD factor (i.e., 3-factor AD/HD and ODD model). Due to the high correlation between HYP and IMP dimensions, the 4-factor model (i.e., separate IN, HYP, IMP, and ODD dimensions) was not tested as previous CFA studies have favoured a combined H/I factor as reported in Chapter 2. As discussed in the previous section, it is expected that Parcels Model 3 will be considered the most appropriate fit. To date, no single source CFA studies have investigated the factor structure of the AD/HD and ODD symptom parcels based on father ratings only.

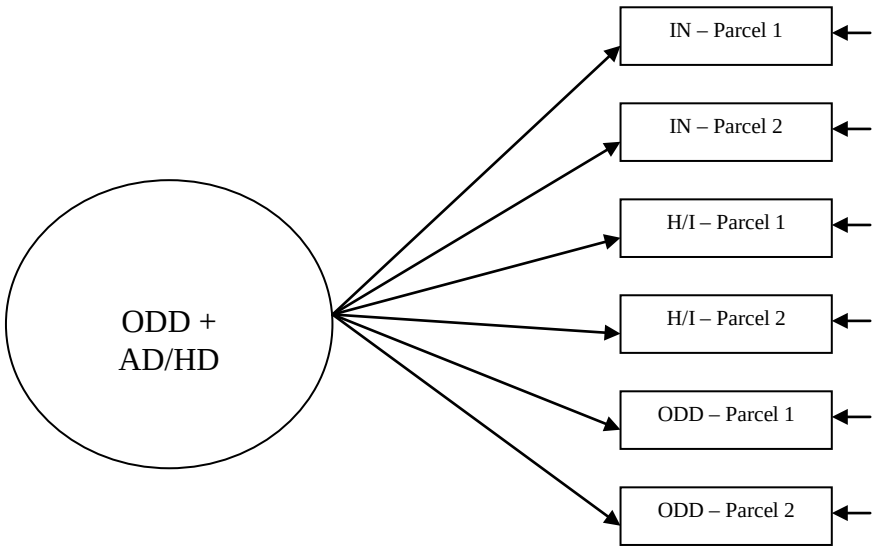

Figure 5: Parcels Model 1 – A schematic representation of the single factor model comprising 2 IN symptom parcels, 2 H/I symptom parcels, and 2 ODD symptom parcels loading onto a single AD/HD and ODD factor.

Note: IN = inattention, H/I = hyperactivity/impulsivity, AD/HD = Attention-Deficit/Hyperactivity Disorder, and ODD = Oppositional behaviour.

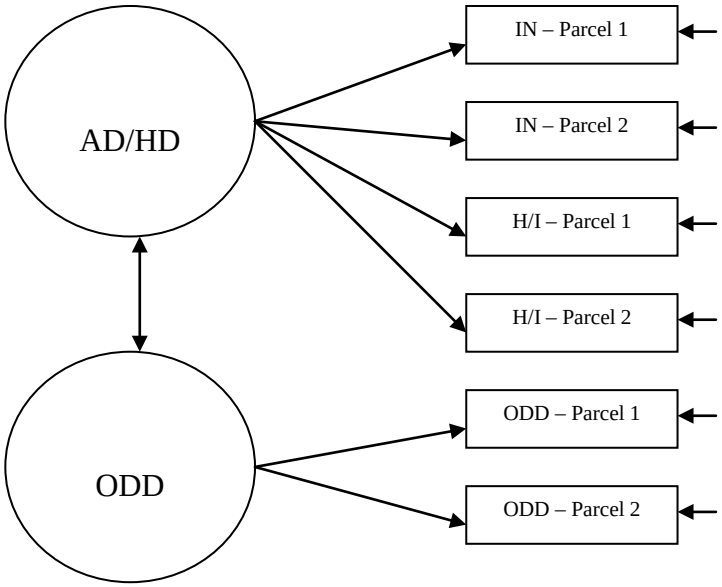

Figure 6: Parcels Model 2 – A schematic representation of the 2-factor model consisting of AD/HD (2 IN and 2 H/I symptom parcels) and ODD (2 ODD symptom parcels).

Note: IN = inattention, H/I = hyperactivity/impulsivity, AD/HD = Attention-Deficit/Hyperactivity Disorder, ODD = Oppositional behaviour.

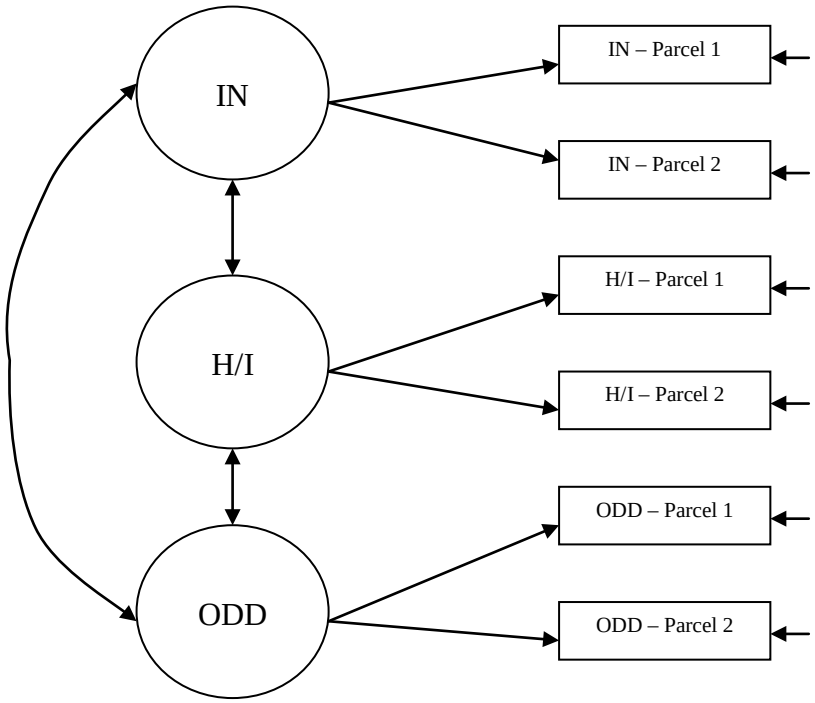

Figure 7: Parcels Model 3 – A schematic representation of the 2 -factor model of AD/HD consisting of an IN factor (2 IN symptom parcels) and a H/I factor (2 HYP and 2 IMP symptom parcels), and an ODD factor (2 ODD symptom parcels).

Note: IN = inattention, H/I = hyperactivity/impulsivity, ODD = Oppositional behaviour.

3. Part 2: Methodology of Study 1

3.1 Participants

The sample consisted of parents or primary caregivers of 326 primary-aged school children in Grade 1 through to Grade 6. A total of 6 schools agreed to participate in the research project. Of these 6 schools, 1 school was public and 5 schools were independent. As advised by the University of Ballarat Human Research Ethics Committee, Department of Education ethics approval was not required as only one public school was used in this research project. For this school, permission was provided directly from the school principal. The schools were located in different Victorian locations including Ballarat, Bacchus Marsh, Melton, and metropolitan Melbourne. From the 6 schools included in the study, the parents of 1,600 children were invited to participate.

Table 9 shows the descriptive information for the mother- and father-rated groups of children. The child information includes the mean age and standard deviation of the sample, gender ratio of children, and place of residence including if the child was living with their mother and father, mother only or father only. The parent information includes the highest education level completed by the parents (i.e., primary, secondary/trade, tertiary, or unknown), and the current/last occupation of the parents. A total of 326 mothers and 205 fathers agreed to participate and returned complete data sets directly to the researcher at the University of Ballarat.

Table 9

Descriptive Information for the Mother- and Father-Rated Groups

Total	Mother Rated Group n = 326	Father Rated Group n = 205
Mean Age of Child	9.21	9.20
Standard Deviation of Age	2.01	1.98
Gender of Child		
% of Males	54.9%	55.4%
% of Females	45.1%	44.6%
Residence		
Mother and Father	84.7%	93.9%
Mother only/or other	15.0%	4.7%
Father only/or other	0.3%	1.4%
Parent's Completed grade		
Primary	0.3%	0.9%
Secondary/Trade	54.9%	51.6%
Tertiary	43.3%	45.1%
Unknown	1.5%	2.3%
Parent's occupation		
Professionals	21.5%	39.6%
Associate Professionals	37.1%	31.1%
Advanced Clerical or Service Workers	23.6%	23.1%
Intermediate Clerical, Sales or Service Workers	9.8%	3.3%

Elementary Clerical and Labourers	1.8%	0.5%
Self Employed/Home Duties	3.4%	1.4%
Unknown	2.8%	0.9%

Note: n = number of participants

As seen in Table 9, the majority of mothers and fathers had completed tertiary and secondary/trade education, with only a small percentage of respondents having completed primary education only. There were also a small percentage of respondents that did not complete the question relating to highest education level completed. The categories of occupations were based on the Australian Standard Classification of Occupations (Australian Bureau of Statistics [ABS], 1999). For parents' occupations, the highest reported category for mothers was Associate Professional followed by Advanced Clerical or Service Worker. This was followed by the Professional category. Only a small percentage of mothers reported Self Employed/Home Duties as their occupation indicating that both parents were currently employed outside the home. In comparison to mothers, the highest reported occupation category of fathers in the sample was Professional, followed by Associate Professional then Advanced Clerical or Service Worker.

Table 10 shows the age distribution of children from the mother- and father-rated groups ranging from 5 years to 13 years. The age distribution of children from both groups was similar. For respective mother and father ratings, the percentages of children for each age were age 5 (3% versus 1%), age 6 (8% versus 9%), age 7 (13% versus 15%), age 8 (13% versus 10%), age 9 (16% versus 19%), age 10 (13% versus 14%), age 11 (21% versus 20%), age 12 (12% versus 11%), and age 13 (1% versus 1%).

Table 10

Age Distribution of Participants for the Mother- and Father-Rated Groups

	Mother-rated (n = 326)			Father-rated (n = 205)		
Age	Male	Female	Total	Male	Female	Total
5 years	3	6	9	0	3	3
6 years	12	13	25	9	10	19
7 years	24	19	43	17	15	32
8 years	27	16	43	13	8	21
9 years	32	22	54	25	15	40
10 years	20	22	42	18	12	30
11 years	34	34	68	19	23	42
12 years	23	15	38	14	9	23
13 years	4	0	4	3	0	3

Note: n = number of participants

3.1.1 Justification of Sample Size

The statistical analyses employed in Study 1 included the CFA method. Although there are no universal guidelines regarding the minimum sample size required to perform the CFA procedure, several different approaches have been suggested (Bentler, 1995; Bentler & Chou, 1987; Kelloway, 1998). For instance, it is recommended that at least 200 observations are to perform the statistical procedure (Kelloway, 1998). For Study 1, there were a total of more than 200 cases for each analysis (e.g., 326 mother and 205 father observations).

3.2. Measures

3.2.1 Disruptive Behaviour Questionnaire

The Disruptive Behaviour Questionnaire (DBQ; Barkley & Murphy, 1998) was used to obtain mother and father ratings of the 18 AD/HD symptoms and the 8 ODD symptoms as presented in the DSM-IV (refer Appendix B). The DBQ assesses IN, H/I, and ODD dimensions and is keyed to the DSM-IV IN, H/I, ODD symptoms. Based on the child's behaviour in the previous 6 months, mothers and fathers rate the occurrence of each symptom from 0 to 3 according to one of the following: "not at all", "just a little", "pretty much", or "very much". The DBQ has been used in previous AD/HD studies (Barkley & Murphy, 1998; DuPaul et al., 1997; DuPaul et al., 1998) and has provided good internal validity. Gomez et al. (2005) reported Cronbach's alphas of .86 and .94 for IN, .84 and .93 for H/I, and .88 and .94 for ODD measures for parent and teacher ratings, respectively. The DBQ also has similar items to the Disruptive Behaviour Disorder Rating Scale (DBD; Pelham Jnr., Gnagy, et al., 1992), which is also keyed to DSM-IV items of AD/HD and ODD and has previously shown good reliability (Molina, Pelham, Blumenthal, & Galiszewksi, 1998; Pelham Jnr., Evans, Gnagy, & Greenslade, 1992; Silva et al., 2005; Waschbusch, Willoughby, & Pelham Jnr., 1998).

3.2.2 Background Information

The background information questionnaire required mothers and fathers to provide some personal information about their child's age and gender, and respondent's educational level and employment (refer Appendix C).

3.3. Procedure

The University of Ballarat Human Research Ethics Committee approved this research project. After approval was obtained, the principals of 16 schools were initially sent a letter outlining the project and were invited to participate. One week later, these schools were contacted by telephone to determine their interest in participating in the research. At this stage, 9 schools showed interest in the study and were forwarded further information regarding the research. Six of these schools agreed to participate in the study and were forwarded information packages, which included the following: Approval letter from the University of Ballarat Human Research Ethics Committee; separate plain language statements for principals and parents providing details of the study (see Appendix D and E); consent forms for the parents (see Appendix F), and; questionnaires to be used in the study. In the details provided to parents and principals it was stated that the aim of the study was to investigate children's behaviour at home and compare how different caregivers view child behaviour. The terms AD/HD and ODD were not included in the information or questionnaires provided.

The information packages were precoded and delivered to the school by the student researcher. Classroom teachers then distributed the information envelopes to each child in their class from Grades 1 to 6, who then passed the information packages on to their mothers and fathers (or primary caregivers). If there was more than one child in a family attending the same school, both children took home a questionnaire set. This was not recorded as to protect the privacy of the participants involved in the study.

One week prior to the distribution of the information packages to parents, a notice was placed in the student newsletter informing parents that they would receive the information packages and a brief description of the study was outlined. It was stated in the newsletter the importance of parents completing the questionnaires on their own

without comparing answers with their partner. This was also highlighted in bold type on the plain language statements to parents. Furthermore, the following statement was placed in bold on top of the questionnaires: 'Please complete on your own'.

Those mothers and fathers who agreed to participate completed the consent form and questionnaires (i.e., background information, academic achievement, SDQ, and Disruptive Behaviour Questionnaire) regarding their children's behaviour at home. Parents were advised that participation was voluntary and they were not required to provide their name or their child's name on any of the questionnaires, which were separated from the consent forms and coded based on a numerical coding system (i.e., corresponding mother and father data was coded M1 and F1, respectively with the number identifying the particular school). Completed mother and father questionnaires were returned to the researchers at the University of Ballarat via prepaid envelopes addressed to the student researcher.

4. Part 3: Results of Study 1

The results section for Study 1 will provide an examination of the factor structure (i.e., internal validity) of the AD/HD and ODD symptoms using the CFA approach based on a single source (i.e., mother and father). The AD/HD and ODD symptoms will be examined based on individual symptoms, which will then be followed by an examination of the symptom parcels. For the individual symptoms, this section will include comparisons of the 1-factor, 2-factor, and 3-factor models of AD/HD. The 1-factor model of ODD will also be examined. For the symptom parcels, comparisons of the 1-factor, 2-factor, and 3-factor models of AD/HD and ODD will be provided.

The current study performed CFA using LISREL 8.51 (Joreskög & Sorböm, 2001). As recommended by Joreskög & Sorböm (1985), all analyses were based on the covariance matrices and all CFA estimations used maximum likelihood (ML) method with robust estimation. Similar to recent CFA MT-MS studies (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003), the level of significance was $p < .001$ for each statistical analyses.

4.*1 Data Screening and Descriptive Information for the AD/HD and ODD Symptoms for Mother and Father Ratings*

Prior to the CFA, data screening and descriptive information are presented for the AD/HD and ODD symptoms based on mother and father ratings. The descriptive information for the AD/HD and ODD symptoms were obtained using PRELIS version 2.51 (Joreskög & Sorböm, 1996). Tables 11 and 12 show the descriptive information including the mean score, standard deviation, skewness, and kurtosis for the DSM-IV AD/HD and ODD symptoms based on mother and father ratings. Mean scores range from 0 to 3, and the summary scores vary according to the construct being reported.

For mother ratings, Table 11 shows the mean AD/HD scores ranged from 0.49 to 1.02 for IN symptoms, 0.29 to 0.88 for HYP symptoms, and 0.45 to 0.79 for IMP symptoms. The mean ODD scores ranged between 0.21 and 0.91. For father ratings, Table 12 shows the mean AD/HD scores ranged from 0.67 to 1.05 for IN symptoms, 0.40 to 1.00 for HYP symptoms, and 0.69 to 0.90 for IMP symptoms. The mean ODD scores ranged between 0.21 and 1.00.

Table 11

Descriptive Information for the DSM-IV AD/HD and ODD Symptoms for Mother Ratings

Item	M	SD	Skewness	Kurtosis
IN Symptoms				
Careless (1)	1.02	.74	.33	-.21
Attention (2)	.49	.70	1.52*	2.29*
Listen (3)	.68	.70	.92*	.91
Instructions (4)	.70	.79	1.08*	.91
Organising (5)	.61	.84	1.31*	.96
Effort (6)	.71	.85	1.11*	.57
Loses (7)	.70	.76	1.30*	.90
Distracted (8)	.92	.88	.83*	.09
Forgetful (9)	.74	.79	.92*	.43
HYP Symptoms				
Fidgets (10)	.72	.86	1.13*	.60
Seat (11)	.35	.63	1.84*	2.99*
Restless (12)	.49	.70	1.42*	1.80*
Quiet (13)	.29	.57	2.05*	4.11*
On the go (14)	.80	.97	.99*	-.13
Talks (15)	.88	.94	.81*	-.30
IMP Symptoms				
Blurts (16)	.54	.72	1.25*	1.13
Waiting turn (17)	.45	.65	1.34*	1.46*
Interrupts (18)	.79	.77	.88*	.67

ODD Symptoms				
Temper (19)	.86	.78	.85*	.69
Argues (20)	.91	.76	.81*	.80*
Defies (21)	.58	.73	1.28*	1.60*
Annoys (22)	.52	.71	1.42*	1.93*
Blames (23)	.79	.83	.98*	.55
Touchy (24)	.85	.85	.78*	-.04
Angry (25)	.43	.66	1.50*	1.99*
Spiteful (26)	.21	.51	2.90*	9.44*
Summary Scores				
IN (*M*)	6.57	5.18	1.05	0.77
HYP (*M*)	3.52	3.32	1.37	2.03
IMP (*M*)	1.78	1.75	1.30	2.02
AD/HD (*M*)	11.87	9.07	1.27	1.82
ODD (*M*)	5.15	4.56	1.62	3.26

Note: * = p <.001; *M* = mean; *SD* = standard deviation; IN = inattention; HYP = hyperactivity; IMP = impulsivity; ODD = oppositional behaviour; AD/HD = Attention-Deficit Hyperactivity Disorder

Table 12

Descriptive Information for the DSM-IV AD/HD and ODD Symptoms for Father Ratings

Item	M	SD	Skewness	Kurtosis
IN Symptoms				
Careless (1)	1.05	.77	.80*	.81
Attention (2)	.67	.79	1.07*	.63
Listen (3)	.78	.75	.92*	.92
Instructions (4)	.84	.83	.87*	.34
Organising (5)	.67	.79	1.01*	.38
Effort (6)	.81	.91	.92*	-.03
Loses (7)	.79	.76	.83*	.52
Distracted (8)	1.05	.87	.65*	-.09
Forgetful (9)	.90	.81	.83*	.50
HYP Symptoms				
Fidgets (10)	.88	.93	.78*	-.34
Seat (11)	.50	.69	1.20*	.80
Restless (12)	.57	.72	1.08*	.59
Quiet (13)	.40	.68	1.71*	2.50*
On the go (14)	.95	1.01	.74*	-.61
Talks (15)	1.00	.97	.61*	-.68
IMP Symptoms				
Blurts (16)	.69	.77	1.08*	.99
Waiting turn (17)	.73	.79	.86*	.12
Interrupts (18)	.90	.85	.66*	-.25

ODD Symptoms				
Temper (19)	.94	.86	.75*	.06
Argues (20)	1.00	.91	.63*	-.40
Defies (21)	.73	.83	1.09*	.74
Annoys (22)	.56	.78	1.49*	1.90
Blames (23)	.90	.88	.82*	.03
Touchy (24)	.92	.78	.62*	.08
Angry (25)	.39	.70	1.91*	3.42*
Spiteful (26)	.21	.55	3.26*	11.72*
Summary Scores				
IN (M)	7.54	5.54	1.02	0.46
HYP (M)	4.30	3.39	0.97	0.52
IMP (M)	2.33	2.01	0.79	0.22
AD/HD (*M*)	14.17	9.44	1.02	.67
ODD (*M*)	5.65	5.03	1.44	2.12

Note: * = p <.001; *M* = mean; *SD* = standard deviation; IN = inattention; HYP = hyperactivity; IMP = impulsivity; ODD = oppositional behaviour; AD/HD = Attention-Deficit Hyperactivity Disorder

To date, there are no formal cut-off points to indicate when scores lie outside the normal distribution (Curran, West, & Finch, 1996). However, Curran et al. (1996) have established categories for skewness and kurtosis values that are not considered normally distributed. For instance, skewness values ranging from 2.00 to 3.00 are considered moderately non-normal scores and values greater than 3.00 are considered extremely non-normal scores. For kurtosis scores, values ranging from 7.00 to 21.00 are considered

moderately non-normal scores and values greater than 21.00 are considered extremely non-normal scores.

As seen in Tables 11 and 12, none of the skewness or kurtosis scores were considered extremely non-normal. However, for mother ratings, item 13 (i.e., *quiet*) had a skewness score in the moderately non-normal range and item 26 (i.e., *spiteful*) had skewness and kurtosis scores in the moderately non-normal range. For father ratings, item 26 (i.e., *spiteful*) had skewness and kurtosis scores considered moderately non-normal. More importantly, the test of univariate and multivariate normality for continuous variables showed significant multivariate skewness and kurtosis for the AD/HD and ODD symptoms.

Based on the test of univariate normality for continuous variables, Table 11 shows that 25 out of 26 AD/HD and ODD symptoms had significant skewness and 10 out of 26 AD/HD and ODD symptoms had significant kurtosis for mother ratings. For father ratings, Table 12 shows that 26 out of 26 AD/HD and ODD symptoms had significant skewness and 3 out of 26 AD/HD and ODD symptoms had significant kurtosis. The test of multivariate normality for continuous variables showed that the respective multivariate skewness and kurtosis values for the AD/HD symptoms were 58.87 ($z = 29.41$, $p < .001$) and 459.50 ($z = 16.50$, $p < .001$) for mother ratings and 60.25 ($z = 16.73$, $p < .001$) and 424.24 ($z = 10.65$, $p < .001$) for father ratings. The respective multivariate skewness and kurtosis values for the ODD symptoms were 66.90 ($z = 49.24$, $p < .001$) and 189.90 ($z = 20.08$, $p < .001$) for mother ratings and 20.82 ($z = 19.40$, $p < .001$) and 108.03 ($z = 9.03$, $p < .001$) for father ratings. Therefore, the assumption of multivariate normality was violated for both the AD/HD and ODD symptoms based on mother and father ratings.

4.2 Violation of the Multivariate Normality Assumption

Any violations of the multivariate normality assumption can lead to several problems for model testing with the CFA procedure (Byrne, 2001). These problems include an inflated chi-square value and a biased overestimation of parameters yielding many significant results when this is not the case (West et al., 1995). Other related problems caused by a violation of the multivariate normality assumption include an underestimation of fit indices and inappropriately low standard errors (Byrne, 2001). The maximum likelihood (ML) procedure with robust estimation is an alternative estimation technique and is considered an appropriate solution to account for the lack of multivariate normality for sample sizes with fewer than 500 cases (Byrne, 2001; Curran et al., 1996; West et al., 1995). This procedure produces a Satorra-Bentler scaled chi-square statistic (S-Bχ^2), which is a robust χ^2 statistic that corrects the data to approximate the normal χ^2 distribution. Robust fit indices and robust standard errors are also provided (West et al., 1995). The S-Bχ^2 has showed no evidence of bias even with severely non-normal distributions (i.e., skewness and kurtosis) in samples fewer than 500 cases (Curran et al., 1996). As previously described in this chapter, the use of item parcels is also a commonly used method to improve a non-normal distribution of scores and are considered to produce more stable estimates in small samples (West et al., 1995).

4.3 Correlations between AD/HD and ODD Symptoms for Mother and Father Ratings

Before the data were analysed using the CFA procedure, the relationship between the 18 DSM-IV AD/HD symptoms and 8 DSM-IV ODD symptoms were examined for both mother and father ratings separately. As seen in Tables 13 and 14, the Pearson's correlations are displayed for the mother and father ratings of the AD/HD and ODD

symptoms. For mother and father ratings, similar patterns appeared to emerge between IN, HYP, IMP, and ODD symptoms. The results show the IN, HYP, IMP, and ODD symptoms were more closely related to their own symptoms than other symptoms. For instance, the IN items showed higher correlations with other IN items than with HYP, IMP, or ODD items.

Table 13

Correlation Matrix for the DSM-IV AD/HD and ODD Symptoms for Mother Ratings

	Careless (1)	Attention (2)	Listen (3)	Instruct (4)	Organise (5)	Effort (6)	Loses (7)	Distract (8)	Forget (9)	Fidget (10)	Seat (11)	Restless (12)	Quiet (13)	On the go (14)	Talks (15)	Blurts (16)	Waiting (17)	Interrupts (18)
IN Symptoms																		
Careless (1)	1.00																	
Attention (2)	.51	1.00																
Listen (3)	.37	.44	1.00															
Instructions (4)	.59	.55	.49	1.00														
Organising (5)	.55	.50	.41	.64	1.00													
Effort (6)	.62	.51	.31	.55	.57	1.00												
Loses (7)	.39	.31	.29	.48	.47	.32	1.00											
Distracted (8)	.57	.61	.45	.62	.55	.58	.38	1.00										
Forgetful (9)	.46	.37	.41	.56	.47	.34	.55	.40	1.00									
HYP Symptoms																		
Fidgets (10)	.43	.55	.46	.43	.42	.44	.29	.53	.30	1.00								
Seat (11)	.42	.56	.56	.53	.48	.51	.31	.56	.30	.50	1.00							
Restless (12)	.51	.62	.52	.49	.51	.54	.37	.63	.34	.68	.26	1.00						
Quiet (13)	.33	.44	.35	.45	.39	.44	.31	.46	.30	.33	.50	.52	1.00					
On the go (14)	.23	.31	.30	.15	.18	.28	.15	.28	.03	.37	.39	.45	.30	1.00				
Talks (15)	.20	.23	.27	.18	.16	.26	.19	.34	.13	.32	.28	.34	.23	.37	1.00			
IMP Symptoms																		
Blurts (16)	.36	.28	.41	.33	.28	.34	.32	.41	.24	.41	.38	.49	.35	.33	.50	1.00		
Waiting turn (17)	.23	.38	.41	.29	.25	.30	.27	.44	.32	.45	.44	.49	.36	.32	.37	.49	1.00	
Interrupts (18)	.30	.34	.46	.30	.29	.34	.28	.37	.31	.42	.42	.47	.39	.36	.47	.51	.53	1.00

	Careless (1)	Attention (2)	Listen (3)	Instruct (4)	Organise (5)	Effort (6)	Loses (7)	Distract (8)	Forget (9)	Fidget (10)	Seat (11)	Restless (12)	Quiet (13)	On the go (14)	Talks (15)	Blurts (16)	Waiting (17)	Interrupts (18)
ODD Symptoms																		
Temper (19)	.25	.33	.31	.32	.29	.35	.23	.34	.22	.33	.38	.41	.33	.31	.27	.32	.38	.48
Argues (20)	.28	.38	.39	.33	.20	.28	.23	.29	.22	.26	.29	.35	.33	.17	.28	.28	.24	.41
Defies (21)	.25	.35	.39	.33	.27	.34	.28	.35	.28	.32	.37	.42	.33	.26	.28	.30	.42	.50
Annoys (22)	.24	.34	.38	.32	.24	.34	.23	.31	.23	.27	.32	.41	.31	.29	.29	.29	.32	.50
Blames (23)	.29	.32	.41	.35	.30	.35	.27	.37	.27	.32	.37	.44	.40	.22	.27	.37	.20	.51
Touchy (24)	.33	.43	.37	.43	.35	.39	.24	.39	.40	.35	.37	.46	.40	.18	.24	.30	.20	.48
Angry (25)	.33	.30	.31	.34	.31	.38	.27	.32	.30	.27	.28	.41	.34	.16	.19	.29	.31	.46
Spiteful (26)	.14	.26	.24	.21	.21	.22	.26	.21	.17	.17	.21	.31	.26	.12	.15	.17	.29	.34

	Temper (19)	Argues (20)	Defies (21)	Annoys (22)	Blames (23)	Touchy (24)	Angry (25)	Spiteful (26)
ODD Symptoms								
Temper (19)	1.00							
Argues (20)	.48	1.00						
Defies (21)	.58	.55	1.00					
Annoys (22)	.52	.44	.64	1.00				
Blames (23)	.47	.47	.58	.61	1.00			
Touchy (24)	.55	.41	.51	.50	.57	1.00		
Angry (25)	.58	.42	.59	.56	.58	.66	1.00	
Spiteful (26)	.40	.35	.59	.50	.46	.45	.62	1.00

Note: IN = inattention; HYP = hyperactivity; IMP = impulsivity; ODD = oppositional behaviour

Table 14

Correlation Matrix for the DSM-IV AD/HD and ODD Symptoms for Father Ratings

	Careless (1)	Attention (2)	Listen (3)	Instruct (4)	Organise (5)	Effort (6)	Loses (7)	Distract (8)	Forget (9)	Fidget (10)	Seat (11)	Restless (12)	Quiet (13)	On the go (14)	Talks (15)	Blurts (16)	Waiting (17)	Interrupts (18)
IN Symptoms																		
Careless (1)	1.00																	
Attention (2)	.49	1.00																
Listen (3)	.40	.52	1.00															
Instructions (4)	.55	.60	.57	1.00														
Organising (5)	.49	.60	.44	.59	1.00													
Effort (6)	.61	.57	.41	.65	.61	1.00												
Loses (7)	.46	.48	.41	.55	.48	.51	1.00											
Distracted (8)	.58	.61	.48	.61	.55	.63	.53	1.00										
Forgetful (9)	.44	.42	.41	.55	.49	.45	.65	.46	1.00									
HYP Symptoms																		
Fidgets (10)	.35	.43	.34	.41	.31	.35	.41	.48	.29	1.00								
Seat (11)	.30	.46	.43	.43	.43	.42	.39	.54	.32	.45	1.00							
Restless (12)	.43	.53	.56	.52	.52	.44	.43	.39	.40	.61	.55	1.00						
Quiet (13)	.27	.43	.46	.41	.46	.39	.37	.16	.34	.44	.36	.54	1.00					
On the go (14)	.05	.08	.16	.02	.09	.06	.14	.36	.12	.22	.14	.32	.24	1.00				
Talks (15)	.18	.23	.19	.28	.16	.24	.27	.35	.22	.33	.22	.35	.23	.41	1.00			
IMP Symptoms																		
Blurts (16)	.32	.27	.32	.29	.29	.31	.33	.36	.30	.31	.31	.39	.33	.37	.43	1.00		
Waiting turn (17)	.19	.22	.34	.23	.29	.26	.27	.38	.33	.29	.34	.39	.32	.36	.34	.43	1.00	
Interrupts (18)	.29	.29	.44	.37	.36	.33	.33	.37	.44	.31	.41	.49	.36	.36	.45	.56	.63	1.00

	Careless (1)	Attention (2)	Listen (3)	Instruct (4)	Organise (5)	Effort (6)	Loses (7)	Distract (8)	Forget (9)	Fidget (10)	Seat (11)	Restless (12)	Quiet (13)	On the go (14)	Talks (15)	Blurts (16)	Waiting (17)	Interrupts (18)
ODD Symptoms																		
Temper (19)	.29	.32	.46	.30	.31	.39	.38	.37	.31	.18	.37	.43	.34	.27	.25	.39	.39	.49
Argues (20)	.38	.30	.43	.43	.35	.42	.43	.39	.40	.29	.41	.45	.39	.26	.36	.48	.47	.56
Defies (21)	.40	.37	.45	.47	.42	.48	.45	.42	.39	.30	.38	.46	.42	.19	.28	.43	.41	.50
Annoys (22)	.36	.29	.37	.40	.35	.40	.31	.39	.30	.27	.29	.44	.42	.26	.38	.32	.37	.49
Blames (23)	.40	.35	.42	.52	.41	.46	.38	.47	.41	.25	.37	.43	.44	.11	.30	.34	.46	.48
Touchy (24)	.38	.31	.38	.41	.44	.36	.42	.37	.34	.27	.30	.47	.43	.19	.25	.35	.40	.49
Angry (25)	.32	.27	.38	.42	.40	.42	.42	.34	.36	.27	.39	.47	.45	.16	.23	.37	.34	.51
Spiteful (26)	.23	.25	.35	.32	.29	.35	.28	.34	.23	.23	.33	.42	.33	.24	.23	.38	.28	.46

	Temper (19)	Argues (20)	Defies (21)	Annoys (22)	Blames (23)	Touchy (24)	Angry (25)	Spiteful (26)
ODD Symptoms								
Temper (19)	1.00							
Argues (20)	.66	1.00						
Defies (21)	.63	.78	1.00					
Annoys (22)	.41	.57	.60	1.00				
Blames (23)	.47	.57	.57	.64	1.00			
Touchy (24)	.57	.56	.57	.50	.59	1.00		
Angry (25)	.59	.66	.69	.61	.63	.63	1.00	
Spiteful (26)	.53	.47	.60	.56	.50	.48	.68	1.00

Note: IN = inattention; HYP = hyperactivity; IMP = impulsivity; ODD = oppositional behaviour

4.4 CFA Procedure

CFA was used to examine the different models for mother and father ratings of ODD and AD/HD symptoms. As previously outlined, the AD/HD symptoms were examined comparing a 1-factor, 2-factor, and 3-factor model of AD/HD for mother and father ratings. The ODD symptoms were examined separately for mother and father ratings using a 1-factor model of ODD. The different models were examined using the ML procedure with robust estimation, which include indices of absolute and comparative fit.

4.4.1 Tests of Absolute Fit

Tests of absolute fit assess the ability of a model to reproduce the actual correlation/covariance matrix (Kelloway, 1998) and include such indices as the S-Bχ^2 statistic, Likelihood Ratio Test statistic (χ^2), root mean squared error of approximation (RMSEA), and the goodness-of-fit index (GFI). The χ^2 test statistic is a traditional measure of the closeness of fit between the covariance matrix proposed by the model and the population covariance matrix (Kelloway, 1998). Therefore, non-significant χ^2 differences signify minimal discrepancy between the model matrix and the population matrix indicating a good fit. However, the χ^2 statistic is sensitive to sample size and any model with a large enough sample size will be invariably rejected (Kelloway, 1998). To remedy this problem and account for the lack of multivariate normality, the S-Bχ^2 statistic was used as a model fit index. Other robust indices of fit that are less sensitive to sample size include the RMSEA and the GFI.

The RMSEA is a goodness-of-fit statistic that is based on the analysis of residuals, with smaller values indicating a better fit to the data (Kelloway, 1998). As recommended by Byrne (2001), values greater than .10 are a poor fit, values from .08 to .10 are a mediocre fit, and values from .06 to .08 represent a reasonable fit. All values

less that .06 indicate a good fit. The RMSEA also provides 90% confidence intervals. A narrow confidence interval indicates good precision of the RMSEA value in reflecting model fit in the population, whereas a wide confidence interval suggests that the RMSEA value is quite imprecise in accurately predicting the degree of fit in the population (MacCullum, Browne, & Sugawara, 1996). The confidence intervals are sensitive to sample size and complexity of the model. Therefore, a model based on a small sample size with a large number of parameters will produce a wide confidence interval (MacCullum et al., 1996). The GFI is based on the ratio of the sum of the squared discrepancies to the observed variances (Kelloway, 1998). The GFI index ranges from 0 to 1, with values exceeding 0.9 indicative of a good fit (Kelloway, 1998).

4.4.2 Tests of Comparative Fit

The assessment of the comparative fit of a model involves the comparison of two or more competing models to determine which provides a better fit to the data (Kelloway, 1998). There are several fit indices that can be reported using the CFA approach such as the comparative fit index (CFI), normed fit index (NFI), and the nonnormed fit index (NNFI). However, many indices provide the same information. Hence, the CFI is considered the index of choice as recommended by Bentler (1990). It is based on the noncentral χ^2 distribution and ranges between 0 to 1, with values exceeding 0.90 indicating a good fit to the data (Kelloway, 1998).

4.4.3 Comparison of Different Models

The comparison between models testing for difference in fit will be examined using the chi-square difference testing procedure appropriate for the Satorra-Bentler scaled chi-square ($\Delta S - B\chi^2$). This procedure involves dividing the difference between

the normal theory weighted least squared chi-square of the nested and comparison models by a difference test scaling correction. The $\Delta S - B\chi^2$ statistic has advantages over the traditional χ^2 difference test as it shows an improved approximation of goodness-of-fit test statistics in non-normal data (Satorra & Bentler, 1994). As previously specified, due to the violation of the multivariate non-normality in the current study, the $\Delta S - B\chi^2$ statistic is an appropriate measure of differences between the comparison models, with higher values representing a better fit.

4.5 CFA Findings for the Examination of the Factor Structure of the DSM-IV AD/HD Symptoms Based on a Single Source

Tables 15 and 16 show the fit indices for the 1-factor, 2-factor, and 3-factor models of the AD/HD symptoms for mother and father ratings. As seen in Table 15, the 1-factor model based on mother ratings showed a reasonable fit (i.e., Model 1). The CFI and GFI values were adequate, but the RMSEA value was poor. In contrast, the 2-factor model (i.e., Model 2) was a good fit and showed a significant improvement in fit over Model 1 ($\Delta S\text{-}B\chi^2 = 6.32$, $p<.001$). The CFI and GFI values were adequate and the RMSEA value was a mediocre fit. The 3-factor model (i.e., Model 3) also showed a good fit and was a significant improvement in fit over Model 2 ($\Delta S\text{-}B\chi^2 = 14.42$, $p<.001$). The CFI and GFI values were adequate and the RMSEA value was a reasonable fit. Overall, the 1-factor model showed a reasonable fit, and the 2-factor and 3-factor models showed a good fit for mother ratings of the AD/HD symptoms.

As seen in Table 16, the 1-factor model (i.e., Model 1) indicated a reasonable fit based on father ratings. The CFI and GFI values were adequate but the RMSEA value was poor. In comparison, the 2-factor model (i.e., Model 2) was a good fit and showed a significant improvement in fit over Model 1 ($\Delta S\text{-}B\chi^2 = 8.38$, $p<.001$). For Model 2, the

CFI and GFI values were adequate and the RMSEA value was a mediocre fit. The 3-factor model (i.e., Model 3) also showed a good fit. The CFI value was a good fit, the GFI value was an adequate fit, and the RMSEA value was a reasonable fit. Model 3 showed a significant improvement in fit over Model 2 (ΔS-B$\chi^2 = 7.79$, $p<.001$). Overall, the 1-factor model showed a reasonable fit, and the 2-factor and 3-factor models showed a good fit for father ratings of the AD/HD symptoms.

Table 15

CFA Findings for Models of AD/HD for Mother Ratings

Model (AD/HD)	χ^2	*df*	S - Bχ^2	RMSEA (90% CI)	CFI	GFI
1 (IN + H/I loading on a single factor)	666.80*	135	643.25*	.11 .099-.12	.81	.77
2 (IN + H/I)	517.37*	134	423.82*	.082 .073-.90	.87	.84
3 (IN, HYP, + IMP)	465.27*	132	356.98*	.072 .063-.082	.88	.86

Note: * = $p<.001$; χ^2 = likelihood ratio test statistic; *df* = degrees of freedom; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness of fit index; CI = confidence interval; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity

Table 16

CFA Findings for Models of AD/HD for Father Ratings

Model (AD/HD)	χ^2	*df*	S - Bχ^2	RMSEA (90% CI)	CFI	GFI
1 (IN + H/I loading on a single factor)	476.71*	135	509.94*	.11 10-.13	.81	.76
2 (IN + H/I)	343.23*	134	323.58*	.082 .070-.093	.88	.83
3 (IN, HYP, + IMP)	280.00*	132	233.39*	.06 .047-.073	.92	.87

Note: * = $p<.001$; χ^2 = likelihood ratio test statistic; *df* = degrees of freedom; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness of fit index; CI = confidence interval; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity

Tables 17 and 18 show the completely standardised loadings for mother and father ratings of the AD/HD symptoms. To determine the amount of variance in the symptom that is explained by each factor, the loading values were squared. The variance amount is presented in parentheses under the associated factor loading for the 2-factor and 3-factor models of AD/HD. Table 17 shows the completely standardised loadings for mother ratings of the IN, HYP, and IMP symptoms. The overall amount of variance in the individual symptoms explained by AD/HD Model 2 (i.e., 2-factor model) ranged from 22% to 72%. For AD/HD Model 2, the explained variance in the individual symptoms for the IN factor was between 30% and 62%, and the H/I factor ranged from

22% to 72%. In comparison, the amount of variance in the individual symptoms explained by AD/HD Model 3 (i.e., 3-factor solution) ranged from 20% to 74%. The amount of explained variance in the individual symptoms was between 29% and 62% for the IN factor, 20% and 74% for the HYP factor, and 49% and 53% for the IMP factor.

Table 18 shows the completely standardised loadings for father ratings of the AD/HD symptoms. The amount of explained variance in the individual symptoms for AD/HD Model 2 ranged from 17% to 66%. For AD/HD Model 2, the amount of explained variance in the individual symptoms for the IN factor was between 41% and 66%, and the H/I factor ranged from 17% to 64%. In comparison, the amount of variance in the individual symptoms explained by AD/HD Model 3 ranged from 13% to 74%. The amount of explained variance in the individual symptoms was between 41% and 66% for the IN factor, 13% and 72% for the HYP factor, and 42% and 74% for the IMP factor.

A similar pattern emerged for the factor loadings explained by AD/HD Models 1, 2, and 3 for both mother and father ratings. For each model, the factor loadings accounted for a significant amount of variance in each symptom accounted for by its underlying factor, except for father-rated *on the go* (e.g., ODD symptom) in the 1-factor model. For father ratings, *on the go* showed only 6% of explained variance for AD/HD Model 1, and 17% and 13% of explained variance for AD/HD Models 2 and 3, respectively. Overall, there were no marked differences in the factor loadings between AD/HD Models 1, 2, and 3 for the IN, HYP, and IMP symptoms for mother and father ratings. This indicated that the 1-factor, 2-factor, and 3-factor models of AD/HD all fit the data appropriately based on the AD/HD factor loadings.

Table 17

Completely Standardised Loadings for the DSM-IV AD/HD Symptoms for Mother Ratings

Item	AD/HD Model 1	AD/HD Model 2		AD/HD Model 3		
	IN + H/I	IN	H/I	IN	HYP	IMP
Careless	.68	.73 (53%)		.73 (53%)		
Attention	.73	.72 (52%)		.73 (53%)		
Listen	.63	.59 (35%)		.59 (35%)		
Instructions	.73	.79 (62%)		.79 (62%)		
Organising	.68	.74 (55%)		.74 (55%)		
Effort	.69	.72 (52%)		.72 (52%)		
Loses	.51	.55 (30%)		.54 (29%)		
Distracted	.78	.79 (62%)		.79 (62%)		
Forgetful	.54	.59 (35%)		.59 (35%)		
Fidgets	.69		.72 (52%)		.73 (52%)	

Item	AD/HD Model 1	AD/HD Model 2		AD/HD Model 3		
	IN + H/I	IN	H/I	IN	HYP	IMP
Seat	.74		.74		.75	
			(55%)		(56%)	
Runs	.81		.85		.86	
			(72%)		(74%)	
Quiet	.60		.61		.61	
			(37%)		(37%)	
On the go	.43		.51		.50	
			(26%)		(25%)	
Talks	.41		.47		.45	
			(22%)		(20%)	
Blurts	.56		.61			.70
			(37%)			(49%)
Waiting turn	.56		.62			.72
			(38%)			(52%)
Interrupts	.57		.63			.73
			(40%)			(53%)

Note: All loadings were significant at $p<.001$; ( ) = amount of variance; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity

Table 18

Completely Standardised Loadings for the DSM-IV AD/HD Symptoms for Father Ratings

Item	Model 1	Model 2		Model 3		
	IN + H/I	IN	H/I	IN	H	I
Careless	.65	.69		.69		
		(48%)		(48%)		
Attention	.73	.74		.75		
		(55%)		(56%)		
Listen	.66	.64		.64		
		(41%)		(41%)		
Instructions	.78	.81		.81		
		(66%)		(66%)		
Organising	.72	.74		.74		
		(55%)		(55%)		
Effort	.73	.77		.77		
		(59%)		(59%)		
Loses	.68	.69		.69		
		(48%)		(48%)		
Distracted	.78	.78		.78		
		(61%)		(61%)		
Forgetful	.64	.65		.65		
		(42%)		(42%)		
Fidgets	.59		.64		.68	
			(41%)		(46%)	

Item	Model 1	Model 2		Model 3		
	IN + H/I	IN	H/I	IN	H	I
Seat	.61		.63		.64	
			(40%)		(41%)	
Runs	.74		.80		.85	
			(64%)		(72%)	
Quiet	.59		.61		.63	
			(37%)		(40%)	
On the go	.24*		.41		.36	
			(17%)		(13%)	
Talks	.40		.50		.46	
			(25%)		(21%)	
Blurts	.49		.59			.65
			(35%)			(42%)
Waiting turn	.47		.59			.71
			(35%)			(50%)
Interrupts	.57		.59			.86
			(35%)			(74%)

Note: All loadings were significant at $p<.001$, except for * = non-significant; ( ) = amount of variance; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity

4.6 Correlations between Dimensions for the 2-Factor and 3-Factor Models of AD/HD for Mother and Father Ratings

To further evaluate the best fit to the data between the 2-factor and 3- factor models for a single source, the correlations between factors for mother and father ratings were examined. To test for any significant differences between the correlations between factors, Fischer's (1921) *z* statistic will be reported. To approximate a normal distribution, Fischer's test involves converting the *t* value to a *z* statistic.

As seen in Table 19, the correlation between each factor was significant. The correlation between IN and HYP was significantly higher than the correlation between IN and IMP (mother $z = 6.33$, $p<.001$; father $z = 4.12$, $p<.001$). The correlation between HYP and IMP was significantly higher than the correlation between IN and IMP for mother ratings ($z = 5.46$, $p<.001$); and the correlation between IN and H/I was significantly higher than the correlation between IN and IMP (mother $z = 5.07$, $p<.001$; father $z = 3.63$, $p<.001$). The patterns of correlations for both mother and father ratings seem to support AD/HD Model 2, based on the high correlation between HYP and IMP.

Table 19

Correlations between Dimensions for the 2-Factor and 3-Factor Models of AD/HD for Mother and Father Ratings

	Mother	Father
2-factor model		
IN + H/I	0.82	0.76
3-factor model		
IN + HYP	0.85	0.78
IN + IMP	0.64	0.56
HYP + IMP	0.83	0.71

Note: All values significant at $p<.001$; IN = inattention; H/I = hyperactivity/impulsivity; HYP = hyperactivity; IMP = impulsivity

4.7 CFA Findings for the Examination of the Factor Structure of the DSM-IV ODD Symptoms Based on a Single Source

Table 20 shows the fit indices for the 1-factor model of ODD based on a single source (i.e., mother and father). The result indicated that the 1-factor model based on mother ratings was a good fit. The RMSEA value showed a mediocre fit, and the CFI and GFI values demonstrated a good fit. In comparison, the 1-factor model based on father ratings showed a marginally good fit. Although the GFI value was an adequate fit and the CFI value indicated a good fit, the RMSEA value was a poor fit. In summary, the 1-factor model of ODD showed a good fit for mother ratings and a marginally good fit for father ratings.

Table 20

CFA Findings for the 1-Factor Model of ODD for Mother and Father Ratings

Model	χ^2	*df*	S - B χ^2	RMSEA (90% CI)	CFI	GFI
Mother						
1 (1-factor ODD)	100.21*	20	70.50*	.088 .066-.11	.94	.93
Father						
1 (1-factor ODD)	102.39*	20	74.41*	.11 .086-.14	.92	.89

Note: * = $p<.001$; *df* = degrees of freedom; χ^2 = chi square; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness-of-fit index; CI = confidence interval; ODD = oppositional behaviour

Table 21 shows the completely standardised loadings for mother and father ratings of the ODD symptoms. Each factor loading for the ODD symptoms was statistically significant for mother and father ratings ($p<.001$). The loading values were squared to determine the amount of variance in the symptom that is explained by each factor. The variance amount is presented in parentheses with the associated factor loading. Both father and mother ratings of the ODD symptoms showed a substantial amount of variance. The results show that the amount of variance explained by ODD Model 1 (i.e., single ODD factor) for mother ratings ranged from 45% to 66%. In comparison, the amount of variance explained by an ODD Model 1 ranged from 50% to

72% for father ratings. The completely standardised loading for each ODD symptom was significant and showed a substantial amount of variance for mother and father ratings.

Table 21

Completely Standardised Factor Loadings for the DSM-IV ODD Symptoms for Mother and Father Ratings

Item	ODD Model 1	
	Mother	Father
Temper	.71 (50%)	.72 (52%)
Argues	.76 (58%)	.82 (67%)
Defies	.81 (66%)	.85 (72%)
Annoys	.76 (58%)	.72 (52%)
Blames	.74 (55%)	.72 (52%)
Touchy	.71 (50%)	.72 (52%)
Angry	.79 (62%)	.84 (71%)
Spiteful	.67 (45%)	.71 (50%)

Note: All loadings were significant at $p<.001$; ( ) = amount of variance

4.8 Summary of the CFA Findings for the Examination of the Factor Structure of the DSM-IV AD/HD and ODD Symptoms Based on a Single Source

For the AD/HD symptoms based on mother and father ratings, the 1-factor model showed a reasonable fit, and the 2-factor and 3-factor models showed a good fit. Overall, there were no marked differences in the factor loadings between the 1-factor, 2-factor, and 3-factor models of AD/HD for the IN, HYP, and IMP symptoms for mother and father ratings. However, the pattern of correlations for mother and father ratings supported the 2-factor model, based on the high correlation between the HYP and IMP dimensions.

The 1-factor solution for ODD symptoms showed a good fit for mother ratings and a marginally good fit for father ratings. For mother ratings, the RMSEA value showed a mediocre fit and the CFI and GFI values demonstrated a good fit. For father ratings, although the GFI value showed an adequate fit and the CFI value showed a good fit, the RMSEA value indicated a poor fit. Further support for the 1-factor model of ODD was provided based on the factor loadings as each ODD symptom was significant and showed a substantial amount of variance.

4.9 An Examination of the Factor Structure of the DSM-IV AD/HD and ODD Symptom Parcels Based on a Single Source

As mentioned earlier in the chapter, CFA was also used to examine the AD/HD and ODD symptom parcels for mother and father ratings. Prior to the CFA, data screening and descriptive information is presented for the AD/HD and ODD symptom parcels based on mother and father ratings.

4.10 Data Screening and Descriptive Information for the AD/HD and ODD Symptom Parcels for Mother and Father Ratings

As previously discussed, item parcels were created based on the AD/HD and ODD symptoms. Tables 22 and 23 show the descriptive information for mother and father ratings of IN, H/I, and ODD symptom parcels. The presented information includes the mean, standard deviation, skewness, and kurtosis for the DSM-IV AD/HD and ODD symptom parcels. The skewness and kurtosis values were all within the normal range for both mother and father ratings (Curran et al., 1996).

According to the test of univariate normality for continuous variables, Table 22 shows that 6 out of 6 AD/HD and ODD symptom parcels had significant skewness and 1

out of 6 AD/HD and ODD symptom parcels had significant kurtosis for mother ratings. Table 23 shows that for father ratings 6 out of 6 AD/HD and ODD symptom parcels had significant skewness and 1 out of 6 AD/HD and ODD symptom parcels had significant kurtosis. The test of multivariate normality for continuous variables showed that the multivariate skewness values for the AD/HD and ODD symptom parcels were 8.30 (z = 11.45, p <.001) for mother ratings and 7.95 (z = 11.06, p <.001) for father ratings. The multivariate kurtosis values for the AD/HD and ODD symptom parcels were 63.56 (z = 6.97, p <.001) for mother ratings and 62.34 (z = 6.64, p <.001) for father ratings. Therefore, the assumption of multivariate normality was violated for the AD/HD and ODD symptom parcels for mother and father ratings.

Table 22

Descriptive Information for IN, H/I, and ODD Symptom Parcels for Mother Ratings

Item Parcel	M	SD	Skewness	Kurtosis
IN – Parcel 1	3.81	2.68	0.75*	0.24
IN – Parcel 2	2.81	2.60	1.22*	1.33
IN – Mean	3.31	2.64	0.99	0.79
H/I – Parcel 1	3.33	2.83	1.17*	1.81
H/I – Parcel 2	1.95	1.95	1.28*	1.70
H/I – Mean	2.64	2.39	1.23	1.76
ODD – Parcel 1	2.64	2.28	0.99*	1.03
ODD – Parcel 2	2.43	2.07	1.22*	2.26*
ODD – Mean	2.54	2.18	1.11	1.65

Note: * = p <.001; M = mean, SD = standard deviation; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

Table 23

Descriptive Information for IN, H/I, and ODD Symptom Parcels for Father Ratings

Item	M	SD	Skewness	Kurtosis
IN – Parcel 1	4.15	2.90	0.97*	0.57
IN – Parcel 2	3.37	2.86	1.00*	0.31
IN – Mean	3.76	2.88	0.99	0.44
H/I – Parcel 1	4.01	3.10	0.79*	0.07
H/I – Parcel 2	2.64	2.18	1.02*	0.87
H/I – Mean	3.33	2.64	0.91	0.47
ODD – Parcel 1	2.99	2.76	1.26*	1.36
ODD – Parcel 2	2.71	2.48	1.44*	2.36*
ODD – Mean	2.85	2.62	1.35	1.86

Note: * = p <.001; M = mean, SD = standard deviation; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

4.11 Correlations between AD/HD and ODD Symptom Parcels for Mother and Father Ratings

Tables 24 and 25 show the Pearson's correlations for the AD/HD and ODD symptom parcels for mother and father ratings. For mother and father ratings, a similar pattern emerged in relation to the IN, H/I, and ODD symptom parcels. All correlations were significant at the p <.001 level. In particular, the correlations between the symptom parcels for each dimension were higher than for other dimensions. For instance, IN – Parcel 1 had a higher correlation with IN – Parcel 2 than the symptom parcels for H/I or ODD.

Table 24

Correlation Matrix for the DSM-IV AD/HD and ODD Symptom Parcels for Mother Ratings

	IN – P1	IN – P2	H/I – P1	H/I – P2	ODD – P1	ODD – P2
IN – P1	1.00					
IN – P2	.78	1.00				
H/I – P1	.54	.55	1.00			
H/I – P2	.53	.60	.77	1.00		
ODD – P1	.45	.42	.49	.51	1.00	
ODD – P2	.47	.49	.50	.55	.85	1.00

Note: All values significant at $p < .001$; P1 = parcel 1; P2 = parcel 2; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

Table 25

Correlation Matrix for the DSM-IV AD/HD and ODD Symptom Parcels for Father Ratings

	IN – P1	IN – P2	H/I – P1	H/I – P2	ODD – P1	ODD – P2
IN – P1	1.00					
IN – P2	.82	1.00				
H/I – P1	.59	.54	1.00			
H/I – P2	.61	.60	.79	1.00		
ODD – P1	.63	.57	.57	.63	1.00	
ODD – P2	.61	.55	.63	.65	.90	1.00

Note: All values significant at $p < .001$; P1 = parcel 1; P2 = parcel 2; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

4.12 CFA Findings for the Examination of the Factor Structure of the DSM-IV AD/HD and ODD Symptom Parcels Based on a Single Source

Tables 26 and 27 show the CFA fit indices for the 1-factor, 2-factor, and 3-factor models of the AD/HD and ODD symptom parcels based on a single source (i.e., mother and father). For mother ratings, Table 26 shows the 1-factor model indicated a poor fit (i.e., Parcels Model 1). The RMSEA, CFI, and GFI values were each a poor fit. In comparison, the 2-factor model (i.e., Parcels Model 2) showed a significantly improved fit over Parcels Model 1 (ΔS-Bχ^2 = -25.19, p<.001), but it was still a marginally poor fit. Although the CFI and GFI values were an adequate fit, the RMSEA value was a poor fit.

In contrast, the 3-factor model (i.e., Parcels Model 3) showed an extremely good fit. The S - Bχ^2 value was non-significant and the RMSEA and GFI indices showed a good fit. Furthermore, the CFI value was a perfect fit to the data. Parcels Model 3 showed a significant improvement in fit over Parcels Model 2 (ΔS-Bχ^2 = 48.94, p<.001).

For father ratings, Table 27 shows the Parcels Model 1 indicated a poor fit. Although the CFI value was an adequate fit, the RMSEA and GFI values were a poor fit. In comparison, the Parcels Model 2 showed a significantly improved fit over Parcels Model 1 (ΔS-Bχ^2 = -24.62, p<.001); however, Parcels Model 2 was still a marginally poor fit. Although the CFI and GFI values were an adequate fit, the RMSEA value showed a poor fit. In contrast, the Parcels Model 3 showed an extremely good fit, with a non-significant S - Bχ^2 value and the RMSEA, CFI, and GFI indices indicated a good fit. There was no significant improvement in fit between Parcels Models 2 and 3 (ΔS-Bχ^2 = -1.92, *ns*). In summary, for mother and father ratings of AD/HD and ODD symptom parcels, the 1-factor model showed a poor fit, the 2-factor model a marginally poor fit, whereas the 3-factor model showed an extremely good fit.

Table 26

CFA Findings for Models of AD/HD and ODD Symptom Parcels for Mother Ratings

Model (Parcels)	χ^2	*df*	S - Bχ^2	RMSEA (90% CI)	CFI	GFI
1 (AD/HD + ODD loading on a single dimension)	250.74*	9	131.00*	.26 .22-.30	.71	.74
2 (AD/HD + ODD)	96.42*	8	69.49*	.19 .15-.24	.89	.86
3 (IN, H/I, + ODD)	9.26	6	7.37	.034 .00-.10	1.00	.98

Note: * = $p<.001$; χ^2 = likelihood ratio test statistic; *df* = degrees of freedom; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness of fit index; CI = confidence interval; IN = inattention; H/I = hyperactivity/impulsivity; AD/HD = attention-deficit/hyperactivity disorder; ODD = oppositional behaviour

Table 27

CFA Findings for Models of AD/HD and ODD Symptom Parcels for Father Ratings

Model (Parcels)	χ^2	*df*	S - Bχ^2	RMSEA (90% CI)	CFI	GFI
1 (AD/HD + ODD)	259.12*	9	155.14*	.28 .24-.32	.76	.70
2 (AD/HD + ODD)	120.55*	8	102.57*	.24 .20-.28	.89	.82
3 (IN, H/I, + ODD)	12.92	6	9.52	.054 .00-.11	.99	.98

Note: * = $p<.001$; χ^2 = likelihood ratio test statistic; *df* = degrees of freedom; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness of fit index; CI = confidence interval; IN = inattention; H/I = hyperactivity/impulsivity; AD/HD = attention-deficit/hyperactivity disorder; ODD = oppositional behaviour

4.13 Summary of the CFA Findings for Study 1

For mother and father ratings of the AD/HD symptoms, the 1-factor model showed a reasonable fit, and the 2-factor and 3-factor models showed a good fit. However, the patterns of correlations for both mother and father ratings supported the 2-factor model, based on the high correlation between the HYP and IMP dimensions. For the ODD symptoms, the 1-factor model showed a good fit for mother ratings and a marginally good fit for father ratings. For the AD/HD and ODD symptom parcels, the 1-

factor model showed a poor fit, the 2-factor model showed a marginally poor fit, whereas the 3-factor model showed an extremely good fit providing support for separate IN, H/I, and ODD dimensions based on mother and father ratings.

5. Part 4: Discussion of Study 1

Based on Study 1, support was provided for separate IN, H/I, and ODD dimensions based on mother and father ratings. This finding is consistent with previous CFA studies that have examined the AD/HD and ODD symptoms simultaneously based on parent and teacher ratings for referred (Boe, 1997; Burns et al., 2001; Molina et al., 2001) and non-referred (Burns & Walsh, 2002; Burns et al., 1997a; Burns et al., 1997b; Gomez et al., 2005; Keogh, 2002; Molina et al., 2001) samples. For instance, Burns et al. (2001) evaluated 5 different models of AD/HD and ODD symptoms based on maternal ratings. They found that the 3-factor model (i.e., IN, H/I, and ODD symptoms) resulted in a good fit and was significantly better than the 2-factor model (i.e., AD/HD and ODD symptoms loaded onto separate factors).

Similar to previous CFA findings (Gomez et al., 1999; Keogh, 2002), Study 1 reported that the 3-factor model of AD/HD (e.g., separate dimensions of IN, HYP, and IMP) was a better model fit than the 2-factor model (e.g., separate dimensions of IN and H/I). However, as suggested by previous researchers (Gomez et al., 1999; Keogh, 2002), the 2-factor model was considered the most appropriate fit of the AD/HD symptoms based on the high correlation between the HYP and IMP dimensions in the 3-factor model of AD/HD. Study 1 reported high correlations between HYP and IMP of .83 for mother ratings and .71 for father ratings based on the 3-factor model of AD/HD, which is

similar to recent CFA studies. Gomez et al. (1999) reported correlations between HYP and IMP for respective parent and teacher ratings of .84 and .86. In an unpublished study, Smith (2003) reported correlations between HYP and IMP of .81 and .80 for respective parent and teacher ratings, and a correlation of .77 for adolescent ratings.

Surprisingly, the correlations between IN and HYP was higher than the correlations between HYP and IMP for both mother and father ratings as outlined in Table 19. The high correlation between IN and HYP appears to support the testing of a 2-factor model including separate IN/HYP and IMP dimensions in Study 1. However, due to a lack of existing empirical support this 2-factor model was not used. As discussed earlier in the chapter, only a recent MT-MS study by Smith (2003) provided a higher correlation between IN and HYP compared to HYP and IMP based on adolescent ratings, but for parent and teacher ratings the correlation between HYP and IMP was higher. Although the majority of recent MT-MS studies do not report the correlations for the separate IN, HYP, and IMP dimensions, when they have been included higher correlations have been reported between HYP and IMP compared to IN and IMP (Gomez et al., 1999; Tallent, 2003).

Given that previous MT-MS studies do not account for cross-situational differences, it may be that within-situations there is a stronger relationship between IN and HYP and across-situations there is a stronger relationship compared to HYP and IMP. For instance, when the AD/HD items are examined in the home setting based on mother and father ratings there is a stronger correlation between the IN and HYP trait dimensions compared to the HYP and IMP trait dimensions, but when the AD/HD items are examined at home and school based on parent and teacher ratings there is a stronger

correlation between the HYP and IMP trait dimensions compared to IN and HYP trait dimensions. This issue will be further addressed in Chapter 4 when discussing recommendations for future research.

Previous CFA studies have also reported high correlations between the IN, H/I, and ODD dimensions, which is consistent with the current study. Study 1 reported correlations of .82 for mother ratings and .76 for father ratings between IN and H/I. As presented in Chapter 3, previous CFA studies have reported correlations between IN and H/I ranging from .73 to .92 for parent ratings (Beiser et al., 2000; DuPaul et al., 1998; Gomez et al., 2003; Gomez et al., 1999) and .75 to .94 for teacher ratings (Beiser et al., 2000; DuPaul et al., 1997). Reported correlations between IN and ODD range between .58 and .68 for parent ratings and .58 and .61 for teacher ratings (Burns et al., 2001; Gomez et al., 2005; Keogh, 2002), and reported correlations between H/I and ODD range between .64 and .72 for parent ratings and .73 and .78 for teacher ratings (Burns et al., 2001; Gomez et al., 2005; Keogh, 2002).

The high correlations between the AD/HD and ODD dimensions raise questions regarding the independence (i.e., internal validity) of these factors. As outlined in Chapter 2, several reasons are outlined that may explain the high correlations between the IN, H/I, and ODD dimensions. In particular, the use of a single source may artificially inflate the correlations between the AD/HD and ODD dimensions. To understand the true meaning of the dimensions, the source variance needs to be separated from the trait variance. As presented in Chapter 2, the majority of EFA and CFA studies have included a single informant (i.e., predominantly mother or teacher). This issue will be addressed in Study 2.

CHAPTER 5: STUDY 2 OF THE CURRENT THESIS – AIMS, HYPOTHESES, METHODOLOGY, RESULTS AND A BRIEF DISCUSSION

1. Introduction

Chapter 5 provides the background, hypothesis, aims, methodology, results and a brief discussion for Study 2 involving an investigation of the AD/HD and ODD symptoms using the CFA MT-MS approach based on mother and father ratings. Part 1 will present the aims and hypotheses for Study 2 will include the different models to be used in the MT-MS approach. Part 2 will provide details of the methodology. Given that the procedure for Study 2 was the same as Study 1, only a brief outline will be provided. In the measure section, only a brief description for the Disruptive Behaviour Questionnaire will be provided as details of the measure were presented for Study 1 (see Chapter 4 for details). Part 3 will include the results of Study 2 and Part 4 will include a brief discussion of the findings of Study 2.

2. Part 1: Aims and Hypotheses of Study 2

As previously addressed in Chapter 3, recent studies have used the CFA MT-MS approach to separate trait and source effects. The majority of these studies have found stronger source variance than trait variance in the AD/HD and ODD dimensions (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002), which may be due to cross-situational differences as childhood behaviour is rated in different settings (i.e., home and school).

The aim of Study 2 is to examine the construct validity of the AD/HD and ODD symptoms in the same setting (i.e., home) using the CFA MT-MS approach based on mother and father ratings, which also provides a better understanding of cross-situational

differences and the nature of source variance (i.e., accuracy versus bias, as outlined in Chapter 3). To account for convergence problems associated with small sample sizes and high levels of skewness and kurtosis, item parcels were created for the IN, H/I, and ODD dimensions (refer to Study 1 for a full description of symptom parcels). Similar to recent CFA MT-MS studies (Gomez et al., 2003; Gomez et al., 2005), alternate assignment of items were made to the different parcels for each dimension. This was determined by the order that they appeared on the original instrument and there was a total of 6 symptom parcels for IN, H/I, and ODD. Items were derived from the Disruptive Behaviour Questionnaire. The IN – Parcel 1 comprised items 1, 5, 9, 13, and 17, and IN – Parcel 2 included items 3, 7, 11, and 15. The H/I – Parcel 1 included items 2, 6, 10, 14, and 18, and H/I – Parcel 2 included items 4, 8, 12, and 16. The ODD – Parcel 1 comprised items 19, 21, 23, and 25, and ODD – Parcel 2 comprised items 20, 22, 24, and 26.

To demonstrate good construct validity of the IN, H/I, and ODD dimensions both convergent and discriminant validity should be established. An examination of the convergent and discriminant validity of the AD/HD and ODD symptom parcels involves using the MT-MS procedure at the matrix and symptom parcel level. At the matrix level, the MT-MS approach involves a comparison of the postulated model with a series of more restrictive (i.e., nested) models, in which specific parameters are constrained or eliminated. The postulated model acts as a baseline against which all other models are compared in order to establish construct validity.

The postulated MT-MS model consists of freely correlated traits and freely correlated sources (MT-MS Model 1; refer Figure 8). The more restrictive models include the following: No traits and freely correlated sources (MT-MS Model 2; refer

Figure 9), perfectly correlated traits and freely correlated sources (MT-MS Model 3; refer Figure 10), and freely correlated traits and uncorrelated sources (MT-MS Model 4; refer Figure 11). Convergent validity of the traits is examined by comparing MT-MS Model 1 to MT-MS Model 2. Discriminant validity of the traits is examined by comparing MT-MS Model 1 to MT-MS Model 3, and discriminant validity of the sources is examined by comparing MT-MS Model 1 to MT-MS Model 4. To demonstrate good convergent and discriminant validity, MT-MS Model 1 should provide a statistically significant improvement in fit over MT-MS Models 2, 3, and 4. As previously discussed, the comparison between models testing for difference in fit will be examined using the chi-square difference testing procedure appropriate for the Satorra-Bentler scaled chi-square ($\Delta S - B\chi^2$).

At the symptom parcel level, the MT-MS approach is used to evaluate the convergent and discriminant validity of the symptom parcel parameters of MT-MS Model 1 (e.g., the amount of trait, source and error variance in each symptom parcel, the correlation between the IN, H/I, and ODD factors, and the correlation between the mother and father sources). A perfect outcome would be for each symptom parcel to have substantial trait variance, with the greater the trait variance the stronger the convergent validity for each symptom parcel. Furthermore, the trait variance should be greater than the source variance for each symptom parcel (Burns & Haynes, in press; Gomez et al., 2003; Gomez et al., 2005). The support for convergent and discriminant validity of the symptom parcels are reduced if the source effect is stronger than the trait effect, therefore reducing the support for construct validity (Byrne, 1998). Furthermore, correlations among the traits should be minimal to provide support for the discriminant validity of

traits, and disciminant validity of the sources is indicated by minimal correlation between sources (Byrne, 1998).

As previously stated in Chapter 3, recent MT-MS studies have found more source than trait variance for the AD/HD and ODD dimensions in multiple settings at home and school (Burns & Walsh, 2002; Gomez et al., 2003; Keogh, 2002). Although minimal trait variance has been found in these studies, it may be explained by cross-situational differences (i.e., parent and teacher sources). An examination of the source and trait effects of the IN, H/I, and ODD dimensions within a situation (i.e., home) using multiple sources (i.e., mother and father) provides a greater understanding of the role of the source effects by eliminating cross-situational differences evident in recent CFA MT-MS studies. In Study 2, the accuracy versus bias view of source effects was addressed with the possibility of several outcomes.

For source effects to reflect accuracy rather than bias, it is expected that a significant amount of trait variance will be stronger than source variance in the current AD/HD and ODD rating scale based on mother and father ratings. Such results would appear to question the stability of the conceptualisation of the IN and H/I dimensions across situations (i.e., home and school) due to the lack of a shared view between sources (i.e., teachers and parents). Alternatively, the bias view is supported over the accuracy view if there are significant source effects and they are stronger than the trait effects, indicating problems with the sources as well as the conceptualisation of AD/HD and/or faulty ratings scales (Burns, Walsh et al., 2003). This outcome would need to be further explored. In Study 2, it is expected that the trait variance will be higher than previous

CFA MT-MS studies as children's behaviour is viewed in a single setting (i.e., home) compared to multiple settings (i.e., home and school).

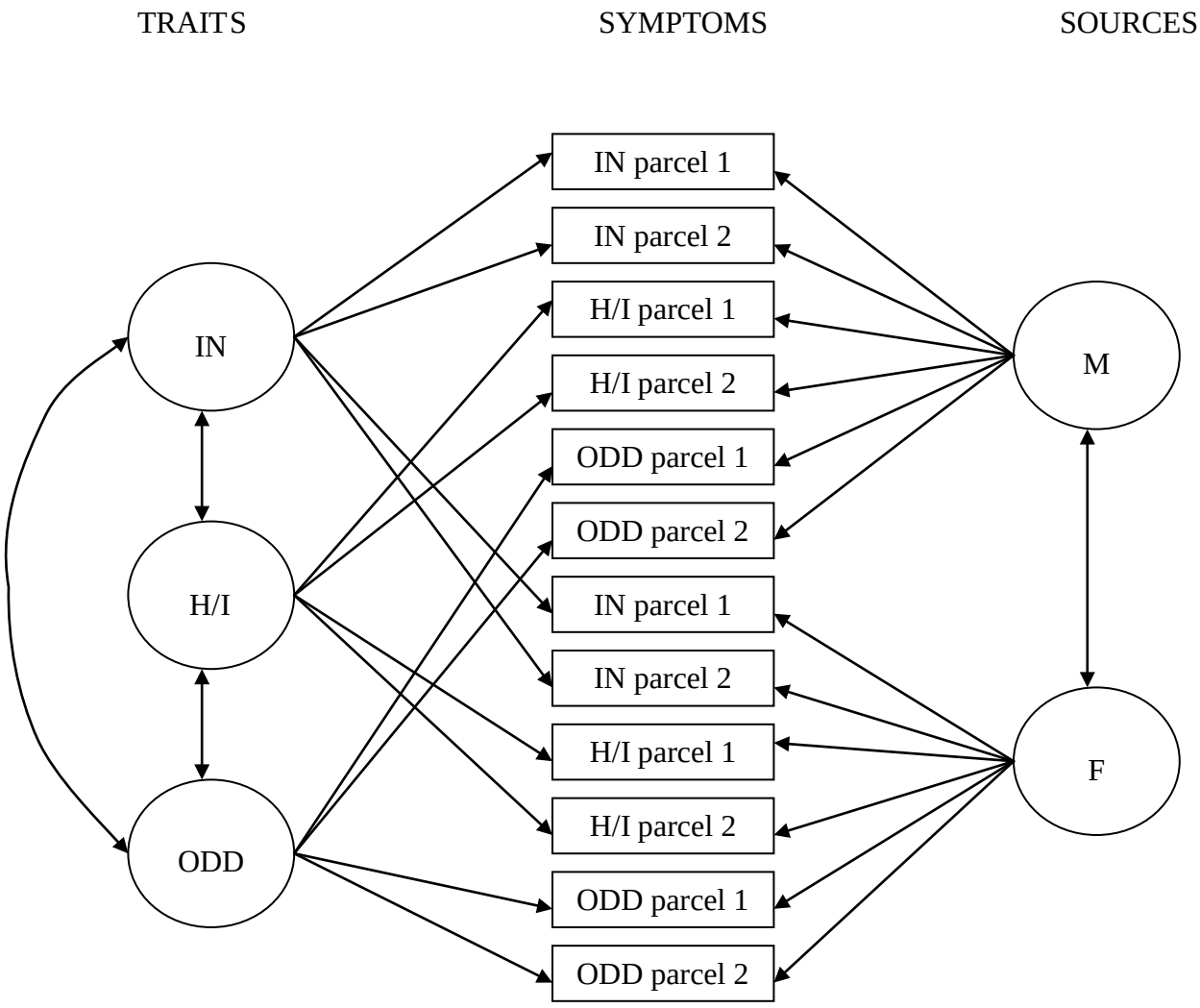

Figure 8

Postulated Multitrait-Multisource Model (MT-MS Model 1; Freely Correlated Traits, Freely Correlated Sources).

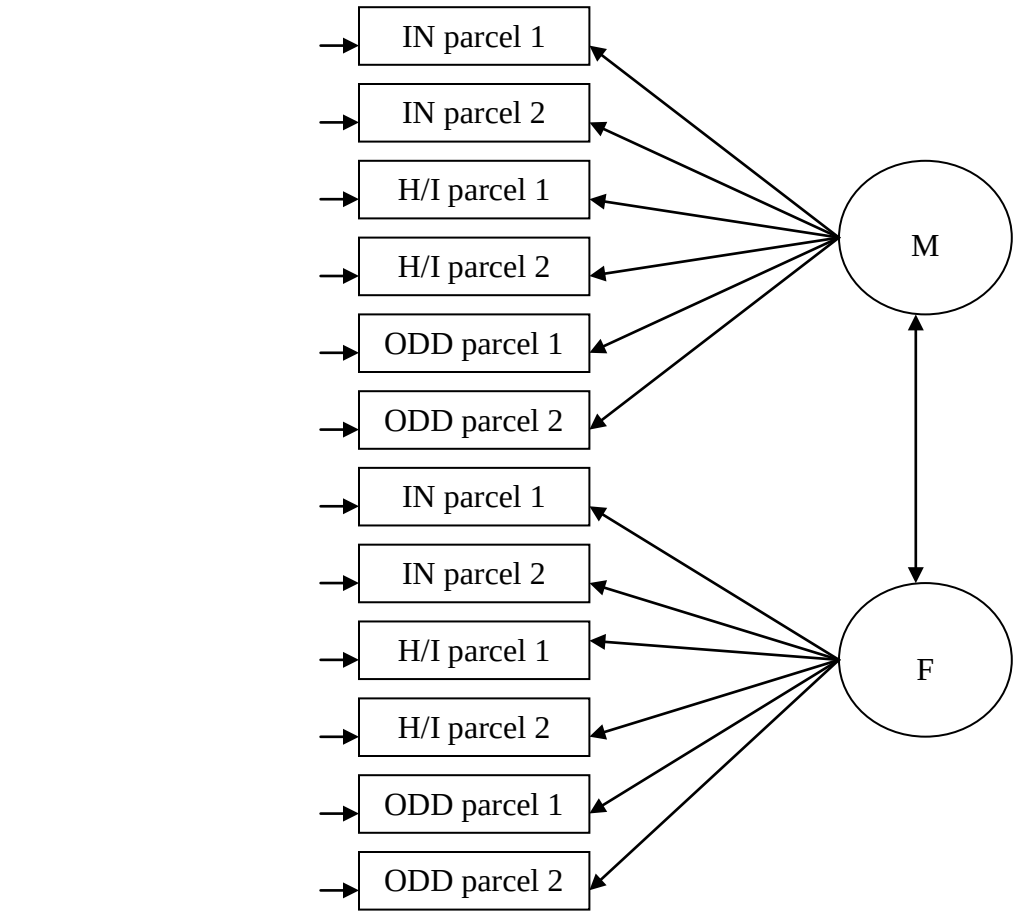

Figure 9

MT-MS Model 2: No Traits; Freely Correlated Sources.

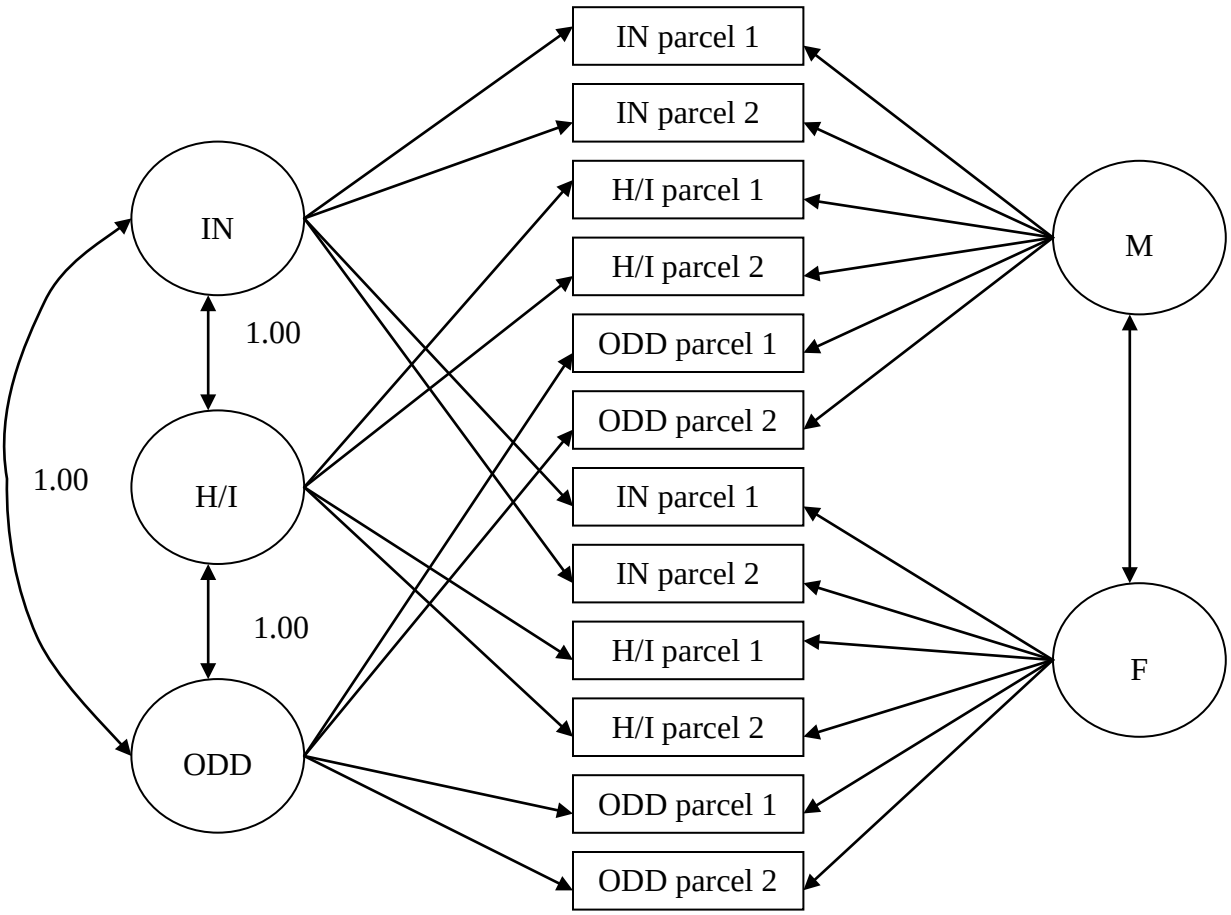

Figure 10

MT-MS Model 3; Perfectly Correlated Traits, Freely Correlated Sources.

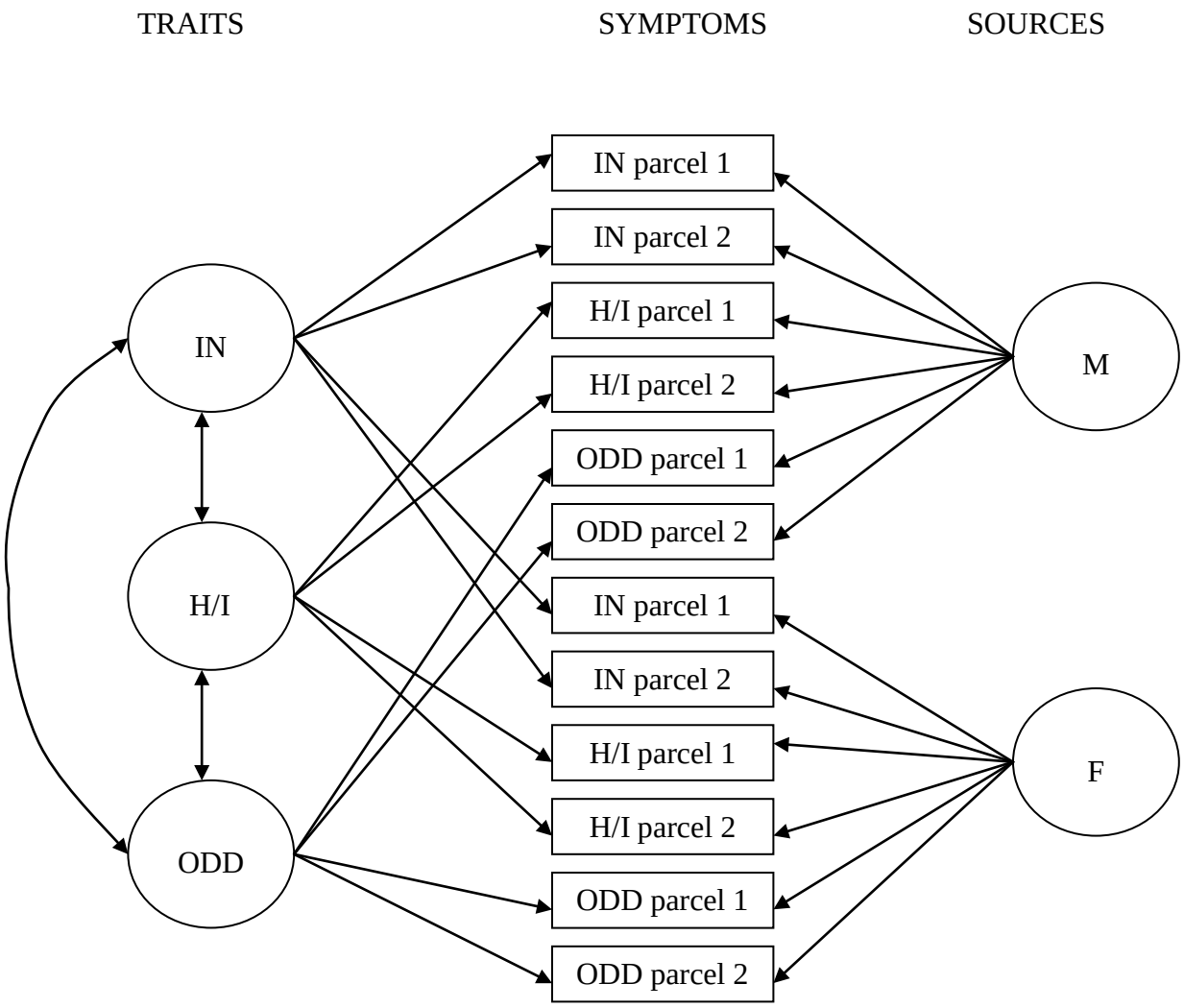

Figure 11

MT-MS Model 4; Freely Correlated Traits, Uncorrelated Sources.

3. Part 2: Methodology of Study 2

3.1 Participants

Study 2 included those families from Study 1 in which both mother and father had completed questionnaires for the same child. In total, 205 observations of paired mother and father ratings were obtained. Similar to Study 1, children ranged from Grade 1 through to Grade 6 and were recruited from 6 different schools (see Chapter 4 for a further description of participants). The demographic details of the participants are the same as those provided for the father rated group in Table 9 (see Chapter 4).

3.2 Measures

3.2.1 Disruptive Behaviour Questionnaire

As presented for Study 1, the DBQ was used to obtain mother and father ratings of the 18 AD/HD symptoms and the 8 ODD symptoms as presented in the DSM-IV (refer Appendix B). For a full description of the DBQ, refer to Chapter 4.

3.3 Procedure

Study 2 used the same procedure as documented for Study 1. To provide a brief description, ethics approval was obtained and the questionnaires were distributed to the children's parents for schools who agreed to participate in the research project. For those parents agreeing to participate, the questionnaires were returned to the student researcher via prepaid envelopes (refer to Chapter 4 for a full description of the procedure).

4. Part 3: Results of Study 2

The results of Study 2 show the CFA MT-MS analyses to establish the convergent and discriminant validity of the AD/HD and ODD symptom parcels. The multiple traits include IN, H/I, and ODD, and the two sources include mother and father. Study 2 performed CFA using LISREL 8.51 (Joreskög & Sorböm, 2001) and the level of significance was $p < .001$ for each statistical analyses.

As described earlier in the chapter, the CFA MT-MS was used to investigate the convergent and discriminant validity of the AD/HD and ODD symptom parcels at the matrix and symptom parcel levels. At the matrix level, indices of absolute and comparative fit were used to evaluate each model (refer to Chapter 4 for a full description of the fit indices). At the symptom parcel level, the trait, source, and error variance was investigated for each parcel. To further evaluate discriminant validity at the symptom parcel level, the correlations between factors and sources were also investigated.

4.1 Testing for Convergent and Discriminant Validity of the AD/HD and ODD Dimensions at the Matrix Level

As seen in Table 28, MT-MS Model 1 (i.e., freely correlated traits and freely correlated sources) showed a good fit. Whereas the χ^2 and S-Bχ^2 statistics showed significant values, the CFI and GFI values indicated a good fit and the RMSEA value was a reasonable fit. In contrast, MT-MS Model 2 (i.e., no traits and freely correlated sources) showed an extremely poor fit as indicated by the RMSEA, CFI, and GFI indices. In comparison, MT-MS Model 1 showed a significant improvement in fit over MT-MS Model 2 (ΔS - B$\chi^2 = 1154.52$, $p<.001$), strongly supporting the convergent validity of the

traits. MT-MS Model 3 (i.e., perfectly correlated traits and freely correlated sources) showed a reasonable fit. Although the CFI and GFI values were an adequate fit, the RMSEA value was a poor fit. MT-MS Model 1 also showed a significant improvement in fit over Model 3 ($\Delta S - B\chi^2 = 197.25$, $p<.001$), strongly supporting the discriminant validity of the traits. MT-MS Model 4 (i.e., freely correlated traits and uncorrelated sources) also showed a good fit. Although the χ^2 and S-Bχ^2 values showed significant values, the CFI and GFI indices showed a good fit and the RMSEA value was a reasonable fit. There was no significant improvement in fit between MT-MS Model 1 and MT-MS Model 4 ($\Delta S - B\chi^2 = 1.51$, $p = ns$), thus not providing support for the discriminant validity of the sources. In summary, support was provided for the convergent and discriminant validity of IN, H/I, and ODD traits at the matrix level, but there was no support for the discriminant validity of sources at the matrix level for mother and father ratings.

Table 28

Summary of Goodness of Fit Indices for MT-MS Models of AD/HD and ODD for Mother and Father Ratings

Model (MT-MS)	χ^2	*df*	S - Bχ^2	RMSEA (90% CI)	CFI	GFI
Model 1 Freely correlated traits; freely correlated methods	92.48*	38	74.45*	.069 .045-.092	.98	.93
Model 2 No traits; freely correlated sources	791.54*	53	745.26*	.25 .24-.27	.67	.53
Model 3 Perfectly correlated traits; freely correlated sources	320.03*	41	299.97*	.18 .16-.19	.87	.77
Model 4 Freely correlated traits; uncorrelated sources	94.81*	39	75.86*	.068 .045-.091	.97	.93

Note: * = $p < .001$; χ^2 = likelihood ratio test statistic; *df* = degrees of freedom; S - Bχ^2 = Satorra-Bentler scaled chi-square; RMSEA = root mean square error of approximation; CFI = comparative fit index; GFI = goodness-of-fit index; CI = confidence interval

4.2 Testing for Convergent and Discriminant Validity of the AD/HD and ODD Dimensions at the Symptom Parcel Level

Convergent validity of the AD/HD and ODD dimensions at the symptom parcel level is represented by the size of the trait loadings. The amount of variance for each parcel due to trait, source, and error effects is derived from the squared loadings. Table 29 shows the amount of trait, source, and error loading for the IN, H/I, and ODD symptom parcels. The results showed that each amount of trait, source, and error variance was statistically significant except for the source variance of mother-rated ODD - Parcel 1 and mother-rated ODD - Parcel 2, and the error variance for mother-rated ODD - Parcel 1, and father-rated ODD - Parcel 2. For mother ratings, the IN, H/I, and ODD symptom parcels had larger trait loadings than source loadings for each symptom parcel. This provided strong evidence for the convergent validity of the mother-rated AD/HD and ODD symptom parcels, as the trait effects were greater than the source effects. For father ratings, the IN and H/I symptom parcels had larger trait loadings than source loadings for each symptom parcel, which provided strong evidence for the convergent validity of the father-rated AD/HD symptom parcels. Although the source loadings were only slightly higher than the trait loadings for the ODD symptom parcels, the trait loadings were still significant providing partial support for the convergent validity of father-rated ODD symptom parcels. In summary, support was provided for the convergent validity of the mother-rated and father-rated IN and H/I dimensions at the symptom parcel level. Although support was provided for the mother-rated ODD dimension, only partial support was provided for the father-rated ODD dimension at the symptom parcel level.

Table 29

Trait, Source, and Error Variance in the AD/HD and ODD Symptom Parcels

Parcel	Trait	Source	Error
Mother – IN 1	0.52	0.24	0.24
Mother – IN 2	0.49	0.30	0.21
Mother - IN (Mean)	0.51	0.27	0.23
Mother – HI 1	0.49	0.24	0.27
Mother – HI 2	0.52	0.27	0.21
Mother - HI (Mean)	0.51	0.26	0.24
Mother – ODD 1	0.83	0.00*	0.13*
Mother – ODD 2	0.71	0.14*	0.15
Mother - ODD (Mean)	0.77	0.07	0.14
Father – IN 1	0.60	0.24	0.16
Father – IN 2	0.58	0.23	0.19
Father - IN (Mean)	0.59	0.24	0.18
Father – HI 1	0.46	0.30	0.24
Father – HI 2	0.45	0.34	0.21
Father - HI (Mean)	0.46	0.32	0.23
Father – ODD 1	0.41	0.46	0.13
Father – ODD 2	0.37	0.58	0.05*
Father - ODD (Mean)	0.39	0.52	0.09

Note: Each value significant at $p<.001$, except * = non-significant; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional behaviour

4.3 Testing for Discriminant Validity of the AD/HD and ODD Dimensions at the Symptom Parcel Level

The evaluation of discriminant validity of traits at the symptom parcel level involves the correlation between the factor loadings (i.e., IN, H/I, and ODD). Discriminant validity of sources involves the correlation between source factors (i.e., mother and father). The perfect solution would be for a low correlation between the traits (e.g., dissimilar traits) and a low correlation between the sources (i.e., dissimilar sources). Although conceptually correlations between the traits and sources should be negligible, in general such findings are highly unlikely (Byrne, 1998).

As seen in Table 30, the correlations between the IN, H/I, and ODD dimensions were significant (p <.001). To determine whether the correlations between factors within the 2-factor and 3-factor models were significantly different, Fisher's (1921) r to z transformation test was used. However, there were no significant differences for the correlations between factors. The two sources shared 13% of their variance in common. Since the rating scales used by mothers and fathers were identical, the results provided support for discriminant validity for the source factors. However, due to the high correlations between traits, discriminant validity is not supported for the trait factors.

Table 30

Correlations between the IN, HI, and ODD Trait Factors and Mother and Father Source Factors

	Traits			Sources	
	IN	H/I	ODD	Mother	Father
IN	1.00				
H/I	0.62*	1.00			
ODD	0.49*	0.57*	1.00		
Mother				1.00	
Father				0.36	1.00

Note: * = p <.001; IN = inattention; H/I = hyperactivity/impulsivity; ODD = oppositional behaviour

4.4 Summary of Findings for the CFA MT-MS Analysis of the AD/HD and ODD Symptom Parcels for Mother and Father Ratings

To establish construct validity at the matrix level, MT-MS Model 1 showed a significant improvement in fit over MT-MS Models 2 and 3, but there was no significant difference between MT-MS Models 1 and 4. These results provide support for the convergent and discriminant validity of IN, H/I, and ODD traits using symptom parcels. However, there was no support for the discriminant validity of sources at the matrix level based on mother and father ratings.

At the symptom parcel level, trait variance was greater than source variance for the IN and H/I symptom parcels for mother and father ratings. The trait variance was

also greater than the source variance for the mother-rated ODD symptom parcels. However, the source variance was greater than the trait variance for the father-rated ODD symptom parcels, but only marginally. These results provide support for the convergent validity of the IN and H/I dimensions, and only partial support for the ODD dimension based on mother and father ratings. Due to the high correlations between the IN, H/I, and ODD dimensions, discriminant validity of traits was not supported at the symptom parcel level. In contrast, support was provided for the discriminant validity of sources at the symptom parcel level.

5. Part 4: Discussion of Study 2

The aim of Study 2 was to examine the construct validity of the DSM-IV AD/HD and ODD symptom parcels in the home setting using the CFA MT-MS approach for mother and father ratings. As expected, Study 2 provided support for the convergent and discriminant validity of the IN, H/I, and ODD dimensions at the matrix level. This finding is consistent with results from recent published and unpublished CFA MT-MS studies that have also provided support for the convergent and discriminant validity of traits at the matrix level (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003; Tallent, 2003). Surprisingly, in Study 2 there was no support provided for the discriminant validity of sources. In contrast, previous CFA MT-MS studies have provided support for the discriminant validity of sources (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003; Tallent, 2003). However, there are several reasons that may explain the lack of discriminant validity between sources in the current study.

With the exception of an unpublished study by Smith (2003), previous CFA MT-MS studies have been based on teacher and parent ratings. Therefore, the respondents are rating children's behaviour in two different settings (i.e., home and school) indicating considerable independence between children's behaviour and raters. In contrast, Study 2 included mother and father ratings of children's behaviour in a single setting (i.e., home). The lack of discriminant validity between sources in the current study may be due to the lack of cross-situational differences in the child's behaviour. Given that previous CFA MT-MS studies have been based on parent and teacher ratings, the lack of discriminant validity between sources in the current study is expected given mothers and fathers provided ratings. However, Smith (2003) investigated the AD/HD and ODD dimensions using adolescent and parent sources in the home setting and provided support for the discriminant validity of sources. These findings indicate that the discriminant validity of sources is not only influenced by cross-situational differences (i.e., single versus multiple settings), but also by the use of different raters (i.e., adolescent-parent versus mother-father).

At the symptom parcel level, support was provided for the convergent validity of the AD/HD traits and only partial support was provided for the ODD traits for the postulated model (e.g., 2-factor model of AD/HD and 1-factor model of ODD). As outlined in Chapter 3, at the individual or symptom parcel level, recent published and unpublished CFA MT-MS studies have provided support for trait variance in parent-rated IN (Gomez et al., 2003; Gomez et al., 2005; Smith, 2003) and teacher-rated H/I (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003). For instance, Burns, Walsh et al. (2003) and Gomez et al. (2003) found a lack of overall support for the

convergent validity of the IN and H/I dimensions in an Australian sample. However, Gomez et al. did provide support for strong trait variance in teacher-rated H/I and parent-rated IN dimensions in a Brazilian sample. Overall, the convergent validity of the AD/HD dimensions has been established within the home setting, whereas across settings convergent validity has only been established for parent-rated IN and teacher-rated H/I. For the ODD dimension, support has been provided for convergent validity of teacher-rated ODD; however, this includes only a single published study (Gomez et al., 2005).

The separation of trait, source, and error variance in Study 2 also indicated that the majority of the variance in the IN, H/I, and ODD dimensions was accounted for by trait and source variance rather than error variance. In Study 2, the error variance ranged between 16% and 27% for the AD/HD symptom parcels, and 5% and 15% for the ODD symptom parcels. Recent CFA MT-MS studies have reported error variance for the AD/HD dimensions ranging from 22% to 50% (Gomez et al., 2003), 10% to 48% (Gomez et al., 2005), and 7% to 24% (Keogh, 2002). For ODD, recent CFA MT-MS studies have reported error variance for the ODD dimensions ranging from 12% to 27% (Gomez et al., 2003), and 21% to 36% (Keogh, 2002). Unlike the current study, these studies were conducted across settings (i.e., home and school), which may account for the higher unexplained variance. Similar to the findings for Study 2, an unpublished study by Smith (2003) reported error variance ranging from 10% to 37% for the AD/HD dimensions based on parent and adolescent (i.e., self-report) ratings in the home setting.

Due to the high correlations between the IN, H/I, and ODD factors in the postulated model, discriminant validity of traits was not supported in the current study. Study 2 provided correlations of .62 between IN and H/I, .49 between IN and ODD, and

.57 between H/I and ODD. Recent CFA MT-MS studies have been mixed as several studies have provided support for the discriminant validity of the IN and H/I dimensions at the individual level (Burns, Walsh et al., 2003; Gomez et al., 2003; Tallent, 2003), whereas other studies have provided minimal support (Keogh, 2002; Smith, 2003). Smith (2003) examined the AD/HD symptoms in the home setting based on adolescent (i.e., self-report) and parent ratings. She reported a correlation between the IN and H/I dimensions of .37, which was lower than the correlation reported in Study 2 (e.g., .62). Similar to the moderate correlations between the AD/HD and ODD dimensions reported in Study 2, other CFA MT-MS studies have provided moderate to high correlations ranging between .20 and .43 for IN and ODD, and .62 and .74 between H/I and ODD (Gomez et al., 2005; Keogh, 2002). Unlike Study 2, these recent studies were based on parent and teacher ratings of the AD/HD and ODD dimensions.

Although discriminant validity of sources (i.e., mother and father) was not supported at the matrix level, Study 2 provided support for the discriminant validity of sources at the symptom parcel level. The correlation of .36 between sources in Study 2 is consistent with previous CFA MT-MS findings that have found moderate correlations of .32 and .52 (Gomez et al., 2003), .43 (Tallent, 2003), and .51 (Smith, 2003) between parent and teacher sources. Given the same rating scale was used in the current study to evaluate the child's behaviour, moderate correlations were expected between mother and father (Byrne, 1994).

In summary, Study 2 provided support for the convergent and discriminant validity of the AD/HD and ODD traits at the matrix level. In contrast, support was not provided for the discriminant validity of mother and father sources. At the symptom

parcel level, there was strong support for the convergent validity of the IN and H/I dimensions for mother and father ratings. Although there was support for the convergent validity of the ODD dimension for mother ratings, there was only partial support for the ODD dimension for father ratings. Due to the high correlations between the IN, H/I, and ODD factors, discriminant validity of traits was not supported at the symptom parcel level. Finally, support was provided for the discriminant validity of mother and father sources at the symptom parcel level.

CHAPTER 6: STUDY 3 OF THE CURRENT THESIS – AIMS, HYPOTHESES, METHODOLOGY, RESULTS AND A BRIEF DISCUSSION

1. Introduction

Chapter 6 provides the background, hypothesis, aims, methodology, results and a brief discussion for Study 3, involving an investigation of the relationships between the AD/HD and ODD trait dimensions with each other and with other trait dimensions using the CFA MT-MS approach based on mother and father ratings. Part 1 will provide the aims and hypotheses for Study 3 and Part 2 will include details of the methodology for Study 3. Given that the procedure for Study 3 was the same as that used for Studies 1 and 2, only a brief description will be provided. In the measure section, only a brief description of the Disruptive Behaviour Questionnaire will be provided as details of the measure were outlined for Study 1 (refer to Chapter 4). Part 3 will present the results of Study 3, which will include the trait correlations of the IN, H/I, and ODD dimensions with academic performance, prosocial behaviour, emotional problems, and peer problems. Part 4 will include a brief discussion of the findings from Study 3.

2. Part 1: Aims and Hypotheses of Study 3

As outlined in Chapter 2, previous studies have reported an association between the IN, H/I, and ODD dimensions with academic performance, prosocial behaviour, emotional problems, and peer problems. For instance, IN has been found to be related to poor academic performance (DuPaul, 1991; Lahey, Applegate, McBurnett et al., 1994; Molina et al., 2001). However, these findings should be viewed with caution as source effects have not been taken into consideration. However, recent studies using the MT-

MS approach to investigate the external validity of the AD/HD and ODD dimensions have accounted for source effects (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003). For instance, Keogh (2002) investigated the external validity of the IN, H/I, and ODD dimensions. She found that IN correlated significantly and negatively with academic performance and prosocial behaviour. Although H/I and ODD also correlated significantly and negatively with academic performance, it was to a lesser degree. Finally, ODD correlated significantly and positively with emotional problems and peer problems. However, based on strong source variance in the AD/HD and ODD dimensions, the correlations with other trait dimensions appear to capture mostly source correlations rather than trait correlations. Strong source variance in the IN, H/I, and ODD dimensions may be due to cross-situational differences, as the findings were based on parent and teacher ratings comparing the child's behaviour at home and school. To date, there are no known studies that have incorporated the MT-MS approach to examine childhood behaviour in the same situation (i.e., home) based on mother and father ratings, thereby addressing problems associated with cross-situational differences.

Study 3 will examine the external validity of the IN, H/I, and ODD dimensions to determine the relationships between the trait dimensions of IN, H/I, and ODD with the trait dimensions of academic performance, prosocial behaviour, emotional problems, and peer problems, once source and error effects have been removed. In Study 3, it is expected that IN will be negatively correlated to academic performance and prosocial behaviour; and ODD will correlate positively with emotional problems and peer problems. Measurement error will be accounted for by reporting the trait correlation obtained from using the MT-MS procedure, which excludes both the source and error

variance from the reported correlation value. As discussed in Chapter 3, it was argued that source variance may lead to inflated correlations between the IN, H/I, and ODD dimensions.

Parcel items were constructed for each dimension as derived from the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), except for academic performance, which comprised only a single item. The symptom parcels for IN, H/I, and ODD were identical to those described previously for Study 2. Those parcels taken from the SDQ included Prosocial Behaviour – Parcel 1 (i.e., items 1, 9, and 20) and Parcel 2 (i.e., items 4 and 17); Emotional Problems – Parcel 1 (i.e., items 3, 13, and 24) and Parcel 2 (i.e., items 8 and 16), and; Peer Problems – Parcel 1 (i.e., items 6, 14, and 23) and Parcel 2 (i.e., items 11 and 19). The relationships between IN, H/I, and ODD, and academic performance, prosocial behaviour, emotional problems, and peer problems was examined separately using the postulated model (i.e., MT-MS Model 1). As seen in Figure 12, the relationship with the IN, H/I, and ODD trait dimensions are examined with the trait dimension of academic performance.

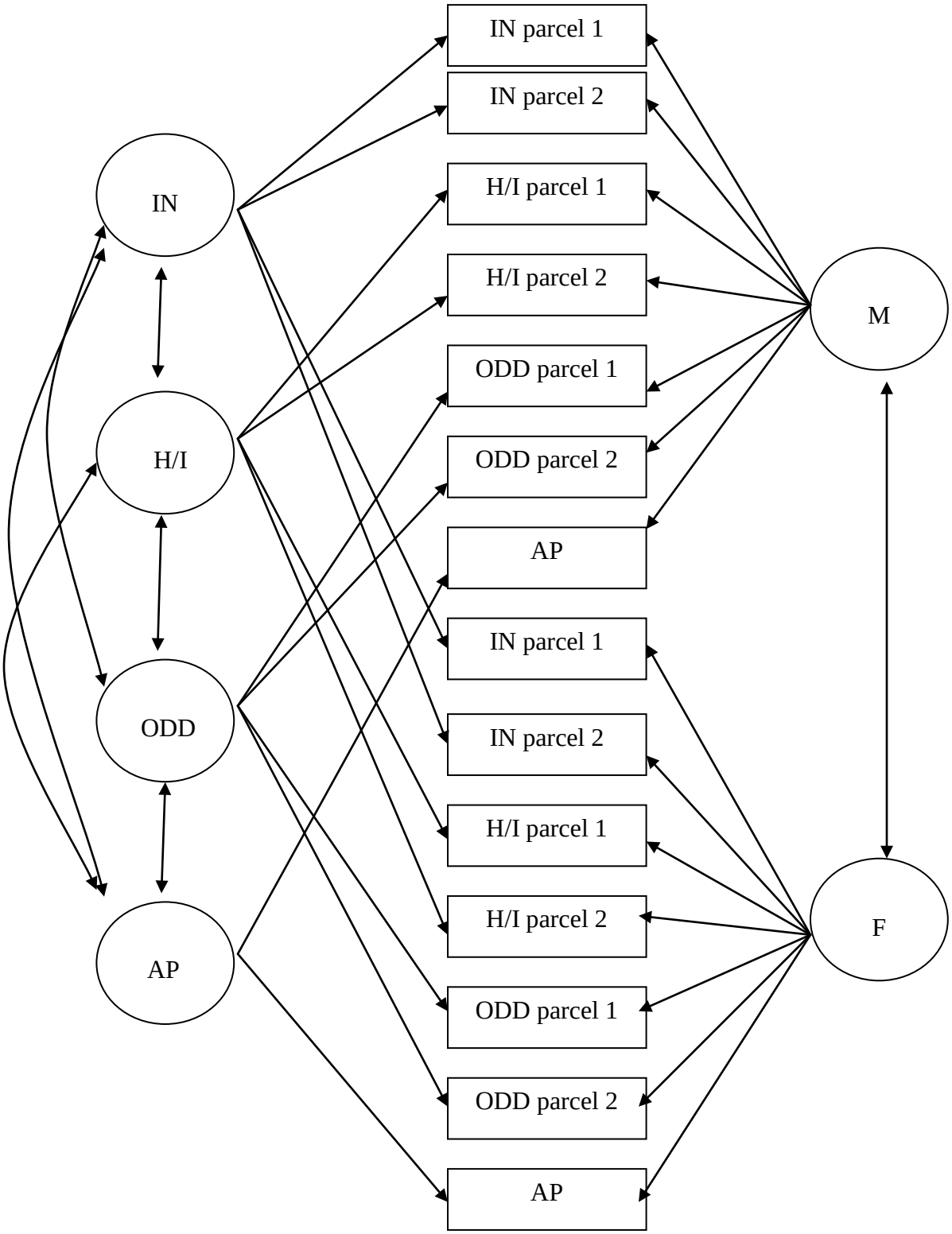

Figure 12: *Postulated Multitrait-Multisource Model (MT-MS Model 1; Freely Correlated Traits, Freely Correlated Sources) including IN, H/I, ODD, and academic performance (AP). Note: AP is provided as an example; a similar model would be used for the other correlated traits.*

3. Part 2: Methodology of Study 3

3.1 Participants

Study 3 included those families from Study 1 in which both mother and father had completed questionnaires for the same child. In total, 205 observations of paired mother and father ratings were obtained. Similar to Study 1, children ranged from Grade 1 through to Grade 6 and were recruited from 6 different schools (refer to Chapter 4 for a more detailed description of participants). The demographic details of the participants are the same as those provided for the father-rated group of children in Table 9 (see Chapter 4).

3.2 Measures

3.2.1 Disruptive Behaviour Questionnaire

As previously described for Study 1, the DBQ was used to obtain mother and father ratings of the 18 AD/HD symptoms and the 8 ODD symptoms as presented in the DSM-IV (refer Appendix B). For a full description of the DBQ, refer to Chapter 4 of the current thesis.

3.2.2 Strengths and Difficulties Questionnaire

The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997) was used to provide ratings for emotional problems, peer problems, and prosocial behaviour (refer Appendix G). The items and the subscales in the SDQ are based on current nosological concepts including the DSM-IV and factor analysis (Goodman, 2001). The SDQ has 25 items and provides measures of hyperactivity (e.g., items 2, 5, 15, 21, and 25), conduct

problems (e.g., items 7, 10, 12, 18, and 22), emotional problems (e.g., items 3, 8, 13, 16, and 24), peer problems (e.g., items 6, 11, 14, 19, and 23) and prosocial behaviour (e.g., items 1, 4, 9, 17, and 20). The 25 items of the SDQ include 10 items that are worded in a way to reflect the strengths of the child, and 15 items that reflect the weaknesses of the child. The items are rated by the respondent on a 3-point Likert scale of the following: "not true", "somewhat true", and "certainly true". The SDQ is considered appropriate for children and adolescents ranging from ages 4 to 16. The teacher and parent versions of the SDQ are identical. All scales, except for prosocial behaviour, are summed to generate a total difficulties score (Goodman & Scott, 1999).

The SDQ has previously demonstrated moderate to good reliability (e.g., internal consistency, test-retest, and inter-rater agreement) and predictive validity (i.e., specific subscales had the ability to predict the presence or absence of diagnoses appropriate to a given scale). In a study of 403 children from dental and psychiatric clinics, the SDQ was administered together with the Rutter questionnaires (Rutter, 1967; Rutter, Tizard, & Whitmore, 1970; Schachar, Rutter, & Smith, 1981). Scores from the SDQ and Rutter questionnaires were highly correlated and the measures were similar in their ability to differentiate between a psychiatric and dental clinic samples. Furthermore, parent-teacher correlations for the SDQ and the Rutter questionnaires were comparable, slightly favouring the SDQ. Compared to the Child Behaviour Checklist (Achenbach, 1991), the SDQ has also shown favourable results. In a study by Goodman and Scott (1999), mothers of 132 children aged 4 to 7 years were recruited from psychiatric and dental clinics and completed the SDQ and the CBCL. The measures were highly correlated and were equally able to discriminate psychiatric from dental cases. The SDQ was also

significantly more effective than the CBCL at detecting IN and H/I, and as equally effective as the CBCL at detecting internalising and externalising problems. There was also a preference by mothers of low-risk children to use the SDQ in favour of the CBCL.

Australian-based studies have generally supported the reliability and validity of the SDQ. In a sample of 910 children aged 7 to 17 years, parents and teachers completed versions of the SDQ and again two weeks later for a subsample of 120 children (Mellor, 2004). The results showed that the SDQ indicated acceptable internal reliability with Cronbach's alpha values of above .70 for each subscale except for conduct problems (.67) and for the total difficulties scores for parent and teacher versions. Regarding both older and younger children, all alpha values were above .60 except for peer problems (.59 and .55, respectively; Mellor, 2004, 2005). Sound interinformant and test-retest reliabilities was also demonstrated with significant interinformant correlations and test-retest correlations (p <.01) for the total difficulties scale and the subscales for the parent, teacher, and child versions of the SDQ (Mellor, 2004). Mathai, Anderson, and Bourne (2003) examined the usefulness of the SDQ for 130 participants in a community child and adolescent mental health service. These participants were then retested after a 6-month period. The SDQ demonstrated clinical validity when compared to the Health of the Nation Outcome Scales for Children and Adolescents (HoNOSCA). In summary, the SDQ is a measure of hyperactivity, conduct problems, emotional problems, peer problems, and prosocial behaviour. Its psychometric properties demonstrate moderate to good reliability and predictive validity.

3.2.3 Academic Performance

Academic performance was measured using a single item (refer Appendix C). Respondents were asked to indicate how well their child is performing at school in comparison to other children of a similar age. This is based on a 5-point Likert scale including the following: 1 = "failing", 2 = "below average", 3 = "average", 4 = "above average", and 5 = "well above average". This single question has been used in several recent MT-MS studies (Gomez et al., 2003; Keogh, 2002; Smith, 2003) and the results are consistent with the existing AD/HD literature in that the IN factor correlated negatively with the academic performance measure (Lahey, Applegate, McBurnett et al., 1994; Molina et al., 2001).

3.3 Procedure

Study 3 used the same procedure as documented for Study 1. As described in Chapter 4, ethics approval was obtained and the questionnaires were distributed to the children's parents for schools who agreed to participate in the research project. For those parents agreeing to participate, the questionnaires were returned to the student researcher via prepaid envelopes.

4. Part 3: Results of Study 3

Part 3 provides the results of the trait relationship between the IN, H/I, and ODD dimensions with academic performance, prosocial behaviour, peer problems, and emotional problems based on the CFA MT-MS approach. The current study performed CFA using LISREL 8.51 (Joreskög & Sorböm, 2001).

4.1 Data Screening and Descriptive Information for Academic Performance, Emotional Problems, Peer Problems, and Prosocial Behaviour

Tables 31 and 32 show the descriptive information including the mean, standard deviation, skewness, and kurtosis for academic performance, emotional problems, peer problems, and prosocial behaviour symptom parcels based on mother and father ratings. The results show mothers provided slightly higher ratings for emotional and peer problems than fathers, whereas fathers provided higher ratings for academic performance and prosocial behaviour compared to mothers. Based on the standard deviation, there was greater variability in the scores for mother-rated emotional problems compared to father-rated emotional problems, whereas father-rated peer problems and prosocial behaviour showed greater variability in scores than those provided by mothers. The variability in the academic performance scores based on the standard deviations were similar for mother and father ratings. The skewness and kurtosis values for mother and father ratings were within the normal range (Curran et al., 1996).

Table 31

Descriptive Information for Academic Performance, Emotional Problems, Peer Problems, and Prosocial Behaviour Symptom Parcels for Mother Ratings

Item	*M*	*SD*	Skewness	Kurtosis
Academic Performance	3.61	0.74	0.16	-0.42
Emotional Problems – Parcel 1	1.00	1.33	1.45	1.44
Emotional Problems – Parcel 2	0.99	1.11	1.03	0.33
Peer Problems – Parcel 1	2.50	0.90	0.74	0.96
Peer Problems – Parcel 2	2.17	0.69	0.39	1.87
Prosocial Behaviour – Parcel 1	1.03	1.24	1.19	0.96
Prosocial Behaviour – Parcel 2	0.59	0.87	1.66	2.98

Note: *M* = mean, *SD* = standard deviation

Table 32

Descriptive Information for Academic Performance, Emotional Problems, Peer Problems, and Prosocial Behaviour Symptom Parcels for Father Ratings

Item	*M*	*SD*	Skewness	Kurtosis
Academic Performance	3.71	0.76	-0.18	0.09
Emotional Problems – Parcel 1	0.90	1.16	1.37	1.46
Emotional Problems – Parcel 2	0.98	1.08	1.07	0.51
Peer Problems – Parcel 1	2.59	0.91	0.76	0.99
Peer Problems – Parcel 2	2.06	0.71	-0.01	1.64
Prosocial Behaviour – Parcel 1	1.16	1.40	1.33	1.43
Prosocial Behaviour – Parcel 2	0.72	0.95	1.20	0.85

Note: *M* = mean, *SD* = standard deviation

4.2 The Analytic Procedure for the CFA MT-MS Approach to Examining the External Validity of the AD/HD and ODD Dimensions

The relationship between trait dimensions IN, H/I, and ODD and academic performance, peer problems, emotional problems, and prosocial behaviour were examined separately using the CFA MT-MS approach. The procedure involved using a similar analysis to that used for MT-MS Model 1 at the matrix level for the IN, H/I, and ODD traits (i.e., freely correlated traits and freely correlated sources). However, it was different from MT-MS Model 1 as the other trait dimensions (e.g., academic performance) were separately entered as a fourth trait factor in five separate analyses. The trait, source, and error variance for the dimensions will not be presented for each

symptom parcel. Instead, the external validity shall be established by examining the trait correlations between IN, H/I, and ODD with academic performance, emotional problems, peer problems, and prosocial behaviour. As discussed previously, Fischer's (1921) *z* score will be provided to test the correlations between factors.

4.3 Correlations between Trait Dimensions IN, HI, and ODD and Academic Performance, Emotional Problems, Peer Problems, and Prosocial Behaviour

As seen in Tables 33, 34, 35, and 36, the matrices show the correlations that contain only trait variance. Therefore, the values are referred to as trait correlations. Both source and error variance has been removed by the using the CFA MT-MS procedure, producing latent scores instead of observed scores. Furthermore, the correlation values vary slightly between IN, H/I, and ODD in each analysis, due to the different external correlates influencing the relationship between the AD/HD and ODD dimensions.

4.4 Correlations between Trait Dimensions IN, H/I, and ODD and Academic Performance

Table 33 shows the association between trait dimensions IN, H/I, and ODD and academic performance. The results showed that academic performance was significantly and negatively correlated with IN. The trait correlation between academic and IN was significantly higher than the trait correlations between academic and H/I ($z = 4.89$, $p<.001$), and academic and ODD ($z = 4.58$, $p <.001$).

Table 33

Correlations between Trait Dimensions IN, HI, and ODD and Academic Performance

	Traits				Sources	
	IN	HI	ODD	AC	Mother	Father
IN	1.00					
HI	0.63*	1.00				
ODD	0.51*	0.59*	1.00			
AC	-0.57*	-0.16	-0.19	1.00		
Mother					1.00	
Father					0.25	1.00

Note: * = p <.001; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional behaviour; AC = academic performance

4.5 Correlations between Trait Dimensions IN, H/I, and ODD and Emotional Problems

Table 34 shows the association between trait dimensions IN, H/I, and ODD and emotional problems. The results showed that emotional problems were significantly and positively correlated with ODD. The trait correlation between emotional problems and ODD was significantly higher than the trait correlation between emotional problems and H/I (z = 3.44, p<.001).

Table 34

Correlations between Trait Dimensions IN, HI, and ODD and Emotional Problems

	Traits				Sources	
	IN	HI	ODD	EP	Mother	Father
IN	1.00					
HI	0.63*	1.00				
ODD	0.50*	0.58*	1.00			
EP	0.32	0.23	0.52*	1.00		
Mother					1.00	
Father					0.17	1.00

Note: * = p <.001; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional behaviour; EP = emotional problems

4.6 Correlations between Trait Dimensions IN, H/I, and ODD and Peer Problems

Table 35 shows the association between trait dimensions IN, H/I, and ODD and peer problems. The results showed that peer problems was significantly and positively associated with IN. The trait correlation between peer problems and IN was significantly higher than the trait correlation between peer problems and H/I (z = 8.64, p<.001).

Table 35

Correlations between Trait Dimensions IN, HI, and ODD and Peer Problems

	Traits				Sources	
	IN	HI	ODD	PP	Mother	Father
IN	1.00					
HI	0.61*	1.00				
ODD	0.47*	0.55*	1.00			
PP	0.37*	0.17	0.24	1.00		
Mother					1.00	
Father					-0.43	1.00

Note: * = p <.001; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional behaviour; PP = peer problems

4.7 Correlations between Trait Dimensions IN, H/I, and ODD and Prosocial Behaviour

Table 36 shows the association between trait dimensions IN, H/I, and ODD and prosocial behaviour. The results showed that prosocial behaviour was significantly and negatively correlated with ODD. The trait correlation between prosocial behaviour and ODD was significantly higher than the trait correlations between prosocial behaviour and IN (z = 3.51, p<.001), and prosocial behaviour and H/I (z = 4.16, p<.001).

Table 36

Correlations between Trait Dimensions IN, HI, and ODD and Prosocial Behaviour

	Traits				Sources	
	IN	HI	ODD	PS	Mother	Father
IN	1.00					
HI	0.65*	1.00				
ODD	0.53*	0.49*	1.00			
PS	-0.29	-0.23	-0.57*	1.00		
Mother					1.00	
Father					0.45*	1.00

Note: * = p <.001; IN = inattention; HI = hyperactivity/impulsivity; ODD = oppositional behaviour; PS = prosocial behaviour

4.8 A Summary of Findings for the CFA MT-MS Examination of the External Validity of the AD/HD and ODD Dimensions for Mother and Father Ratings

The MT-MS trait correlations showed that once source effects were removed, academic performance was significantly and negatively correlated with IN, emotional problems were significantly and positively correlated with ODD, peer problems was significantly and positively associated with IN, and prosocial behaviour was significantly and negatively correlated with ODD.

5. Part 4: Discussion of Study 3

Part 4 of this chapter addresses Study 3, which involved an investigation of the correlations between the trait effects of IN, H/I, and ODD and the trait effects of academic performance, prosocial behaviour, peer problems, and emotional problems using the CFA MT-MS approach based on mother and father ratings.

4.1 The Relationship between Trait Dimensions IN, H/I, and ODD and Academic Performance

The results of Study 3 showed that academic performance was significantly and negatively correlated with IN, which is consistent with the Gomez et al. (2003) study that reported an association between poor academic performance and IN. Several unpublished CFA MT-MS studies have also reported an association between poor academic performance and IN (Keogh, 2002; Smith, 2003), whereas several published correlational studies using raw scores have reported an association between poor academic performance with IN (Lahey, Applegate, McBurnett et al., 1994; Molina et al., 2001) and H/I (DuPaul, 1991). Other correlational studies using raw scores to investigate the AD/HD subtypes have also provided support for a relationship between low academic and IN as indicated by associations between academic difficulties and AD/HD – C (Gaub & Carlson, 1997; Lahey, Applegate, McBurnett et al., 1994; Morgan et al., 1996) and AD/HD – IN (Baumgaertel et al., 1995; McBurnett et al., 1999; Morgan et al., 1996; Wolraich et al., 1996).

4.2 The Relationship between Trait Dimensions IN, H/I, and ODD and Emotional Problems

The results of Study 3 showed that emotional problems were significantly and positively correlated with ODD. In a single unpublished CFA MT-MS study, Keogh (2002) also found emotional problems were significantly and positively related to ODD. In contrast to Study 3, previous correlational studies have found support for a positive association between emotional problems and IN. However, these findings are based on raw scores and do not reflect the true association between emotional problems and IN. For instance, Willcutt et al. (1999) reported a positive correlation between IN and higher depression scores for referred and non-referred samples. Although based on raw scores, previous studies investigating the AD/HD subtypes have also provided support for a positive relationship between emotional problems and IN as indicated by associations between anxiety and depression with AD/HD – C and AD/HD – IN (Eiraldi et al., 1997; Morgan et al., 1996).

4.3 The Relationship between Trait Dimensions IN, H/I, and ODD and Peer Problems

The results of Study 3 showed that peer problems was significantly and positively associated with IN. No previous MT-MS studies have showed an association between peer problems and IN. In an unpublished CFA MT-MS study by Keogh (2002), a significant and positive correlation was reported between peer problems and ODD. The differences in the results between the Keogh study and Study 3 may be expected given the different situations and sources used in the each study. In the Keogh (2002) study,

AD/HD symptoms and peer problem were examined in multiple situations (e.g., school and home) as rated by parents and teachers, whereas Study 3 examined the variables in a single setting (e.g., home) as rated by mothers and fathers.

Although there was a non-significant relationship between peer problems and H/I in Study 3, previous correlational studies using raw scores to investigate the AD/HD subtypes have provided support for a positive relationship between peer problems and H/I as indicated by associations between peer problems with AD/HD – C and AD/HD – H/I (Gaub & Carlson, 1997; Lahey, Applegate, McBurnett et al., 1994).

4.4 The Relationship between Trait Dimensions IN, H/I, and ODD and Prosocial Behaviour

The results of Study 3 showed that prosocial behaviour was significantly and negatively correlated with ODD, which is in contrast to previous CFA MT-MS studies and correlational studies. In two unpublished CFA MT-MS studies, IN was found to be significantly and negatively correlated with prosocial behaviour (Keogh, 2002; Smith, 2003). Previous correlational studies using raw scores to investigate the AD/HD subtypes have provided support for a negative relationship between prosocial behaviour and IN as indicated by associations between social impairment with AD/HD – C and AD/HD – IN (Gaub & Carlson, 1997).

CHAPTER 7: GENERAL DISCUSSION

1. Introduction

Chapter 7 will include a general discussion that addresses the implications of the results in relation to the DSM-IV conceptualisation of the AD/HD and ODD symptoms and the nature of source effects (i.e., accuracy versus bias debate). The findings of the current study will also be examined in relation to AD/HD and ODD assessment and suggestions for future studies will be provided. Finally, the major strengths and limitations of the current study will be addressed.

2. Part 1: Implications of the Current Findings

The findings of the current study have several implications for the conceptualisation, assessment, and future research of the AD/HD and ODD symptoms. Furthermore, the current study provides a better understanding of the nature of source effects in recent CFA MT-MS studies, which will be discussed in relation to the bias versus accuracy debate.

2.1 Accuracy Versus Bias View of Source Effects

As outlined in Chapter 2, recent CFA MT-MS studies have reported more source variance than trait variance in AD/HD and ODD symptoms when investigated across situations (i.e., home and school). Although generally lower than source variance, several recent CFA MT-MS studies have provided noticeable trait variance in the parent-rated IN and teacher-rated H/I symptoms (Burns, Gomez, Walsh, & De Moura, 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003). To date, there has been support

for minimal trait variance in the parent-rated H/I and teacher-rated IN. However, these studies have been based on parent and teacher ratings and have not taken cross-situational differences in childhood behaviour into consideration. Although the aim of Study 2 was to examine the construct validity of the AD/HD dimensions using mother and father ratings, it also addressed the cross-situational debate of AD/HD providing a better understanding of source effects. More specifically, the results of Study 2 can be used to determine if source effects represent mostly the characteristics of the rater (i.e., bias view) or source-specific behaviour (i.e., accuracy view).

As discussed in Chapter 3, the bias view suggests that source effects may represent a source specific bias (Bagozzi & Youjae, 1990; Kenny & Kashy, 1992). The high source variance reported in recent CFA MT-MS studies does not provide an accurate representation of the IN, H/I, and ODD symptoms. Therefore, the bias view suggests that source effects represent bias in parent and teacher ratings of the AD/HD and ODD dimensions. Alternatively, the accuracy view suggests that strong source effects may represent an accurate and contrasting view of the child's behaviour as held by different sources (Dishion et al., 2002; Dishion & Patterson, 1999; Lance et al., 2002).

As stated earlier, the results of Study 2 showed that once cross-situational differences were allowed for, there was strong trait variance in the AD/HD and ODD dimensions within the home setting. Study 2 indicated strong trait variance in the AD/HD symptoms supporting the construct validity of AD/HD indicating a consensual view of AD/HD behaviours in the home setting. In contrast, partial support was provided for the ODD behaviours in the home setting. This provides support for the accuracy view of source effects suggesting that recent CFA MT-MS studies (i.e., reporting mostly

source effects), which have investigated the construct validity of the AD/HD and ODD symptoms, are capturing meaningful differences in childhood behaviour rather than rater bias (Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003). Based on the findings of Study 2, it is argued that source effects appear to be mostly reflecting differences in AD/HD and ODD behaviours between the home and school setting rather than bias of parents and/or teachers.

Consistent with Study 2, Burns, Walsh et al. (2003) have recently argued for the accuracy view of source effects rather than the bias view. As outlined in Chapter 3, Burns, Walsh et al. examined the construct validity of the IN and H/I dimensions across a 3-month interval based on parent and teacher ratings. They reported strong source variance in the AD/HD symptoms that was consistent across a 3-month interval, in which the researchers interpreted that source effects in the current AD/HD rating scales should be viewed as accuracy rather than bias (i.e., most of the source effects represent the situational specificity of the child's behaviour rather than a form of bias associated with the characteristics of the rater).

2.2 Implications for the Conceptualisation of the DSM-IV AD/HD and ODD Symptoms

Study 1 provided support for the 2-factor model of AD/HD, which is consistent with the DSM-IV organisation of the AD/HD symptoms including separate dimensions of IN and H/I (APA, 1994). The strong trait variance in the IN and H/I dimensions reported in Study 2 indicates that when cross-situational differences are accounted for, the current

AD/HD rating scales are capturing mostly trait effects, thus providing support for the DSM-IV organisation of the AD/HD symptoms.

The DSM-IV also requires that the AD/HD symptoms be evident across two or more settings (i.e., home and school; APA, 1994). However, recent published and unpublished CFA MT-MS studies have shown that once source effects are removed, the IN and H/I dimensions are not represented equally across the home and school settings (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Keogh, 2002; Smith, 2003). This raises questions regarding the current DSM conceptualisation of AD/HD that requires the IN and H/I symptoms to be present in multiple settings (APA, 1994). Instead it could be argued that the AD/HD symptoms should be considered more situational specific rather than cross-situational (i.e., home and school). However, the current study did not address the DSM-IV cross-situational nature of the AD/HD symptoms as childhood behaviour was examined only in the home setting and not the school setting.

For ODD, Studies 1 and 2 showed only partial support for the DSM-IV organisation of the ODD symptoms as previously discussed. Although support was provided for the 1-factor model for mother ratings, only partial support was provided for the 1-factor model for father ratings for Studies 1 and 2. Recent CFA MT-MS studies have also provided partial support for the construct validity of the ODD dimension (Gomez et al., 2005; Keogh, 2002). More specifically, Gomez et al. (2005) provided support for strong trait variance in teacher-rated ODD, Keogh (2002) provided support for the strong trait variance in parent-rated ODD.

2.3 Implications for Understanding the Relationship Between Trait Dimensions IN, H/I, and ODD and Academic Performance, Prosocial Behaviour, Peer Problems, and Emotional Problems

Due to the strong trait variance in the AD/HD and ODD dimensions outlined in Study 2, the correlations presented in Study 3 between the trait dimensions of IN, H/I, and ODD, and academic performance, emotional problems, peer problems, and prosocial behaviour are considered meaningful (i.e., correlations between constructs are mostly due to trait variance rather than source or error variance).

As previously discussed, past EFA and CFA studies have provided support for associations between the AD/HD and ODD dimensions with other dimensions (e.g., academic problems). However, these studies have produced unclear results as the findings are derived from a single source and the relationship between the AD/HD and ODD dimensions contain varying amounts of trait and source variance. Recent CFA MT-MS studies have provided a trait correlation by removing the source and error variance from the constructs under investigation. The findings indicate large discrepancies between the raw score correlations and trait correlations of IN and H/I with other constructs. For instance, Gomez et al. (2003) reported significant correlations between IN and H/I with academic problems using the raw score correlation procedure. However, when source and error variance was removed, academic problems were significantly correlated with IN (r = .60), but non-significantly correlated with H/I (r = .02). This puts into question the findings of previous EFA and CFA studies that have reported correlations between the AD/HD and ODD dimensions with other associated features based on the raw score correlation procedure.

Based on the findings from Study 2 supporting the accuracy view of source effects, it is argued that the relationships the AD/HD and ODD trait dimensions have with each other and with other trait dimensions should be considered meaningful. Therefore, recent CFA MT-MS studies, which have reported the relationships between the AD/HD and ODD dimensions with other dimensions (e.g., academic performance), should be viewed as a clearer representation of the relationship between constructs and not rater bias (Gomez et al., 2003; Keogh, 2002; Smith, 2003). For instance, although Gomez et al. (2003) reported that IN was associated with academic problems based on teacher and parent ratings, the IN dimension contained strong source variance. This would suggest that the relationship between the two dimensions is contaminated with source effects according to the bias view of source effects. However, according to the accuracy view of source effects, the relationship between IN and academic problems is considered meaningful due to the differences in the two dimensions in the home and school setting, and not bias in parent and teacher ratings.

3. Part 2: Implications for the Assessment of AD/HD and ODD

The current findings have several implications for the assessment of AD/HD and ODD. The current research is the first known study to examine the construct validity of the AD/HD and ODD dimensions using the CFA MT-MS approach based on mother and father ratings. Previous parent-rated EFA and CFA studies investigating the AD/HD and ODD symptoms in children have been predominantly based on mother ratings (Beiser et al., 2000; Boe, 1997; Burns et al., 2001; Burns & Patterson, 1991; Burns et al., 1997b; DuPaul, 1991; DuPaul et al., 1998; Gomez et al., 2003; Molina et al., 2001; Sherman et

al., 1997; Smith, 2003). To date, there have been no known published studies that have used fathers alone to rate AD/HD and ODD symptoms. However, the current study indicated that it is appropriate for mothers or fathers to rate AD/HD behaviours in children. The findings of Study 2 support the DSM-IV conceptualisation that is non-specific as to who should rate the AD/HD symptoms in the home setting (APA, 1994). For ODD, the current study indicated that mothers provide more accurate ratings of ODD behaviour compared to fathers.

4. Part 3: Implications of the Current Findings for Future Research on AD/HD and ODD

Given the problems previously outlined with EFA and CFA studies using single source ratings, the current study highlights the importance of using multiple sources to investigate childhood behaviour in order to separate trait variance from source variance. Although Study 2 determined that there was a consensual view of childhood behaviour at home, this was not examined in the school setting. Therefore, one must be cautious generalising the findings of Study 2 to the school setting.

It is recommended that future studies use the MT-MS approach to investigate the construct validity of the AD/HD and ODD dimensions in both the home and school setting using multiple sources (Burns & Haynes, in press; Gomez et al., 2005). Sources would include teacher and teacher aide in the school setting, and mother and father in the home setting. Strong trait variance for mother and father ratings, and teacher and teacher aide ratings would provide support for the accuracy view of source effects. In contrast, strong source variance for mother and father ratings, and teacher and teacher aide ratings

would provide support for the bias view of source effects. Although this study design evaluates the AD/HD and ODD dimensions within situations (i.e., home and school), the design could be further developed with the inclusion of multiple methods to evaluate the AD/HD and ODD dimensions across settings.

This more sophisticated design would consist of multiple traits (e.g., IN, H/I, and ODD), multiple sources (e.g., mothers, fathers, teachers, and teacher aides), and multiple methods (e.g., direct observation and rating scales). For each dimension (e.g., IN, H/I, and ODD), such a design would provide the amount of variance due to trait, source, method, and error. Support would be provided for the accuracy view of source effects if the parent and teacher source effects were strong compared to trait and method effects. In contrast, support would be provided for the bias view of source effects if the parent and teacher source effects were weak compared to trait and method effects. However, there are several complexities involved in the use of multiple methods that need to be considered in this type of analysis (see Burns & Haynes, in press).

Given the results of the current study, the most likely outcome would be support for the construct validity of the IN, H/I, and ODD dimensions, due to strong trait variance compared to source variance. In the same settings (i.e., home or school), similar ratings (i.e., strong trait variance in the IN, H/I, and ODD dimensions) between teachers and teacher aides, and mothers and fathers would indicate that that the AD/HD and ODD dimensions are situational specific providing support for the accuracy view. Across settings (i.e., home and school), strong parent and teacher source effects compared to trait and method effects would also indicate support for the accuracy view instead of the bias view of source effects. In contrast, strong source variance in the IN, H/I, and ODD

dimensions would reflect different ratings between teachers and teacher aides, and mother and fathers providing support for the bias view. For the outcome supporting the bias view, additional research would be required to determine the specific factors responsible for the bias for mother and father, and teacher and teacher aide sources. Further support for the bias view would be provided if parent and teacher source effects were weak compared to trait and method effects.

More studies are also required that incorporate the CFA MT-MS design into studies with clinical samples to address the cross-situational nature of the AD/HD symptoms. It may be the case that AD/HD and ODD trait dimensions across-settings have stronger convergent validity in referred than non-referred samples (DuPaul, 2003). It is argued that children without AD/HD or ODD (i.e., non-referred sample) may tend to exhibit situation-specific behaviours and be less consistent over time (DuPaul, 2003). To date, only one unpublished study was located that has used the CFA MT-MS method to investigate the construct validity of the AD/HD dimensions in a clinical sample based on parent and teacher ratings (Tallent, 2003). Tallent (2003) reported that trait variance was stronger than source variance in teacher-rated H/I and parent-rated IN, which was consistent with previous CFA MT-MS studies for community samples (Burns, Walsh et al., 2003; Gomez et al., 2003; Gomez et al., 2005; Smith, 2003).

In Study 3, the trait correlations were examined for IN, H/I, and ODD dimensions with each other and with other trait dimensions. Although the findings included trait correlations once source and error variance was removed, Study 3 did not compare trait, source, and error variance for academic performance, emotional problems, peer problems, and prosocial behaviour. This was not the focus of the current thesis as the

aim was to investigate the construct validity of the AD/HD and ODD dimensions. It is recommended that future studies examine the amount of trait, soure, and error variance in the dimensions of academic performance, emotional problems, peer problems, and prosocial behaviour to determine if similar kinds of variance exists as what was identified for the IN, H/I, and ODD dimensions in the current project.

Finally, given that the trait correlations between IN and HYP were higher than HYP and IMP in Study 1 (see Chapter 4), it was suggested that within-situations there is a stronger relationship between IN and HYP compared to HYP and IMP and across-situations there is a stronger relationship compared to HYP and IMP compared to IN and HYP. This needs to be explored further by examining the AD/HD symptoms using the MT-MS procedure in single settings (i.e., home or school). Furthermore, based on the findings of Study 1, it is recommended that a 2-factor model including separate dimensions of IN/HYP and IMP be tested using the CFA procedure to determine if it is a better fit to the data than the 2-factor model of IN and H/I.

5. Part 4: Strengths and Limitations of the Current Study

The current study had several strengths and limitations that will be addressed in this section. The limitations of the current study will be presented and then followed by the strengths of the current study. First, the use of mothers and fathers to rate the child's behaviour may be problematic due to the possible lack of independence of the sources. However, it is believed that the independence of sources was maintained in the current study. It was recommended by Burns, Walsh et al. (2003) that verbal communication between mothers and fathers should be controlled so as to not influence the other in the

perception of the child's behaviour. This was addressed in the current study by informing the respondents several times in the information package of the importance of completing the questionnaires on their own. Furthermore, in parent newsletters that were distributed prior to the distribution of the questionnaires, mothers and fathers were told of the importance of completing the questionnaires independently and without discussion with their partners. Although it may be the case that this did not occur, future studies could choose a sub-sample (e.g., 100 participants) to complete the questionnaires in the presence of the researcher and compare the results to the overall sample.

Second, the sample used in the current study was derived from children of elementary and independent schools between the ages of 6 and 13 years. Therefore, the findings may not be generalisable to other samples (e.g., clinical samples and children outside the age range of the current study). For instance, AD/HD and ODD items would be higher in a clinical sample rather than community samples (APA, 1994). Furthermore, the influence of age and gender could also influence results, given that AD/HD and ODD symptoms are more commonly found in boys rather than girls (DuPaul et al., 1997; DuPaul et al., 1998; Gadow et al., 2001; Gomez et al., 1999; Graetz et al., 2001; Rohde et al., 1999), and younger children demonstrate higher levels of AD/HD symptoms (DuPaul et al., 1997). Although recent CFA MT-MS studies have showed that the IN and H/I dimensions are stable across different cultures (Gomez et al., 2003; Gomez et al., 2005), the influence of ethnicity and culture were not addressed in the current study. Third, the use of symptom parcels instead of individual AD/HD and ODD symptoms prohibited the investigation of the trait, source, and error variance at the individual symptom level. It also should be noted that only approximately 20% of mothers and 13% of fathers

returned questionnaires from the schools targeted. This may indicate that there may have been a sample selection bias.

Furthermore, academic performance was measured using a single item asking mothers and fathers to rate their child's school performance compared to other children of a similar age. The parent ratings were based on a 5-point Likert scale. Similar CFA MT-MS studies have rated academic performance based on multiple scales (Gomez et al., 2003). For instance, Gomez et al. (2003) examined the relationship between IN and H/I with academic performance by using five different measures of academic performance based on parent and teacher ratings. Measures included quality of homework, reading, arithmetic, and writing. Teachers also used the children's classroom work to measure academic performance. In contrast, recent unpublished CFA MT-MS studies have measured academic performance based on a single item and have provided similar findings to previous studies that have used multiple items to measure academic performance (Keogh, 2002; Smith, 2003).

There are also several strengths of the current study. This is the first known CFA MT-MS study to investigate the AD/HD and ODD dimensions based on mother and father ratings. To date, no previous CFA MT-MS studies have examined how fathers rate AD/HD and ODD symptoms. The current study also provided a clearer picture of the relationship between the IN, H/I, and ODD trait dimensions with other trait dimensions including academic performance, emotional problems, peer problems, and prosocial behaviour. To date, there have been no reported studies that have examined the relationship between these trait dimensions based on mother and father ratings.

Furthermore, it was unknown if strong source effects reported in recent CFA MT-MS studies examining the AD/HD and ODD dimensions across situations were due to accuracy or bias. This issue was addressed in the current study by using mother and father ratings of the AD/HD and ODD dimensions and allowing for cross-situational differences. The current findings indicated that once cross-situational differences were addressed, source variance was reduced and trait variance was increase in the IN, H/I, and ODD dimensions. With the exception of Burns, Walsh et al. (2003), the nature of source effects in the IN, H/I, and ODD dimensions has not been explored in recent CFA MT-MS studies.

6. Part 5: Conclusion

Based on single source ratings, Study 1 provided support for the DSM-IV conceptualisation of AD/HD including separate dimensions of IN and H/I. For the DSM-IV ODD, only partial support was provided. At the matrix level, Study 2 provided support for the convergent validity of the IN, H/I, and ODD dimensions for mother and father ratings, but support was not provided for the discriminant validity of sources. At the symptom parcel level, support was provided for the convergent validity of the separate IN and H/I dimensions and only partial support was provided for the ODD dimension. Although discriminant validity of sources was supported at the symptom parcel level, support was not provided for the discriminant validity of traits. The findings of Study 2 also provided support for the accuracy view, which states that source effects should be considered as meaningful differences in childhood behaviour rather than rater bias. Study 3 provided support for the external validity of the IN, H/I, and ODD trait

dimensions. Future studies were also recommended including the use of the CFA MT-MS approach to investigate the construct validity of the AD/HD and ODD dimensions in both the home and school setting using multiple sources and methods. Limitations of the current study included the generalisability of the results, the use of symptom parcels, and a single item measure of academic performance. The strengths of the current study included the use of father and mother ratings, and the CFA MT-MS design that addressed the cross-situational debate. Thus, it provided a greater understanding of source effects identified in recent CFA MT-MS studies.

In conclusion, there has been considerable debate regarding the validity of the AD/HD and ODD dimensions. It was my aim to contribute to AD/HD and ODD research by providing evidence supporting the existence of AD/HD by using a sophisticated statistical method that incorporated both mother and father views of the AD/HD and ODD symptoms. Furthermore, the current study also provided support indicating that the AD/HD and ODD behaviour should not be perceived as bias of the parents in viewing their child's behaviour, but meaningful problematic behaviour demonstrated by their children in the home setting.

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APPENDIX A

DSM-IV-TR criterion for AD/HD and ODD

Attention-Deficit/Hyperactivity Disorder

A. Either (1) or (2):

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

Inattention

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

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

Hyperactivity

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

Impulsivity

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

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

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

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

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

Oppositional Defiant Disorder

A. A pattern of negativistic, hostile, and defiant behaviour lasting at least 6 months, during which four (or more) of the following are present:

(1) often loses temper
(2) often argues with adults
(3) often actively defies or refuses to comply with adults' requests or rules
(4) often deliberately annoys people
(5) often blames others for his or her mistakes or misbehaviour
(6) is often touchy or easily annoyed by others
(7) is often angry and resentful
(8) is often spiteful or vindictive

Note: Consider a criterion met only if the behaviour occurs more frequently that is typically observed in individuals of comparable age and developmental level.

B. The disturbance in behaviour causes clinically significant impairment in social, academic, or occupational functioning.

C. The behaviour does not occur exclusively during the course of a Psychotic or Mood Disorder.

D. Criteria are not met for Conduct Disorder, and, if the individual is age 18 years or older, criteria are not met for Antisocial Personality Disorder.

APPENDIX B

PLEASE COMPLETE AND RETURN IN ENVELOPE **DISRUPTIVE BEHAVIOUR QUESTIONNAIRE**

Instructions: Please circle the number next to each item that best describes the behaviour of this child during the past 6 months

Item	Not at all	Just a little	Pretty much	Very much
1. Fails to give close attention to details or makes careless mistakes in his/her work	0	1	2	3
2. Fidgets with hands or feet or squirms in seat	0	1	2	3
3. Has difficulty sustaining his/her attention in tasks or fun activities	0	1	2	3
4. Leaves his/her seat in classroom or in other situations in which seating is expected	0	1	2	3
5. Doesn't listen when spoken to directly	0	1	2	3
6. Seems restless	0	1	2	3
7. Doesn't follow through on instructions and fails to finish work	0	1	2	3
8. Has difficult engaging in leisure activities or doing fun things quietly	0	1	2	3
9. Has difficulty organising tasks and activities	0	1	2	3
10. Seems "on the go" or "driven by a motor"	0	1	2	3
11. Avoids, dislikes, or is reluctant to engage in work that requires sustained mental effort	0	1	2	3
12. Talks excessively	0	1	2	3
13. Loses things necessary for tasks or activities	0	1	2	3
14. Blurts out answers before questions have been completed	0	1	2	3
15. Is easily distracted	0	1	2	3
16. Has difficulty awaiting turn	0	1	2	3
17. Is forgetful in daily activities	0	1	2	3
18. Interrupts or intrudes on others	0	1	2	3
19. Loses temper	0	1	2	3
20. Argues with adults	0	1	2	3
21. Actively defies or refuses to comply with adults requests or rules	0	1	2	3
22. Deliberately annoys people	0	1	2	3
23. Blames others for his/her mistakes or misbehaviour	0	1	2	3
24. Is touchy or easily annoyed by others	0	1	2	3
25. Is angry or resentful	0	1	2	3
26. Is spiteful or vindictive	0	1	2	3

APPENDIX C

PLEASE RETURN IN ENVELOPE

BACKGROUND INFORMATION: Please circle the appropriate answer or fill in the blank

1. Your relationship to child: Mother Father Other:

2. Age of your child:

3. Sex of your child: Female Male

4. Child currently lives with:

Mother and Father; Mother only; Father only; Mother and Stepfather;

Father and Stepmother; Grandparents; Foster Parents; Other:

6. Highest grade you finished:

7. Your current/last occupation:

8. How well does your child perform at school compared with other children of a similar age:

Failing below average average above average well above average
average

9. This questionnaire was completed by me alone: Yes No

APPENDIX D

UNIVERSITY OF BALLARAT
PLAIN LANGUAGE STATEMENT
FOR PRINCIPALS

Project Title: A Comparison of Mother and Father Ratings of Childhood Behaviours at Home

Student Researcher: Steve Carroll, Doctor of Psychology Student
Staff Supervisor: Assoc. Professor Rapson Gomez, School of Behavioural and Social Sciences and Humanities.

My name is Steve Carroll and I am currently undertaking a project as part of the Doctor of Psychology course at the University of Ballarat. My supervisor's name is Associate Professor Rapson Gomez. The project aims to investigate children's behaviour at home and compare how different caregivers view child behaviour. Although you will not receive direct benefit, as a result of this project health professionals will have a better understanding of childrens' behaviour at home and how their behaviour should best be assessed.

We hope to recruit mothers and fathers (or caregivers) of primary school children aged between 6 and 11 years for this study. Attached is a copy of the ethics approval from the University of Ballarat Human Research Ethics Committee for this study. This project involves recruiting private school students, and to have their mothers and fathers (or caregivers) complete several questionnaires taking between 10-15 minutes. The mothers and fathers of children from participating schools will be provided with an information package. This includes information about the study, background information about the child and parents, and questionnaires covering the behaviour of the child at home (see attached). We will cover all costs and materials for the study.

If mothers and fathers agree to participate, they will then be requested to complete the questionnaires regarding their childrens' behaviour at home. Even if only one parent or caregiver decides to participate, their data is still valuable to the project. All parents will be informed that they will be free to withdraw consent and discontinue participation from this study at any time. When the questionnaires are completed mothers and fathers will be requested to return both the questionnaires and consent forms to the University of Ballarat, in a prepaid self-addressed envelope provided by the student researcher, free of cost. I would like to ensure the data provided by all participants is confidential, as no information provided will be disclosed in any form to anyone and parents are not required to provide their name or their child's name on any of the questionnaires. To further ensure confidentiality, the questionnaires will be given a code number and all information will be examined together. At no stage of the study will parents or the school have access to individual information.

Principals will be requested to distribute the information packages (containing information and questionnaires) to the teachers for distribution to their pupils, with instruction to give them to their mothers and fathers. If requested by the school principal, the student researcher will personally distribute the questionnaires to the children during class, with permission from the class teacher. There will be minimal work required on part of the teacher, as they will only be requested to distribute the questionnaires to the children and parents will return completed questionnaires directly to the student researcher at University of Ballarat.

The questions that participants will be completing reflect everyday behaviours, and are not generally expected to cause undue distress. However, individuals who experience discomfort or distress during the course of completing the study will have the opportunity to contact my supervisor, Assoc. Professor Rapson Gomez, who is a clinical psychologist with specialist qualifications in child and adolescent behaviour problems. He will take the appropriate action to deal with any concerns, which will be provided without any cost to the individual participant.

I hope to hear from you soon, and I hope your school will be able to participate in this research project.

Steve Carroll
Doctor of Psychology Student
University of Ballarat

Any questions regarding this project can be directed to the Principal Researcher Assoc. Professor Rapson Gomez of the School of Behavioural and Social Sciences and Humanities on telephone number (03) 53279760. Should you have any concerns about the conduct of this research project please contact the Executive Officer, Human Research Ethics Committee, Scholarship and Educational Development Services Branch, University of Ballarat, PO Box 663, Mt Helen, VIC, 3353. Telephone (03) 53279765.

APPENDIX E

UNIVERSITY OF BALLARAT
PLAIN LANGUAGE STATEMENT
FOR MOTHERS AND FATHERS

Project Title: A Comparison of Mother and Father Ratings of Childhood Behaviours at Home

Student Researcher: Steve Carroll, Doctor of Psychology Student
Staff Supervisor: Assoc. Professor Rapson Gomez, School of Behavioural and Social Sciences and Humanities.

My name is Steve Carroll and I am currently undertaking a project as part of the Doctor of Psychology course at the University of Ballarat. My supervisor's name is Associate Professor Rapson Gomez. The project aims to investigate children's behaviour at home and compare how different caregivers view child behaviour. The project is very important to people who are working with primary school children. Although you will not derive any direct benefit, as a result of this project health professionals will have a better understanding of childrens' behaviour at home and how the behaviour should best be assessed.

The project involves collecting information from mothers and fathers (or primary caregivers). If you decide to take part in the study, you will be requested to anonymously complete several questionnaires regarding your child's behaviour at home. In total, the questionnaires will take between 10 to 15 minutes to complete. There are two sets of questionnaires, one for you and another for your spouse or partner. You are not required to provide your name or your child's name at any stage of the study. As this study would like to compare how mothers and fathers view their childrens' behaviour, **it is really important that you complete the questionnaires on your own so that we can get more reliable information. You can still take part in the study by returning the questionnaire even if your husband, wife, or partner chooses not to take part.**

Finally, you will be required to return the questionnaires to myself at the University of Ballarat in the stamped self-addressed envelope provided (please return both sets of questionnaires for each child in the same envelope). All questionnaires will be given a code number. No information about you or your child will be disclosed in any form to the school or anyone else and you will not be able to access your child's results. To further ensure your confidentiality, your data will be immediately entered into our master file, and all information will be examined together.

I acknowledge that the information asked of you is personal, and I appreciate that you may feel uncomfortable whilst participating in the study. If you do feel distressed at any stage, you are free to withdraw from the study. In the event you may feel distressed, you may contact my supervisor, Assoc. Professor Rapson Gomez, who is a clinical psychologist with specialist qualifications in child and adolescent behaviour problems. He will take the appropriate action to deal with any concerns.

Thank you for your assistance in this study.

Steve Carroll
Doctor of Psychology Student
University of Ballarat

Any questions regarding this project can be directed to the Principal Researcher Assoc. Professor Rapson Gomez of the School of Behavioural and Social Sciences and Humanities on telephone number (03) 53279760. Should you have any concerns about the conduct of this research project please contact the Executive Officer, Human Research Ethics Committee, Scholarship and Educational Development Services Branch, University of Ballarat, PO Box 663, Mt Helen, VIC, 3353. Telephone (03) 53279765.

APPENDIX F

UNIVERSITY OF BALLARAT

INFORMED CONSENT

4. **Code number (if any) allocated to the participant** . . . .

5. **Consent (fill out below)**

I. . . . . of . . . . . .

. . . . . .
hereby consent to participate as a subject in the above research study.

The research program in which I am being asked to participate has been explained fully to me, verbally and in writing, and any matters on which I have sought information have been answered to my satisfaction.

I understand that:

- all information I provide (including questionnaires) will be treated with the strictest confidence and data will be stored separately from any listing that includes my name and address
- aggregated results will be used for research purposes and may be reported in scientific and academic journals
- I am free to withdraw my consent at any time during the study in which event my participation in the research study will immediately cease and any information obtained from it will not be used.

SIGNATURE: . . . . . **DATE**: . . . . . .

APPENDIX G

Strengths and Difficulties Questionnaire P or T[4-10]

For each item, please mark the box for Not True, Somewhat True or Certainly True. It would help us if you answered all items as best you can even if you are not absolutely certain. Please give your answers on the basis of the child's behaviour **over the last six months or this school year**.

Child's name ..... Male/Female

Date of birth .....

	Not True	Somewhat True	Certainly True
Considerate of other people's feelings	☐	☐	☐
Restless, overactive, cannot stay still for long	☐	☐	☐
Often complains of headaches, stomach-aches or sickness	☐	☐	☐
Shares readily with other children, for example toys, treats, pencils	☐	☐	☐
Often loses temper	☐	☐	☐
Rather solitary, prefers to play alone	☐	☐	☐
Generally well behaved, usually does what adults request	☐	☐	☐
Many worries or often seems worried	☐	☐	☐
Helpful if someone is hurt, upset or feeling ill	☐	☐	☐
Constantly fidgeting or squirming	☐	☐	☐
Has at least one good friend	☐	☐	☐
Often fights with other children or bullies them	☐	☐	☐
Often unhappy, depressed or tearful	☐	☐	☐
Generally liked by other children	☐	☐	☐
Easily distracted, concentration wanders	☐	☐	☐
Nervous or clingy in new situations, easily loses confidence	☐	☐	☐
Kind to younger children	☐	☐	☐
Often lies or cheats	☐	☐	☐
Picked on or bullied by other children	☐	☐	☐
Often volunteers to help others (parents, teachers, other children)	☐	☐	☐
Thinks things out before acting	☐	☐	☐
Steals from home, school or elsewhere	☐	☐	☐
Gets along better with adults than with other children	☐	☐	☐
Many fears, easily scared	☐	☐	☐
Good attention span, sees tasks through to the end	☐	☐	☐

Signature ..... Date .....

Parent / Teacher / Other (Please specify:)

Thank you very much for your help