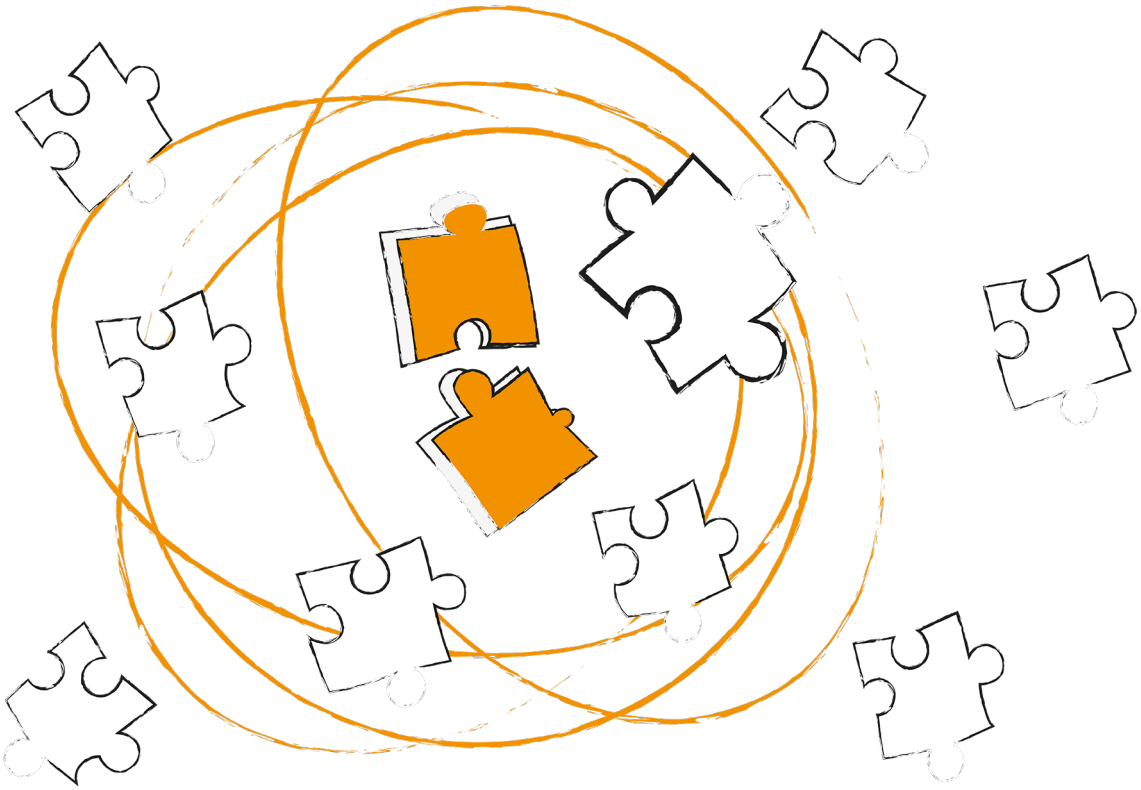
JYU DISSERTATIONS 723

Iines Palmu

The Negative Cycle

A Longitudinal Study of Externalising Behaviours, Learning Motivation and Academic Performance in School-Age Children



UNIVERSITY OF JYVÄSKYLÄ
FACULTY OF EDUCATION AND PSYCHOLOGY

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Iines Palmu

The Negative Cycle

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ABSTRACT

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This dissertation comprises three individual research articles investigating longitudinal mechanisms between different externalising behaviour symptoms, learning motivation, academic and social adjustment, and their prediction of later academic performance during later primary school years and during the transition to lower secondary school. This research is part of the ISKE longitudinal study, which followed 588 fifth-grade students until the end of seventh grade.

Study I examined the longitudinal interaction between a) externalising behaviour symptoms composite and academic performance, b) attention deficit hyperactivity disorder (ADHD) symptoms and academic performance and c) conduct disorder (CDs) symptoms and academic performance during the transition, while considering child- and family-related covariates (e.g., sex, standardised test scores and parental education level). Study II investigated concurrent and longitudinal associations between ADHD and CD symptoms (separately) with maladaptive achievement strategies (MAS) between fifth and sixth grades, and how they predict academic performance after school transition. Finally, Study III focussed on the mechanisms of how ADHD symptoms interact with social and academic adjustment and tax academic performance during the first year of lower secondary school, as well as possible sex differences in the mechanisms.

The results suggest that during this phase in education, ADHD symptoms in particular pose a significant risk for decreasing academic performance. They seem to exert longitudinal effects on later academic performance, and even when child- and family-related variables are controlled, they are associated reciprocally with MAS. Furthermore, the negative effects tax academic performance during the transition to lower secondary school. MAS also seem to exert mediating effects on the negative association between ADHD symptoms and later academic performance. Additionally, the mechanism of how ADHD symptoms tax academic performance was found to be different with males and females. It also is possible that, particularly among girls, inattention's effect becomes more prominent in lower secondary school. Therefore, early detection of ADHD symptoms and MAS in primary school and targeted support before and during school transition are needed.

Keywords: externalising behaviour problems; ADHD; conduct disorder; maladaptive achievement strategies; academic performance; school transition

TIIVISTELMÄ

Palmu, Iines
Negatiivinen kehä – ulospäin suuntautuvat käytösongelmat, oppimismotivaatio ja koulumenestys kouluikäisillä lapsilla
Jyväskylä: Jyväskylän yliopisto, 2023, 79 s.
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Tämä kolmesta osatutkimuksesta koostuva väitöskirjatutkimus kohdistui pitkän aikavälin vaikutusmekanismeihin ulospäin suuntautuvien käytösongelmien, oppimismotivaation, akateemisen ja sosiaalisen sopeutumisen ja koulumenestyksen välillä. Tutkimus on osa ISKE-hanketta, jossa seurattiin 588 viidesluokkalaista oppilasta yli yläkoulusiirtymän, aina seitsemännen luokan loppuun asti. Osatutkimuksessa 1 tutkittiin a) ulospäin suuntautuvien käytösongelmien (summa) ja koulumenestyksen, b) aktiivisuuden ja tarkkaavuuden häiriön (ADHD) oireiden ja koulumenestyksen sekä c) käytöshäiriöoireiden ja koulumenestyksen välisiä yhteyksiä kuudennen ja seitsemännen luokan välillä. Lisäksi kontrolloitiin lapseen ja perheeseen liittyviä muuttujia (esim. sukupuoli, standardoidut testitulokset, huoltajien koulutustaso). Osatutkimuksessa 2 tutkittiin, miten ADHD-oireet ja käytöshäiriöoireet erikseen olivat vuorovaikutuksessa negatiivisten suoritusstrategioiden kanssa alakoulun viimeisinä vuosina, ja miten tämä heijastui seitsemännen luokan koulumenestykseen. Osatutkimuksessa 3 tutkittiin akateemisen ja sosiaalisen sopeutumisen välittäviä mekanismeja, joiden kautta ADHD-oireet verottavat koulumenestystä ensimmäisen yläkouluvuoden aikana sekä tyttöjen ja poikien välisiä eroja näissä mekanismeissa.

Tulokset osoittavat, että tässä kehitysvaiheessa erityisesti ADHD-oireet ovat riski heikkenevälle koulumenestykselle. Niillä on pitkän aikavälin negatiivisia vaikutuksia koulumenestykseen myös silloin kun lapseen ja perheeseen liittyviä tekijöitä kontrolloidaan, ne vaikuttavat negatiivisten suoritusstrategioiden kanssa toisiaan vahvistaen, ja nämä negatiiviset vaikutukset heijastuvat yli koulusiirtymän. Lisäksi negatiiviset suoritusstrategiat välittävät ADHD-oireiden vaikutusta koulumenestykseen pojilla, mutta tytöillä oireiden vaikutus on suora. On myös mahdollista, että tarkkaamattomuusoireiden vaikutukset vahvistuvat tytöillä vasta yläkoulussa. ADHD-oireiden ja negatiivisten suoritusstrategioiden varhainen tunnistaminen alakoulussa sekä kohdennettu tuki ennen koulusiirtymää ja sen aikana ovat tarpeen.

Asiasanat: ulospäin suuntautuvat käytösongelmat, ADHD, käytöshäiriö, negatiiviset suoritusstrategiat, koulumenestys, koulusiirtymä

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I never thought a PhD degree would be something for me to pursue. How did I get here? With pure luck, a long detour, unexpected collisions, and tons of help from incredible people. There are number of people to whom I want to express my deepest gratitude. First, I want to thank the group of supervisors that I have had the privilege of working with: Professor Hannu Savolainen, Senior Researcher Vesa Närhi and Dr. Sami Määttä. Hannu, thank you for being enthusiastic about my research interests, providing new angles and information, and answering my never-ending questions. You always kindly encouraged me to figure things out by myself. Vesa, thank you for being my strictest opponent. You prepared me well and taught me the most about academic writing. Sami, thank you for keeping hope and faith alive. I met you during my first masters' thesis, and it seems you could not shake me off ever since. You were my north star during this prolonged process, helping me to tie together the curious worlds of special education and motivation studies. You walked beside me through it all. No one has ever believed in me like you do.

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A very special thank you goes to all my wonderful colleagues at the Niilo Mäki Institute (NMI), the University of Jyväskylä, Co-teaching research group, and Valteri. NMI has provided me not only colleagues, but a family and life-long friends. I hope we work together again soon. You all have provided me with intellectual challenge, constructive criticism, and enormous amounts of indispensable support. My colleagues at Valteri have provided me with the ever so needed so what -experience. You can have all the and studies in the world - but how do you use it to help the children and youth we work with?

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Jyväskylässä 03.10.2023

Iines Palmu

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I Palmu, I., Närhi, V., & Savolainen, H. (2018). Externalizing behaviour and academic performance: the cross-lagged relationship during school transition. *Emotional and Behavioural Difficulties, 23*(2), 111–126. https://doi.org/10.1080/13632752.2017.1376968

II Palmu, I., Määttä, S., Närhi, V., & Savolainen, H. (2023). ADHD symptoms and maladaptive achievement strategies: The reciprocal prediction of academic performance beyond the transition to middle school. *Emotional and Behavioural Difficulties.* Advance online publication. http://dx.doi.org/10.1080/13632752.2023.2189404

III Palmu, I., Määttä, S., Närhi, V., & Savolainen, H. (2023). The effects of ADHD symptoms during transition to middle school – academic and social adjustment. *European Journal of Special Needs Education.* Advance online publication. https://doi.org/10.1080/08856257.2023.2191106

The research articles (Studies I–III) are reprinted with the kind permission of the publishers. Copies of the articles are appended to this report.

While carefully considering the supervisors and co-authors' comments and instructions, this dissertation's author wrote the original research plan, conducted the analyses and wrote the reports on the three individual studies.

1 INTRODUCTION

Early adolescence can be a challenging phase in young people's lives, as it is characterised by changes in the school context, academic demands, peer and family relationships, and other developmental processes. While most young people perform well during this stage, externalising behaviour problems' effects become more prominent, and cascading effects occur between these behaviours and academic performance in childhood and adolescence (Moilanen et al., 2010). During lower secondary years, academic performance (Barber & Olsen, 2004) and learning motivation often decline (Eccles et al., 1991; Gottfried et al., 2005), whilst the long-term implications from academic performance increase (Eccles & Harold, 1993; Eccles 2004; Goldstein et al., 2015). Eccles et al. (1993) demonstrated that a discrepancy exists between the learning environment in lower secondary school and the developmental phase of adolescence. Also, individual differences exist between general attitudes towards school and learning, which then are reflected in students' learning motivation. These experiences accumulate in different situations, generalising into a tendency to view all learning situations in a certain way, whether or not the student exhibits externalising behaviours (Nicholls, 1984). Thus, students' beliefs about their own abilities and expectations that result from learning situations can affect behaviours and elicit these situations (Eccles et al., 1983).

Throughout the past few decades, scholars have tried to define *externalising behaviour problems* further (for an overview, see Frick & Thornton, 2017). Different kinds of categorisations and thresholds have been developed for both clinical and practical purposes. Generally, externalising behaviour problems can be described as a) categories or b) continuums of traits (dimensions), and different types of externalising behaviours often co-occur (Krueger et al., 2005). When these behaviours reach a certain level, they become a problem for the individual and others around them. Classification manuals such as the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5: American Psychology Association, 2013) and the *International Classification of Diseases* (ICD-11: World Health Organisation, 2019) typically have provided criteria for three main externalising disorders: attention deficit hyperactivity disorder (ADHD); oppositional defiant

disorder (ODD) and conduct disorder (CD). Even though factor analyses generally indicate distinctions among these three disorders, such behaviours tend to overlap (Abikoff & Klein, 1992; Waschbusch, 2002).

Externalising behaviour problems lead to significant distress in the student and those around them (e.g., family members, peers and school personnel). These behaviours often are associated with other problems in their social, academic and emotional adjustment. In community studies, the worldwide prevalence estimate is 3.6% for ODD, 2.1% for CD and 3.4% for ADHD, but age and study methods affect these rates (Polanczyk et al., 2015). However, even in milder forms, these symptoms seem to hamper children and youths' academic (Rodriguez et al., 2007) and social (Taylor et al., 2008) functioning. Externalising behaviours also are associated with self-regulation skills, particularly inhibition control and emotion regulation (Perry et al., 2018). In the long run, these behaviours are highly predictive of, e.g., mental health, medical, legal, occupational and social problems (Erskine et al., 2016; Odgers et al., 2008). All in all, externalising behaviour problems are associated strongly with academic and social adjustment (Trout et al., 2003). However, a long-standing debate has simmered about which comes first: externalising or academic problems (for reviews, see: Hinshaw, 1992; Kulkarni et al., 2021).

Extant literature indicates that consistent negative relationships exist between externalising behaviour problems and educational outcomes (e.g., Evensen et al., 2016; Hinshaw, 1992; Trout et al., 2003). Children and youths with a wide range of emotional and behavioural disorders have significant deficits in both academic performance and overall academic achievement (Evensen et al., 2016; Reid et al., 2004). Although the negative association is clear, results vary concerning causal relationships between different behavioural symptoms and academic performance. Extant research suggests that these two have a reciprocal relationship, exerting both short- and long-term impacts on students' future outcomes. However, further examination still is needed on causal factors related to academic underachievement, academic performance and various externalising problems during different developmental phases.

Variations in causal directions found in the substantial extant literature can be explained using multiple factors. First, the variation found in the causal relations can be explained at least partly by the variance in the definitions of *externalising behaviours* and *academic outcomes*. Second, ADHD and ODD/CD symptoms likely interact differently depending on academic and social environment and academic performance. For example, scholars have suggested that with respect to academic performance, ADHD and ODD/CD should be studied separately, or that inattention should be viewed as a covariate due to its unique effects on learning (Hinshaw, 1992; Langberg et al., 2013). Inattention forms a specific risk regarding both academic performance and overall educational attainment (Polderman et al., 2010). Third, the interactions can vary between ages and sexes. Fourth, antecedent variables can contribute to variances, e.g., the learning-motivation perspective comes into play, particularly during early adolescence (Eccles et al., 1993; Eccles & Roeser, 2011).

School transitions can be significant milestones on student's educational journey and often involve adjustments and adaptations to new academic, social and environmental demands. The transition to lower secondary challenges students as they try to adapt to new demands with their individual support needs (Figure 1), and this puzzle's pieces may not match ideally. Changes in academic and social environment elicit new demands regarding independence, skills and adjustment (Evans et al., 2018; Pietarinen et al., 2010). This is a challenge for self-regulation, which demands emotional, cognitive and behavioural flexibility (Berger et al., 2007), which often is difficult for students with externalising behaviours. Self-regulation refers to individuals' regulation of thoughts, feelings and behaviours, and this regulation is conducted through executive functions (EFs: Hofmann et al., 2012). For example, youths with ADHD often have deficits in EFs that also are linked to academic performance (Biederman et al., 2004).

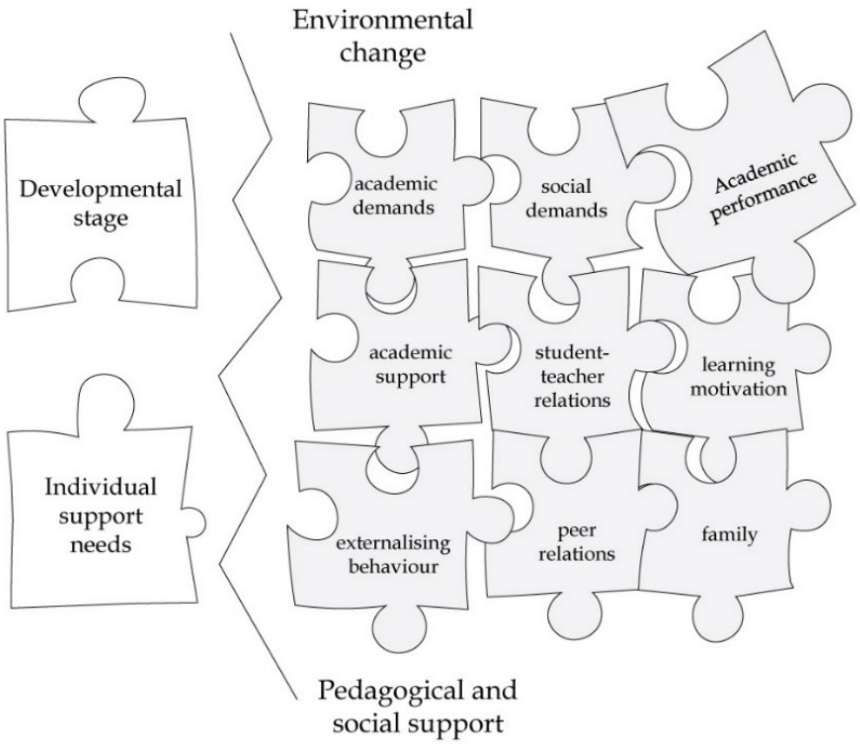

Figure 1

The theoretical framework: the mismatch of individual support needs, environmental change and demands

Motivation has a crucial role in shaping academic outcomes (Ryan & Deci, 2017; Wentzel & Wigfield, 1998). Students with ADHD have lower academic motivation compared to their peers without ADHD (Smith & Langberg, 2018), and the comorbidity of cognitive and social difficulties or ODD/CD may increase this risk. In addition to behavioural difficulties, students with ODD/CD symptoms may have some cognitive, language development and, above all,

social difficulties that increase the risk of academic underperformance and low learning motivation, particularly during adolescence (Crum et al., 2016; Erskine et al., 2016).

Nevertheless, contemporary understanding of various externalising behaviours' effects on academic performance during the transition to lower secondary school is minimal. Subsequently, more research is needed to identify these mechanisms more accurately. Thus, this dissertations' purpose is to investigate, how different kinds of externalising symptoms, learning motivation and lowered academic performance intertwine during this developmentally important stage. By understanding these mechanisms, we can understand these interactions more thoroughly and provide better targeted support and interventions.

1.1 Externalising behaviours and academic performance

The terms, definitions and measures describing academic outcomes vary. Academic performance can be measured via general grade point average (GPA) or various achievement tests, but generally, academic achievement refers to the extent to which a student has achieved short- or long-term education goals (Voyer & Voyer, 2014). However, in this doctoral dissertation, GPA was used to measure academic performance during a school year, and standardised tests in reading and math were used as control variables. Academic performance tends to be higher among females, and previous academic performance (correlated with IQ) is often the best predictor of future performance (Voyer & Voyer, 2014). Furthermore, academic underachievement refers to a situation in which a student is performing under the expected level based on their intellectual abilities (Hinshaw, 1992; Preckel et al., 2006).

The link between externalising behaviour problems and academic performance (or underachievement) has been noted for decades (for reviews, see: Hinshaw, 1992; Kulkarni et al., 2021; Trout et al., 2003). Academic difficulties tend to overlap with externalising behaviour problems (Trout et al., 2003), but the evidence concerning causal effects between academic performance and externalising behaviours is mixed (Hinshaw, 1992; Kulkarni, 2021). This association still continues to generate both research and debate for several reasons: 1) Both externalising behaviours and academic difficulties comprise major problems in childhood and adolescence; 2) both externalising behaviours and academic underachievement strongly predict later maladjustment, educational attainment and even employment, as externalising behaviour problems often lead to antisocial behaviour and negative outcomes throughout a person's lifetime; 3) expounding on underlying mechanisms may yield theoretical insights on behaviour-cognition links in both typical and atypical development; and 4) the association poses direct implications for policy and efforts to provide special education services in terms of learning and behaviour (Hinshaw, 1992; Kulkarni et al., 2021).

In childhood and early adolescence, externalising behaviours involve under-controlled behaviours that can manifest, e.g., as defiance, impulsivity, disruptiveness, aggression, antisocial behaviour and overactivity (Achenbach & Edelbrock, 1978). The common denominator is that these behaviours are characterised by actions in and towards the external world (i.e., acting out, antisocial behaviour, hostility and aggression). Furthermore, they can occur whether the child's development is viewed as typical or atypical, and these behavioural traits exist on a severity continuum (e.g., Lubke et al., 2009).

The two main psychiatric classification systems used to make diagnoses, DSM-5 (American Psychiatric Association [APA], 2013) and ICD-11 (WHO, 2019), are very categorical in nature and serve clinical work needs. In the DSM-5 (2013), ADHD is categorised under "neurodevelopmental disorders", whereas ODD and CD are grouped under "disruptive, impulse control and conduct disorders". In this doctoral dissertation, ADHD's core symptoms are referred to as ADHD symptoms, and ODD and CDs' core symptoms are referred to as symptoms of CDs within a community sample. The terms indicate teacher-rated behaviours observed in schools and measured as continuous scores. Use of the term *problems* refers to these continuous scores on problem behaviour, a result of the sum of item scores on a rating scale. The terms *ADHD* and *CDs* are used to separate categorical outcomes. The term *sex* is used to denote biological male or female status (while acknowledging that this is not a binary designation), whereas *gender* refers to the social or cultural role applied to biological sex or personal identification with such roles. This distinction is made because both CDs and ADHD are more prevalent among males (Maughan, et al., 2004; Ramtekkar et al., 2010), and interest has been growing over the manifestation of ADHD in females (e.g., Hinshaw et al., 2022; Quinn & Madhoo, 2014).

1.1.1 ADHD

ADHD is a common neurodevelopmental disorder. The symptoms begin in childhood, but it can persist into adulthood (APA 2013; Thapar & Cooper, 2016). The disorder is highly inheritable, and it is believed to have genetic, biological and environmental factors contributing to its development (Nigg et al., 2010; Thapar & Cooper, 2016). ADHD's core symptoms are developmentally inappropriate levels of hyperactivity, impulsivity and/or inattention, but manifestation of these symptoms can vary across the lifespan (APA, 2013). It is a complex disorder and individuals with ADHD often also have comorbid conditions such as learning disorders (DuPaul et al., 2013), anxiety or depression (APA 2013; Thapar & Cooper, 2016). Diagnoses are more common among boys (Ramtekkar et al., 2010); however, girls with ADHD tend to present inattention as the most prominent symptom, and they may develop better coping strategies than males, resulting in greater ability to mask or mitigate their symptoms' impact, with informants more likely to overlook their symptoms (Quinn & Madhoo, 2014). This doctoral dissertation focusses on *ADHD symptoms* defined as teacher-rated restlessness, impulsiveness, fidgetiness and inattention. These symptoms are basic to the diagnostic criteria listed in the DSM-5, and they appear

in widely used parent, teacher and self-report instruments (e.g., Rutter Scale, Strengths and Difficulties Questionnaire, Conners rating scale and Child Behaviour Checklist [CBCL]). Extant research has indicated that teacher ratings are stronger contributors in predicting ADHD subtype than parent ratings (Power et al., 1998), and they exhibit higher classification accuracy in ADHD diagnoses (Hall et al., 2019; Tripp et al., 2006) compared with, e.g., parent ratings.

Furthermore, it can be difficult to distinguish inattention and impulsivity from typical age-appropriate behaviour (Brahmbatt et al., 2016). ADHD symptoms affect academic performance differently along the school path. In everyday school life, attention problems can comprise a variety of behavioural and social issues. Students with ADHD symptoms often have difficulties regulating their attention, emotions and actions, i.e., organising tasks and activities, managing sequential tasks, keeping materials and belongings in order, time management and generating neat and organised work all can be difficult for these students. Consequently, difficulties with academic performance are common and quite persistent among students with these symptoms (DuPaul & Langberg, 2015). School transition is associated with an abate in the developmental decline of ADHD symptoms (Langberg et al., 2008).

The prevalence of academic problems among youth with ADHD ranges from 50–80%, and these problems most often persist into adolescence and adulthood (DuPaul & Langberg, 2015). Much of the research evidence still comes from studies on individuals with diagnosed ADHD who can be viewed as the extreme of a continuous dimension of individual differences in attentional control and behavioural self-regulation (Arnold et al., 2020; Fergusson & Horwood, 1995). In students with diagnosed ADHD, academic impairment primarily is associated with the core symptoms of inattention and cognitive deficits in executive functions (EFs: Langberg et al., 2013; White et al., 2013). Moreover, hyperactivity and inattention's negative effects on academic performance remain after controlling for intelligence, comorbidity of ODD/CD and socioeconomic status (SES) (Polderman et al., 2010). It is worth noting, that not all children with ADHD experience academic problems to the same extent.

However, several reports have confirmed that the symptoms (especially inattention) impair many children who do not meet the diagnostic criteria (e.g., Hinshaw et al., 2022; Rodriguez et al., 2007). Youth who merely present ADHD symptoms are likely to perform below their known ability levels (Diamantopoulou et al., 2007; Rodriquez et al., 2007) and experience poor educational outcomes (Arnold et al., 2020; Loe & Feldman, 2007).

Inattention per se is a multidimensional concept that refers to the inability to focus, high distractibility levels, forgetfulness and difficulties organising and planning activities and tasks (APA, 2013). It is a rather persistent symptom, whereas hyperactivity and impulsivity often decrease with age (Polanczyk et al., 2014). However, population-based studies with nonreferred samples have found the full range of ADHD symptoms to be related to academic skill impairment (Rodriguez et al., 2007), inhibitory control (Tillman et al., 2007; Wåhlsted, 2009), EFs (Freidman et al., 2007) and peer relations (Diamantopolou et al., 2005).

Teacher-rated attention problems (e.g., inattention, disorganisation, impulsivity and hyperactivity) are quite stable and predict later levels of response inhibition, working memory updating and, to some extent, mental set shifting among students ages 7 to 14 (Friedman et al., 2007). Problems related to sustained attention and distractibility, together with age and sex, are important predictors of academic performance (Lundervold et al., 2017). Diamantopoulou et al. (2007) also found that EFs independently predict poor academic performance, and that high inattention levels and deficits in EFs predicted higher levels of special education needs. These results suggest that a students' success in learning situations stipulates skills to regulate learning and social interactions, both of which can be difficult for students with ADHD symptoms. However, previous literature suggests that deficits in EFs are not common in all children with ADHD (Sonuga-Barke, 2002).

Students with ADHD symptoms often have social problems in school with adults and peers (Erskine et al., 2016). They also seem to experience more negative student-teacher relations compared with their peers (Rodriguez et al., 2007). A recent literature review comprising both qualitative and mixed methods studies (Plantin-Ewe, 2019) found that students with ADHD generally feel less close to their teachers compared with their peers. Furthermore, youths with ADHD often have fewer friends or lower-quality friendships, and experience greater peer victimisation than their peers (Hoza et al., 2005).

In predicting students' academic and social adjustment, parental involvement, i.e., support that the student receives at home, plays an important role (Barger et al., 2019), along with family SES (Piotrowska et al., 2015). For example, reading at home, communicating about school, parents' high expectations for their children's achievement and schooling, and parental encouragement and support for learning are important correlates of overall academic achievement (Boonk et al., 2018). However, students with ADHD may lack social and academic support at home: Children in families with low SES are more likely to have ADHD than their peers in high SES families (Russell et al., 2016), and the diagnosis is associated with parents' low education levels (Torvik et al., 2020).

1.1.2 ODD and CD

In this dissertation, the plural term *CDs* refers to the core symptoms of ODD and CD. This choice was made using guidance from the International Classification of Diseases (ICD-10: WHO, 2019), which views ODD as a subtype of CD. Furthermore, in many screening instruments, particularly ones targeting this age group (e.g., the SDQ: Goodman, 1997), conduct problem scales often include both ODD and CD symptoms. In the literature, the two also are referred to as disruptive behavioural disorders (APA, 2013).

Oppositional Defiant Disorder is typically diagnosed in childhood, and it is characterised by a pattern of defiant, argumentative and disobedient behaviour (WHO, 2019). Conduct disorder (CD) is a more severe condition. It is a psychiatric disorder that emerges in childhood or adolescence, characterised by

patterns of behaviours that violate rights of others or societal norms (Fairchild et al., 2019; Maughan et al., 2004). It often results from multiple risk factors regarding both the child and their context, and children with CDs tend to have multiple comorbid disorders, e.g., ADHD or developmental language disorder (Fairchild et al., 2019), or internalising problems (depression, anxiety: McDonough-Caplan et al., 2018). They also may co-occur with other difficulties, e.g., learning disabilities and verbal deficits (Lynam & Henry, 2001; Närhi et al., 2010; Teichner & Golden, 2000), which alone create a risk for academic problems. CDs are more prevalent among males (Maughan, et al., 2004). The core symptoms comprise persistent oppositional, aggressive and antisocial behavioural patterns (APA, 2013; DSM-5) or repetitive and persistent dissocial, aggressive or defiant conduct patterns (WHO 2019; ICD-10), e.g., breaking common rules, lying, being physically or verbally aggressive, bullying and/or damaging other people's property on purpose (APA, 2013; DSM-5).

Children with CDs can vary greatly in the types and severity of their antisocial behaviours, and manifestation of symptoms may change with age (Moffitt, 1993). Thus, effects may vary during different stages of the school path. However, children and youth with these symptoms are at an increased risk of experiencing academic problems, as they tend to exhibit low academic achievement, disruptive behaviour in classroom, lack of social skills and rule violations and other evident behavioural problems (APA, 2013; DSM-5). High levels of reactive aggression are associated with low academic performance, and peer rejection accounts for this association (Fite et al., 2013). Youths with CDs historically have had more special class placements and have performed similar to their peers with learning difficulties (i.e., lower than expected) (e.g., Trout et al., 2003). They also are involved in frequent disciplinary encounters with school staff and administrators (Wilson et al., 2001). These behaviours interfere with learning and school adjustment, which can reflect on academic performance. These students also are at higher risk of dropout than their peers (Erskine et al., 2016) and demonstrate higher levels of academic failure and disengagement from school (Elias & Haynes, 2008). In the long run, CD often is associated with both mental and substance use disorders and criminality (Erskine et al., 2016). Furthermore, employment and relationship instability are characteristic of individuals with CDs (Loeber et al., 2000).

Symptoms of CDs can affect academic performance in at least two ways: 1) Negative interactions with peers and teachers may reinforce CD behaviours and eventually lead to fewer opportunities to experience social and academic success, or 2) repeated failures in academic tasks can produce behavioural problems, which some have suggested could be tied to comorbidity (Patterson et al., 2017). It also has been suggested that comorbidity between CDs and academic underperformance develops through repeated failure in academic tasks (Patterson et al., 2017). To avoid experiencing failure and frustration, children may start presenting symptoms of CDs, allowing them to escape the uncomfortable learning task or situation (McIntosh et al., 2006). This cycle leads to motivational problems (Nurmi, 2015).

Unsurprisingly, students with CDs tend to have social problems with teachers (Crum et al., 2016; Stipek & Miles, 2008), peers and parents (Miller-Johnson et al., 2002). They also tend to display a lack of remorse, guilt or empathy after misbehaviour, and they may be indifferent to others' well-being and their own performance in developmentally important areas of functioning (Frick & Thornton, 2017).

Furthermore, students with CDs may lack support at home. Home-related risk factors for CDs include poor parental supervision, punitive or erratic parental discipline, cold parental attitude, child physical abuse, parental conflict, disrupted families, antisocial parents, large family size, low family income and/or high crime neighbourhoods (Murray & Farrington, 2010). Studies also have suggested that sex (i.e., being a male) may function as a moderator of the relationship between family SES and a child's antisocial behaviour (Letourneau et al., 2013; Pietrowska et al., 2015). Parental involvement also is related negatively to delinquency (Barger et al., 2019); however, not all forms of parental involvement are associated positively with academic performance (help with homework: Barger et al., 2019), and some benefits from parental involvement are stratified with family SES (Tan et al., 2020).

1.2 The developmental dynamics: externalising behaviours and academic performance

The developmental dynamics and long-term consequences between externalising behaviours and academic performance have been examined over several decades via various pathways (for reviews: Hinshaw, 1992; Kulkarni et al., 2021) and trajectory studies (e.g., Bongers et al., 2004; Van der Ende et al., 2016). Extant literature confirms that externalising behaviours are rather stable, and that a comorbidity exists between academic outcomes and externalising behaviours (Hinshaw, 1992; Kulkarni, 2021). However, the results regarding the causal basis are inconclusive. Multiple theories have been posed about this association that have potential benefits regarding prevention and intervention. Most pathway studies and theories about the development of behavioural problems are based on dynamic systems theory (Kulkarni et al., 2021), which suggests that changes in one area of functioning activate a sequence of consequences that eventually exert larger developmental effects (Thelen, 2005) or elicit a developmental cascade (Masten & Cicchetti, 2010). Consequently, intervention in one domain could prevent negative developments in another (Thelen, 2005).

In 1992, Stephen Hinshaw made the first endeavour to review the causal mechanisms between externalising behaviour problems and academic underachievement (*academic underachievement* is defined as academic achievement that differs from a student's potential as measured by intelligence tests). Hinshaw hypothesised that four possible pathways could explain the

relationship (Figure 2). The first two pathways were unidirectional: 1) low academic performance preceding externalising behaviour problems or 2) externalising behaviour problems preceding low academic performance. The third option was that the pathway is bidirectional, wherein both domains influence each other similarly. The fourth pathway suggestion was that an antecedent variable exists, e.g., language skills, that could precede and affect both domains. Hinshaw's (1992) conclusions were cautionary to say the least, and he reported that limitations in study designs, unstandardised variables and inadequate statistical methodology hampered drawing any real causal conclusions. It also was suggested later that the measurement error intrinsic in quantifying both academic performance and externalising behaviours could affect study outcomes (Algozzine et al., 2011; Kulkarni et al., 2021). However, Hinshaw (1992) emphasised that in primary grades, inattention-hyperactivity is a more consistent correlate of underachievement than aggression (CDs) and called for defining attentional deficits' nature. In Figure 2, each constructs' stability over time is included in all four models.

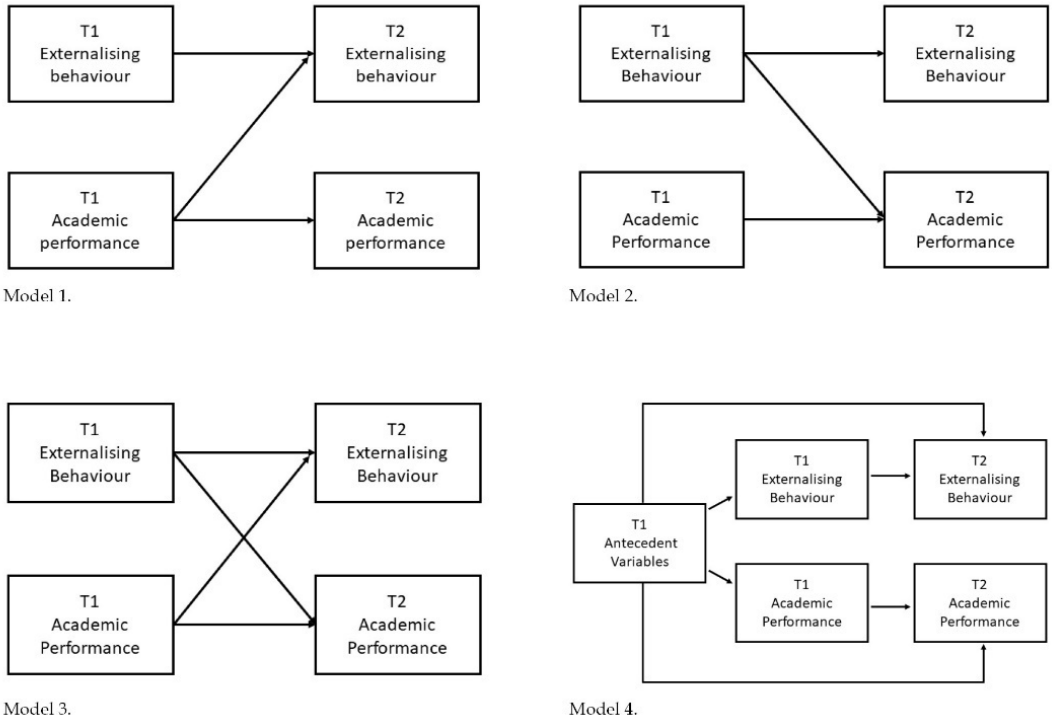

Figure 2

The various pathway models (adapted from Hinshaw, 1992)

Kulkarni et al. (2021) strived to update Hinshaw's systematic review, in which they used the terms *low* or *poor achievement* instead of *underachievement* to include students with academic deficits instead of academic discrepancies. They found little evidence for causal or predictive association. All in all, they did not find

evidence of bidirectional effects, and only five studies included in their review found significant unidirectional effects, mostly from externalising behaviours to later low academic performance (Kulkarni et al., 2021). Thus, their results were consistent with Hinshaw's (1992): Evidence of the pathways' existence was inconclusive. This result could be due to antecedent variables, e.g., SES (Breslau et al., 2009) and cognitive ability (Burt & Roisman, 2010), affecting the relationship between outcomes. In their results, Kulkarni et al. (2021) concluded that antecedent variables – e.g., inattention, language skills, parenting and family SES – likely are associated with both behavioural outcomes and academic achievement. Furthermore, they reported interesting findings on inattention: First, studies that included inattention as a covariate were more likely to find nonsignificant effects between externalising behaviour problems and later academic performance, and second, inattention was also a consistent predictor of externalising behaviours (Kulkarni et al., 2021). These results support the perspective that from a variety of behavioural symptoms, inattention is associated negatively with later low academic performance (Fergusson & Horwood, 1995; Gray et al., 2017; Hinshaw, 1992) and likely is associated with the development of both low academic performance and externalising behaviours. However, multiple aspects of this tricky equation and additional factors affecting the causal effects remain unresolved.

1.3 Maladaptive achievement strategies, ADHD, and CDs

Multiple methods can be used to conceptualise motivation, and several theoretical frameworks have been developed, such as self-determination theory (Deci & Ryan 2000; Ryan & Deci, 2017), expectancy-value theory (Eccles et al., 1983), and achievement goal orientation theory (Nicholls, 1984). Learning motivation can be viewed as an individual's intrinsic desire to engage in learning activities, pursue mastery goals and develop competence in a particular domain (Nicholls, 1984). In this dissertation, learning motivation is defined as individuals' general attitude towards learning, as well as their tendency to think, act and behave in a certain way in challenging learning situations (Nurmi, 2015). Thus, the focus is on the learning process, rather than external outcomes. This broad aspect of achievement motivation can be conceptualised as achievement strategies (e.g., Aunola et al., 2000), which usually are classified as adaptive or maladaptive, contributing to an individual's success in various situations (e.g., Aunola et al., 2000; Määttä, 2007). They develop as a process (Figure 3, adapted from Määttä 2011; Nurmi, 2011) wherein previous experiences and feedback modify an individual's perceptions about the situation at hand and their ability to deal with it.

Achievement strategies can be described as a subsequent process of thoughts and actions an individual goes through while facing a challenge. In the first phase, self-concept creates the basis for task-related expectations. After this, certain behaviours are activated (Figure 3). The actions taken produce results,

and the process ends with consideration of possible causes of behavioural outcomes (i.e., causal attributions; Jones & Berglas, 1978; Midgley et al., 1996; Weiner, 1985). Maladaptive achievement strategies (MAS) refer to ineffective or counterproductive approaches that individuals may adopt in their pursuit of academic success. Manifestation of these strategies include fear of failure and task-avoidant behaviour in challenging situations (Elliot & Hulleman, 2017; Nurmi 1993; Zhang et al., 2011). In the previous literature these concepts have been described in various ways, such as self-handicapping (Jones & Berglas, 1978), learned helplessness (Dweck & Leggett, 1988), and performance avoidance (Elliot & Hulleman, 2017), and task-avoidant behaviour (Nurmi, 1993; Zhang et al., 2011).

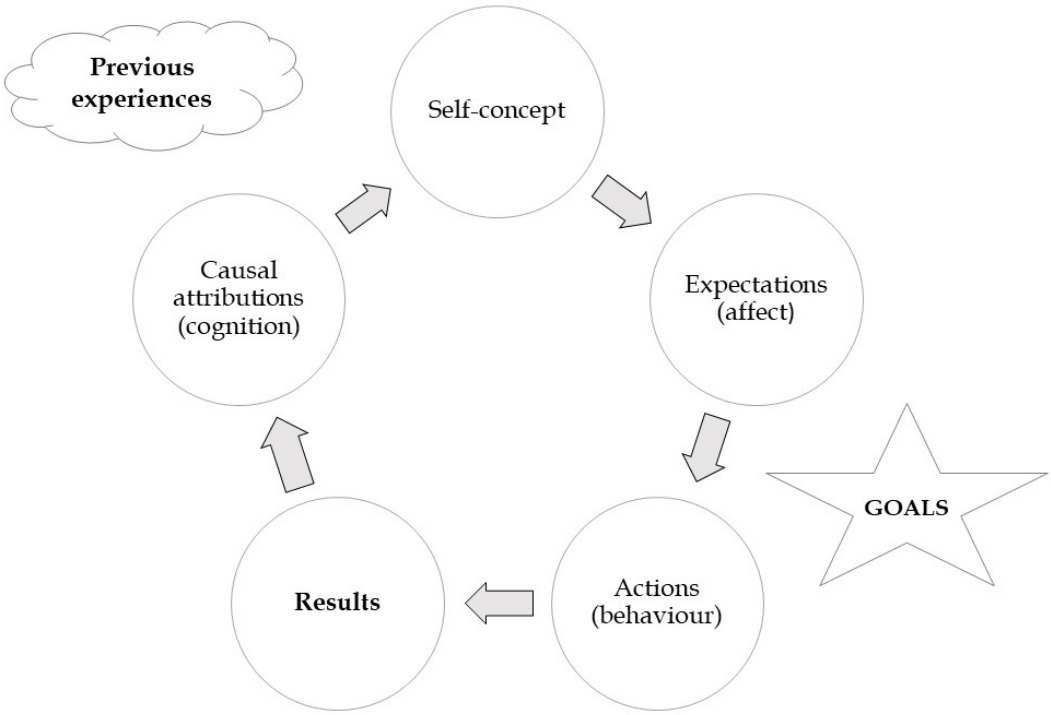

Figure 3

The development of maladaptive achievement strategies

These concepts constitute a negative cyclical process (Figure 4), consisting of failure-oriented cognition (e.g., low beliefs in personal control), negative affects (e.g., fear of failure, need to avoid embarrassment) e) and detrimental behavioural strategies (e.g., task-avoidance) that students experience in challenging learning situations (Elliot & Harackiewicz, 1996; Nurmi, 1993). Throughout this negative cycle, MAS hinder learning, effect goal setting, impede progress, and have negative consequences on academic performance and well-being. To sum up, maladaptive strategies are characterised by failure

expectations, active and passive task avoidance (Midgley & Urdan, 1995) and negative associations with academic performance (Urdan & Midgley, 2001). The achievement strategies that students deploy are reflected both in school adjustment and overall problem behaviour (Aunola et al., 2000). Low self-concept (failure-oriented cognition) is associated with adolescents' use of MAS, which are tied to maladjustment at school, and to internalising and externalising problem behaviours (Aunola et al., 2002).

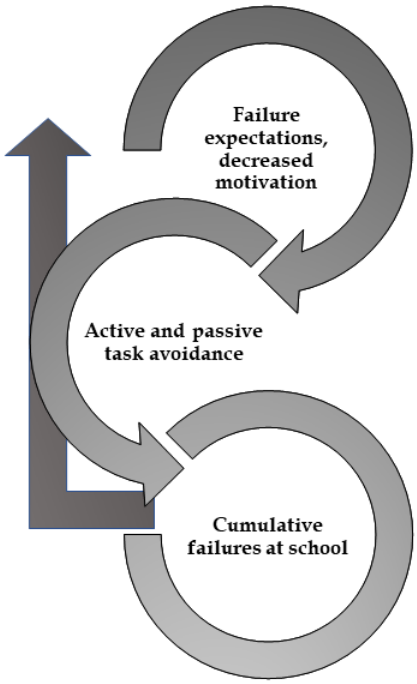

Figure 4

The negative cycle

Numerous studies have explored the relationship between achievement strategies and academic performance (e.g., Carr, et al., 1991; Määttä, 2007; Nurmi, et al., 1995). In school, MAS predict accumulative poor academic performance (Midgley & Urdan, 1995), which can decrease school engagement (Määttä et al., 2007). Altogether, the focus of research has been on task avoidance (Midgley & Urdan, 1995; Nurmi, 1993), and wider aspects of MAS, including failure-oriented cognition and negative emotions, have often been overlooked. Nevertheless, task avoidance has been found to predict subsequent poor academic performance among both young children (Aunola et al., 2002; Mägi, et al., 2010) and adolescents (Midgley & Urdan, 1995). During early primary school years learning difficulties, slow academic progress and low levels of literacy together predict an increase in task avoidance (Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000; Pakarinen et al., 2011). Furthermore, some reciprocal effects of low academic

performance and task avoidance have also been reported (Metsäpelto et al., 2015; Onatsu-Arvilommi & Nurmi, 2000).

Scholars also have investigated changes in utilisation of achievement strategies and sex differences in strategy utilisation during school paths. During early primary school years, MAS that students deploy remain quite consistent (Hirvonen et al., 2016; Onatsu-Arvilommi & Nurmi, 2000). Recently, Syal and Torppa (2019), in a longitudinal study focussing on dyslexia, found that the use of a task-avoidant strategy increases between second and seventh grade, but decreases between ages 15 and 20. The literature suggests that task-avoidant behaviour already is more typical with males at the beginning of their school paths (Kervinen & Aunola, 2013), whereas girls tend to use more task-oriented strategies (Lepola, 2004). However, Syal and Torppa (2019) did not find significant associations between task-avoidant strategies and students' sex.

Literature on achievement strategies has mainly focussed on skill-specific areas, e.g., reading, writing and mathematics (Lee & Zentall, 2012; Zentall & Beike, 2012). Overall academic performance and externalising behaviours have aroused less interest among researchers, and study designs seldom have included both ADHD and CD symptoms as separate variables. In one of the studies researchers found that during Grades 1-4, the negative association between externalising problems (a measure containing both ADHD and CD symptoms) and academic performance was mediated partially via task-avoidant behaviour (Metsäpelto et al., 2015). In another study, Gut et al. (2012) found that among children with ADHD, achievement motivation was the key factor in developing receptive language and mathematical thinking. Yet, this was not the case for children with CDs. Their results suggest that achievement motivation might interact differently with ADHD and CD symptoms.

Although the prevalence of academic difficulties is high among youths with ADHD (Arnold et al., 2020; DuPaul & Langberg, 2015), some evidence indicates that poor academic performance predicts utilisation of MAS (Aunola et al., 2002; Metsäpelto et al., 2015), and only a few studies have investigated learning motivation and ADHD (Barron et al., 2006; Birchwood & Daley, 2012; Langberg et al., 2018; Smith et al., 2020). Students with ADHD symptoms seem to have more school-related motivational problems than their peers without the symptoms (Birchwood & Daley, 2012; Smith & Langberg, 2018; Smith et al., 2020). However, there can be multiple reasons why students with ADHD have motivational problems e.g., deficits in EFs, reward sensitivity, boredom and under-stimulation (Smith & Langberg, 2018).

Low learning motivation often has been suggested as an explanation for academic impairments in students with ADHD symptoms, which is understandable, as these youths often report difficulties engaging in repetitive or slow-paced tasks, e.g., homework and studying (Morsink et al., 2017). It also has been suggested that instead of striving to achieve success and engage in tasks, these students' main goal is to avoid failure (Olivier & Steenkamp, 2004). This hypothesis is understandable, as students with ADHD have low-competence beliefs (Barron et al., 2006; Zentall & Beike, 2012), low achievement motivation

and task persistence (Gut et al., 2012), frustration during tasks requiring focussed attention (Martínez et al., 2016), and active task avoidance in situations requiring sustained self-regulation (Barron et al., 2006; Olivier & Steenkamp, 2004). And yet, motivation is a task-specific construct that varies across settings (Schwarzer, 2014), and some evidence indicates that ADHD symptoms' hindering effects are also contextual (Imeraj et al., 2013).

All in all, MAS and low-competence beliefs are quite common among students with ADHD symptoms, but visible manifestations of low motivation (e.g., task persistence, frustration during tasks requiring focussed attention) may be difficult to distinguish from core symptoms. Furthermore, motivational features, such as achievement strategies, can resemble the manifestation of ADHD's core symptoms, and the distinction between the symptoms and MAS can be quite difficult to determine. Regardless, having MAS does not always mean having ADHD symptoms, and vice versa. For example, students with diagnosed ADHD and high motivation to succeed with tasks have been found to do as well as their normal counterparts with tasks requiring language skills and mathematical thinking (Gut et al., 2012).

However, it is highly likely that ADHD-related cascading experiences with failure at school (difficulties initiating, staying focussed on, organising and finishing tasks) contribute to subsequent experiences with failure and, thus, a negative academic self-concept accompanied with low competence beliefs. This may lead to less effort and increasing task-avoidant behaviours (Nurmi, 2015; Onatsu-Arvilommi & Nurmi, 2000), making academic failure more likely and, resulting new experiences of failure (Aunola et al., 2002; Metsäpelto et al., 2015).

Most research examining conduct problems and some aspects of learning motivation is focussed on school engagement (e.g., Lätsch et al., 2016; Wang & Fredricks, 2014), using varying definitions of externalising behaviour. Scant research has been conducted on CDs and MAS per se. In their comparison study, Gut et al. (2012) did not find any differences in achievement motivation between students with CDs (defined as disruptive behaviours) and the reference group. However, there are factors related to CDs (e.g., problem behaviours at school or cognitive and verbal deficits) that may lead to the utilisation of MAS (Aunola et al., 2000; Nurmi et al., 1994). Thus, negative experiences at school may constitute decreasing self-esteem (e.g., Zimmermann et al., 2013). Furthermore, poor student-teacher relationships can affect both behaviour and academic ratings (Zee et al., 2017), which can perpetuate the development of MAS. The evidence is scant, but it is plausible that externalising behaviours and academic failures together generate a reciprocal negative cycle (i.e., one problem aggravates the other). Thus, further research is needed.

1.4 Academic and behavioural adjustment during school transition

Compulsory education in Finland comprises one year of pre-primary education for 6-year-olds, nine years of basic education for children ages 7 to 16 and upper secondary level education. Comprehensive school education (primary and lower secondary education) comprises Grades 1–9, and education is compulsory for those ages 7–18) (Finnish National Agency for Education and Culture, 2022). At the end of ninth grade, the student must apply for post-comprehensive education. Compulsory education ends when the student reaches age 18 or completes general upper secondary or vocational qualification. Local authorities and other education providers maintain comprehensive schools, and from pre-primary to secondary level, education is free of charge.

Finland has an individualised education system (see: Keppens & Spruyt, 2018) in which all students are offered a common curriculum, and students are not grouped, e.g., by skill level. In pre-primary and basic education (Grades 1-9), a three-tiered support system is utilised in which the tiers are general, intensified and special support (Basic Education Act 1998; 642/2010). In the most recent statistics available 22.9% of students in basic education received intensified (13.9%) or special support (9.7%) (Statistics Finland, 2023). Pedagogical support is provided mainly within mainstream education and can target students' academic and behavioural needs. Successful inclusion of students with externalising behaviours in neighbourhood schools and general education classrooms stipulates providing evidence-based support. Despite this everyday challenge, over the past decade, few efforts have been made to develop support for students with externalising behaviours (Karhu et al., 2018; Karhu et al., 2021; Närhi et al., 2015) or deficits in attention and EFs (Paananen et al., 2018). In everyday school life, the support provided often remains insufficient for these students to achieve academic and social success (Gagnon, 2022).

Between sixth and seventh grades, a transition occurs from primary to lower secondary school. This transition is a time of considerable changes in learning environments, including academic and social demands, that usually entail changing school buildings and class composition, and shifting from a classroom-teacher system to a subject-teacher system. It can be described as one of the most strenuous phases in young students' lives, bringing forth challenges in cognitive, socioemotional and motivational adjustment (Eccles & Roeser, 2011). In the long run, this transition's success is associated with one's subsequent academic achievement and psychological well-being (Evans et al., 2018).

A successful school transition is a combination of multiple factors regarding the individual and the environment. This entails academic adaptation to new environments (e.g., new, larger schools and classrooms) and different structural demands (multiple teachers and/or switching teachers, classrooms and materials throughout the day). On top of this, youths also must form new student-teacher relationships and peer relationships as they encounter new teachers and

changing class compositions, as well as adjust to changes in teacher expectations and declines in student autonomy (Evans et al., 2018). This success can be described through the concept of stage-environment fit, i.e., how well the new school environment's characteristics and students' developmental needs mesh (Eccles et al., 1993). Unfortunately, lower secondary school students generally tend to suffer from an exceptionally poor stage-environment fit (Eccles & Roeser, 2011). Students with ADHD symptoms (Zendarski et al., 2016, 2017), particularly poor executive functions (Jacobson et al., 2011), are likely to be at specific risk due to cascading academic and social demands.

While most students cope well, this is a risky stage for students who have learning and behavioural difficulties (Evans et al., 2018; Sainio, 2021), e.g., learning-related emotions are more negative during school transition, and the risk is particularly high among students with learning difficulties (Sainio, 2021). This likely applies to students with externalising behaviours. Previous studies have established that at-risk students have more transition-related stress and anxiety, as well as difficulties adjusting to new school environments and academic demands compared with their peers (Anderson et al., 2000; Sainio 2021).

The ability to navigate successfully through school transition depends on multiple factors, including personal maturity and coping skills (e.g., EFs), the new school environment's characteristics and the social support available both before and after the transition, along with students' own perceptions of changes in the environment (e.g., McDougall & Hymel, 1998), including school climate (Way et al., 2007). While academic demands grow and the school environment changes, behavioural adjustment also may be a challenge. For example, Jacobson et al. (2011) found that during the transition to lower secondary school, parents reported more behavioural problems and less regulatory control in students with poor EFs, whereas teachers reported greater academic difficulties. EF skills significantly affect adjustment to academic and social demands during school transition, which emphasises the risk that students with ADHD symptoms face during this stage.

Perceived social support is important in adolescence, and positive peer relationships promote school adjustment during the transition (Wentzel, 2003). Furthermore, youths usually have a growing need for social support in a new school environment (Roorda et al., 2017), and yet, lower secondary school transition is associated with declines in perceived total support and teacher support, and an increase in self-reported school problems (Martínez et al., 2011). Youths also tend to gravitate towards peer groups that resemble themselves, e.g., in terms of academic achievement and family background (Kiuru et al., 2009). Peer problems during this time are linked with poor school functioning, decreased learning motivation and increased problem behaviours (Evans et al., 2018). Support from home may decrease as students age and strive for independence as academic demands grow.

1.5 The study's aims

Students' behavioural problems, combined with academic difficulties, are a constant challenge in everyday teaching. The data were gathered soon after the Basic Education Act (1998, 642/2010) was passed, and the transition to three-tiered support began, after which no other major changes were made to support systems. The Finnish National Core Curriculum of Basic Education 2014 (Finnish National Board of Education, 2016) states that "The development of basic education is guided by the inclusion principle".

This dissertation's overall aim was to investigate the longitudinal mechanisms between different externalising behaviour problems (ADHD and CDs), learning motivation and academic performance during the later primary school years and during the transition to lower secondary school. The goal was to increase understanding of the mechanisms of how ADHD and CD symptoms in the general population interact with and predict academic performance, MAS during the transition from primary to lower secondary school and whether any mediating effects from academic or social adjustment exist.

The main question addressed in this dissertation was, how are externalising behaviour problems and academic performance associated during the transition from primary to lower secondary school? The first sub-study aimed to detect possible causal relations between externalising behaviour composite and academic performance, ADHD symptoms and academic performance, and CD symptoms and academic performance while considering child- and family-related covariates. The second sub-study aimed to determine whether longitudinal causal relations exist between ADHD and MAS or CDs and MAS during fifth and sixth grades and how these constructs were associated with academic performance after the first year of lower secondary school. The third sub-study examined the mechanisms concerning how previous ADHD symptoms affected academic performance after the first year of lower secondary school and whether any academic or social adjustment mediators or sex differences existed. An overview of the study's aims, specific research questions and analytical methods are presented in Table 3 (p. 35).

2 METHOD

2.1 Participants and procedure

The data for this dissertation were collected from the Eastern Finland Education Development Project (ISKE) during the years 2010–2012. The Finnish National Board of Education funded the research, which encompassed seven municipalities from Eastern Finland. Altogether, 30 schools representing both urban and rural areas participated in the study. A cohort of fifth-grade students (n = 588, 53,6% female) was followed until the end of their first year of lower secondary school (seventh grade). Data were gathered from the students, teachers and students' guardians. The students were ages 11–12 at the time of the first measurement point and ages 13–14 at the last measurement point. The original study population was of Finnish origin (> 95%). Most of the students (84.3%) were from two-parent households. The percentage of students with special education needs each year, intensified support varying between 8.6% and 10.3%, and special support varying between 3.9% and 5.9% was in line with the overall atmosphere in Finland at the time of the study (Statistics Finland, 2011; 2012). However, the numbers varied between grades and years.

The students examined for this dissertation were a subset of this community-based longitudinal sample. From this cohort, the researchers randomly selected six students per class to provide individual teacher ratings using the Strengths and Difficulties Questionnaire. At the first measurement point (T1), this was 282 students and 54 teachers, but the number of students rated varied over the years (T2: n = 311; T3: n = 202). For behavioural ratings (SDQ), a random sample of six students per class was used to avoid burdening teachers and to ensure their participation. The teacher response rate was approximately 90%. The students filled out questionnaires concerning their achievement strategies and well-being in January during their fifth-, sixth- and seventh-grade school years. Teachers administered the questionnaires during

normal school days, and research assistants collected them from the schools. Written consent was obtained from both the students and their legal guardians. Participation was voluntary for schools and teachers. Summaries of the measures used in Studies I–III are presented in Tables 1 and 2.

2.2 Measures

In this section, the study's main variables and the measurement points are presented. More detailed descriptions of the measures are included in the appended original papers.

2.2.1 SDQ – symptoms of ADHD and CDs

The classroom teachers (fifth and sixth grades) and class supervisors (seventh grade) assessed the symptoms of ADHD and CDs using the Finnish version of the Strengths and Difficulties Questionnaire (Koskelainen, 2008; see, also, the SDQ: Goodman, 1997). The SDQ survey includes 25 items that comprise five five-item subscales: hyperactivity-inattention; emotional symptoms; conduct problems; peer problems and prosocial behaviour. In this dissertation, we utilised the scales for hyperactivity-inattention (ADHD symptoms) and conduct problems (CD symptoms). The hyperactivity-inattention scale contains five items ("Restless", "Overactive", "Cannot stay still for long", "Easily distracted" and "Concentration wanders"), as does the conduct problems scale (e.g., "Often fights with other youths or bullies them" and "Often lies or cheats"). Items were rated on a three-point scale (1 = not true, 2 = somewhat true or 3 = certainly true). The SDQ is used widely to screen children and adolescents' behaviour between ages 4 and 16 and is viewed as a valid screening instrument (Goodman et al., 2000) in Finland (Koskelainen, 2008). SDQ data from each year were used as each symptom's mean score, and the Cronbach's alpha measures of reliability were .76, .87 and .91 for hyperactivity/inattention symptoms and .78, .63 and .80 for CD symptoms (fifth, sixth and seventh grades, respectively).

2.2.2 Academic performance

Academic performance was measured using individual student grades each year. Fifth- and sixth-grade subject grades were collected from teachers, and seventh-grade subject grades were collected from school registrars at the end of the school year. The academic grade point average (GPA) in seventh grade comprised four core school subjects' means: Finnish language and literature; math; English and Swedish. Classroom teachers (primary school) and subject-specific teachers (lower secondary school, e.g., English and math) assign grades based on several exams throughout the school year. At the end of the school year, each student receives a final grade for every subject they have studied throughout the year. Finland's general subject grading scale ranges from 4 (fail) to 10 (excellent).

2.2.3 SAQ – maladaptive achievement strategies

Maladaptive achievement strategies (MAS) were assessed using the Strategy and Attribution Questionnaire (Nurmi et al., 1995), modified for children. To get a representative measure of all aspects (cognition, affect and behaviour), nine items measuring MAS were utilised, e.g., "When we are doing exercises at school, I'm afraid I can't do them", "If something is difficult at school, I gladly do something else", "If something goes wrong at school, I think teachers and other students consider me stupid". All students were asked to rate statements on a four-point scale (1 = strongly disagree to 4 = strongly agree) during each grade's spring semester. The Cronbach's alpha reliability measures for MAS were .83, .87 and .88 (fifth, sixth and seventh grades, respectively).

2.2.4 Student perceptions of peer relations, student-teacher relationships and family support

To measure adaptation to social context, we utilised parts of the large School Well-Being Profile Questionnaire (SWBPQ; Konu et al., 2002), a student-rated measure of their overall well-being covering four dimensions: school conditions; social relationships; self-fulfilment and health status (Konu et al., 2002; Konu & Lintonen, 2006). Students were asked to respond to 56 items on a three-point scale (1 = disagree, 2 = neither agree nor disagree, 3 = agree). The SWBPQ's internal consistency and validity were found to be adequate (Konu et al., 2002). In the third individual study, the focus concerned mediating effects on students' perceptions of student-teacher relationships, peer relations and family support. Based on an exploratory factor analysis (EFA), we extracted factors that measured student-teacher relationships (STR), peer relations (PRL) and family support (FAMSUP), and we validated these subscales by studying their internal consistency. The students rated these items at the beginning of the spring during their first lower secondary school year. The peer relations measure focussed on students' adaptation in their peer group within the class and comprised five items (e.g., "Students in my class feel comfortable with each other" and "Students in my class help each other in problematic situations"). The Cronbach's alpha for peer relations in seventh grade was .85 (only a T3 measure was used). Lower secondary school students encounter multiple teachers within one day; consequently, student-teacher relations were measured using eight items focussing on school-level interaction between students and school personnel, e.g., "It is easy to get along with teachers" and "Students' opinions are considered in our school". The Cronbach's alpha for student-teacher relations was .85. The support that students receive from home was measured using three items (e.g., "My parents consider my schoolwork to be important" and "My parents help me in school tasks"), and the Cronbach's alpha was .80.

2.2.5 Basic academic skills in reading and mathematics

Basic academic skills were measured using academic achievement tests on reading comprehension and basic math skills. Reading comprehension in Finnish was measured using a subtest of a widely used standardised test battery (ALLU: Lindeman, 1998), in which students answered 12 multiple-choice questions based on a two-page silently read text within a 60-minute time frame. The text was available while the students answered the questions. The test has acceptable validity and reliability (Cronbach's alpha = .64, Lindeman, 1998). Basic math skills were measured using the standardised Basic Arithmetic Test (RMAT: Räsänen, 2004), a timed test comprising 56 items covering basic addition, multi-digit calculations, fractions, decimals, measurement and algebraic tasks. The students performed mental calculations on 28 tasks and wrote their answers on the test sheet. The total score is the number of items answered correctly in 10 minutes. The test has high internal validity and reliability in Finland: The Cronbach's alphas ranged from .92 to .95 for ages 9–12 (Räsänen, 2004). With this data, total scores from the test results were collected in both reading comprehension and math.

2.2.6 Special education needs – status

Finland utilises a three-tiered support system (e.g., Pulkkinen et al., 2019). A categorical variable of students' educational support status in seventh grade (n = 244 [subset], n = 489 [total sample]) was used in the third individual study. Students who received general support were coded as 0, those receiving intensified (Tier 2) support were coded as 1 and those receiving special support (Tier 3) were coded as 2. This variable was used only in Study III. Altogether, 17.7% of the subset had received either Tier 2 (n = 29) or Tier 3 (n = 26) support. These data were acquired from special education teachers at participating schools.

2.2.7 Family-related variables

From family-related variables, SES and family structure were included. SES was measured via the education level of students' guardians (Study I: maternal and paternal education level; Studies II–III: maternal education level) and was measured by surveying guardians using an eight-point scale ranging from comprehensive education only to master's/doctoral education level. Bachelor's-level degrees from the University of Applied Sciences and Universities were re-coded into one combined category using a seven-point scale. Only 2.4% of mothers and 3.6% of fathers had no education beyond the comprehensive level (i.e., no vocational degree), and 33.7% of the mothers and 28.1% of the fathers had higher education levels (e.g., higher vocational diplomas; bachelor's, master's or doctoral degrees). The overall distribution of mothers' education level was comparable to that of the general population at the time of the study

(Statistics Finland, 2013). The family structure was measured as a dichotomous variable of one- or two-parent households.

Table 1

Assessment points and measurements used in Studies I–III

Measurement time	*n*	Informant	Measure	Measured constructs	Studies		
					I	II	III
Fifth grade January	281	Teacher	SDQ	ADHD and CD symptoms		X	X
	262	Student	SAQ	MAS		X	
Fifth grade January	245	Teacher	GPA	reading, writing, math and language arts	X		X
Sixth grade January	311	Teacher	SDQ	ADHD and CD symptoms	X	X	X
				ADHD + CD symptoms composite	X		
	289		SAQ	MAS		X	
Sixth grade January	285	Teacher	GPA	reading, writing, math and language arts	X	X	X
Seventh grade January	202	Teacher	SDQ	ADHD and CD symptoms	X		X
				ADHD + CD symptoms composite	X		
	226	Student	SAQ	MAS			X
	232 230 231	Student	SWBPQ	Peer relations (PRL), Student-teacher relations (STR) and Support from home (SUP home)			X
Seventh grade June	251	School register	GPA	reading, writing, math and language arts	X	X	X

Notes. SDQ = Strengths and Difficulties Questionnaire, SAQ = Strategy and Attribution Questionnaire, SWBPQ = School Well-Being Profile Questionnaire, GPA = general grade point average

In addition to the main variables, several covariates were used in Studies I–III. This information is presented in Table 2.

Table 2

Covariates

Measurement point	*n*	Source	Measure	Scales	Studies		
					I	II	III
Sixth grade January	229	Student	Family structure	Dichotomous variable: single or two-parent household	X		
Sixth grade March	272	Teacher	Reading comprehension	Reading comprehension sum score (ALLU)	X	X	
	279		Basic arithmetic skills	RMAT sum score	X	X	
Seventh grade January	244	Special education teachers	Special education needs	Three categories: general support (0); intensified support (1); special support (2)			X
Collected annually	311	Student	Sex	Participants' biological sex (1 = female, 2 = male)	X	X	X
Collected annually	224	Parent	Parental education level: mother	The highest education level of the participant's mother during data collection; seven categories	X	X	X
Collected annually	208	Parent	Parental education level: father	The highest education level of the participant's father during data collection; seven categories	X		

2.3 Statistical analysis

These studies utilised variable-oriented approaches using measured variables. Statistical analyses were conducted using IBM SPSS (Statistics for Windows, versions 19.00-24.00) and Mplus statistical package versions 7.4–8.4 (Muthén & Muthén, 1998-2012). Table 3 presents an overview of the research aims, specific research questions and analytical methods for each individual study (I–III). In the individual studies, structural equation modelling (SEM) was used to test theoretically driven hypotheses on the phenomenon. SEM helps explain relationships between measured (and latent) variables by providing estimates of coefficients based on hypothesised relationships between the variables.

The analyses were selected based on the research questions and assumption that symptoms of ADHD and CDs, MAS, and academic performance develop jointly and predict later academic performance. Correlations between the study variables are provided in Appendix 1. Significant correlations were found within and between school years, indicating that these constructs are both stable and possibly interconnected. Consequently, further investigation of their joint development over time was justifiable. The correlations between CDs and academic performance were a bit smaller than those between ADHD and academic performance. The correlations between ADHD and CDs ranged from medium to high, whereas concurrent correlations between MAS and both behavioural symptoms were small to medium. Sex correlated with ADHD, CDs and academic performance, indicating possible mean differences between boys and girls. No significant correlations were found between sex and MAS. SES correlated with seventh grade ADHD and MAS in fifth and sixth grades.

Table 3

Overview of study aims and analytical methods in Studies I–III

Study and aims	Specific research questions	Data analyses
I Investigating the longitudinal association between externalising behaviour problems and academic performance during school transition.	1) What is the direction and strength of the cross-lagged relationship between composite externalising behaviour problems and academic performance? 2) Do CD and ADHD symptoms differ in their association with academic performance? 3) Does controlling child- and family-related covariates change the aforementioned relationships' strength or direction?	Cross-lagged path models (CLPM) with controlled variables; multigroup analysis
II Examining concurrent and longitudinal associations between ADHD/CD symptoms and MAS during later primary years and how they predict academic performance during school transition.	1) Do symptoms of ADHD or CDs have cross-lagged associations with MAS? If they do, what are these associations' direction and strength? 2) How do symptoms of ADHD or CDs, together with MAS, predict later academic performance?	Cross-lagged path models (CLPM) with controlled variables
III Investigating whether early lower secondary school adjustment mediates ADHD symptoms' effects on academic performance during the first year of lower secondary school, and whether these effects are similar with girls and boys.	1) What roles do possible mediating factors – e.g., MAS, social context, parental support or special education needs support status – play in the relation between ADHD symptoms and academic performance during school transition? 2) Are these effects similar with boys vs. girls?	Cross-lagged path analysis (mediating effects); multigroup analysis (Exploratory factor analysis)

2.3.1 Study analyses

In these studies, the full-information maximum likelihood (FIML) method was used in the SEM modelling to address missing data (Muthén & Muthén, 1998-2010). It allows for using all available observations in the data for parameter estimation and does not require the same number of items, observations or variables for every individual. Instead, it writes the log-likelihoods for each individual based on the individual's observed data (e.g., Enders, 2010; Graham & Coffman, 2012). This constitutes more valid results, and it is recommended over other methods, as it retains the principal relationships among the variables, estimates variability within the data and improves parameter estimates' accuracy (Enders, 2010; Jeličić et al., 2009). Moreover, FIML assumes that missing values

are missing at random (MAR), so it is not as strict as methods that require data to be missing completely at random (MCAR).

With Mplus, several fit indices are provided to assess the model's goodness-of-fit, including Bentler's comparative fit index (CFI), Tucker-Lewis index (TLI), chi-square test, root mean square error of approximation (RMSEA) and standardised root mean residual (SRMR) (Geiser, 2013; Hu & Bentler, 1999; Muthén & Muthén, 1998-2010). Good model fit indicators were considered as follows: chi-square test: $p > .05$; CFI > .95; TLI > .95; RMSEA < .06 and SRMR < .08 (Geiser, 2013). Nevertheless, these values should be used merely as guidelines for evaluating model fit, rather than as definite cut-off criteria (Marsh et al., 2004). For example, the chi-square test's significance provides a *p*-value that indicates whether the model seems to be explaining an important enough part of the variation in the data. However, this value is sensitive to large sample sizes, and it should be interpreted with caution (Kyriazos, 2018). In addition to the model fit indices, relevant theories also can be utilised when specifying the models.

In Study I, three separate cross-lagged path models were tested (CLPM: Selig & Little, 2012) to assess reciprocal relationships between academic performance and a) externalising behaviour problem composite, b) ADHD symptoms and academic performance, and c) CD symptoms and academic performance. With the ADHD and CD models, two sets of control variables were tested: 1) child-related (sex, reading comprehension and basic math skills) and 2) family-related variables (family structure and both parental education levels).

In Study II, two cross-lagged path models were tested to examine whether a) ADHD symptoms and MAS were associated and together predicted seventh-grade academic performance and b) the same for CD symptoms and MAS. In both models, control variables were utilised. In Study III, the main approach was path analysis with mediating effects and control variables over the three time points. EFA was utilised as an assistive tool while establishing the dimensions of social adjustment (student-teacher relations, peer relations and support from families), and sex differences were investigated using multigroup modelling.

The estimation method was maximum likelihood with robust standard errors (MLR; Muthén & Muthén, 1998-2012), which allows for handling non-normally distributed variables. Some attrition occurred after the transition from primary to lower secondary school. The seventh-grade externalising behaviour rating was received from 65% and academic performance 79% of the students who had ratings from sixth grade. Also, some data were missing from the sixth-grade control variables: standardised tests in math, 10%; reading comprehension, 13%; maternal education level, 28% and paternal education level, 33%. Missing value analysis was conducted in every individual study, and the results suggest that the data were missing completely at random (Little's MCAR: Study I, $p = .220$, $\chi^2 = 86.249$ (77); Study II, $p = .197$, $\chi^2 = 438.33$ (41); Study III, $p = .552$, $\chi^2 = 103.447$ (106).

2.3.2 Cross-lagged models: path analysis and panel models

Cross-lagged models (i.e., cross-lagged path/panel analysis) are among the most common analytical methods in longitudinal studies focussing on developmental associations, relationships and influences over time. They are used widely to investigate data- and theory-supported causal relations further (e.g., Newsom, 2015). In these models, panel (i.e., cohort studies) or longitudinal data (i.e., each observation/person) are recorded at several time points (Kearney, 2017). In this doctoral dissertation, both path and panel analysis were utilised to answer the individual studies' research questions.

Cross-lagged path analysis can be viewed as multivariate regression models that simultaneously consider multiple dependent and independent variables, while independent variables are allowed to correlate (Geiser, 2013; Newsom, 2015). This approach serves social sciences, as the theories often include hypotheses with both direct and indirect effects. Indirect effects are mediated through other variables (i.e., mediated effects). If the path analysis contains one or more indirect effects, an effect decomposition is often of interest. The total effect is equal to the sum of direct effects plus all indirect effects in the model (Geiser, 2013). Mediation models are used to describe the mechanisms of one variable influencing another (Muthén et al., 2016). In longitudinal research, this can help explain the relationship between variables, developmental processes or combinations of these, which is why it served Study III well.

However, cross-lagged panel models (CLPMs) allow for estimation of cross-lagged effects and control for correlations within time points and autoregressive effects, or stability, across time (Kearney, 2017; Selig & Little, 2012), which is why they were utilised in Studies I and II. Autoregressive effects reflect stability in constructs over time: Small (close to 0) autoregressive coefficients indicate more variance in the construct (i.e., less stability or influence from the previous time point), whereas large autoregressive coefficients indicate little variance over time (Selig & Little, 2012). General CLPM only accounts for temporal stability via inclusion of autoregressive parameters. This suggests that every person varies over time around the same grand mean, and that no trait-like individual differences exist (Hamaker et al., 2015).

The three main objectives of CLPM research are to determine a) whether variables influence each other, b) which of the variables is dominant causally and c) what the sign of influence is (Hamaker et al., 2015). In its most basic form, a CLPM includes two constructs measured at two time points (i.e., four variables), similar to Studies I and II. CLPMs assume that each time a construct is measured, it is a variable (i.e., the timepoint itself is a variable). Furthermore, the CLPM model includes 10 parameters of four variables: four variances and six covariances (e.g., exogenous variances, synchronous correlations, cross-lagged paths, autoregressive paths and endogenous residuals) making it just identified (Kearney, 2017). Estimates of cross-lagged effects control for contemporaneous effects and variance across time (rank-order stability: Hamaker et al., 2015; Kearney, 2017).

Kearney (2017) emphasised that CLPM makes seven important assumptions, including: 1) the measurements at each time point occurred at the exact same times (synchronicity); 2) variables and relationships remain the same across time (stationarity); 3) comparing cross-lagged coefficients: To make claims about causal predominance, the analysis typically includes comparing cross-lagged coefficients' relative sizes. Furthermore, 4) the CLPM also assumes that variables are measured without error. Some scholars have argued that in models with only two timepoints, measurement errors may be misinterpreted as real changes (Hamaker et al., 2015; Kearney, 2017). 5). The models also assume that *X1* occurs before *X2* without explicitly including time (the effect's time frame). Thus, it assumes that one variable's effect on another is a function of a lag (time) between measurement points (Kearney, 2017). 6) In theory, CLPMs assume that all possible variables were measured and included in the model. This definition of causality (originating from econometrics) is unlikely to hold while studying young people and their academic and behavioural development. Thus, interpretations of cross-lagged analysis are worded use words such as 'influence' instead of 'causality'. However, when utilising cross-lagged models with longitudinal data, constructs' substantial stability over time solves most endogenic problems (Antonakis et al., 2014). Finally, 7) CLPMs usually lack explicit theories on change, and autoregressive parameters are included to account for stability for everyone across time (Kearney, 2017). Consequently, this leads to the assumption of no inter-individual differences (differences between people) in stability over time. Interindividual differences that do exist (i.e., unobserved, trait-like influences or dependencies) may bias results (Hamaker et al., 2015). All in all, CLPMs include significant limitations: Changes among individuals and differences between individuals both can produce variances that the model does not reach.

2.3.3 Multigroup analysis

Multigroup analysis is used to study group differences. Separate models are tested in two or more separate groups. Equality constraints across groups are used to conduct nested tests using likelihood ratio comparisons between a model with certain parameters constrained to be equal and a model with those same parameters freely estimated (i.e., allowed to differ) across the groups (Byrne, 2012; Newsom 2015). This allows for investigating whether means, predictive paths or loadings differ across two groups (Newsom, 2015). Generally, these models follow the same structure in each group and can provide separate estimates of within-group parameters (e.g., paths and correlations), and chi-square and fit indices can be calculated for each group separately and for the joint multigroup model (Newsom, 2015).

After this, constraints can be determined in a subsequent model that sets any parameter or set of parameters as equal across the groups to determine whether a significant increase occurs in chi-square, i.e., a decrease in model fit (Newsom, 2015). This configural model's fit then provides the baseline $\chi 2$ value against which a series of increasingly restrictive invariance models are compared

to identify the non-invariance source. A nonsignificant chi-square difference would serve as evidence of equivalency across groups. In Studies I and III, a chi-square difference test was performed for estimation of multigroup effects (Werner & Schermelleh-Engel, 2010). In Study I, no significant differences were found. In Study III, to obtain more compelling evidence of variance/non-invariance in path coefficients across the two groups, an analysis was performed through a series of chi-square difference tests. Notably, sample size directly affected chi-square difference tests applied to mis-specified nested models (Werner & Schermelleh-Engel, 2010), i.e., for large samples, even inconsequential differences may become statistically significant. In two sequential multigroups that were compared – a freely estimated model and a model in which path coefficients for both groups were fixed as equal – CFI decreased from 1.00 to .94, indicating a poorer fit in the model that assumed equality of path coefficients across the groups. The comparison of models using the Satorra-Bentler chi-square difference test (p = .0003) (Satorra & Bentler, 2010) indicated that the same model did not fit boys and girls; thus, separate, freely estimated models were created for the two groups.

3 OVERVIEW OF THE ORIGINAL STUDIES

This dissertations' overall aim was to investigate the longitudinal mechanisms between different kinds of externalising behaviour problems (ADHD and CDs), learning motivation, academic and social adjustment, and their prediction of later academic performance. The dissertation comprises three individual studies. Study I focussed on the longitudinal relationships between externalising behaviour composite and academic performance, and further investigated how ADHD and CD symptoms separately interacted with academic performance during the transition from primary to lower secondary school. Study II focussed on the concurrent and longitudinal interaction between ADHD symptoms and MAS, and CD symptoms and MAS during fifth and sixth grades, and how these predicted academic performance after the first year of lower secondary school. Finally, Study III focussed on the mediating effects of academic and social adjustment behind ADHD symptoms' direct effects on academic performance during the first year of lower secondary school, as well as possible sex differences in the mediating effects.

3.1 Study I: Externalising behaviours and academic performance – the chicken or the egg?

Externalising behaviours and academic performance: the cross-lagged relationship during school transition

Study I aimed to investigate the association (particularly the direction) between externalising behaviour problems and academic performance during school transition over time, particularly to reveal whether the externalising behaviour composite and ADHD and CD symptoms separately differ in their relationship with academic performance, and whether controlling child- or family-related covariates altered the relationship's strength or direction. The participants comprised 311 (52% female) sixth grade students ages 12–13. Between grades was the transition from primary school to lower secondary school. Externalising

behaviours were assessed using the SDQ teacher rating, with academic performance gathered from teachers (sixth grade) and school registrars (seventh trade). A GPA comprising reading, language arts (Finnish, English and Swedish) and math was used to represent academic performance. Multiple child- and family-related covariates (e.g., biological sex, basic academic skills and parental education level) were controlled in the alternative models.

Cross-lagged panel modelling was used to test the alternative models. Analyses were conducted separately for the externalising behaviour composite (ADHD and CD symptoms), CD symptoms and ADHD symptoms. The models indicated differing interactions between ADHD, CD and externalising symptoms composite and academic performance. Thus, the covariate models were tested for each domain separately. The externalising behaviour composite was associated with a decrease in academic performance during school transition. However, good academic performance in sixth grade was associated with low CD symptoms in seventh grade. The effect remained significant when child-related covariates were controlled, but not after controlling for family-related covariates, e.g., parents' education level and family structure. Family SES may play a role in how CDs interact with academic performance, as some benefits from parental involvement are stratified with family SES (Tan et al., 2020). Instead, ADHD symptoms systematically affected seventh grade GPA negatively, even after child- and family-related covariates were controlled.

The results indicated that during early adolescence and school transition, ADHD and CDs differ in their association with academic performance, in line with previous literature, as the negative association from previous externalising behaviours to later academic performance was found in the models that included ADHD symptoms (Hinshaw, 1992; Kulkarni et al., 2021; Loe & Feldman, 2007), and controlling for child- and family-related variables did not change this negative association. Thus, ADHD symptoms hold importance concerning academic performance, and the effects reach beyond school transition. As sex was associated with externalising problems, a multigroup method was conducted to test for differences between boys and girls, but no significant differences were found.

Overall, these results emphasise the importance of independent consideration of externalising behaviours' dimensions in relation to academic performance during these early school years. Symptoms such as inattention, hyperactivity and impulsivity with or without a formal diagnosis of ADHD exert a unique negative effect on academic performance. Transition to lower secondary school elicits changes in both academic demands and social environment, along with how students perceive themselves in their social roles (Pietarinen et al., 2010). ADHD symptoms likely raise the risk of unsuccessful transition to lower secondary school. With early recognition and intervention, students may be more likely to enter a positive behavioural and academic cycle.

3.2 Study II: The role of maladaptive achievement strategies – or is it something else?

ADHD symptoms and maladaptive achievement strategies: the reciprocal prediction of academic performance beyond the transition to middle school

Study II mainly aimed to examine concurrent and longitudinal associations between ADHD symptoms and maladaptive achievement strategies (MAS), and between conduct disorder (CD) symptoms and MAS between fifth and sixth grades, and their longitudinal effects on students' academic performance in seventh grade with two cross-lagged panel models. Different informants were utilised, as teachers rated the symptoms of ADHD/CDs, and students rated their MAS. Teachers who rated primary school academic performance (control variable) were different from the ones rating seventh grade academic performance. Furthermore, child-related and family-related covariates were controlled.

The symptoms of ADHD and CDs were studied separately, and differing associations with MAS were found. The results indicated reciprocal cross-lagged effects between ADHD symptoms and MAS between fifth and sixth grades, along with concurrent negative correlations. Between the grades five and six, teacher-rated ADHD symptoms seemed to increase students' self-reported MAS, while MAS increased ADHD symptoms the next school year. Both also negatively affected seventh-grade GPA during the transition to lower secondary school. With CDs, such cross-lagged paths were not found. CDs and MAS were correlated at both time points and were very stable over time, and as for sixth-grade measures, both negatively predicted later academic performance. CDs and MAS seemed to develop side by side, but they did not affect each other's levels over time or create a negative cycle like ADHD symptoms and MAS. In short, ADHD and CD symptoms differ in how they interact with MAS. Students with ADHD symptoms may be more vulnerable to negative learning experiences and the development of MAS than students with CDs.

It is likely that the negative cycle of ADHD symptoms and MAS exerts is negative effects on academic performance even after the transition to lower secondary school. MAS are evoked from experiences with failure at school, ADHD symptoms increase the risk of MAS and the symptoms also can be mistaken for MAS. This makes early screening for ADHD and MAS symptoms extremely important. Students at risk for this cumulative cycle of failure need well-targeted support for ADHD symptoms and in learning more adaptive achievement strategies to facilitate successful self-regulation and goal-oriented behaviour at school. Holistic support containing realistic informative feedback could decrease the number of experienced failures and improve learning motivation and, thus, endorse successful self-regulation in school (Nurmi, 2015).

All in all, the findings suggest that more research is needed on the negative cycle of ADHD symptoms and MAS, which are strengthening risks for each other, and the negative cycle can be disrupted only in learning situations. Compared to

students with CDs, students with ADHD symptoms may be more likely to develop MAS when facing negative learning experiences. This indicates the need to screen for ADHD symptoms and MAS during primary grades, as well as develop interventions that target both domains.

3.3 Study III: ADHD symptoms and academic performance – possible mediators and sex differences?

ADHD symptoms and transition to middle school: the effects of academic and social adjustment

Study III examined the cross-lagged relationships between ADHD symptoms and academic performance, and possible mediating effects of early middle school adjustment during the transition from primary to lower secondary school. The second aim was to investigate whether any sex differences existed using multigroup modelling. Cross-lagged path analysis and multigroup analysis were used to answer these research questions: 1) What roles do possible mediating factors – e.g., MAS, social context, parental support or special education needs support status – play in the relation between ADHD symptoms and academic performance during school transition, and 2) are the effects similar with boys vs. girls?

The first model indicated both students' MAS and pedagogical support mediate ADHD symptoms' effect on academic performance in seventh grade. Social adjustment measures did not exert any mediating effects, though ADHD symptoms were associated negatively with teacher-student relationships and support received at home. Furthermore, we found that the same model did not fit boys and girls. From investigating separate models, MAS mediated ADHD symptoms' effects on academic performance with boys, but with girls, ADHD symptoms' effects on lowering academic performance in seventh grade were direct. Furthermore, ADHD symptoms were associated with SES and pedagogical support status only among boys. Pedagogical support reaches boys with ADHD, but is not enough to break the negative cycle of ADHD, MAS and academic performance. Simultaneously, ADHD symptoms do not seem to increase the likelihood of receiving pedagogical support among girls.

To sum up, the models differed in a) the mechanisms through which ADHD symptoms affected academic performance, b) how pedagogical support was received and c) how academic and social adjustment interacted at this stage. The differences may be due to more recognizable behavioural symptoms among boys, and primarily inattentive symptoms among girls (Biederman et al., 2002; Hinshaw et al., 2022). It is also possible that the symptoms' effect becomes more apparent during the first year of middle school as academic and social demands increase (Barkley, 1997). Eventually, battling with inattention during school days can be extremely burdensome, taxing academic performance and leading to

school-related anxiety, depression and problems with parents (Joelsson et al., 2016).

Overall, this dissertation represents a unique effort to investigate the interrelationships among ADHD symptoms, academic and social adjustment, and academic performance during school transition. The results also suggest that with boys, ADHD symptoms' effect on academic performance is mediated via MAS, and that pedagogical support reaches these boys. Simultaneously, pedagogical support does not seem to reach girls with ADHD symptoms, and the symptoms' effects on academic performance are direct. Social support was not as important a factor concerning academic performance as one would have anticipated (Virtanen et al., 2019). These results indicate that scholars should examine school transitions' effects on the development of achievement strategies further, and that ADHD symptoms and sex differences' roles should be noted.

Table 4

Overview of the main results by symptom category

ADHD SYMPTOMS	CD SYMPTOMS
✓ Predict academic performance during the transition to lower secondary school even after controlling for students' sex, achievement test scores, parental education levels and family structure	✓ Do not predict academic performance during the transition to lower secondary school
✓ Reciprocal cross-lagged relationship with MAS between fifth and sixth grades	✓ After controlling for parental education levels, family structure and students' sex, higher academic performance predicts lower levels of CD symptoms
✓ Both domains negatively predict academic performance after the first year of lower secondary school	✓ CDs and MAS have concurrent relationships in fifth and sixth grades
✓ Previous ADHD symptoms predict academic performance	✓ No longitudinal effects on each other's level between the grades
✓ With boys, the effect that ADHD symptoms exert on academic performance is mediated via MAS	✓ Both domains negatively predict academic performance after the first year of lower secondary school
✓ With girls, the effect that ADHD symptoms exert on academic performance is direct	

4 DISCUSSION

This dissertation investigated the longitudinal mechanisms between different externalising behaviour problems (ADHD and CDs), learning motivation, academic and social adjustment, and their prediction of later academic performance during later primary school years and during the transition to lower secondary school. The results indicate that ADHD symptoms in particular are a risk factor for decreasing academic performance during early adolescence. They seem to exert longitudinal effects on later academic performance, and even when child- and family-related variables (e.g., sex, SES and standardised reading and math test scores) are considered, they are associated reciprocally with MAS, and the negative effects tax academic performance during the transition to lower secondary school. Furthermore, MAS seem to exert mediating effects on the negative association between ADHD symptoms and later academic performance.

4.1 Differing pathways of influence for ADHD and CDs

Study I's results indicated that 1) ADHD and CD symptoms differed in their association with academic performance during the transition from primary to lower secondary school, 2) ADHD symptoms negatively affected later academic performance even when child- and family-related covariates were controlled and 3) controlling for child (i.e., sex and standardised reading and math test scores) and family-related (both parental education levels and family structure) factors exerted some effects in the direction and strength of the relationships regarding CDs, with controlled family-related variables resulting in no cross-lagged effects. In light of Hinshaw's (1992) theoretical pathway models, the results were consistent with Model 2 (Figure 2), in which previous externalising behaviour problems' composite and ADHD symptoms predicted lower later academic performance. This is understandable, as both of these measures included ADHD symptoms (i.e., inattention items, see: Hinshaw, 1992; Kulkarni et al., 2021). However, previous academic performance was associated with low levels of CD

symptoms, which is a kind of reverse version of Hinshaw's Model 1: the higher the academic performance, the fewer the CD symptoms. Controlling for child- and family-related covariates did not change these relationships' strength or direction with ADHD symptoms, but in the case of CDs, controlling for family-related covariates resulted in an insignificant cross-lagged relationship. However, in the CD model, SES was associated with academic performance, and family structure (one- or two-parent household) was associated with CD symptoms. This indicates that in terms of CDs, family SES (parental education levels and family structure) plays a role in students' academic performance at least cross-sectionally, which also has been found among referred youths with CDs (e.g., Breslau et al., 2009; Tanin et al., 2020).

In Study II, reciprocal cross-lagged relationships between ADHD and MAS were found, but similar effects were not found between CDs and MAS. All three – MAS, ADHD and CDs – negatively predicted academic performance during the transition to lower secondary school. Sex exerted significant direct effects only in the model with CDs. Overall, ADHD symptoms and MAS created a double dilemma in terms of academic performance. ADHD symptoms likely hamper the execution of adaptive achievement strategies and elicit experiences with failure, which then lead to negative attitudes towards schoolwork and learning situations (Nicholls, 1984), generating more maladaptive achievement strategies (Nurmi, 2015). This negative cycle seems to exert an effect beyond school transition and changing school environment.

Further investigations in Study III indicated that the mechanism of how ADHD symptoms tax academic performance during the first year of lower secondary school is different with boys vs. girls: With boys, the effect was mediated via MAS, but with girls, the effect was direct. ADHD symptoms among girls also were associated with MAS, although no further effects on academic performance were found. Previous academic performance was associated with MAS and pedagogical support status for both sexes. Also, it seems that parental education level is associated with ADHD symptoms and pedagogical support level only among boys. Interestingly, student-teacher relationships and MAS were associated negatively only with the girls' model.

In terms of ADHD, students' perceptions of social support differed between both sexes. With boys, no concurrent correlations were found between social and academic adjustment, but they were found with girls. Also, ADHD symptoms were not associated with peer relations over time. Previous literature has associated middle school transition with declines in perceived total support and teacher support, and an increase in self-reported school problems (Martínez et al., 2011). In these results, negative longitudinal relationships from ADHD symptoms to student-teacher relationships and lack of family support were found only with boys. However, in the girls' model, negative concurrent associations were found between both family support and student-teacher relations, and MAS. In the boys' model, strong positive concurrent associations were found between peer relationships, student-teacher relationships and family support, while in the girls' model, the correlations were a bit weaker. Family SES

was associated with pedagogical support status and ADHD symptoms only among boys. This may indicate that some benefits from family involvement are stratified with family SES (Tan et al., 2020).

Concerning CDs, the results seem a bit tenuous. At this age, CDs, MAS and low academic performance develop hand in hand, but they do not affect each other's level over time the same way they do with ADHD symptoms. Possibly, at this age, CDs are not longitudinally associated with the development of achievement strategies (or vice versa). MAS and CDs seem to coexist and exacerbate each other but are not causally related. CDs' symptoms are related more to social functioning, whereas ADHD symptoms, particularly inattention, also hamper learning situations (Langberg et al., 2013). It could be, that motivation co-effects differently with ADHD and CDs as motivational problems may arise from different background factors. For students with ADHD, the key factor for comorbid motivational problems could be, for example, deficits in EFs (e.g., working memory, inhibition), difficulties with delayed gratification (e.g., studying for exams), under-stimulation or lack of task-related interest. For CDs the factors contributing to motivation problems could be low academic self-concept and academic disengagement, external pressure (e.g., poor social skills, disruptive behaviour in the classroom), lack of goal or direction (e.g., poor decision-making skills) or other comorbid psychological factors.

Furthermore, CDs usually peak later in middle adolescence: These problems' severity may become more prevalent during later lower secondary years, then exert longitudinal effects on other domains (Murray & Farrington, 2010). In study I, controlling family-related covariates in the CD model resulted no cross-lagged effects. Also, in Study II, parental education level and the student's sex exerted direct effects on academic performance in the CD model, whereas in the ADHD model, only parental education level exerted direct effects on later academic performance. Thus, CDs likely are associated more with other social factors, e.g., the student's family background and peer relationships (Crum et al., 2016; Murray & Farrington, 2010). These results fit well within extant research, indicating that higher family SES relates to lower levels of CD symptoms (Piotrowska et al., 2015). However, this leaves students with low SES and a lack of family support at risk for further negative turns of events. CDs already were associated with MAS in primary school, and in the long run, they can be more harmful and hamper academic performance. Thus, students with low SES could benefit from systematic support to reduce MAS.

To sum up, ADHD symptoms and CDs differ in how they a) interact with academic performance and b) interact with MAS, and at this developmental stage, ADHD symptoms form a specific risk factor in terms of academic performance. Also, the mechanisms on how ADHD symptoms tax academic performance during school transition are different with boys vs. girls. In addition to the mediating effects of MAS, these results emphasise the moderating role of sex among students with ADHD symptoms. The finding of sex differences in the pathways of Study III provides some support for extant literature (e.g., Quinn & Madhoo, 2014), i.e., that ADHD symptoms' manifestation and effects vary

between the sexes, at least in terms of MAS. This may result in different social and academic adaptation problems in lower secondary schools, e.g., student-teacher relationships had negative correlations with MAS only among girls.

4.2 Practical implications

A remarkable portion of school-age youths' daily lives involves meeting school-driven challenges. Changes in demands at school increase the probability that behavioural and motivational problems will develop. This dissertations' results highlight ADHD symptoms' effect on academic performance and learning motivation within a community sample. Previously, Zendarski et al.'s (2017) cross-sectional study found that students with diagnosed ADHD are at increased risk of academic problems during the lower secondary school and early upper secondary school period. This dissertation supplements previous literature revealing that the risk a) exists among nonreferred youths with ADHD symptoms, b) is evident already during later primary school years and during the transition to lower secondary school, and c) may incur longitudinal effects. Furthermore, MAS constitute another risk factor that may diminish academic performance at this age, as they have developed into quite a stable process (Syal & Torppa, 2019).

The association between ADHD symptoms and MAS is not surprising. ADHD-related symptoms and difficulties in self-regulation and EFs (e.g., inhibitory control, problem-solving strategies and self-monitoring; Langberg et al., 2013) may strengthen utilisation of MAS throughout the school path, thereby strengthening the strategy itself. When it is difficult to monitor and modulate cognition, emotion and behaviour, accomplishing one's goal and/or adapting to learning situations' cognitive and social demands is difficult. This likely leads to development of a negative cycle (Figure 4). Utilisation of MAS may strengthen ADHD symptoms' effect on academic performance over time.

Moreover, externalising and internalising behaviour problems tend to overlap (Masten et al., 2005), and academic problems and internalising problems exert reciprocal effects (Weidman et al., 2015). In theory, ADHD symptoms are associated with poor academic functioning (Arnold et al., 2020), and poor academic functioning is associated with an increase in negative affects (Sainio, 2021), decreasing positive self-concept and perceived control, all of which could increase utilisation of MAS (Nurmi, 2015) and possibly create internalising behaviour problems (Maughan et al., 2004). Finally, failing in school also can hamper social status**,** which also can lead to strengthening negative (academic) self-concept and subsequent socioemotional problems.

Increased understanding of these mechanisms can improve targeted intervention efforts to boost both academic and behavioural functioning (McIntosh et al., 2006), and even influence long-term outcomes related to deficits (Masten & Ciccetti, 2010). Thus, intervention in one domain (MAS) could prevent further cascading development of problems in another (ADHD symptoms and

academic performance), potentially saving on school resources. Further understanding of these mechanisms is vital for the development and implementation of effective prevention and intervention efforts.

We already know that up to 80% of adolescents with diagnosed ADHD experience significant learning and academic achievement problems (Arnold et al., 2020; DuPaul & Langberg, 2015). Importantly, almost every school class contains students with these difficulties, indicating the need for prevention and anticipation on a universal support level. These students often need accommodations at school (DuPaul et al., 2014). The results indicate that pedagogical support reached boys with ADHD symptoms, but that this support was not enough to disrupt this negative cycle. Furthermore, in considering more targeted support, determining early whether students a) have ADHD symptoms that make learning situations a challenge, b) have motivational deficits and MAS and c) are associated with their academic performance is important. These results indicate a strengthening cycle between symptoms and MAS; thus, considering achievement strategies in supporting students' learning processes is extremely important. ADHD symptoms are quite persistent, but school-based interventions exist for both primary (e.g., behavioural, academics and self-regulation: DuPaul et al., 2014) and middle school (e.g., note-taking, self-management, homework, organisation and planning skills: Evans et al., 2014) contexts. Executing these interventions requires structures and consistency, time and staff. Unfortunately, use of evidence-based behavioural support in schools is not systematic in Finland. However, structured, differentiated instruction and targeted behavioural support (Karhu et al., 2018) and EF support (Paananen et al., 2018) programmes, e.g., have been demonstrated to exert positive effects.

Motivation interventions that target enhancement of motivation and academic performance also have demonstrated promising results (Meta-analytic review: Lazowski & Hulleman, 2016). MAS are typical ways of thinking and (re)acting. MAS can be generated by various factors entailing individual traits, environmental pressure and learned behaviours, and this negative process can be disrupted. However, it requires an external agent (i.e., a teacher or school counsellor), time and well-planned effort. Evidence-based motivation support includes clear, optimally challenging goals; experiences with autonomy; addressing potential barriers; creating a sense of achievement and continuous assessment and adjustment (Lazowski & Hulleman, 2016). Considering ADHD symptoms' effects on teaching more adaptive achievement strategies is crucial. The aforementioned ADHD intervention programmes could be utilised within the broader support framework. Becoming aware of maladaptive achievement strategies and teaching more adaptive achievement strategies involves equipping students with the skills and mindset needed to approach challenges, overcome obstacles and ultimately achieve their goals effectively.

Support that targets both motivation and externalising behaviours can be utilised within the three-tiered support system. The first obvious task in schools is systematic screening for learning difficulties, ADHD (particularly inattention symptoms) and MAS in primary school. In detecting support needs and

delivering support, student-teacher relations must be considered on both individual and school levels. This seems to be particularly important with girls who display ADHD symptoms, which were not associated with received pedagogical support, but rather social and academic adjustment correlated negatively. At this age, SES (parental education level) seems to be an important correlate, particularly among males, as it is associated with their academic performance, ADHD and CD symptoms, and special education needs status. The results also leave us to question how girls' ADHD symptoms are detected at this age, and how support is delivered at school. Among girls, previous academic performance was associated with pedagogic support level, thereby eliciting the question of whether attention problems have been investigated, or whether learning difficulties are masking symptoms. It also is possible that inattentive symptoms' negative effects become more prominent among girls during this stage. Even though boys with ADHD symptoms seemed to get special education services, the support is not enough to disrupt the negative cycle of symptoms and low learning motivation. This indicates that in delivering support, disrupting the negative MAS cycle needs to be considered.

The second task is to plan and deliver intensified and special support that targets students with externalising behaviours and MAS. Concerning MAS, this could entail, e.g., recognizing the ineffective strategies, modelling adaptive strategies, providing explicit and differentiated instruction, fostering metacognition, co-regulating and encouraging self-regulation, teaching problem-solving skills, promoting a resilience and growth mindset, providing feedback and reflection opportunities, scaffolding learning experiences, fostering collaboration and peer learning, promoting reflection and practising skills transfer (Lazowski & Hulleman, 2016; Nurmi, 2015; Yeager et al., 2018).

Figure 3 describes the development of maladaptive achievement strategies, and Figure 5 presents a theoretical model that considers possible mechanisms to disrupt this negative cycle. The model has been adapted from previous achievement strategy literature (Määttä, 2007; Nurmi, 2011, 2015), behavioural support methods studied in Finland (e.g., Karhu et al., 2018; Paananen et al., 2018) and this doctoral dissertation's results to target students with ADHD symptoms and MAS specifically. Motivation is a task-specific construct that varies across settings (Schwarzer, 2014), and ADHD symptoms' strength and hampering effects are also contextual (Imeraj et al., 2013). With adequate support and the provision of co-regulation in challenging situations, the symptoms' hampering effect presumably can weaken, and learning a more adaptive achievement strategy can become an opportunity. The framework comprises teaching more adaptive achievement strategies while considering targeted support for ADHD (e.g., learning, behaviour and EFs) within holistic support. The emphasis is on social and co-regulative aspects of support, as well as utilisation of evidence-based support systems in which teachers need training (Gagnon, 2022).

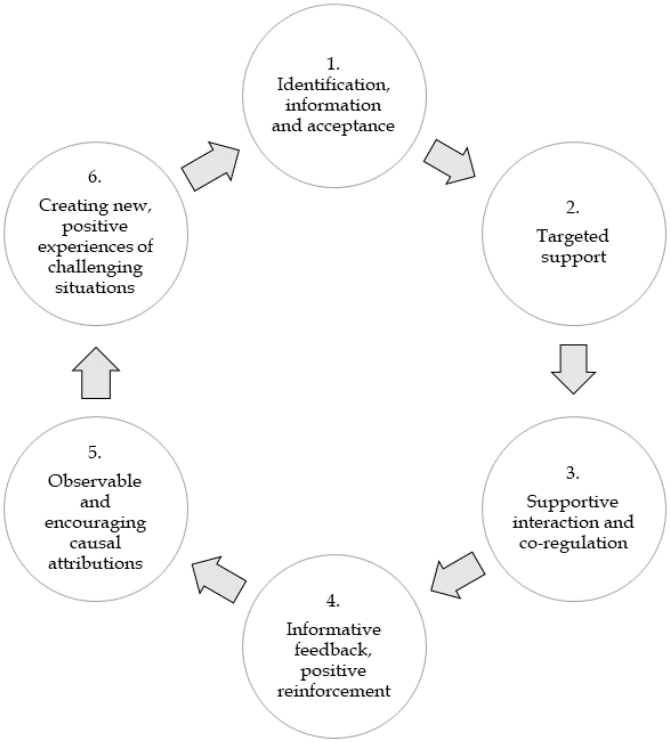

Figure 5

Disrupting the negative cycle

Delivering this kind of support requires both supportive structures on the school level (e.g., increasing knowledge with teacher trainings, screening and anticipation of cascading academic and behavioural problems, and multidisciplinary collaboration) for all students and targeted support for individuals at risk. Considering that the negative cycle is prominent during the transition to lower secondary school, collaborating with lower secondary school personnel and securing school transition and continuity in both academic and behavioural support are necessary. This kind of holistic support likely would fit in within, e.g., school-wide positive behaviour support systems that have raised interest in Finland during the past decade (e.g., Karhu et al., 2018; Närhi et al., 2015). The holistic approach can be divided into the following six steps:

1. **Identification, information and acceptance (school level)**

   - Mapping students' support needs in different domains (e.g., academic-specific skills, externalising behaviour, achievement strategies) and identifying students who need support
   - General accommodations in learning situations and differentiated instruction
   - Accepting students as they are by providing psychoeducation on the difficulties and information about how they affect learning situations and achievement strategies

2. **Targeted support and clear goals (group- and individual level)**
    - Utilisation of evidence-based support programmes for academic skills, externalising behaviour problems and/or EFs or MAS
    - Establishing optimally challenging academic and social goals to which the student is committed
3. **Supportive interaction and co-regulation (individual level)**
    - Sensitivity and responsiveness: EF-supporting interaction
    - Scaffolding: verbalising thoughts, feelings, reactions, and/or behaviours
    - Mapping, modelling and teaching more adaptive achievement strategies
4. **Information and constructive feedback (individual level)**
    - Providing realistic feedback that focusses on positive aspects and promoting a growth mindset
    - Providing direct positive reinforcement (and reward systems when needed)
5. **Concretisation and owning progress (individual level)**
    - Providing 'data' on progress (e.g., visual aids)
    - Observing and utilising encouraging causal attributions to elaborate on progress
6. **Creating new positive experiences (individual level)**
    - Ensuring that the student gains small 'forced experiences with success', with differentiation and scaffolding that address their individual support needs
    - Creating a sense of achievement

At its best, this kind of broad approach to pedagogical support entailing identification, instructional practices and evidence-based support integrated in everyday schoolwork could provide short- and long-term benefits, e.g., improving academic, behavioural and social skills; developing more positive attitudes towards learning and school; and leading to more positive social interaction, fewer externalising behaviour problems and less emotional distress. At this age, one of the driving forces of youths' behaviour is their desire to determine their identities and how they fit in the world around them. As early adolescents try harder with adequate support, they discover more about themselves and build their identities. When students at this stage have pedagogical and behavioural support needs, this process becomes more difficult. Simultaneously, they have increased developmental needs for autonomy, but the external pressure to make choices increases from primary to lower secondary school, and outside demands may outweigh their functional capacity, resulting in a poor stage-environment fit (Eccles et al., 1993; Ryan & Deci, 2017). Concerning ADHD symptoms, this means balancing developmental stage and individual support needs.

4.3 Strengths, limitations and future aspects

The present study's major strength was the longitudinal prospective follow-up over the first year of lower secondary school, entailing school transition and multiple informants (parents, teachers in both primary and lower secondary schools, and student self-reports). With CLPM, we can establish the direction and strength of the relationships investigated, and from a practical perspective, this is a rather appealing method. Nevertheless, the study must be understood in the context of limitations: The sample is rather small and from a decade ago, and the general understanding of externalising behaviour problems in schools may have changed. However, the data were gathered right after Basic Education Act (1998, amendment 624/2010) reforms and the transition to three-tiered support, after which there have not been other significant changes in support systems. Even though the use of ADHD medication (which requires a formal diagnosis) and diagnoses have increased in Finland (Vuori et al., 2018), there have only been individual research-based efforts to support students with these symptoms (e.g., Karhu et al., 2018; Karhu et al., 2021; Paananen et al., 2018). No evident systematic changes in support systems have occurred but developing practices cannot be ruled out completely.

While studying constructs such as reasons for behaviour or motivation and academic performance, acquiring evidence for cause and effect can be challenging. In the framework of this research, at least three aspects need to be considered: First, externalising behaviours or academic performance can be correlated with a variety of factors (Kulkarni et al., 2021; Offord & Kraemer, 2000). Second, these constructs can be measured at every time point, rendering temporal precedence a challenge. This is particularly problematic as participants age (Polanczyk et al., 2015) or their environments change (Imeraj et al., 2013), as such factors can affect the manifestation of externalising symptoms. Consequently, parameter estimates of causal inference can be affected by the statistical methodology and measures used (Pearl, 2009), as well as the participant's age and learning environment. Third, limitations and critiques are associated with CLPM models (e.g., Hamaker et al., 2015).

Although we included multiple covariates, the models are just that – models based on a data sample. They provide a description of the actual underlying mechanisms as they were identified and have proper goodness-of-fit indices. These simple models separately scrutinised the various dimensions of externalising behaviour problems that share similarities and often co-occur in real life (Abikoff & Klein, 1992; Waschbusch, 2002). Antecedent variables may contribute to these mechanisms, e.g., specific challenges in the development of self-regulative skills and EFs. The longitudinal association between ADHD and MAS is likely to include additional factors, e.g., quality of instruction, nature of the learning environment and student-teacher relationships (Murray & Murray, 2004; Rodgers et al., 2015). These developmental dynamics should be examined

in greater detail, particularly at earlier stages of the school path and concerning school transition.

In this most basic form (two waves), the CLPM attempts to identify causal predominance by comparing the cross-lagged paths' standardised coefficients (Kearney, 2017). Although this is a useful tool for describing cross-lagged relationships, one should be cautious about using it simply as evidence of causality due to omitted variable bias and endogeneity problems. CL models' causality is modelling the change in rank correlation between participants, i.e., the rank order can change between measurement points. It does not reach individual change, as it does not adequately separate the *within-person* and *between-person* levels in the presence of time-invariant, trait-like individual differences (Hamaker et al., 2015; Kearney, 2017). Hamaker et al. (2015) have argued that most psychological constructs studied with the CLPM are 'to some extent characterised by time-invariant stability reflecting a trait-like property' – at least for the study's duration. Consequently, many lagged parameters reported in the literature do not reflect actual *within-person* (causal) development, which may result in incorrect conclusions regarding causal effects' presence, predominance and signs (Hamaker et al., 2015). These sub-studies focussed on associations between the externalising symptoms learning motivation and academic performance, not these symptoms' changes.

In the future, random-intercept cross-lagged models (RI-CLPM) with latent variables could better reach within-person causal mechanisms while also tackling possible measurement errors (Hamaker et al., 2015). Nevertheless, the ability to validate causal associations is important and useful, particularly to those interested in the efficacy of interventions and improving outcomes (Glass et al., 2013). Moreover, considering mediators and moderators also can be crucial for future investigations that determine these relationships (Kulkarni, 2021), as well as considering risk factors' co-effects (Kraemer et al., 2001). However, to operate with longitudinal data, constructs' substantial stability over time solves most endogenic problems (Antonakis et al., 2014). This, combined with utilisation of multiple control variables, makes the models more plausible in terms of causal associations.

To capture student variability in externalising behaviours, MAS, and academic performance further, person-centred methods, e.g., latent profile analysis (LPA; Muthén & Muthén, 1998—2012), also could be utilised to identify the profiles of students transitioning from primary to lower secondary school. Also, when investigating causal mechanisms on how ADHD symptoms tax academic performance, clarifying the construct and role of inattention could make a major impact. One interesting perspective would be to study how the development of MAS and self-regulative skills are entwined during early primary school years.

The ethical perspectives of this dissertation involve considering the ontology of the variables, constructs and results. First, it must be noted that defining teacher-reported behaviours using psychiatric terminology is a value-reflecting normative act because through a different lens, the phenomena can be

viewed as a culturally and socially produced shared description of behaviours and actions, not an explanation (Honkasilta, 2017). However, this was a thoroughly considered, conscious choice to best describe behaviours that hamper learning in everyday school life, while simultaneously emphasising that even in their mild forms, these behaviours are associated with MAS and academic performance, and exert long-term effects. Other than that, ethical research principles in the humanities and social and behavioural sciences were followed: The autonomy of research subjects was respected, harming subjects was avoided and privacy and data protection were handled with care.

4.4 General conclusions

Some of the worst long-term outcomes for youths (e.g., subsequent low academic performance, not completing secondary education, mental health problems and substance use, and low employment levels) are associated with both externalising behaviours and low academic performance (Erskine et al., 2016; Trout et al., 2003), and school transitions are risk stages in this developmental path (Evans et al., 2018). The prominent role that externalising behaviour symptoms and academic performance play at all stages of the school path and later in life (Erskine et al., 2016; Odgers et al., 2008) means that studying these interactions and the cascading problems' longitudinal development is important. Providing information that contributes to means of support for students, teachers and families facing these challenges is a justified goal for research as well. Despite previous developments in identifying and supporting students with externalising behaviours in schools (e.g., Karhu et al., 2018; Paananen et al., 2018), identifying students at risk early and accurately, as well as addressing their specific support needs, is a work in progress. Support systems, particularly tools for behavioural support, are needed not only at the individual level, but also at the school level. This could include in-service teacher training, multidisciplinary collaboration and structural systems to support all students' school transition and the continuum of academic and behavioural support across primary and lower secondary school.

This research contributes to extant literature in multiple ways by 1) considering differences between ADHD and CDs in relation to academic performance; 2) modelling the joint development and predictive relations of ADHD/CD symptoms and MAS, and 3) their prediction of academic performance; 4) investigating the mediating effects behind the negative association between ADHD symptoms and later academic performance and 5) critically evaluating these results' implications for early detection and pedagogical support delivery. The results imply that a longitudinal link exists between ADHD symptoms, MAS and academic performance, and that these traits are significantly stable over time. The findings of medium to strong interrelations both concurrently and over time emphasise that these negative

patterns develop together. In light of pathway theories, this means that intervention in one domain also could benefit the other domain (Thelen, 2005).

The findings in studies I-III pose some noteworthy implications for early detection and pedagogical support delivery, as well as targeted support for learning and behaviour during school transition. First, early detection of students with ADHD symptoms and MAS (and related learning difficulties) is important due to the double dilemma that they create concerning academic performance. Second, screening girls for these difficulties is particularly important, as they may mask their attention problems behind other learning difficulties, utilise MAS and are at clear risk of not receiving needed support. Third, support measures need to be improved: Although the support system seems to detect and aid boys with ADHD symptoms, this support is not enough to disrupt the negative cycle of ADHD symptoms and MAS. This disruption is needed to prevent long-term negative outcomes. It is likely that before and during school transition, these students would benefit from metacognitive skills training combined with academic, organisation and planning support, choices and opportunities for autonomy.

During this developmental stage, youths are determining whether they can do well in school; therefore, this is a critical window of time for both primary and lower secondary school teachers to help students develop positive academic identities through more adaptive achievement strategies and adequate pedagogical support. Thus, a better way of meeting these at-risk students' developmental and special educational needs must be found. Finally, environmental and motivational factors affect these students' functional capacity (the extent of symptoms and how much they hamper learning in different situations), which needs to be considered while planning instruction and support. Maybe then, the pieces of this puzzle entailing individual support needs, changing environment and growing demands fit better together.

YHTEENVETO (SUMMARY IN FINNISH)

Negatiivinen kehä: ulospäin suuntautuvat käytösoireet, oppimismotivaatio ja koulumenestys

Tämän tutkimuksen tavoitteena oli tarkastella pitkittäisvaikutuksia erilaisten käytösoireiden (ADHD ja käytöshäiriö) sekä akateemisen ja sosiaalisen sopeutumisen välillä, sekä miten ne yhdessä ennustavat koulumenestystä alakoulusta yläkouluun. Elämänkaaressa monet haitallisimmista pitkän aikavälin kehityskuluista, kuten koulutuksen keskeyttäminen, matala koulutustaso, mielenterveys- ja päihdeongelmat, ovat yhteydessä sekä ulospäinsuuntautuviin käytösongelmiin että heikkoon koulumenestykseen (Erskine ym., 2016; Trout ym., 2003), ja koulusiirtymät ovat riskin paikkoja tällä kehityspolulla (Evans ym., 2018). Sekä käytösongelmilla että koulumenestyksellä on merkittävä rooli kaikissa koulupolun vaiheissa sekä myöhemmin elämässä (Erskine ym., 2016; Odgers ym., 2008), mikä tekee näiden yhteyksien ja kasautuvien riskien pitkittäistutkimuksesta tärkeää. Tiedon ja varhaisen tuen lisääminen oppilaille, opettajille ja perheille on merkityksellinen tutkimustavoite. Vaikka käyttäytymisen tukea onkin alettu kehittää suomalaiskouluissa (esim. Karhu ym., 2018; Närhi, ym., 2015; Paananen ym., 2018), haasteiden varhainen tunnistaminen sekä kohdennettu tuki edellyttävät vielä kehitystyötä sekä opettajien täydennyskoulutusta (Gagnon, 2022).

Tämä tutkimus rakentuu mittavan aiemman tutkimuskirjallisuuden päälle, ja lisää ymmärrystä tutkimalla erikseen ADHD – ja käytöshäiriöoireiden suhdetta akateemiseen suoriutumiseen. Tutkimuksessa mallinnetaan niiden yhteistä kehittymistä alakoulun aikana, sekä käytösoireiden ja negatiivisten suoritusstrategioiden ennustavia sekä välittäviä rooleja myöhempään akateemiseen suoriutumiseen. Samalla tutkimus arvioi kriittisesti tulosten implikaatioita varhaisen tunnistamisen ja pedagogisen tuen kohdentamisen näkökulmista.

Tutkimus koostuu kolmesta osatutkimuksesta. Osatutkimuksessa 1 tutkittiin a) ulospäin suuntautuvien käytösongelmien (ADHD oireiden ja käytöshäiriöoireiden summa) ja koulumenestyksen, b) ADHD oireiden ja koulumenestyksen sekä c) käytöshäiriöoireiden ja koulumenestyksen välisiä yhteyksiä kuudennen ja seitsemännen luokan välillä. Lisäksi kontrolloitiin lapseen ja perheeseen liittyviä muuttujia. Osatutkimuksessa 2 tutkittiin, miten ADHD-oireet ja käytöshäiriöoireet erikseen olivat vuorovaikutuksessa negatiivisten suoritusstrategioiden kanssa alakoulun viimeisinä vuosina, ja miten tämä heijastui seitsemännen luokan koulumenestykseen. Osatutkimuksessa 3 keskityttiin akateemiseen ja sosiaaliseen sopeutumiseen liittyviin välittäviin mekanismeihin, joiden kautta ADHD-oireet verottavat koulumenestystä ensimmäisen yläkouluvuoden aikana. Lisäksi tutkittiin tyttöjen ja poikien välisiä eroja näissä mekanismeissa.

Tutkimuksella oli kolme päätavoitetta. Ensimmäinen tavoite oli tutkia ulospäinsuuntautuvien käytösongelmien (ADHD, käytöshäiriö) ja koulumenestyksen pitkittäisyhteyksiä alakoulusta yläkouluun siirryttäessä. Toisena tavoitteena oli tutkia ADHD-oireiden sekä käytöshäiriöoireiden ja negatiivisten suoritusstrategioiden yhteyksiä alakoulun viimeisten luokkien aikana, ja miten nämä

yhdessä ennustivat seitsemännen luokan koulumenestystä. Kolmantena tavoitteena oli tutkia, miten varhainen yläkouluun sopeutuminen välittää ADHD-oireiden vaikutuksia koulumenestykseen seitsemännen luokan aikana, ja ovatko nämä yhteydet samanlaisia tytöille ja pojille.

Tulokset tukevat aiempaa tutkimusta: pitkittäisyhteys ADHD-oireiden, negatiivisten suoritusstrategioiden ja akateemisen suoriutumisen välillä on olemassa, ja nämä taipumukset ovat merkittävän pysyviä yli ajan. Keskikokoisesta vahvaan vaihtelevat yhteydet ajassa ja ajan yli korostavat sitä, että nämä negatiiviset toimintamallit kehittyvät yhdessä. Polkuteorioiden näkökulmasta asialla on valoisakin puoli: interventio yhdellä osa-alueella voi myös hyödyttää toisella (Thelen, 2005).

Yhteydet ADHD-oireiden ja negatiivisten suoritusstrategioiden välillä eivät ole yllättäviä, sillä aivojen tarkkaavuustoiminnot ovat keskeisessä roolissa adaptiivisessa käyttäytymisessä – tarkkaavuus käsittää sen suuntaamisen, vireystilan, sekä valikoivan toiminnanohjauksen (Berger ym., 2007). Tarkkaavuuteen liittyvät vaikeudet itsesäätelyssä ja toiminnanohjauksessa (l. inhibitiokontrolli, ongelmanratkaisu, itsetarkkailu), todennäköisesti lisäävät negatiivisten suoritusstrategioiden käyttöä koulupolun varrella, samalla vahvistaen negatiivisia strategioita. Kun oppilaan on vaikea tarkkailla ja säädellä kognitioitaan, emootioitaan ja käyttäytymistään, tavoitteiden saavuttaminen ja/tai sopeutuminen kognitiivisiin ja sosiaalisiin vaatimuksiin oppimistilanteissa on vaikeaa.

Tuloksilla on tärkeitä implikaatioita varhaiseen tunnistamiseen ja pedagogisen tuen toteuttamiseen yleisen tuen tasolla sekä tuen kohdentamiseen (käyttäytyminen, toiminnanohjaus, oppimisen tuki) jo alakoulussa ja jatkuvuuteen siirryttäessä alakoulusta yläkouluun. Tulosten perusteella ADHD-oireet muodostavat merkittävän riskin koulumenestykselle tässä koulupolun vaiheessa. Riski liittyy ADHD-oireiden ja negatiivisten strategioiden toisiaan vahvistavaan negatiiviseen kehään, joka muodostuu jo alakoulun aikana. Tämän negatiivisen kehän vaikutukset akateemiseen suoriutumiseen yltävät jopa ensimmäisen yläkouluvuoden loppuun. Yhtenäiset käytänteet ja tuen jatkuvuus olisivat ensiarvoisen tärkeitä tässä muutosvaiheissa erityisesti niille oppilaille, joilla on ADHD-oireita.

Varhaisnuoruuden kehitysvaiheessa nuoret määrittelevät, ovatko he sellaisia henkilöitä, jotka pärjäävät hyvin koulussa. Alakoulun viimeiset vuodet ja yläkoulun alku on kriittinen aikaikkuna, jolloin opettajat molemmilla kouluasteilla voivat auttaa oppilaita kehittämään positiivista akateemista identiteettiä suotuisien suoritusstrategioiden opettamisen ja pedagogisen tuen kautta. Tämä tarkoittaa tasapainottelua kehitysvaiheeseen liittyvien autonomian, kykenevyyden ja yhteenkuuluvuuden (Eccles ym., 1993; Ryan & Deci, 2017) tarpeiden ja käyttäytymisen ja oppimisen tuen tarpeiden välillä. Ympäristöön ja motivaatioon liittyvät tekijät vaikuttavat yksilön toimintakykyyn eri tilanteissa kuten siihen, miten paljon ADHD-oireet haittaavat oppimista eri tilanteissa, ja nämä on huomioitava opetusta ja tukea suunniteltaessa. Ensin on tärkeää tunnistaa oppilaat, joilla on ADHD-oireita ja negatiivisia suoritusstrategioita ja ennakoida näihin liittyviä oppimisen tuen tarpeita. Tämä on erityisen tärkeää ADHD-oireiden ja negatiivisten

suoritusstrategioiden muodostaman tuplariskin vuoksi. Toiseksi erityisesti tyttöjen, joilla näitä haasteita on, tunnistaminen olisi tärkeää. Koska ADHD-oireet ilmenevät tytöillä ja pojilla hieman eri tavoin, saattavat tytöt tässä vaiheessa naamioida tarkkaavaisuuden haasteensa muiden oppimis- tai motivaatiovaikeuksien taakse, käyttää negatiivisia suoritusstrategioita ja jäädä näin oikein kohdennetun tuen ulkopuolelle. Tukitoimia tulee myös kehittää: vaikka pojat, joilla oli ADHD-oireita, saivat pedagogista tukea, tämä tuki ei riittänyt keskeyttämään ADHD-oireiden ja negatiivisten strategioiden toisiaan vahvistavaa kierrettä. Pitkän aikavälin negatiivisten seurausten välttäminen edellyttää kierteen katkaisemista. Nämä oppilaat hyötyisivät todennäköisesti kokonaisvaltaisesta tuesta, johon sisältyy kohdennettua oppimisen ja käyttäytymisen tukea sekä oppimisitilanteissa suotuisampien suoritusstrategioiden opettamista ja motivaation tukea. Tällaista tukea voi olla esimerkiksi metakognitiivisten taitojen harjoittelu, johon yhdistetään akateemista ja toiminnanohjauksen tukea sekä valinnan ja itselähtöisen päätöksenteon mahdollisuuksia.

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APPENDIX 1

Correlation matrix of the main variables

Variable	1	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1. ADHD 5													
2. ADHD 6	.76**												
3. ADHD 7	.52**	.68**											
4. CD 5	.71**	.66**	.48**										
5. CD 6	.57**	.71**	.57**	.62**									
6. CD 7	.43**	.50**	.74**	.49**	.51**								
7. MAS 5	.22**	.30**	.23**	.22**	.20**	.21**							
8. MAS 6	.24**	.32**	.32**	.20**	.33**	.28**	.62**						
9. MAS 7	.20**	.31**	.36**	.22**	.25**	.24**	.51**	.62**					
10. GPA 5	-.39**	-.44**	-.39**	-.28**	-.25**	-.27**	-.35**	-.35**	-.33**				
11. GPA 6	-.49**	-.60**	-.51**	-.37**	-.43**	-.35**	-.38**	-.37**	-.36**	.83**			
12. GPA 7	-.41**	-.55**	-.56**	-.32**	-.40**	-.43**	-.31**	-.39**	-.46**	.71**	.75**		
13. SEX	.35**	.38**	.32**	.29**	.26**	.18*	.009	.006	.03	-.18**	-.22**	-.27**	
14. SES	-.07	-.11	-.16*	-.13	.16	-.10	-.21*	-.16**	-.08	-.05	.21**	.25**	.27**

Notes. ADHD = ADHD symptoms in each grade year, CD = conduct disorder symptoms in each grade year, MAS = maladaptive achievement strategies in each grade, GPA = general grade point average, SEX = students' biological sex (1= female, 2 = male), SES = Familys' socioeconomic status, measured as mothers' highest level of educatio

ORIGINAL PAPERS

I

EXTERNALIZING BEHAVIOUR AND ACADEMIC PERFORMANCE – THE CROSS-LAGGED RELATIONSHIP DURING SCHOOL TRANSITION

by

Iines R. Palmu, Vesa M. Närhi & Hannu K. Savolainen, 2018

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Externalizing Behaviour and Academic Performance — The Cross-Lagged Relationship During School Transition

The current study examined the over-time association between externalizing behaviour problems and academic performance during school transition in a cross-lagged design. The main focus was to reveal whether the externalizing behaviour composite and its components separately, including symptoms of CD and ADHD, differ in their relationship with academic performance; and if controlling child- or family-related covariates altered the strength or direction of the relationship. Externalizing behaviour composite was associated with a decrease in academic performance over a 1-year time lag. Academic performance at Grade 6 was associated with low CD symptoms at Grade 7. The effect remained significant when child-related covariates were controlled, but not after controlling family-related covariates. ADHD symptoms systematically had a negative effect on grade 7 GPA, even after child- and family-related covariates were controlled. The results indicate that during early adolescence and school transition, CD and ADHD symptoms differ in their association with academic performance.
Keywords: externalizing behaviour, conduct disorder, ADHD, academic performance, school transition

Introduction

Externalizing behaviour problems refer to a broad range of disruptive behaviours, such as aggressiveness, oppositional behaviour, conduct problems, impulsivity, hyperactivity, and attention problems (Hinshaw, 1992; McMahon, 1994). These problems tend to be persistent and lead to costly, broad ranging, and long-term negative outcomes for the individuals and the societies they live in (Fergusson, Horwood, & Ridder, 2007; Maughan, Gray, & Rutter 1985; Moffitt, 1993). Externalizing behaviour problems are significantly associated with low achievement in reading and mathematics (Adams, Snowling, & Hennessy, 1999; Willcutt et al., 2013) and with overall low academic achievement (Reid, Gonzalez, Nordness, Trout, & Epstein, 2004). In the long term, students with externalizing behaviour problems are more likely to drop

out of school and are less likely to participate in, and complete postsecondary education than their peers (Finn, Fish, & Scott, 2008; Hakkarainen 2016; McLeod & Kaiser, 2004). Majority of the studies on the relationship between externalizing behaviours and academic outcomes have been conducted on clinical samples and whereas fewer studies have focused on community samples (for examples see, Halonen et al., 2006; Metsäpelto et al. 2015; Zimmermann et al., 2013). Furthermore, none of the community sample studies have analysed separately the sub-dimensions of externalizing behaviour in the same study. This study seeks to find how the mechanisms between different externalizing symptoms and academic performance work in a community sample of 12-13 year-olds and if they differ from one another.

The most common approach is to categorize the symptoms of externalizing behaviour into conduct disorder (CD) and attention deficit/hyperactivity (ADHD) symptoms (Hinshaw, 1987). Both types of externalizing behaviour problems have some common developmental pathways and overlapping symptoms, but in relation to academic performance, conduct disorder/aggression should be distinguished from attention deficit/hyperactivity because of the unique effects ADHD symptoms may have on learning (Hinshaw, 1992).

Academic performance, that is, how well a student meets the learning objectives set in school, is a cumulative process, where earlier learning facilitates the learning of later content. It is often measured as a grade point average of the overall grades earned. Academic achievement, on the other hand, refers to the fundamental skills (e.g., literacy and numeracy) and is often measured by standardized tests. *Academic attainment* is used to describe the educational level one achieves in the long term. Academic performance and skills in reading, writing, and mathematics are important correlates of overall academic attainment **(**Zahn-Waxler, 1993). Externalizing behaviour problems are negatively related with the above-mentioned academic

outcomes (see, Frazier, Youngström, Glutting, & Watkins, 2007; Hinshaw, 1992; Reid et al., 2004).

Though the negative association of externalizing behaviour problems and academic outcomes has been well-established, there is a lack of consensus regarding the cause and direction of this relation. Hinshaw (1992) introduced four possible explanatory models: (a) academic performance predicts externalizing behaviour problems; (b) externalizing behaviour problems predict academic performance; (c) the relationship is reciprocal; or (d) there are antecedent factors affecting both outcomes.

First, there is some evidence indicating that academic problems lead to CD (Halonen, Aunola, Ahonen & Nurmi, 2006; Miles & Stipek, 2006). Second, other studies have shown that CD, especially aggression, leads to academic difficulties (Moilanen, Shaw, & Maxwell, 2010; Wentzel 1993). Other studies indicated a reciprocal relation, suggesting that both domains affect one another (Chen, Rubin, & Li, 1997; Stipek & Miles, 2008). Additionally, some studies indicated that there are other underlying variables, such as family adversities, leading to both domains (McGee, Williams, Share, Anderson, & Silva, 1986; Offord, Alder, & Boyle, 1986; Trapolini, McMahon, & Ungerer, 2007). Other scholars have found some support to all these explanatory models regarding CD, but only partial support regarding ADHD.

Fewer studies have had a focus on the direction of the relationship between ADHD symptoms and academic performance beyond preschool age. The few that did often used high-risk boys as the sample. There seems to be no evidence of academic performance predicting ADHD symptoms. Most of these studies indicated support for ADHD symptoms predicting academic performance and the two having a reciprocal relationship (Frazier et al., 2007). Metcalfe, Harvey, and Laws (2013) observed some support for ADHD symptoms predicting

academic performance and a reciprocal relation between inattention and academic achievement. In addition, in their meta-analysis, Duncan et al. (2007) found that with school-entry math and reading, attention skills are among the strongest predictors of later achievement.

Furthermore, in some studies externalizing behaviour problems are reported as a composite containing both CD and ADHD dimensions. These studies have found for example that externalizing behaviour problems at ages 6 and 11 independently predict mathematics and reading test scores in high school (Breslau, Breslau, Miller, & Raykov, 2011). Also, Metsäpelto et al. (2015) found a mediating effect, where externalizing behaviour was linked to a decrease in academic performance via task-avoidant behaviour during elementary grades. Zimmermann, Schütte, Taskinen, and Köller (2013) found that externalizing behaviour was reflected in academic performance more consistently than in achievement, and thus, both teacher-given grades and standardized test scores should be included in analysis. In addition, they found that worse grades contributed to an increase of externalizing problems, and they observed harmful reciprocal effects repeatedly between Grades 5–9.

There might be various reasons for the mixed findings found in previous research. First, the direction of the relationship might vary as a result of how academic performance is measured and defined (Zimmermann et al., 2013) and whether the externalizing measures focus solely on aggression or entail also hyperactivity, and inattention (Metcalfe et al., 2013). Also, some differences in the results might be explained by the fact that different studies have used different informants: parents, teachers or peers.

Second, many of the previous studies have focused on high-risk boys (see, Reid et al., 2004). This limits the generalizability of those studies, since gender differences in academic achievement (Jacob, 2002; OECD, 2012; Voyer & Voyer, 2014) and externalizing behaviour

problems (Fernandez Castelao & Kröner-Herwig, 2014; Gershon, 2002; Lahey, McBurnett, & Loeber, 2000; Storvoll & Wichstrøm, 2003) are clear: boys seem to have more both externalizing and academic achievement problems.

Third, several family-related factors have been found to affect both externalizing behaviour problems and academic performance but have been included in studies in various ways. These family-related factors include socioeconomic status (Achenbach, Howell, Quay, & Connors 1991; Dupow & Ippolito, 1994), parental education level (Duncan, Brooks-Gunn & Klebanov, 1994) and family structure (Achenbach et al., 1991; Deckard, Dodge, Bates, & Pettit 1998). Parental educational level is an important predictor of children's educational (Davis-Kean, 2005; Dubow, Boxer, & Huesmann, 2009; Haveman & Wolfe, 1995) and behavioural outcomes (Nagin & Tremblay, 2001). Some research also indicates that maternal and paternal education levels have a different association with a child's academic outcomes (Serafino & Tonkin, 2014). In addition, children of single-parent households seem to be more likely to develop externalizing behaviour than their peers from two-parent households (Achenbach et al., 1991; Duncan et al., 1994).

The purpose of the current study was to examine cross-lagged associations between externalizing problems and academic performance over a school transition from elementary to lower secondary school. We had three research questions: (a) What is the direction and strength of the cross-lagged relationship between composite externalizing behaviour problems and academic performance? (b) Do CD and ADHD symptoms differ in their association with academic performance? (c) Does controlling child- and family- related covariates change the strength or direction of the above-mentioned relationships? With the current study, we add to previous research by investigating separately the relationships that CD and ADHD symptoms

have with academic performance in a community sample during school transition and whether controlling child- and family- related covariates affects the strength or direction of this cross-lagged relationship.

Method

The participants were 311 (52% female) sixth grade students who took part in a larger longitudinal study in seven municipalities in eastern Finland between years 2010–2013. The data in this study are from 2012 to 2013, following students from Grade 6 into Grade 7. In Finland, sixth-grade students are usually 12 to 13 years old. Between grades was the transition from elementary school to lower secondary school. In the original data sample, there were 614 students from sixth grade, and six students per class (311) were randomly drawn for teacher ratings in externalizing behaviour.

Measures

Externalizing problems were assessed by teacher ratings in Grades 6–7 using the Finnish version of the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997). The SDQ is a 25-item instrument rated on a 3-point scale (1 = not true, 2 = somewhat true, 3 = certainly true) and is widely used for screening the behaviour of children and adolescents between 4–16 years of age. The SDQ has been proved to be a highly valid screening instrument (Goodman, Ford, Simmons, Gatward, & Meltzer, 2000). The Finnish version (SDQ-Fin) has been shown to have a good validity, reliability, and comparability with international versions of the SDQ (Koskelainen, 2008).

The SDQ provides scales for conduct problems, hyperactivity/inattention, emotional symptoms, peer problems, and prosocial behaviour. In the current study, the scales for conduct

problems (five items, for example, “often fights with other youth or bullies them”) and hyperactivity/inattention (five items, for example, “restless, overactive, cannot stay still for long” and “easily distracted, concentration wanders”) were used to measure externalizing problems. The composite score for externalizing problems was formed as a sum score of the conduct problems and hyperactivity/inattention scale. The Cronbach’s alpha reliabilities for externalizing problems composites were .87 (Grade 6) and .91 (Grade 7). For conduct problems, Cronbach’s alpha was .63 (Grade 6) and .79 (Grade 7) and for hyperactivity/inattention .87 (Grade 6) and .91 (Grade 7). The average level of externalizing problems was low but varied largely between students (Table 1).

Academic performance was assessed using individual student grades (ranging between 4 to 10) given by the teachers. Grade points of reading, language arts, and mathematics were averaged (GPA) and used in the analysis.

T1 child-related covariates consisted of academic achievement tests on literacy and numeracy skills. *Reading comprehension* was measured using a standardized test battery developed for students between the Grades 1–6 (Lindeman, 1998). It assessed the child’s skills in gleaning factual knowledge, concepts, and inferences from text. The children were asked to answer 12 multiple-choice questions based on silently read text within a 60-minute time frame. For each correct answer, the children received 1 point, with a maximum score of 12 points. This test is widely used in Finland, and it has been proven to have good validity and reliability (Lindeman, 1998).

Basic mathematics’ skills were assessed using a standardized basic mathematics’ skills test, designed for children 9–12 years old (Räsänen, 2004). It consists of 56 items (basic additions, multiplications, subtractions, etc.). The total score is the number of items correctly

answered in 10 minutes. The test has been shown to have high internal validity and reliability (Räsänen, 2004).

T1 family-related covariates consisted of maternal and paternal education levels and family structure. Socio-economical variances between families are rather small in Finland compared to, for example, North America–only 6% of school-aged children's families scored low in the family affluence scale (FAS) index (Kämppi et al., 2012). Therefore, the chosen indicator for the sociocultural background of children was parental education level.

Parental education level was measured using a 7-point scale ranging from basic education level to advanced educational training. Only 2.4% of mothers and 3.6% of fathers had no education beyond a basic education, that is, had no vocational degree, and 33.7% of the mothers and 28.1 % of the fathers had higher vocational diplomas, bachelor's, master's or doctoral degrees. The overall distribution of parental education was comparable to the general population (Official Statistics Finland 2013).

Family structure was coded into a dummy variable, indicating whether the child lives with two parents (nuclear or blended family) or with a single parent. Overall, 84.3% of children in this study lived in two-parent households, 15.7 % in single-parent households. At national level, the percentage of single-parent households in Finland is roughly 21%.

Gender was included as a covariate in all covariate models because significant gender differences in both externalizing behaviour problems and academic achievement have been well established.

Analyses

The study utilized a cross-lagged structural equation modelling to test alternative models in testing the direction of causality and the stability of the studies phenomena. Analyses were

conducted separately for the general externalizing behaviour composite, CD symptoms, and ADHD symptoms.

There was some non-normality in variable scales, so the robust maximum likelihood (MLR) estimator was used (Finney & DiStefano 2008). It corrects non-normality-induced bias in the standard errors, and produces a Satorra-Bentler χ^2, that more accurately captures the appropriate amount of misfit in the model than the standard χ^2 of the perfect fit (Satorra & Bentler, 2010). Baseline models for the three behaviour indicators (M1-externalizing behaviours, M2-conduct disorder, and M3-ADHD) were run to test the cross-lagged relationship of externalizing behaviour and academic performance.

Thereafter, all child-related covariates (test scores in reading comprehension and mathematics) along with gender were added to the baseline models; separate CD and ADHD scores were used. All the covariates that predicted at least one significant T1 dependent variable were kept in the model. After this, family-related covariates (maternal and paternal education levels, family structure) and gender were added to both baseline models (CD and ADHD), and all paths were estimated. In the covariate-models, the model fit was evaluated with five indicators: X^2/df, Root-Mean-Square Error of Approximation (RMSEA), Bentler's comparative fit index (CFI), Tucker-Lewis index (TLI), and Standardized Root-Mean-Square (SRMR).

The externalizing behaviour rating was received on 65% of the students who received the rating on sixth grade and academic performance on 79%. Also, some data were missing from the Grade 6 control variables: gender 0.3%, standardized tests in mathematics 10%, reading comprehension 13%, maternal education level 28%, and paternal education level 33%. The missing data were handled with the Full Information Maximum Likelihood (FIML) procedure in MPlus (Enders, 2010, 86; 113). In the FIML procedure, the log-likelihoods are written for each

individual based on all the individual's observed data (e.g., Enders, 2010; Graham & Coffman, 2012). It has been shown that FIML yields valid results and is recommended over other methods, such as list- or pairwise deletion, especially when the data are not missing completely at random (see, Enders, 2010; Jeličić, Phelps, & Lerner, 2009).

Table 1. Descriptive Statistics and Correlations Between the Study Variables and Controls.

Results

Descriptives and correlations

The descriptive statics containing means, standard deviations, and correlations among all variables are shown in Table 1. As one would expect, T1 and T2 GPA were highly correlated with each other. T1 GPA had a highly positive correlation with reading comprehension and a highly negative correlation with both T1 and T2 ADHD symptoms. T1 ADHD symptoms were highly correlated with T1 CD symptoms and moderately correlated with T2 ADHD symptoms and T2 CD symptoms. CD symptoms were moderately correlated with each other and GPA at both time points. T2 ADHD symptoms and CD symptoms were highly correlated with each other.

Cross-lagged Relationships

Baseline models. We first estimated the baseline model for the externalizing behaviour composite and academic performance (Figure 1). The saturated model (N = 311) showed a direct negative effect (–.12) from Grade 6 externalizing behaviour to Grade 7 academic performance, but the path from Grade 6 academic performance into Grade 7 externalizing behaviour was not significant.

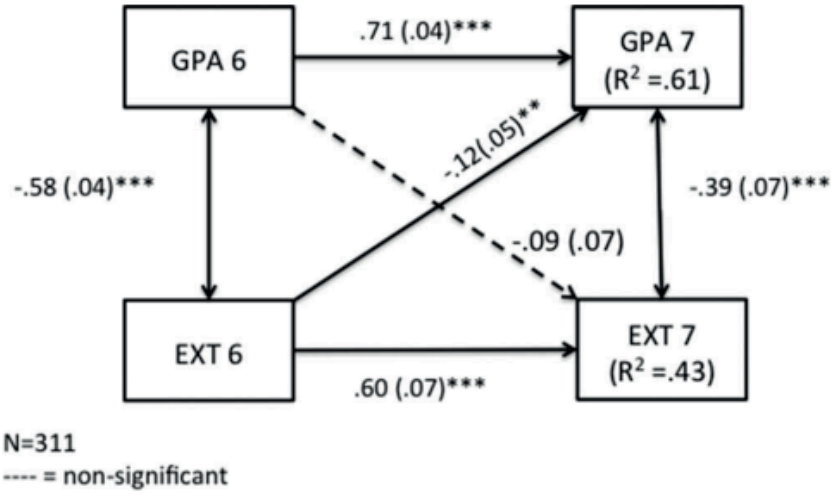

Figure 1. Baseline model for the externalizing behaviour composite. Paths are presented as standardized estimates. *Note.* GPA = Grade point average, EXT = Externalizing behaviour composite. ***p* <.01., **** p* < .001.

A similar saturated baseline model was estimated for both subscales of externalizing behaviour (Figure 2). For the CD model (N = 311), there was a significant negative effect (–.16) from academic performance to conduct problems. For the ADHD model (N = 311), there was a significant negative effect (–.14) from sixth grade ADHD symptoms to seventh grade GPA. It was also found that both externalizing behaviour (.60) and ADHD symptoms (.61) were stable over time. CD symptoms were not as stable as ADHD symptoms over time (.42). Further, GPA was the most stable of all the variables in all the tested models (.70–.75).

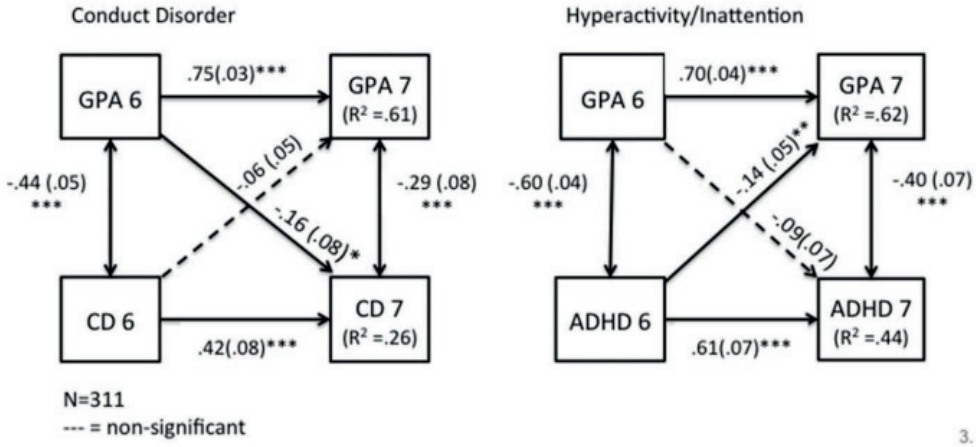

Figure 2. Baseline models for CD and ADHD symptoms. Paths are presented as standardized estimates.
GPA = Grade point average, CD = Conduct disorder symptoms, ADHD = ADHD symptoms. *p < .05, **p < .01, ***p < .001.

Figure 2. Baseline models for CD and ADHD symptoms. Paths are presented as standardized estimates. Note. GPA = Grade point average, CD = Conduct disorder symptoms, ADHD = ADHD symptoms. *p < .05, ** p < .01., *** p < .001.

The variables were allowed to correlate at both time points. In T1, the externalizing behaviour composite and GPA had a strong negative correlation (–.58), as did T1 ADHD symptoms and GPA (–.60). The negative correlation at T1 between CD symptoms and GPA was not as large (-.44). It was noteworthy that the residual correlations at T2 remained significant, even when cross-lagged effects were controlled. At the seventh grade, the relationship between externalizing behaviour composite and GPA (–.39) was similar to that of ADHD symptoms and GPA (–.40). CD symptoms and GPA had a slightly smaller negative association (–.29).

Covariate Models. Because the two subscales differed regarding their association to academic performance, all child-related covariates (reading comprehension scores and mathematics skills) along with gender were added as covariates to both the CD and ADHD baseline models. In the CD model with child-related covariates (Figure 3), Grade 6 GPA predicted conduct problems in the seventh grade (–.18). Both the cross-lagged effect and the

stability of CD symptoms (.41) and GPA (.75) were similar to those of the baseline model. The model fitted the data well (N = 241, χ^2 = 8.35, *df* = 6, *p* = 0.21, RMSEA = 0.04, CFI = 0.99, TLI = 0.98, SRMR = 0.02). There was a moderate negative correlation between CD symptoms and GPA at T1 (–.34) and T2 (–.19) Mathematics skills had a direct effect on sixth grade GPA (.32) and a negative effect on conduct problems in the same grade (–.19). Reading comprehension skills had a direct effect on sixth grade GPA (.51), and gender had effects on both sixth grade GPA (–.14) and conduct problems (.19). Being a boy and having low mathematics skills were associated with conduct problems in Grade 6.

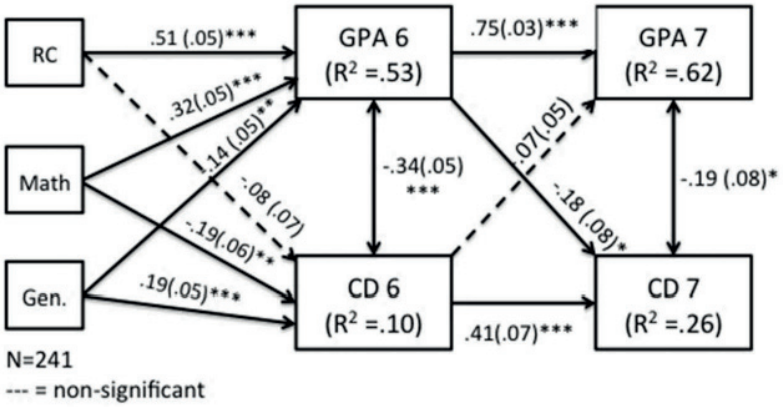

Figure 3. Conduct disorder-model with child-related covariates. Paths are presented as standardized estimates.
GPA = Grade point average, CD = Conduct disorder symptoms, RC = Reading comprehension test score, Math = Mathematics achievement test score, Gen. = Gender. *p < .05, **p < .01, ***p < .001.

Figure 3. Conduct disorder -model with child-related covariates. Paths are presented as standardized estimates. *Note.* GPA = Grade point average, CD = Conduct disorder symptoms, RC = Reading comprehension test score, Math = Mathematics achievement test score, Gen. = Gender. * p < .05, **p <.01., *** p < .001.

In the ADHD child-covariate model (Figure 4), ADHD symptoms in Grade 6 predicted academic performance in Grade 7 (–.16). The model fit was good (N = 241 χ^2 = 9.77, *df* = 16 *p* = 0.13, RMSEA = 0.05, CFI = 0.99, TLI = 0.98, SRMR = 0.02). The longitudinal stability of

ADHD symptoms (.63) was higher than that of CD symptoms (.41). The negative correlations in time between ADHD symptoms and GPA were moderate at both the first (–.45) and second time points (–.34). All covariates were associated with both T1 variables. Mathematics skills were associated with both Grade 6 GPA (.31) and ADHD symptoms (-.21). Also, reading comprehension had a positive effect on sixth grade GPA (.51) and a negative effect on sixth grade ADHD (–.18). Gender had a small negative effect on sixth grade GPA (-.14) and a moderate effect on ADHD symptoms in Grade 6 (.30). Being a boy and scoring low in both reading comprehension and mathematics were associated with ADHD symptoms in Grade 6.

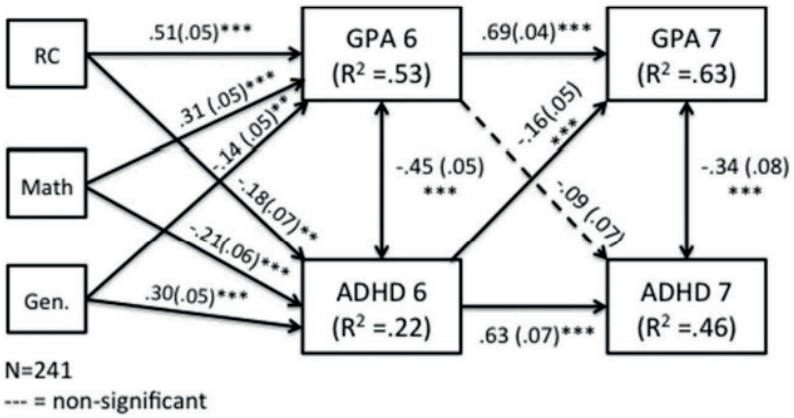

Figure 4. ADHD-model with child-related covariates. Paths are presented as standardized estimates.
GPA = Grade point average, ADHD = ADHD symptoms, RC = Reading comprehension test score, Math = Mathematics achievement test score, Gen. = Gender. **p < .01, ***p < .001.

Figure 4. ADHD-model with child-related covariates. Paths are presented as standardized estimates. *Note.* GPA = Grade point average, ADHD = ADHD symptoms, RC = Reading comprehension test score, Math = Mathematics achievement test score, Gen. = Gender. ** p <.01., *** p < .001.

Next, we similarly tested the CD and ADHD symptom models with family-related covariates (maternal and paternal education levels, family structure, and child's gender). For the

CD model (Figure 5), the best model fit was where all cross-lagged effects disappeared (N = 202, $\chi^2 = 14.23$, $df = 8$, $p = 0.08$, RMSEA = 0.06, CFI = 0.98, TLI = 0.94, SRMR = 0.04). Controlling family-related covariates decreased the number of cases in the analysis, and the effect from GPA 6 to CD 7 was no longer significant (–.17, $p = .10$). The negative associations between GPA and CD symptoms were moderate at both time points (T1 –.41, T2 –.29). Paternal education level had a significant direct effect on T1 GPA (.27), and gender had direct effects on both T1 GPA (–.25) and CD (.27). In addition, family structure, that is, a single-parent household, was associated with CD symptoms in Grade 6 (.18). Maternal education level had no significant direct effects on T1 dependent variables.

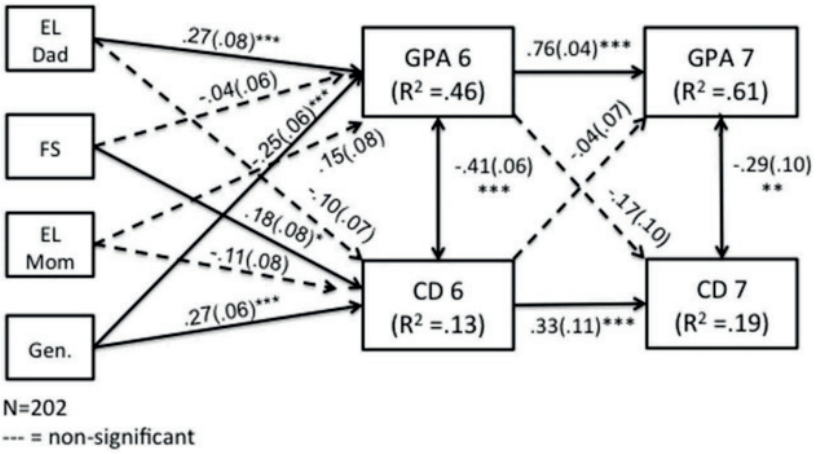

Figure 5. Conduct disorder-model with family-related covariates. Paths are presented as standardized estimates.
GPA = Grade point average, CD = Conduct disorder symptoms, EL Dad = Father's education level, FS = Family structure, EL Mom = Mother's education level, Gen. = Gender. **p < .01, ***p < .001.

Figure 5. Conduct disorder -model with family-related covariates. Paths are presented as standardized estimates. *Note.* GPA = Grade point average, CD = Conduct disorder symptoms, EL Dad = Father's education level, FS = Family structure, EL Mom = Mother's education level, Gen. = Gender. **p <.01., *** p < .001.

For the ADHD family covariate model (Figure 6) the model fit was good (N = 202, χ^2 =9.69, *df* =8 *p* =0.29, RMSEA = 0.03, CFI =1.00, TLI =0.99, SRMR = 0.03). Grade 6 ADHD symptoms predicted Grade 7 GPA negatively (–.21). The correlation between GPA and ADHD symptoms was rather high on T1 (–.56). From the covariates, paternal education had a direct effect on T1 GPA (.27), as did gender (–.24). Gender also had an effect on Grade 6 ADHD symptoms (.37). Family structure, living in a single parent-household (-.15) was associated with Grade 6 ADHD symptoms. Both GPA (.65) and ADHD symptoms (.59) were quite stable over time. Even with controlled covariates and cross-lagged effects, the negative in-time association between Grade 7 GPA and ADHD symptoms remained medium-sized (–.35).

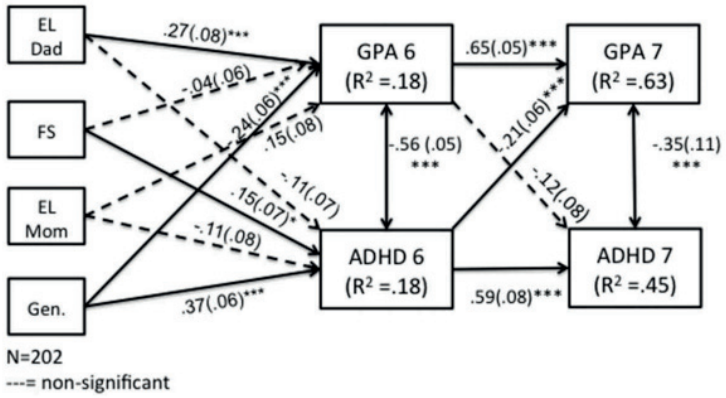

Figure 6. ADHD-model with family-related covariates. Paths are presented as standardized estimates.
GPA = Grade point average, ADHD = ADHD symptoms, EL Dad = Father's education level, FS = Family structure, EL Mom = Mother's education level, Gen. = Gender. **p < .01, ***p < .001.

Figure 6. ADHD-model with family-related covariates. Paths are presented as standardized estimates. *Note.* GPA = Grade point average, ADHD = ADHD symptoms, EL Dad = Father's education level, FS = Family structure, EL Mom = Mother's education level, Gen. = Gender. ***p* <.01., *** *p* < .001.

Gender had an effect on externalizing problems, so a multigroup method was used to test whether the aforementioned paths differed between boys and girls. The Satorra-Bentler–scaled

chi-square difference tests showed that model fit did not significantly decrease if the main effects among girls and boys were constrained to be equal (p >.05). Thus, the multigroup analyses revealed no group differences, suggesting that the cross-lagged path models were similar among boys and girls. Also, gender was included as a covariate in all covariate models.

Discussion

In this study, we utilized a cross-lagged design to investigate the associations among children's externalizing behaviour problems, CD and ADHD symptoms, and academic performance during the transition from elementary to lower secondary school. The externalizing behaviour composite was found to predict academic performance (Hinshaw, 1992). Additionally, our findings indicated the importance of distinguishing between the symptoms of ADHD and CD and how they are related to academic performance. We found these symptoms to differ in their association with academic performance during this transition period: good academic performance in Grade 6 predicted low Grade 7 CD symptoms, but Grade 6 high ADHD symptoms predicted low academic performance on Grade 7. This difference remained significant when the child's gender, academic achievement tests, family structure and parental education levels were controlled. Academic performance was negatively associated with later CD symptoms (Hinshaw, 1992; Model 1). The analyses with and without covariates consistently showed, that previous ADHD symptoms were negatively associated with later GPA (Hinshaw, 1992; Model 2). This could suggest that among young adolescents, the relationship between ADHD symptoms and academic performance differs from that of other externalizing symptoms, just as what was found earlier with younger children (Metcalfe et al., 2013).

The high stability of the externalizing behaviour composite, ADHD symptoms, and academic performance ranging between .59–.75 was similar to those reported in previous studies

(Dekovic, Buist, & Reitz, 2004; Reitz, Dekovic, & Meijer, 2005). Concurrent association between both CD and ADHD symptoms and academic performance was quite high, even when cross-lagged effects were controlled. Findings in the externalizing behaviour problems composite model were similar to the findings of another Finnish study utilizing a similar composite measure of externalizing behaviour among younger children (Metsäpelto et al., 2015). On the other hand, Grade 6 ADHD symptoms negatively predicted next year's academic performance, which was found in other studies that utilized ADHD symptoms as part of externalizing measures and in studies that had a focus on ADHD symptoms (Loe & Feldman, 2007; Metcalfe et al., 2013).

Controlling child-related covariates did not change the direction or the strength of the association between externalizing behaviours and academic performance in either of the models. In line with existing research, reading comprehension was positively associated with Grade 6 GPA and negatively with ADHD symptoms (Willcutt & Pennington, 2000). Mathematics achievement seemed to be predictive of academic performance and symptoms of both CD and ADHD (Duncan et al., 2007; Loe & Feldman, 2007). Also, being a girl was associated with a higher GPA (Jacob, 2002; OECD, 2012; Voyer & Voyer, 2014) whereas being a boy was associated with both ADHD and CD symptoms **(**Gershon, 2002; Lahey et al., 2000).

Family structure was associated with both CD and ADHD symptoms, indicating that children from single-parent families were more likely to show externalizing behaviour problems than their peers, as established in existing literature (Achenbach et al., 1991; Duncan et al., 1994). Furthermore, the father's education level was positively associated with the child's GPA, unlike the mother's education level. This is an interesting result, because the fathers had a slightly lower level of education than the mothers in general, and in earlier research, the

significant relationship has usually been the mother's level of education (Davis-Kean, 2005; Dubow et al., 2009; Haveman & Wolfe, 1995). Only a few studies (e.g., Serafino & Tonkin, 2014) have found similar effects.

There are a number of possible processes underlying these cross-lagged relationships. Our finding of the negative association between low academic performance and later CD symptoms may be related to the situation where students struggling with academics at the end of primary school are likely to face even bigger academic challenges in the following year as the academic requirements increase in lower secondary education. Our findings suggest that good academic performance can protect from the symptoms of CD, whereas growing academic demands and students' inability to respond to these demands may lead some students to steer away from schoolwork. This might manifest as CD type of problem behaviour. Earlier research also indicated that among elementary school students, task-avoidant behaviour might mediate this relationship (Metsäpelto et al., 2015).

ADHD symptoms may hinder the students' ability to benefit from lessons because concentrating on tasks and learning might be difficult (Loe & Feldman, 2007), and by this age, there may be gaps in basic academic skills (Rodriguez et al., 2007). Also, ADHD symptoms and problems in executive functions are often interrelated (Daley & Birchwood, 2010). As the student continues to lower secondary school, the demands for executive functions increase because of multiple teachers, growing amounts of homework, and an increase in the learning contents that simultaneously become more complex. Thus, this school transition with its new and growing requirements may be especially difficult for these children and relate to a decrease in academic performance. In addition, research conducted on clinical samples suggests, that the effect ADHD symptoms have on academic performance may be primarily driven by the

symptoms of inattention (Metcalfe, et al., 2013) and the comorbidity of underlying cognitive deficits and ADHD symptoms (Daley & Birchwood, 2010).

Practical Implications

These results showed the importance of distinguishing between symptoms of CD and ADHD (Hinshaw, 1992; Massetti et al., 2008) because they seem to have a distinct relationship with academic performance among young adolescents (Hinshaw, 1992). Symptoms of inattention, hyperactivity, and impulsivity with or without a formal diagnosis of ADHD have a unique negative effect on academic and educational outcomes. Although teachers probably are aware of the disruptive nature of ADHD symptoms and the available interventions, alternative combinations of interventions and interventions targeting the learning outcomes more directly should perhaps be considered (DuPaul & Eckert, 1997; Raggi & Chronis, 2006). With early recognition and intervention, students may be more likely to enter a positive behaviour and academic cycle.

Most students make school transitions, like the primary secondary school transition covered by this study, successfully, but during the transition there can be both positive and negative changes in students' academic achievement, learning, motivation, interpersonal relationships, and well being (Anderson, Jacobs, Schramm, & Splittgerber, 2000; Rimpelä, Kuusela, Rigoff, Saaristo, & Wiss, 2008; Rimpelä, Rigoff, Kuusela, & Peltonen, 2007). The cascading effects of externalizing problems and academic competence in early adolescence are more likely to occur during school-related transitions (Moilanen et al., 2010). Transition to lower secondary school brings about changes both in academic demands and social environment, along with how students perceive themselves in their social roles (Pietarinen, Pyhältö, & Soini, 2010). In Finland, most students move to a different school building when they enter lower secondary

school, and both the class structure and the peer group change. How well the student adapts into this new situation can have long-term effects on their academic outcomes, including graduation from upper secondary education and success in entering work life (Hakkarainen 2016). At worst, the student's failure to adapt can lead to exclusion from education and employment and marginalization.

Limitations

The first obvious limitation of this study was that externalizing behaviours were measured by teachers' reports. Although teachers have been shown to be very reliable reporters of child behaviour (Koskelainen, Sourander, & Kaljonen, 2000; Tripp, Schaughency, & Clarke, 2006), future research should utilize other measures of child behaviour, including observational data and parent reports. Second, conclusions were drawn from correlational data. Even though we used a cross-lagged design and included several important covariates, causal conclusions should be made with caution. There might be other variables affecting the over-time associations. Third limitation is international generalization, since school transitions happen at different ages in different countries and school systems. Generalizations to other geographical areas should also be made with caution.

The strength of this study was in the longitudinal design with a natural transition period. In addition, considering school grades and simultaneously controlling achievement tests also adds to earlier studies (Zimmermann et al., 2013).

Conclusions

The present study provided new insights into the process of how different externalizing problems and academic performance are linked over time. However, prior research is still inconclusive on

the potential mechanisms linking externalizing problems and academic performance. These dynamics should be examined in future studies both in relation to CD and ADHD symptoms, but also considering the specific role of inattention. Scholars should further examine the developmental trajectories of CD and ADHD symptoms and academic performance across time and how a more varied set of covariates may help to explain the mechanisms in such trajectories. The developmental changes in these relations should be examined, utilizing multiple time points from elementary to secondary school. Also, it might be useful to examine whether specific types of parent–student or teacher–student interactions or achievement strategies mediate the relations between academic performance and different externalizing symptoms.

In conclusion, this study was an effort to investigate the interrelationships among different externalizing symptoms and academic performance, covariates affecting their over-time associations, and how they shape each other in early adolescence. Our study indicated that during school transition symptoms of CD and ADHD have a different relation to academic performance.

Table 1. Descriptive Statistics and Correlations Between the Study Variables and Control Variables.

Variable	*M (SD)*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Gender	1.47 (.50)	–													
2. T1 GPA	8.13(.91)	-.22**	–												
3. T2 GPA	7.96(1.07)	-.27**	.75**	–											
4. T1 MATH	38.84(6.75)	-.08	.51**	.50**	–										
5. T1 RC	30.65(6.93)	-.14**	.63**	.58**	.38**	–									
6. T1 ADHD	1.51(.53)	.38**	-.60**	-.55**	-.28**	-.29**	–								
7. T1 CD	1.22(.29)	.26**	-.43**	-.40**	-.18**	-.16**	.71**	–							
8. T2 ADHD	1.50(.56)	.33**	-.51**	-.56**	-.21**	-.31**	.68**	.57**	–						
9. T2 CD	1.23(.37)	.19**	-.35**	-.43**	-.15**	-.27**	.50**	.51**	.74**	–					
10. T1 EXT	2.72(.76)	.36**	-.58**	-.53**	-.27**	-.26**	.96**	.87**	.69**	.54**	–				
11. T2 EXT	2.73(.86)	.29**	-.48**	-.54**	-.20**	-.32**	.65**	.59**	.96**	.90**	.67**	–			
12. Mother's education	4.41 (1.63)	.04	.25**	.27**	.14**	.27**	-.11	-.10	-.16*	-.21*	-.11	-.20*	–		
13. Father's education	4.14(1.73)	.02	.28**	.32**	-.16**	.27**	-.14*	-.15*	-.12	-.13	-.16*	-.13	.50**	–	
14. Family structure	1.16 (0.36)	-.026	-.057	-.043	-.029	-.012	.21**	.22**	.17*	.17**	.23**	.19**	-.03	-.04	–

Note. T1= Time 1, T2= Time 2, GPA= Grade Point Average, Math= Mathematics achievement test score, RC= Reading Comprehension test score, CD= Conduct Disorder symptoms, ADHD= ADHD symptoms, EXT= Externalizing behaviour composite. *p<.05, **p<.01

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II

ADHD SYMPTOMS AND MALADAPTIVE ACHIEVEMENT STRATEGIES: THE RECIPROCAL PREDICTION OF ACADEMIC PERFORMANCE BEYOND TRANSITION TO MIDDLE SCHOOL

by

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ADHD Symptoms and Maladaptive Achievement Strategies: The Reciprocal Prediction of Academic Performance Beyond the Transition to Middle School

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This longitudinal study examined how two externalizing behaviour problems, attention-deficit hyperactivity disorder (ADHD) and conduct disorder (CDs), are associated over time with low motivation (MAS), and how these problems effect academic performance. In our cross-lagged analysis we found reciprocal effects between ADHD symptoms and MAS between Grades 5 and 6. Both domains also negatively predicted later academic performance. With CDs and MAS, no cross-lagged effects were found, although both were correlated and very stable over time, and negatively predicted later academic performance. These different kinds of externalizing problem behaviors seem to differ in the way in which they interact with students' MAS and academic performance in the long term. Students with ADHD symptoms are likely to be more vulnerable to negative learning experiences and the development of MAS than students with CDs.

Keywords: ADHD, conduct disorders, maladaptive achievement strategies, academic performance

Highlights

- ADHD and MAS had a reciprocal over-time association, and both negatively predicted academic performance beyond school transition.
- CDs and MAS had a strong within-time association and they separately predicted academic performance beyond school transition.
- Students with ADHD symptoms seem to be more vulnerable to the negative effects of MAS than students with CDs.

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Introduction

Externalizing behaviour problems are negatively associated with academic outcomes in both the short and long term and often have negative effects on multiple aspects of life (Fergusson, et al., 2007; Frazier et al., 2007; Reid et al., 2004). In addition, the maladaptive achievement strategies (MAS), that students deploy can have negative short- and long-term effects on both academic performance and overall academic achievement (Midgley & Urdan, 1995; Midgley, et al., 1996; Nurmi, 2003). These strategies are often associated with externalizing behaviour problems (see, e.g., Aunola, et al., 2000). However, little is known about how MAS are related specifically to the different dimensions of externalizing behaviour problems—that is, the symptoms of ADHD (inattention, hyperactivity and impulsivity) and conduct disorders (CDs: oppositional, aggressive, antisocial)—and how, the different symptom dimensions together with MAS, contribute to academic performance.

There is strong evidence indicating that in relation to academic performance, the symptoms of ADHD and CDs should be studied separately (Hinshaw, 1992). The negative associations between ADHD and academic performance are well established (Loe & Feldman, 2007). However, for CDs, the association with academic performance is not as clear (Reid et al., 2004). In addition, the symptoms of ADHD and CDs seem to interact differently with academic performance over the transition from primary to middle school (Palmu et al., 2018).

The vast majority of the achievement strategy literature focuses on adolescents (see, e.g., Aunola et al., 2000; Määttä et al., 2006), young adults (Kusurkar et al., 2013), or on young children (Gut et al., 2012; Metsäpelto et al., 2015), while middle childhood and early adolescence have remained understudied. This is an important stage for development, as the transition from primary to middle school entails a significant change of environment and increasing academic demands (Pietarinen et al., 2010). Moreover, the evidence that considers symptoms of ADHD and CD and academic outcomes is largely based on clinical or high-risk

samples from disadvantaged populations (e.g., Gut et al., 2012), and the achievement strategies are often evaluated by teachers or guardians instead of the students themselves (e.g., Olivier & Steenkamp, 2004). Consequently, the present study addresses the need to examine separately teacher-evaluated symptoms of ADHD and CDs and how they interact with students' self-evaluated MAS and predict later academic performance after students' transition from primary to middle schools in a community sample.

ADHD, CDs, and Academic Performance

The core symptoms of ADHD are developmentally inappropriate levels of hyperactivity, impulsivity, and/or inattention (American Psychiatric Association, 2013: DSM-V). ADHD is a highly heritable, childhood-onset, multifactorial, neurodevelopmental disorder generated by a combination of genetic, biological, and psychosocial factors (Nigg, et al., 2010; Thapar & Cooper, 2016). It is highly comorbid with other externalizing and internalizing problems (American Psychiatric Association, 2013; DSM-V; Thapar & Cooper, 2016) and learning disorders (DuPaul, et al., 2013), all of which can hinder learning. ADHD diagnoses are more common among boys (Ramtekkar et al., 2010) and the diagnoses are also associated with low parental education level (Torvik et al., 2020).

The prevalence rates of learning and/or achievement problems at school in samples of youth with ADHD range from 50–80%, and academic problems persist into adolescence and adulthood in most cases (DuPaul & Langberg, 2015). Both students with formally diagnosed ADHD and those with ADHD symptoms are likely to perform below their levels of ability (Diamantopoulou et al., 2007; Rodriquez et al., 2007), have poor educational outcomes (Arnold et al., 2015; Frazier et al., 2007; Loe & Feldman 2007), and higher rates school dropout in comparison to their peers (Fried et al., 2016). The negative effects that ADHD symptoms have on academic performance remain after controlling for intelligence, comorbidity, and socioeconomic status (Polderman et al., 2010).

These students' academic impairment is primarily related to the core symptoms of inattention and to the cognitive deficits in executive functions (working memory, inhibition, and mental-set shifting) (EFs; Langberg et al., 2013; White, et al., 2013). Success in learning situations requires skills to regulate learning and manage social interaction, both of which can be difficult for students with ADHD symptoms. Difficulties initiating, staying focused on, organizing, or finishing tasks hamper learning and academic performance, creating frequent experiences of failure, which are related to development of MAS (Nurmi, 2015).

Hyperactivity and impulsivity tend to decrease with age (Polanczyk et al., 2014), school transition, an important environmental change, is associated with a disruption in the developmental decline of these symptoms (Langberg et al., 2008). The transition to middle school includes changes in both the academic and social environment, bringing forth new demands regarding independence, skills, and adjustment (Pietarinen et al., 2010).

CDs are characterised by persistent oppositional, aggressive, and antisocial behaviour patterns (American Psychiatric Association, 2013; DSM-V) and typically emerge during either childhood or adolescence and are more common among males than females (Maughan et al., 2004). The core symptoms include breaking common rules, lying, being physically or verbally aggressive, bullying or damaging other peoples' property on purpose (American Psychiatric Association, 2013; DSM-V), which can lead to various social difficulties at school (Erskine et al., 2016). They are often comorbid with internalizing problems (MacDonough-Caplan, et al., 2018), and may co-occur with learning disabilities and verbal deficits (Lynam & Henry, 2001; Närhi et al., 2010; Teichner & Golden, 2000), which by themselves are a risk for failure at school. Youth with CDs have a higher risk of school dropout than their peers (Arnold, 1997), and show higher levels of academic failure and disengagement with school (Elias & Haynes, 2008).

In conclusion, students with ADHD symptoms have increased risk of motivational problems (Smith & Langberg, 2018) and school failure due to the cognitive, social, and

behavioural difficulties experienced alongside the symptoms (Birchwood & Daley, 2012; Gut et al., 2012; Olivier & Steenkamp, 2004). Students with CDs may have some cognitive and, most importantly, social, and behavioural difficulties that are a risk for developing low academic performance and motivation, especially in adolescence (Crum et al., 2016; Erskine et al., 2016).

MAS and Academic Performance

One aspect of achievement motivation can be conceptualised as achievement strategies. Achievement strategies refer to a person's typical tendency to deal with challenging and demanding situations and are usually classified as adaptive or maladaptive. MAS are also often called task-avoidant strategies (Onatsu-Arvilommi & Nurmi, 2000), and typically include fears of failure and avoidant behaviour in challenging situations. They have been described in the literature using multiple concepts (e.g., self-handicapping: Jones & Berglas, 1978; learned helplessness: Dweck & Leggett, 1988; task-avoidant behaviour: Nurmi, 1993; Zhang et al., 2011; performance avoidance: Elliot & Hulleman, 2017). All these concepts are related to a negative cyclical process that consists of *failure-oriented cognition (e.g., low beliefs in personal control)*, *negative affects (e.g., fear of failure)*, and *harmful behavioural strategies (e.g., task avoidant behaviour)* that students experience in challenging learning situations (Elliot & Harackiewicz, 1996; Nurmi, 1993).

The development of MAS is a process whereby previous experiences and concepts of the self in certain kinds of situations direct how one anticipates one's ability to perform in similar situations, creating a risk for a negative cycle (Nurmi, 2015). Failures in school tasks with the associated direct and indirect negative feedback can create a negative academic self-concept of ability and low efficacy beliefs. This may lead to low effort and task-avoiding behaviours in academic settings (Nurmi, 2015; Onatsu-Arvilommi & Nurmi, 2000), which often make failure more likely, thereby creating new experiences of failure (Aunola et al., 2002). The student then strives to avoid the negative emotions in challenging situations by

avoiding the task at hand. In the moment, MAS may provide the student with a way out, but they tend to lead to poor academic performance and subsequent experiences of failure (Midgley & Urdan, 1995; Zuckerman et al., 1998). In the long term, the deployed strategies are reflected in students' school adjustment (Nurmi, et al., 1994) overall adjustment (Midgley et al., 1996; Roeser et al., 1998) and academic achievement (Midgley & Urdan, 1995).

A substantial amount of research has been carried out on the association between students' achievement strategies and their academic performance (e.g., Carr, et al., 1991; Nurmi, et al., 1995). MAS have been found to predict subsequent poor academic performance among both young children (Aunola et al., 2002; Mägi, et al., 2010) and adolescents (Midgley & Urdan, 1995), especially in terms of task avoidance. In addition, among younger children with learning difficulties, slow academic progress and low levels of literacy skills seem to predict an increase in task avoidance (Aunola et al., 2002; Onatsu-Arvilommi & Nurmi, 2000; Pakarinen et al., 2011). Also, some reciprocal effects (Aunola et al., 2002; Metsäpelto et al., 2015) and cumulative cycles of low academic performance and task avoidance have been reported (Metsäpelto et al., 2015; Onatsu-Arvilommi & Nurmi, 2000). However, previous research has focused mainly on task-avoidant behaviour (Midgley & Urdan, 1995; Nurmi, 1993), but not wider aspects of MAS.

ADHD, CDs, and MAS

Students with ADHD have shown to have more motivational problems in relation to school than their peers (Smith & Langberg, 2018) and it has been suggested that they, similarly to MAS, also strive to avoid failure, rather than to obtain success and engage in tasks (Olivier & Steenkamp, 2004). Students with ADHD show low competence beliefs (Barron et al., 2006; Zentall & Beike, 2012), low achievement motivation and task persistence (Gut et al., 2012), active avoidance of tasks requiring sustained self-regulation (Barron et al., 2006; Carlson et al., 2002; Olivier & Steenkamp, 2004), and frustration during tasks requiring focused attention (Martínez et al., 2016). These mostly teacher or parent-reported motivational

features resemble the observable core symptoms of ADHD. Consequently, the distinction between these symptoms and MAS can be rather difficult from the outside. Part of these reported motivational difficulties may be manifestation of core symptoms of ADHD; however, some of the observations are just as likely related to negative learning experiences. Every student showing MAS does not necessarily have ADHD symptoms, and vice versa. For example, Gut and colleagues (2012) found that students with diagnosed ADHD who showed a high will to succeed and engage with tasks did as well as their typical student comparisons in tasks requiring language skills and mathematical thinking.

There is very little research about CD's and MAS. Gut and colleagues (2012) found no differences in achievement motivation between students with disruptive behaviours and the reference group. Yet, there are factors related to CD's which may lead to development of MAS, such as problem behaviour at school or cognitive deficits (i.e., learning disabilities, verbal deficits) (Aunola et al., 2000; Nurmi et al., 1994). School may feel unrewarding, and students' self-esteem may decrease (e.g., Zimmermann et al., 2013). In addition, poor student-teacher relationships can strengthen the development of MAS, as they can negatively affect both behaviour and academic achievement (Zee, et al., 2017). It is possible that problem behaviours and academic failures together create a reciprocal cycle in which each problem exacerbates the other, and the effects may extend to achievement strategies.

Much of the achievement strategy literature focuses on skill-specific areas, such as reading, writing, and mathematics (Lee & Zentall, 2012; Zentall & Beike, 2012), instead of overall academic performance and rarely entails the differentiation of ADHD and CD symptoms. Metsäpelto and colleagues (2015) found that during the early primary school years, the negative association between externalizing problems (including both ADHD and CD symptoms) and academic performance was partly mediated via task-avoidant behaviour. Gut and colleagues (2012) studied language skills, mathematical thinking, and achievement motivation in 6–10-year-old children with diagnosed ADHD, CDs, and normal controls.

They found that achievement motivation was a key factor in the development of receptive language and mathematical thinking in children with ADHD but not in children with CDs. This suggests that achievement motivation should be investigated separately with ADHD and CD symptoms.

The authors (Palmu et al., 2018) studied the over-time association between externalizing behaviour problems and academic performance from Grade 6 to Grade 7. When child- and family related covariates were controlled, previous ADHD symptoms systematically had a negative effect on Grade 7 academic performance, whereas the results for CD models were inconsistent. As we know, the symptoms of ADHD and CDs are quite stable over time. MAS, especially avoidance of learning tasks, are quite stable, more common among boys and have a negative impact on academic performance (Midgley & Urdan, 1995; Onatsu-Arviolommi & Nurmi, 2000). What remains to be examined is a) how the symptoms of ADHD and CDs are associated with MAS during late primary years and school transition and b) what common effects the symptoms of ADHD, CDs, and MAS have on academic performance. Our research questions were as follows:

(1) Do the symptoms of ADHD or CDs have cross-lagged associations with MAS? If they do, what are the direction and strength of these associations?
(2) How do the symptoms of ADHD or CDs together with MAS predict later academic performance?

Method

Participants

The data used in this study was collected as a part of a large longitudinal study that took place in Eastern Finland between 2010–2013. A cohort of pupils, their teachers and parents were given a questionnaire while pupils were in 5th, 6th, and 7th grade. Six 5th grade student per class (11-year-olds, 52% female), were randomly drawn for teacher ratings of

externalizing behaviour problems and followed until the end of 7th grade. While the number of data varied between measurement points and individual variables (see: Table 1), full information maximum likelihood estimation in the SEM-models used data from 311 participants.

Measures

The symptoms of ADHD and CDs were assessed by classroom teacher using the Finnish version of the Strengths and Difficulties Questionnaire (Goodman, 1997). Hyperactivity/ inattention scale has five items (e.g., *"Restless, overactive, cannot stay still for long"* and *"Easily distracted, concentration wanders"*) as does the conduct problems scale (e.g., *"Often fights with other youth or bullies them"* and*, "Often lies or cheats"*). Items were rated on a 3-point scale (1 = not true, 2 = somewhat true, and 3 = certainly true). The SDQ is widely used to screen the behaviour of children and adolescents between 4 and 16 years of age and has been shown to be a valid screening instrument (Goodman et al., 2000) also in Finland (Koskelainen, 2008). SDQ data from 5th and 6th grade was used in this study as the mean score of each symptom and the Cronbach's alpha reliabilities were .75 and .87 for hyperactivity/inattention symptoms and .77 and .63 for CD symptoms (Grades 5 and 6, respectively).

MAS were assessed with the Strategy and Attribution Questionnaire for Children (SAQ-C; Aunola et al., 1999). Mean score of nine items measuring maladaptive strategies (e.g., *"When we are doing exercises at school, I'm afraid I can't do them," "If something is difficult at school, I gladly do something else,"* and *"If something goes wrong at school, I think teachers and other students consider me stupid"*) was used. The pupils rated statements on a 4-point scale (1 = strongly agree to 4 = strongly disagree). The Cronbach's alpha reliabilities were .76 (Grade 5) and .79 (Grade 6).

Academic performance was assessed using individual student grades given by the teachers each year (Grade 5 N = 245 Grade 7 N = 251). In Finnish comprehensive schools

grading ranges from 4 (F, fail), to 10 (A, excellent). In grade 5 performance grades in reading, language arts, and mathematics were received from teachers and in Grade 7 corresponding grades were drawn from school registers.

Basic academic skills were measured by academic achievement test on reading comprehension (Lindeman, 1998) and basic mathematic skills (Räsänen, 2004). *Reading comprehension* was measured using a subtest of a widely used standardised test battery where students answered 12 multiple-choice questions based on a two-page silently read text within a 60-minute time frame. The text was available while the students answered the questions. This test has been shown to have acceptable validity and reliability (Cronbach's alpha .64 and Revelle's omega .86; Lindeman, 1998). *Basic mathematics skills* were assessed with a standardised test (RMAT: Räsänen, 2004) that is a time-restricted test consisting of 56 items (basic addition, multi-digit calculations, fractions, decimals, measurement, and algebra tasks). The total score is the number of items answered correctly in 10 minutes. The test has been shown to have high internal validity and reliability in Finland: the Cronbach's alpha reliability for the test was .92–.95 between the ages of 9 to 12 (Räsänen, 2004).

Students' mothers' level of education (later: parent educational level: PED) was measured using an 8-point scale ranging from comprehensive education only to master's/doctoral education level. Only 2.4% of mothers had no education beyond the comprehensive level (i.e., no vocational degree), and 33.7% had higher vocational diplomas, bachelor's, master's, or doctoral degrees. The overall distribution of mothers' education level was comparable to that of the general population at the time of the study (Official Statistics Finland, 2013).

Analyses

The analyses strategy was to use cross-lagged models to test the directions of association between studies variables. Two cross-lagged path models were estimated: one for the symptoms of ADHD and MAS and another for CDs and MAS. In these models, both stability

and cross-lagged paths between externalizing behaviours and MAS were estimated. Simultaneously measured constructs in the models were allowed to correlate. The models were set to predict Grade 7 academic performance and covariates were included to the models. The analyses were performed with Mplus statistical package (Version 7) using the maximum likelihood robust (MLR) estimation (Muthén & Muthén 1998–2013) as the distributions of the variables used were not completely normal.

In this study sample, the proportion of nonresponses in the different variables ranged from 1% to 35% (M = 17.42%). The rate of attrition in all variables of a particular wave was relatively small and the missingness was tested to be completely at random (Little's MCAR p = .197). Additionally, Mplus uses the full-information maximum likelihood estimation (FIML) which used all available data and is an effective approach to handle missing data (Enders, 2010). Model fit was evaluated with five indicators: X^2/df, root-mean-square error of approximation (RMSEA), Bentler's comparative fit index (CFI), Tucker-Lewis index (TLI), and standardised root-mean-square (SRMR).

Table 1. Descriptive Statistics of Observed Variables

Variable	*n*	*M*	*SD*	*Skew (SE)*	*Kurt. (SE)*	*Min.*	*Max.*
1. T1 Conduct problem symptoms	281	1.19	.31	2.15 (.15)	5.06 (.29)	1.00	2.80
2. T2 Conduct problem symptoms	311	1.22	.29	1.50 (.14)	1.87 (.28)	1.00	2.33
3. T1 ADHD symptoms	281	1.50	.46	1.13 (.15)	1.03 (.29)	1.00	3.00
4. T2 ADHD symptoms	311	1.51	.53	1.06 (.14)	.27 (.28)	1.00	3.00
5. T1 Maladaptive achievement strategies	262	2.37	.74	.47 (.15)	-.08 (.30)	1.00	4.93
6. T2 Maladaptive achievement strategies	289	2.41	.77	.18 (.14)	-.36(.29)	1.00	5.00
7. T3 Grade Point Average	251	7.88	1.11	-.26 (.15)	-.74 (.30)	5.00	10.00
8. Parental education level	224	4	1.72	.54 (.16)	-.45 (.32)	1.00	8.00
9. Reading comprehension	272	30.60	6.88	-.21 (.15)	-.21 (.29)	9.00	47.00
10. Basic mathematics test	279	38.53	7.02	-.13 (.15)	.33 (.29)	12.00	56.00
11. Gender (1=girl 2=boy)	311	1.48	.50	.08 (.14)	-2.01 (.28)	1.00	2.00
12. T1 Grade Point Average	245	8.22	.88	-.43 (.16)	-.31 (.31)	5.33	10.00

Note. T1 = Grade 5, T2 = Grade 6, T3 = Grade 7, M = mean, SD = standard deviation, Skew = skewness statistics, Kurt. = kurtosis statistics, Min. = minimum value, and Max. = maximum value.

Table 2. Sample Correlation Matrix

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1. T1 CD	–											
2. T2 CD	.62**	–										
3. T1 ADHD	.70**	.57**	–									
4. T2 ADHD	.66**	.71**	.76**	–								
5. T1 MAS	.24**	.20**	.24**	.30**	–							
6. T2 MAS	.19**	.33**	.24**	.32**	.62**	–						
7. T3 GPA	-.30**	-.40**	-.41**	-.55**	-.31**	-.44**	–					
8. T1 GPA	-.37**	-.43**	-.50**	-.60**	-.38**	-.43**	.77**	–				
9. PED	-.12	-.10	-.06	-.11	-.16*	-.04	.24**	.26**	–			
10. RC	-.19**	-.16**	-.29**	-.29**	-.32**	-.33**	.58**	.64**	.31**	–		
11. MATH	-.13*	-.18**	-.22**	-.28**	-.24**	-.24**	-.50**	-.52**	.12	.41**	–	
12. GENDER	.28**	.26**	.36**	.38**	.01	.05	-.27**	-.29**	.10	-.14*	-.14*	–

Note. T1 = Grade 5, T2 = Grade 6, T3 = Grade 7, CD = conduct disorders symptoms, ADHD = hyperactivity/inattention symptoms, MAS = maladaptive achievement strategies, GPA = Grade Point Average, PED = parental education level, RC = reading comprehension *p<.05, **p<.01

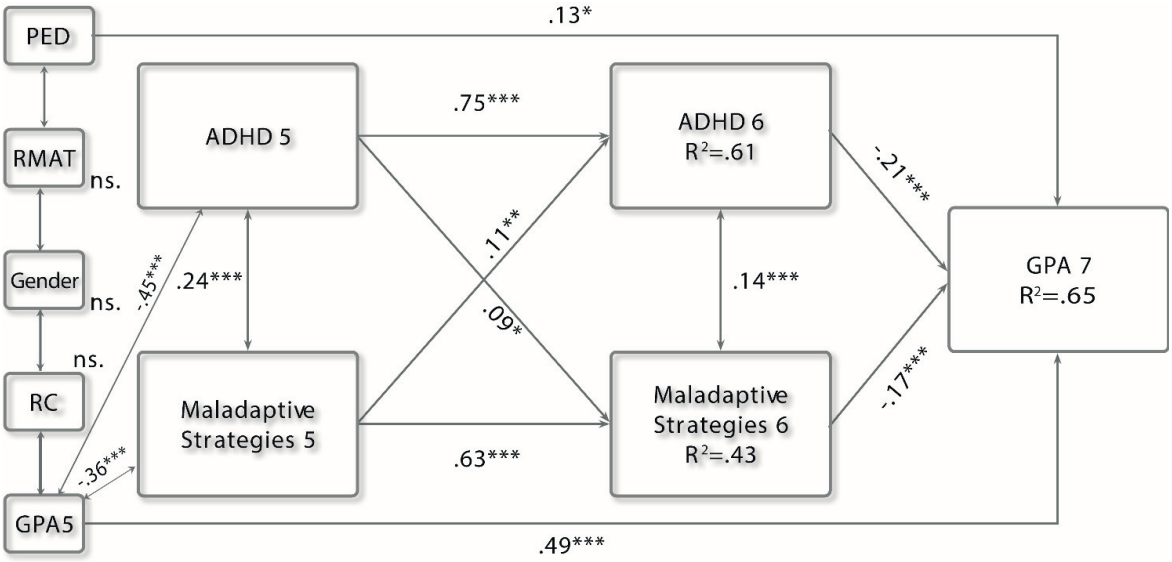
Results

The descriptive statistics and correlations of the observed variables are shown in Tables 1 and 2. The correlations of study variables across grades indicated moderate to high inter-individual stability.

The Dynamics Between ADHD Symptoms, MAS, and Academic Performance

The ADHD symptom model (*Figure 1*, $n = 311$, $\chi^2 = 23.55$, df = 12, $p = 0.02$, RMSEA = 0.06, CFI = 0.98, TLI = 0.96, and SRMR = 0.03) showed reciprocal cross-lagged associations. Grade 5 MAS predicted Grade 6 ADHD symptoms and Grade 5 ADHD symptoms predicted Grade 6 MAS. Of the covariates, only PED and Grade 5 academic performance predicted the academic performance of Grade 7. Grade 5 GPA was strongly associated with Grade 5 ADHD symptoms and MAS. In addition, Grade 5 GPA correlated with gender (-.24***), i.e., being a boy. The indirect effects were tested with the Model Indirect command in Mplus. A significant indirect effect (-.02*) from Grade 5 MAS via ADHD 6 to GPA 7 was found. In addition, both Grade 5 ADHD symptoms (-.16***) and MAS (-.11***) indirectly affected Grade 7 GPA via the same Grade 6 measures.

Figure 1. ADHD symptom model with covariates – standardised coefficients.

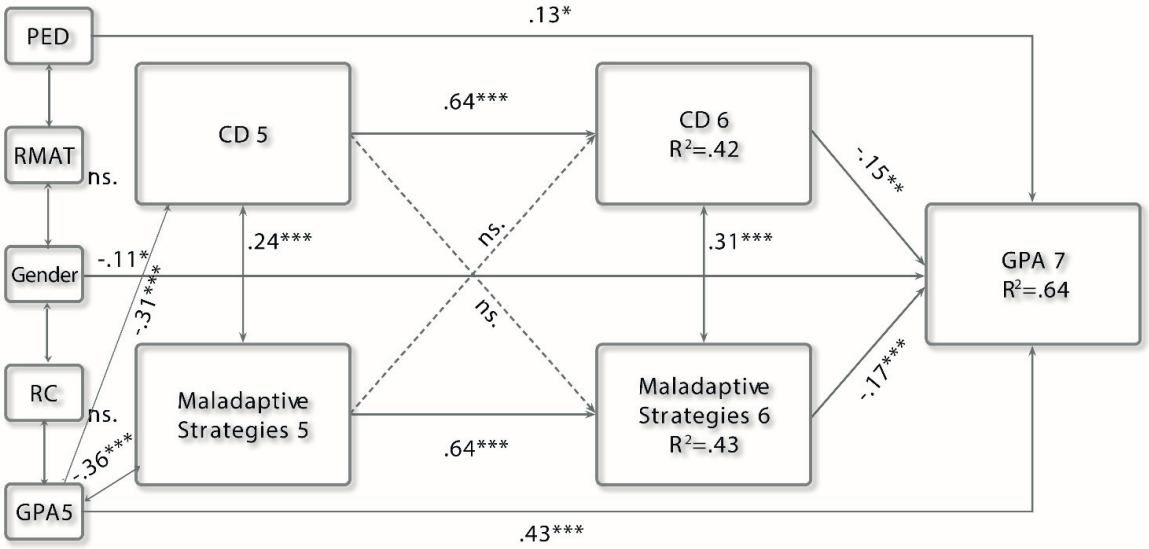


Note. GPA = Grade Point Average, ADHD = hyperactivity/inattention symptoms, PED = parental education level, RC = reading comprehension, RMAT = standardised math test score. *p<.05 *** p < .001.

The Dynamics Between CD Symptoms, MAS, and Academic Performance

The CD symptom model (*Figure 2, n* = 311, χ^2 = 16.40, df = 12, p = 0.17, RMSEA = 0.03, CFI = 0.99, TLI = 0.98, and SRMR = 0.03) showed no cross-lagged associations after the covariates were added to the baseline model. CDs and MAS correlated at both times points. Grade 5 GPA was associated with Grade 5 CD symptoms and MAS. In addition, Grade 5 GPA correlated with gender (-.31***). PED, gender, and previous academic performance predicted Grade 7 academic performance. In addition, Grade 5 CD symptoms (-.10**) and MAS (-.11***) both indirectly affected Grade 7 GPA via the same Grade 6 measures.

Figure 2. CD symptom model with covariates – standardised coefficients.



Note. GPA = Grade Point Average, ADHD = hyperactivity/inattention symptoms, PED = parental education level, RC = reading comprehension, RMAT = standardised math test score. *p<.05 **p <.01., *** p < .001.

Discussion

In this study, we utilised a cross-lagged design to investigate the associations between students' teacher-rated ADHD and CD symptoms, self-reported MAS, and how these constructs predict academic performance beyond the transition from primary to middle school. The symptoms of ADHD and CDs were studied separately and differing associations with MAS were found. Over the one-year time gap teacher-rated ADHD symptoms seemed to increase student's self-reported MAS, and MAS on the other hand, increased ADHD symptoms the next school year. Both also had a negative effect on Grade 7 GPA over the transition to middle school. With CD's, such cross-lagged paths

were not found. CDs and MAS were correlated at both time points and Grade 6 measures both had negative effect on Grade 7 GPA.

The high stability of ADHD symptoms and MAS were in line with the findings of previous studies (Gut et al., 2012; Palmu et al., 2018). All grade 6 measures (ADHD, CD and MAS) negatively predicted Grade 7 academic performance, which was expected in the light of existing literature (Palmu et al., 2018; Metsäpelto et al., 2015). Also, an indirect effect from Grade 5 MAS via Grade 6 ADHD symptoms to grade 7 GPA was found. The negative effects of Grade 6 MAS and CD symptoms on later academic performance were almost equivalent. In both models, parental education level and previous academic performance predicted Grade 7 GPA in addition to externalizing behaviour symptoms. Although gender had a significant negative effect in GPA in the CD model but not in the ADHD model, the practical effect size was similar in both models. In contrast to previous literature (Maughan et al., 2014), PED was not associated with students' ADHD symptoms (Torvik et al., 2020).

There are at least two mechanisms that may explain the reciprocal effects between ADHD symptoms and MAS. First, the symptoms of inattention and ADHD-related deficits in executive functions (Langberg et al., 2013; White et al., 2013) are likely to make it difficult for students to manage schools' everyday demands, which may generate MAS in challenging situations. Students experiencing ADHD symptoms are also likely to have increased negative interactions and feedback with teachers (Rogers et al., 2015), which may, in turn, generate low competence beliefs; failure expectations; and, finally, a low tendency to exert the effort needed for success in academic work (Nurmi et al., 2003). Second, as academic demands increase when moving to higher grades (i.e., from 5^{th} to 6^{th}), MAS may increasingly influence a student's behaviour in learning situations. Specifically, ADHD-symptoms may become

more prominent in everyday learning situations as learning processes become more frustrating, partially as a result of MAS use. The data suggests, that over time these negative patterns both hinder learning and strengthen each other, creating a negative cycle, together taxing academic performance even after transition to middle school. For example, Zentall and Beike (2012) found that from Grade 3, students with ADHD symptoms started to utilise MAS more than their peers. It is likely that by Grade 5, these students have experienced a significant amount of failure and negative feedback at school, resulting a negative academic self-concept, as both correlations of MAS, ADHD symptoms and GPA on grade 5, and the reciprocal effects observed indicate.

From practical point of view the lack of this kind of negative cycle in the CD model seems rather understandable. Similar reciprocal interactions do not exist between CDs and MAS, as the CDs do not affect learning situations and learning as directly as ADHD symptoms. CDs are more reflected in social interactions with peers and adults (Crum et al., 2016; Erskine et al., 2016), which may also explain the correlations of MAS and CDs. From Grade 5 to 6 the academic demands and social structure of the classroom remain quite stable, which may indicate that this age is not relevant to the reciprocal development of CDs and MAS: both have already grown to be quite stable and are associated within time, but they no longer influence each other's level. Thus, MAS do not increase CD symptoms or vice versa, but these challenges develop side by side. The correlations between MAS and CDs may be at least partly due to social interaction, especially teacher–student relationships (Murray & Murray, 2004; Spilt & Koomen, 2009; Zee et al., 2017). Students with CDs are known to have increased negative feedback and conflictual interactions with teachers and peers (Murray & Murray, 2004), which can also be reflected in their grades (Spilt & Koomen, 2009). It is likely that negative experiences in learning situations and classroom interactions

accumulate (the indirect effects), leading to low competence beliefs, general negative feelings toward school, and low interest and effort in learning situations (Nurmi, 2015).

Previous studies have indicated that among younger students, a high quality of instructional support by teachers lowers the level of students' MAS (Pakarinen et al., 2011). This combined with our results indicates that early detection of students with ADHD symptoms and helping them learn more adaptive achievement strategies through targeted motivational intervention is important. Providing adequate learning support and feedback is especially important to decrease the development of MAS in students with ADHD symptoms. MAS should be further investigated especially among children with ADHD symptoms for at least two reasons: first, learning more adaptive strategies and ways of learning can reduce the effect ADHD symptoms have on learning, and finding new ways to learn may itself improve academic performance.

The negative cycle of ADHD symptoms and MAS has negative effects on academic performance even after the school transition. MAS are generated by experiences of failure, having ADHD symptoms increases the risk of MAS and the symptoms can also be mistaken for MAS. To detect the students at risk early screening for ADHD symptoms as well as MAS is important. It is not always clear from the outside, which one is hampering learning. These students need adequate pedagogical support for especially inattention symptoms and targeted support in learning more adaptive achievement strategies to succeed in self-regulation and goal-oriented behaviour. Support combined with realistic informative feedback, would likely decrease experienced failures, improve motivation and thus successful self-regulation in school (Nurmi, 2015).

To interrupt the strengthening of the negative cycle of (ADHD – MAS – decreasing academic performance), interventions should entail both support for

executive functions (e.g., structured teaching and materials, support for inhibition, and working memory; Hofmann et al., 2012) and targeted teaching of more adaptive achievement strategies as a process (Nurmi, 2015). These students need to learn that earlier failures do not necessarily lead to new experiences of failure when the process is interrupted. One more thing to consider is the contextuality in the strength of ADHD symptoms (Imeraj et al., 2013) – the provided support needs to be well structured and accessible in an optimal (social) environment. More adaptive strategies help the students have more positive attitudes towards learning situations, and thus, to better to orientate to task at hand, which helps them to succeed better.

The teaching of more adaptive, task-oriented strategies includes making one's typical ways of thinking and (re)acting more conscious (Aunola et al., 2000; Nurmi, 2015), as achievement strategies are activated when the challenging situation rises. The process starts with overall academic self-concept, which creates the basis of how one expects to cope (i.e., failure expectations; Nurmi, 2015). For this, the early recognition and acknowledgement of previous negative experiences and the effects of ADHD symptoms and MAS behind them is important. These students need support for understanding the challenges (for example: working memory, inhibition, emotion regulation, mental-set shifting), outlining the steps to take to complete the task (for example: planning, organization, initiating, self-monitoring), support in anticipating positive outcomes (i.e., more task-oriented behaviour), positive and realistic feedback (with information of the steps leading to success), new encouraging causal attributions (feedback, self-monitoring) and anticipation strategies and action plans for dealing with expectations (for example: emotion regulation: Nurmi, 2015).

The dynamics between ADHD or CDs and MAS are likely to include additional components—for example, the quality of instruction, nature of the learning

environment, and relationship between students and teachers (Murray & Murray, 2004; Rodgers et al., 2015; Spilt & Koomen, 2009). These developmental dynamics should be examined in greater detail, especially on earlier stages of school path and in relation to school transition. The field could also benefit from boarder theoretical frameworks in conceptualization and operationalization of motivation in relation to ADHD symptoms. All in all, the findings suggest that more attention needs to be paid to the negative cycle of ADHD symptoms and MAS; these two are strengthening risks for each other, and the negative cycle can only be interrupted in learning situations.

There are some limitations to this study. The data set is rather small and from about ten years ago. Another possible limitation is that the cross-lagged investigations records development only at a group level while person-oriented approach might provide more detailed information about the phenomena. In addition, as a screener the SDQ only entails the subset of ADHD and CD symptoms. Although we considered multiple important covariates, the causal conclusions should be made with caution. There might be multiple other factors effecting over-time associations. A deeper understanding of the interactions between MAS, ADHD and CDs during school transition is needed.

Both behaviour problems and MAS experienced in primary school extend their effects beyond school transition. Our results indicate that especially ADHD symptoms and MAS together can have significant longitudinal effects on academic performance from primary to middle school. Students with ADHD symptoms are more vulnerable to facing negative learning experiences and developing MAS than students with CDs. The strength of the study lies in its prospective longitudinal design including school transition, as well as the multiple assessments and informants over time, which enabled testing of the cross-lagged associations. Future research should further examine the

stability of the MAS and reciprocal effects of MAS and ADHD earlier on school path. In addition, the role, and different aspects of school transition in the development of MAS should be further examined.

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III

THE EFFECTS OF ADHD SYMPTOMS DURING TRANSITION TO MIDDLE SCHOOL – ACADEMIC AND SOCIAL ADJUSTMENT

by

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ADHD-symptoms and transition to middle school: the effects of academic and social adjustment

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This longitudinal study examined the cross-lagged relationships of ADHD symptoms, school adjustment and academic performance during the transition from primary to middle school (Grades 6-7) in a Finnish community sample (N=311). We found that the mechanisms were different for boys and girls: for boys (N=149) the effect ADHD symptoms had on academic performance mediated via maladaptive achievement strategies, but for girls (N=162) the effects on lowering Grade 7 academic performance were direct. In addition, ADHD symptoms were associated with SES and pedagogical support only among boys.

Keywords: ADHD, School Transition, Maladaptive Achievement Strategies, Social adjustment, support, Academic Performance

Highlights

- the mechanisms of how ADHD symptoms tax academic performance are different for boys and girls at this stage
- for boys, there is a mediating effect of MAS
- pedagogical support seems to catch boys with ADHD symptoms, but this support is not enough to turn around the negative cycle of ADHD, MAS and academic performance
- for girls, the effects of ADHD symptoms on later academic performance are direct

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Introduction

A transition from primary to middle school contains a variety of academic and social adjustment demands. Successful school transition is an interaction sum of multiple environment- and individual-level factors: increasing academic demands, adaptation to new environments (e.g., larger schools, classrooms), and different structural demands (multiple teachers, classrooms, and materials throughout the day). On top of that, youth must also form new student-teacher relationships, peer relationships (changing class composition) and adjust to changes in teacher expectations and declines in student autonomy (Evans et al., 2018; Zendarski et al., 2016). The success of school transition is associated with academic achievement and psychological well-being (Evans et al., 2018).

While most students cope with school transitions successfully, students with inattentiveness, hyperactivity and impulsivity, usually defined as a*ttention deficit hyperactivity disorder* (ADHD), are at risk for negative changes during this stage (Evans et al., 2018; Zendarski et al., 2016). ADHD symptoms are associated with negative developments in academic performance (Loe & Feldman, 2007), learning difficulties (DuPaul et al., 2013), generally negative attitudes towards school, disengagement (Ngyuen et al., 2019) and academic motivation deficits (Smith et al., 2020). Endeavouring towards more inclusive education system, Finland passed through a reform of the comprehensive school support system in 2010 (the Basic Education Act). Inclusion regarding challenging behaviour is still noted as one of the most demanding challenges for teachers (Øen & Krumsvik, 2022). However, there have only been individual attempts to systematically support children with ADHD behaviours in Finnish schools (e.g., Karhu et al., 2018; Karhu et al., 2021).

Social relations are important factors in a successful school transition (Virtanen et al., 2019). Yet, students with ADHD symptoms do not always adjust in the social context: they seem to have more negative relationships with teachers than their peers (Rodriguez et al., 2007), and their peer relationships are not always optimal (Gardner & Gerdes, 2013). They may also lack social and

academic support from home (Rogers et al., 2009), and the diagnosis is associated with a low parental education level (Torvik et al., 2020).

In sum, ADHD symptoms can make school transition challenging and reflect on academic performance, but we do not yet fully understand the mechanisms behind them and decreasing academic performance. Consequently, in this study we take a closer look at mediating factors, such as social and academic adjustment, that may influence school transition and academic performance. We are especially interested in possible sex differences.

ADHD and academic performance

Attention Deficit Hyperactivity Disorder (ADHD) is a rather common neurodevelopmental disorder characterized by inattention, impulsivity, and hyperactivity (American Psychiatric Association, 2013: DSM-V). Students with ADHD symptoms often have difficulties regulating their attention, emotions, and actions. Consequently, difficulties with academic performance are common and quite persistent (DuPaul & Langberg, 2015). Both students with the formal diagnosis and those with ADHD symptoms are likely to perform below their levels of ability and the general expectations in academic settings (Diamantopoulou et al., 2007) and have poor educational outcomes (Arnold et al., 2015; Loe & Feldman 2007). The academic difficulties are primarily related to symptoms of inattention and cognitive deficits in executive functions (working memory, inhibition, and mental-set shifting; Langberg et al., 2013), and the effect of the symptoms decline with age (Biederman et al., 2000). Transition to middle school can also make inattentive symptoms more apparent, as demands of school shift from self-regulation to independent completion (Barkley, 1997), and there is evidence that school transition interrupts the age-related decline in the symptoms (Langberg et al., 2008).

Girls with ADHD display more inattentive symptoms than boys, have less disruptive behaviours and problems at school (Sciutto et al., 2004), and have more language deficits, anxiety, and depression (Joelsson et al., 2016), but learning difficulties are more common among boys

(Biederman et al., 2002). The diagnostic criteria are derived predominantly from males, but the expression of the disorder differs between the sexes – thus, boys with ADHD are more easily detected (Biederman, 2005). Girls get detected later, they may get misdiagnosed (depression, anxiety), and the symptoms are often already more severe (Gershon, 2002). The current literature may not fully reach the differences age and sex bring to the expression of these symptoms. For example, in their review Quinn & Madhoo (2014) suggested that females with ADHD may develop better coping strategies than males and mask their symptoms, and that girls who seem to underachieve should be further studied regarding inattention symptoms.

Transition to middle school - factors contributing to academic and social adjustment

In Finland, the transition to middle school takes place between Grades 6 and 7. Primary and middle schools often differ from one another on several student-, teacher- and school-level variables that are important for students' academic performance and socio-emotional well-being (Evans et al., 2018). Commonly, this means changes in a school building, class composition, and entering from a class teacher system to having multiple subject teachers (i.e., switching teachers, classrooms, and materials). In addition, students need to form new student-teacher relationships and adjust to different kinds of teacher expectations. From a developmental perspective (Stage-environment fit: Eccles et al., 1993) this is a fragile state and youth are vulnerable to multiple developmental risk factors, as demands of independence increase and early adolescence brings on physical, psychological, and social changes. There is an ongoing interplay between the individual and the environment: how well the student adapts to the environment and vice versa (Eccles et al., 1993).

Academic adjustment is a major contributor to successful school transition (Evans, et al., 2018). Failure to adapt well enough is likely to cause increased stress and anxiety, loss of self-esteem, and decreased school enjoyment (Waters et al., 2012). This may impact general attitudes toward school, engagement, and academic performance. This kind of adaptation to changes in

academic demands, environment, and social settings can be difficult for students with ADHD symptoms (Zendarski et al., 2016).

How a person typically deals with challenging and demanding situations can be referred to as achievement strategies. These are usually classified as adaptive or maladaptive, and they contribute to an individual's success in various situations (e.g., Aunola et al., 2000). Maladaptive achievement strategies (MAS) include fears of failure, low competence beliefs, and avoidant behavior in challenging situations (task avoidant behaviour: Nurmi, 1993). They develop in a process where previous experiences direct one's presumptions about the ability to perform in similar situations later (Nurmi, 2015).

MAS and low competence beliefs are rather common among students with ADHD (Gut, et al., 2012; Zentall & Beike, 2012). ADHD-related cascading experiences of failure at school can create a negative academic self-concept and low efficacy beliefs. This may lead to low effort and increasing task-avoiding behaviours (Nurmi, 2015; Onatsu-Arvilommi & Nurmi, 2000), making academic failure more likely, thereby creating new experiences of failure. MAS alone predict subsequent poor academic performance among adolescents (Midgley & Urdan, 1995). There is also some evidence that poor academic performance predicts the utilization of MAS, and some reciprocal effects have been found (Palmu, in press; Metsäpelto et al., 2015).

School adjustment is greatly regulated by social interactions with peers and school personnel (Wentzel et al., 2010). Students with ADHD tend to have more negative student-teacher -relations (Rodriguez et al., 2007), feel less emotional closeness, cooperate less with, and have more conflicts with their teachers than their peers (Platin-Ewe, 2019). This is a risk for forming new student-teacher relationships (Rogers et al., 2015), especially as teacher support generally is reported to decrease at this stage (Barber & Olsen, 2004).

Perceived social support is important in adolescence and positive peer relationships promote school adjustment during the transition (Wentzel, 2003). Yet, middle school transition is associated

with declines in perceived total support, teacher support, and an increase in self-reported school problems (Martinéz et al., 2011). Peer problems during this time are linked with poor school functioning, decreased motivation, and increased problem behaviours (Evans et al., 2018). In addition, youth with ADHD often have fewer friends, lower quality friendships, and experience greater peer victimization than their peers (Hoza et al., 2005).

Parental support, on the other hand, may buffer children from the emotional effects of transition (Helsen, et al., 2000), but the literature suggests that students with ADHD may lack support from home (Rogers et al., 2009). Additionally, socioeconomic status, especially mothers' low level of education, has been associated with both lower levels of academic performance and higher levels of ADHD (Torvik et al., 2020). Considering the comorbidity between ADHD and learning difficulties, the pedagogical support received at school is also likely to play a role. Boys with ADHD symptoms are usually detected (Nussbaum, 2011) which likely makes pedagogical support accessible. However, this may not be true for girls (Biederman, 2005).

The Present Study

The first aim of this study is to provide a better understanding of the mechanisms between ADHD symptoms and academic performance during school transition. Specifically, this study explores whether early middle school adjustment (MAS, pedagogical support, peer relations, student-teacher relationships, support at home) mediate the teacher rated ADHD symptoms (inattention, hyperactivity and impulsivity) have on academic performance during the first year of middle school. The second aim was to study whether these effects are similar for girls and boys. Thus, our research questions were as follows:

1) What roles do possible mediating factors, such as MAS, social context, parental support, or special needs education support status play in the relation between ADHD symptoms and academic performance during school transition; and

2) are these effects similar for boys and girls?

Method

Participants

This study is a part of larger longitudinal study that took place in seven municipalities in Eastern Finland during years 2010–2013. This study is based on a sub-sample of the larger data, and it investigates a sample of students from different schools throughout the transition from Grade 6 (n= 311) to Grade 7 and until the end of first middle school year. Six students per class were randomly drawn for teachers to rate with the SDQ for ADHD symptoms.

Measures

The ADHD symptoms were assessed by teacher ratings using the hyperactivity/inattention scale of the Finnish version of Strengths and Difficulties Questionnaire (Koskelainen, 2008; see also: The SDQ, Goodman, 1997). Six students per class (N=311) were randomly drawn by the researchers for full SDQ teacher ratings. The 25-item instrument is rated on 3-point scale (1=not true, 2=somewhat true, 3= certainly true). It is widely used, valid screening instrument for the behavior of children and adolescents between 4–16 years of age (Goodman, et al., 2000; Koskelainen 2008). The hyperactivity/inattention scale includes five items, for example: “Restless, overactive, cannot stay still for long”, “Easily distracted, concentration wanders”. The Cronbach’s alpha reliability for ADHD symptoms was .75 (Grade 6).

To get a representative measure of Maladaptive achievement strategies (MAS) we utilised nine items from the Strategy and Attribution Questionnaire (Nurmi et al., 1995) modified for children. For example: ‘When we are doing exercises at school, I’m afraid I can’t do them’, ‘If something is difficult at school, I gladly do something else’, If something goes wrong at school, I think teachers and other students consider me stupid’. The students were asked to rate statements on a 4-point scale (1 strongly disagree - 4 strongly agree) at the spring semester of Grade 7 (N=580). The Cronbach’s alpha reliability for MAS was .85.

To measure adaptation to social context, we utilized parts of the large Well-being at School Questionnaire (Konu, 2002). Via exploratory factor analysis we found three subscales: peer relations, student-teacher relations and the support received at home. The items were rated by students on a scale 1-3 at the beginning of the spring of their first middle school year. The peer relations measure focused on students' adaptation in their peer group within class and consisted of five items (for example: 'Students in my class feel comfortable with each other' and 'Students in my class help each in problematic situations'). The Cronbach's alpha for peer relations on Grade 7 was .85. Middle school students encounter multiple teachers within one day; consequently, student-teacher relations were measured with eight items focusing on school level interaction between students and school personnel. These items included for example: 'It is easy to get along with teachers' and 'Students' opinions are considered in our school'). The Cronbach's alpha for student-teacher relations was .84. The support students received from home was measured via three items (for example: 'My parents consider my schoolwork to be important' and 'My parents help me in school tasks' and The Cronbach's alpha for support received at home was .80.

The pedagogical support received at school was measured with students' educational support status at school ranging from 0 to 2 (0 = general support, 1 = intensified support, 2 = special support). This information was gathered from the school registers indicating the intensity of support received at school. Academic performance was assessed using individual student grades (ranging from 4 to 10) given by the teachers each year. Grade 6 grades were collected from teachers and Grade 7 grades from school registers at the end of the school year.

Covariates and additional analyses

The covariates included previous academic performance and the socioeconomic status of the family. The measure of previous academic performance was Grade 6 GPA consisting of reading, language arts, and mathematics, gathered from the teachers. The socioeconomic status of the family was measured as the highest level of education of the student's mother. It was measured using an 8-

point scale ranging from basic education level to master and doctoral education of students' mothers. Only 2.4% of mothers had no education beyond comprehensive education (i.e., no vocational degree), and 33.7% of the mothers had higher vocational diplomas, bachelor's, master's, or doctoral degrees. The overall distribution of mothers' education level was comparable to the general population at the time of the study (Official Statistics Finland, 2013).

Analytic approach

The cross-lagged path analysis is used to describe reciprocal relationships, or directional influences over time and it is widely used to further investigate data and theory supported causal relations (e.g., Geiser, 2013). The analyses were chosen based on the assumption that ADHD behaviours, MAS, and academic performance develop in interaction with each other and are connected to later academic performance. The analyses were carried out with the Mplus statistical package (Version 7, Muthén & Muthén, 1998–2013) and parameters were estimated using full-information maximum likelihood estimation (FIML) with non-normality robust standard errors (MLR; Muthén & Muthén, 1998–2013) since the distributions of the variables used were not completely normal (Table 1). The proportion of nonresponses in the variables of the sample ranged between 0–34 % and the data missing was missing completely at random (Little's MCAR: p=.552). The model fits were evaluated with X2/df, Root-Mean-Square Error of Approximation (RMSEA), Bentler's comparative fit index (CFI), and Standardized Root-Mean-Square (SRMR).

First, we examined the overall model: all the cross-lagged paths were estimated. Simultaneously measured constructs in the model were allowed to correlate and statistically significant correlations were kept in the model. Next, to study sex differences we used the multigroup analyses in the Mplus. The chi-square difference test was performed for the estimation of the multi-group effects (Werner & Schermelleh-Engel, 2010). Due to the results of the Satorra-Bentler Chi Square difference test, separate freely estimated models were conducted for boys and girls.

Table 1. Descriptive Statistics of Observed Variables

Variable	*n*	*M*	*SD*	*Skew (SE)*	*Kurt. (SE)*	*Min.*	*Max.*
1. Grade 6 ADHD symptoms	311	2.54	2.6	1.06(.14)	.25(.28)	0	10
2. Grade 6 GPA	285	8.07	.89	-.22(.14)	-.76(29)	6	10
3. Grade 7 GPA	251	8.00	1.07	-.27 (.10)	-.65 (.20)	5	10
4. Grade 7 MAS	226	2.58	.80	.17 (.16)	-.36 (.32)	1	4.78
5. Peer Relations	232	2.47	.47	-.89(.16)	.28(.52)	1.00	3.00
6. Student-Teacher Relations	230	2.45	.42	-.77(.16)	.52(.32)	1.00	3.00
7. Support Received at home	231	2.75	.43	-1.95(.16)	3.62(.32)	1.00	3.00
8. Special Education Status	244	0.33	.67	1.76(.16)	1.59(.31)	0.00	2.00
9. Sex	311	1.48	.50	.08 (.14)	-2.01 (.28)	1.00	2.00
10. SES (Mother's education level)	224	4.37	1.72	.54 (.16)	-.45 (.32)	1.00	8.00

Note. *M* = mean, *SD* = Standard Deviation, Skew. = skewness statistics, Kurt. = kurtosis statistics, *SE* = Stand. Error, Min. = minimum value, Max = maximum value. GPA= Grade Point Average, MAS=Maladaptive Achievement Strategies, SES: socio-economic status.

Table 2. Correlation Matrix

Whole sample (*N*=311)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Grade 6 ADHD	–								
2. Grade 6 GPA	-.60**	–							
3. Grade 7 GPA	-.55**	.75**	–						
4. Grade 7 MAS	.32**	-.34**	-.46**	–					
5. Peer Relations	.04	-.06	.03	-.16**	–				
6. Student-Teacher Relations	-.23**	.09*	.20**	-.36**	.38**	–			
7. Support Received at home	-.16*	.09*	.19**	-.28**	.25**	.49**	–		
8. Support at school (SNE Status)	.46**	-.45**	-.49**	.20**	-.06	-.11*	-.15**	–	
9. SES (Mother's Education Level)	-.11	.25**	.27**	-.03	.10	.08	.22	-.22**	–
10. Sex	.38**	-.23**	-.29**	-.07	.06	-.07	-.05	.16**	.01

Table 3. Correlation matrix by sex

Girls (*N*=162) **Boys** (*N*=149)

Variable	1.	2.	3.	4.	5.	6.	7.	8.	9.
1. Grade 6 ADHD	–	-.55	-.49**	.30**	-.07	-.25**	-.16	-.52**	-.22*
2. Grade 6 GPA	-.57**	–	.74**	-.30**	-.09	.12	.14*	-.51**	.26**
3. Grade 7 GPA	-.54**	.74**	–	-.42**	-.009	.16*	.15*	-.49**	.32**
4. Grade 7 MAS	.38**	-.37**	-.49**	–	-.10	-.32**	-.24**	.23**	.008
5. Peer Relations	.15	-.004	.10	-.21**	–	.51**	.36**	-.10	.04
6. Student-Teacher Relations	-.13	.05	.19**	-.39**	.30**	–	.53**	-.14*	.06
7. Support Received at home	-.14	.02	.22**	-.31**	.17**	.44**	–	-.14*	.03
8. Support at school	.20*	-.34**	-.44**	.15*	-.04	-.04	-.14**	–	-.30**
9. SES (Mother's Education Level)	-.06	.28**	.27**	-.08	.13	.10	.16**	-.17**	–

Table 4. Comparison of study variables between boys and girls

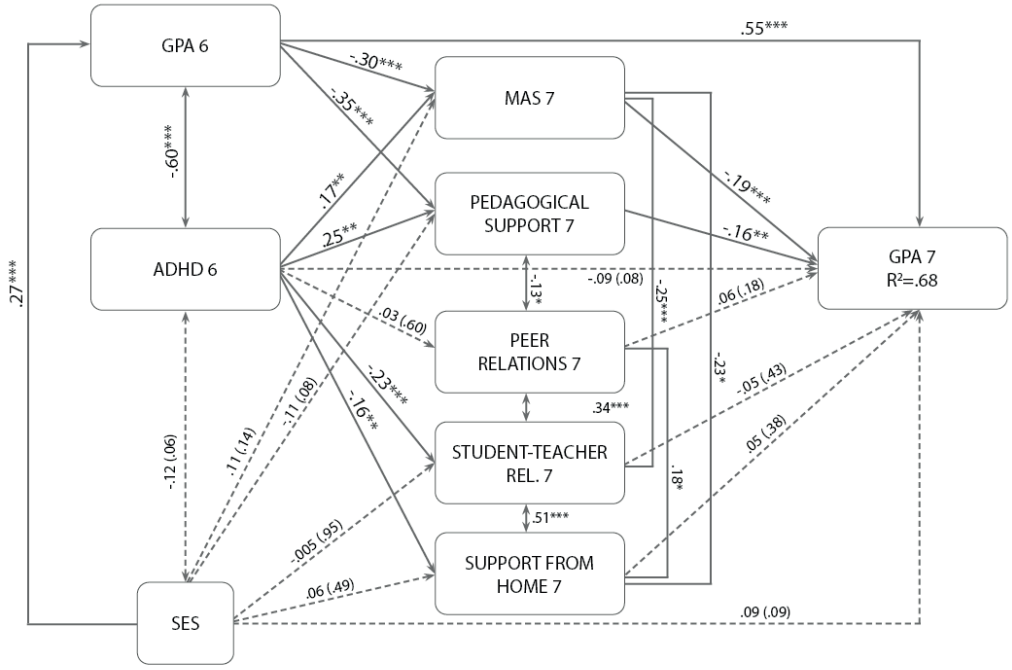
Variable	Boys		Girls		
	Mean (*SE*)	*SD*	Mean (*SE*)	*SD*	Cohen's *d*
ADHD symptoms (N=311)	3.56 (.24)	2.94	1.61 (.15)	1.92	-.79
Grade 6 GPA (N=285)	7.81 (.08)	.91	8.33 (.07)	.79	.61
Grade 7 GPA (N=251)	7.57 (.10)	1.12	8.17 (.09)	1.02	.56
MAS (N=226)	2.64 (.08)	.80	2.53 (.07)	.80	-.14
Peer relations (N=232)	2.47 (.04)	.46	2.44 (.04)	.48	-.02
Student-teacher relations (N=230)	2.41 (.04)	.45	2.49 (.03)	.38	.19
Support received at home (N=231)	2.72 (.04)	.44	2.77 (.04)	.41	.14
Special Education Support (N=244)	.49 (.07)	.77	.19 (.04)	.51	-.48
SES (Mother's Education level) (N=224)	4.52 (.18)	1.78	4.24 (.15)	1.66	-.16

Results

The cross-lagged relationships: ADHD, GPA, academic and social adjustment

We started by testing the overall model (Figure 1), which included all measured constructs, their cross-lagged relationships, and significant correlations of simultaneously measured constructs. SES and previous academic performance status were controlled. The model fit was good (n = 311, X^2 = 10.956, df=8, p=.20, $RMSEA$=.03, CFI=.99, TLI=.97, $SRMR$=.04). We found two mediating effects: ADHD symptoms were associated with lowering Grade 7 GPA via both MAS and intensity of support at school. In addition, Grade 6 ADHD symptoms were associated with more negative student-teacher relationships and a low level of support received at home in Grade 7. It seems that MAS and pedagogical support are partial mediators for the relationship between ADHD symptoms and GPA. Grade 6 GPA had a medium-sized association with SES and a strong association with ADHD symptoms. MAS were negatively associated with student-teacher relationships and parental support in Grade 7. Peer relationships were positively associated with student-teacher relationships and support received at home, and negatively associated with pedagogical support. Student-teacher relationships and support from home were strongly associated.

Figure 1. The overall model -standardized coefficients



Note. GPA = Grade Point Average, ADHD 6 = hyperactivity/inattention symptoms on Grade 6, MAS = Maladaptive Achievement Strategies, Rel. = relationship. *p<.05 **p <.01., *** p < .001. Dashed lines indicate non-significant paths.

Differences between boys and girls

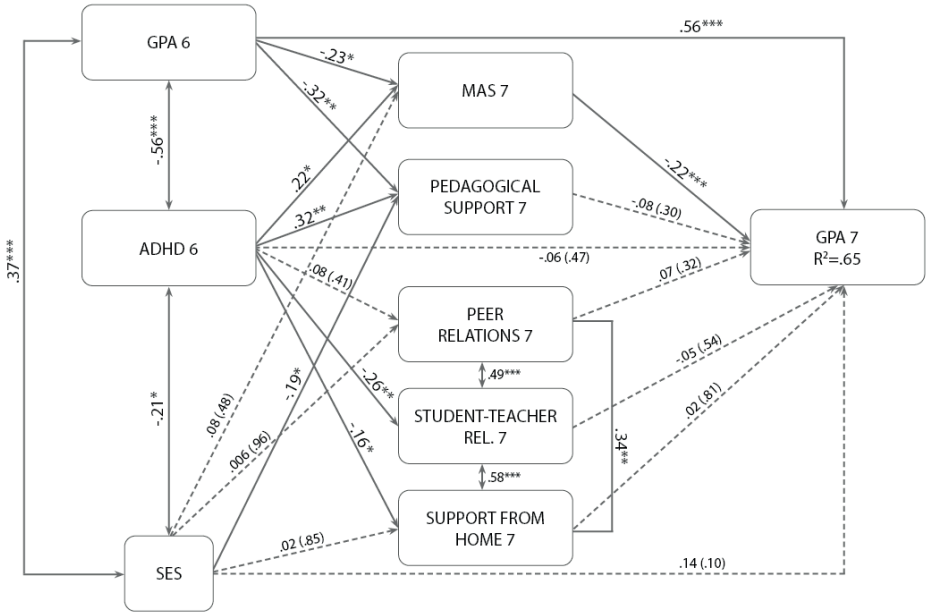
Next, we examined whether the same model fitted both girls and boys. In two sequential multigroup compared, the freely estimated model and the model where path coefficients for boys and girls were fixed equal and found that the CFI decreased from 1.00 to .94 indicating a poorer fit of the model that assumed equality of path coefficients. The comparison of models with the Satorra-Bentler Chi-Square difference test (p= .0003) confirmed this finding, and we concluded that the same model did not fit girls and boys. Thus, we report the multigroup model estimated freely for boys and girls, and it fitted the data well (n boys = 149, n girls = 162, X^2 = 21.578, df=18, p= .25, $RMSEA$=.04,

CFI=.99, *TLI*=.97, *SRMR*=.05). The Chi Square distribution was boys 6.227 and girls 15.346.

Model boys

In Model boys (Figure 2) MAS mediated the negative effect of ADHD symptoms on Grade 7 GPA. ADHD symptoms increased the likelihood to receive pedagogical support and predicted more negative student-teacher relations and a lower level of support received at home in Grade 7. Low Grade 6 GPA predicted higher levels of MAS and pedagogical support status. GPA 6 had a strong negative association with Grade 6 ADHD symptoms and a medium-sized association with SES. In this model, low SES was also associated with high ADHD symptoms. Peer relations were associated with student-teacher relationships and support from home, which was also associated with student-teacher relations.

Figure 2. Model boys - standardized coefficients

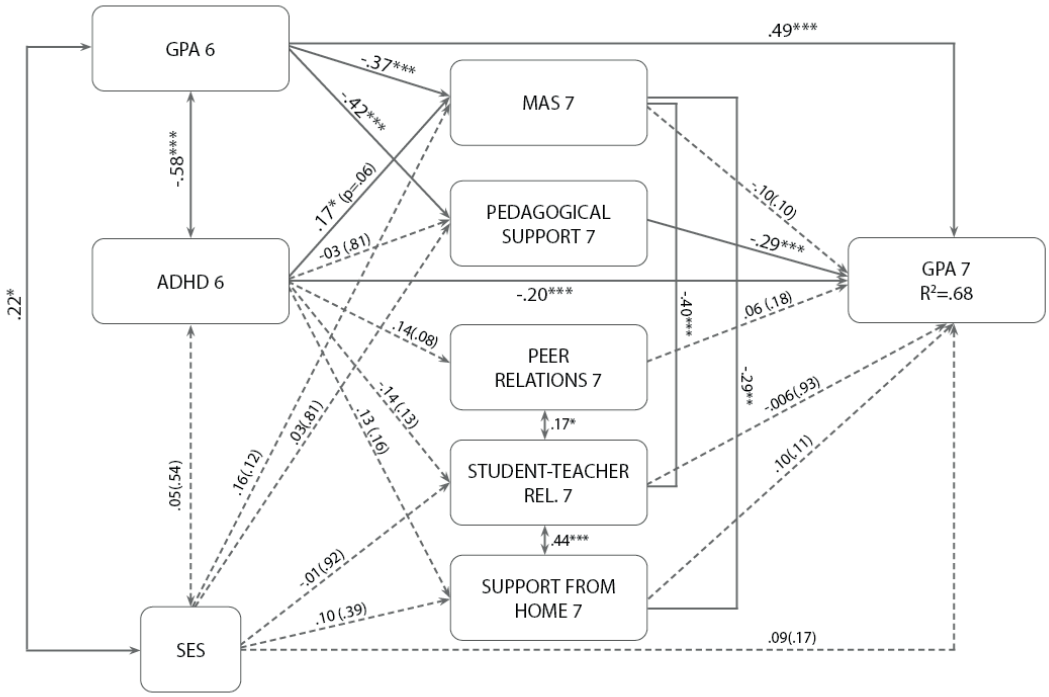


Note. GPA = Grade Point Average, ADHD 6 = hyperactivity/inattention symptoms on Grade 6, MAS = Maladaptive Achievement Strategies, Rel. = relationship. *p<.05 **p <.01., *** p < .001. Dashed lines indicate non-significant paths.

Model girls

For girls, the effects of ADHD symptoms on Grade 7 academic performance were direct and not mediated by any of the other variables. However, receiving pedagogical support was a partial mediator of Grade 6 GPA on Grade 7 GPA, but the effect on Grade 7 GPA was negative. Grade 6 GPA was associated with SES and Grade 6 ADHD symptoms. MAS was negatively associated with student-teacher relations and support received at home. Peer relations had a positive association with student-teacher relations and support from home, and student-teacher relations were positively associated with the support received at home.

Figure 3. Model girls - standardized coefficients



Note. GPA = Grade Point Average, ADHD 6 = hyperactivity/inattention symptoms on Grade 6, MAS = Maladaptive Achievement Strategies, Rel. = relationship. *p<.05 **p <.01., *** p < .001. Dashed lines indicate non-significant paths.

DISCUSSION

This study investigated how the effects of ADHD symptoms on academic performance during school transition are mediated by social adjustment factors. We found that the mediating effects were different for boys and girls, i.e., sex moderates the mechanisms by which ADHD symptoms are related to decreasing academic performance during school transition. Interestingly, MAS was not associated with the level of pedagogical support in any of the models.

The boys' model supported previous research: the effect ADHD symptoms had on GPA mediated via MAS (Metsäpelto et al., 2015) and symptoms were associated with negative student-teacher relations, and low support from home (Platin-Ewe, 2019). The pedagogical support seems to find boys with ADHD, but it is not enough to turn around the negative cycle. Positive peer relations, student-teacher relations, and support from home had moderate to strong positive correlations, but no further effects on GPA. SES was positively associated with Grade 6 academic performance and negatively with ADHD symptoms and the level of pedagogical support: the lower the SES, the more pedagogical support and the higher the ADHD symptoms, in line with the existing literature (Torvik et al., 2020).

For girls, the level of pedagogical support was associated with both low previous and decreasing Grade 7 academic performance, but not with ADHD symptoms. The pedagogical support reached girls with previous learning problems without associated ADHD symptoms. It is possible, that these girls' symptoms are primarily inattentive, and they do not cause disturbances gaining the teachers' attention (Biederman, 2005). It is also notable, that the association between ADHD symptoms and MAS was near significant – with a larger sample, there may have been a mediating effect. Interestingly, girls' academic and social adjustment measures were associated: MAS had negative correlations with both student-teacher relations and support from home. This is curious, as previous literature suggests a negative association between ADHD symptoms and school engagement, and the interaction between MAS and behavior problems is partly mediated via school engagement (Ngyuen et al., 2019). In addition, MAS is associated with low social relations and self-esteem (Aunola et al., 2000).

In sum, the models differed in a) the mechanisms ADHD symptoms affected GPA, b) received pedagogical support and c) how academic and social adjustment

interacted at this stage. The differences may be due to more recognizable behavioural symptoms among boys – and primarily inattentive symptoms among girls (Biderman & Faraone, 2002; Sciutto et al., 2004). It is also possible, that the effect of the symptoms becomes more apparent during the first year of middle school as the academic and social demands increase (Barkley, 1997). Eventually, battling with inattention during school days can be extremely burdening, tax academic performance, and lead to school-related anxiety, depression, and problems with parents (Joelsson, et al., 2016).

For girls, academic and social adjustment were associated with each other, and for boys, ADHD symptoms predicted negative student-teacher relations. It could be that for girls with ADHD symptoms, low social adjustment and support leads to weak school engagement. These girls do not achieve positive teacher relations over transition whereas the boys continue having negative relationships with teachers although the school context and teachers change. The transition-related vulnerability among girls may lie within the interaction of social and academic adjustment. Forming new social relations with peers and adults is likely difficult for these girls.

It is possible that support for MAS and ADHD-related difficulties is not sufficient, especially for girls. Girls seem to experience a decline in social support during school transition (Martinéz et al, 2011), and MAS correlated with the social adjustment measures after the transition. Our cross-sectional results support Nguyen and colleagues (2019) suggestion, that interventions targeting youth with ADHD symptoms should also consider family and school community factors, as they likely strengthen more positive attitudes towards school. Youth could benefit from a component that provides adult-initiated social support during adjusting to a new school environment and academic demands. In layman's terms, a reliable adult, who would help with academic struggles and promote social relations within the school.

This research has some limitations: first, the sample was small. Second, the data is rather old. For example, the national number of ADHD diagnoses has increased since then (Vuori et al., 2018). However, the data were gathered right after the education support reform (Basic Education Act, 2010) and there is no evidence about changes in the schools' support systems on this regard. Still, we cannot rule out changes in school practices. Third, even though the SDQ teacher-ratings are good predictors of the formal diagnoses of ADHD (Hall et al., 2019), using only teacher ratings is a limitation. Fourth, there may be multiple other factors that affect over-time associations that we did not include in this study. Although important covariates were considered within the study design, the causal conclusions should be made with caution. A deeper understanding of how the symptoms of ADHD and MAS interact during school transition is needed. Third, the strength of ADHD symptoms changes with age (Biederman et al., 2000; Langberg et al., 2008), and school transition happens at different ages in different countries. The results should be interpreted in relation to the age when the school transition takes place.

In conclusion, this study represents a unique effort to investigate the interrelationships among ADHD symptoms, academic and social adjustment, and academic performance during school transition. It suggests, that for boys, the effect ADHD symptoms have on academic performance is mediated via MAS and the pedagogical support reaches these boys (Nussbaum, 2011). Yet, this is not enough to stop the negative cycle. Simultaneously, pedagogical support does not seem to catch the girls with ADHD symptoms, and the effects these symptoms have on academic performance are direct. Social support was not as important a factor concerning academic performance, as one would have anticipated (Virtanen et al., 2019). In the future, scholars should further examine the effects of school transitions on the

development of achievement strategies, and the role of inattention symptoms and sex differences should be noted.

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